Filogenia e sistemática de *Mimosa* L.:

M. ser. *Pachycarpae* Benth. e *M.* ser. *Setosae* Barneby

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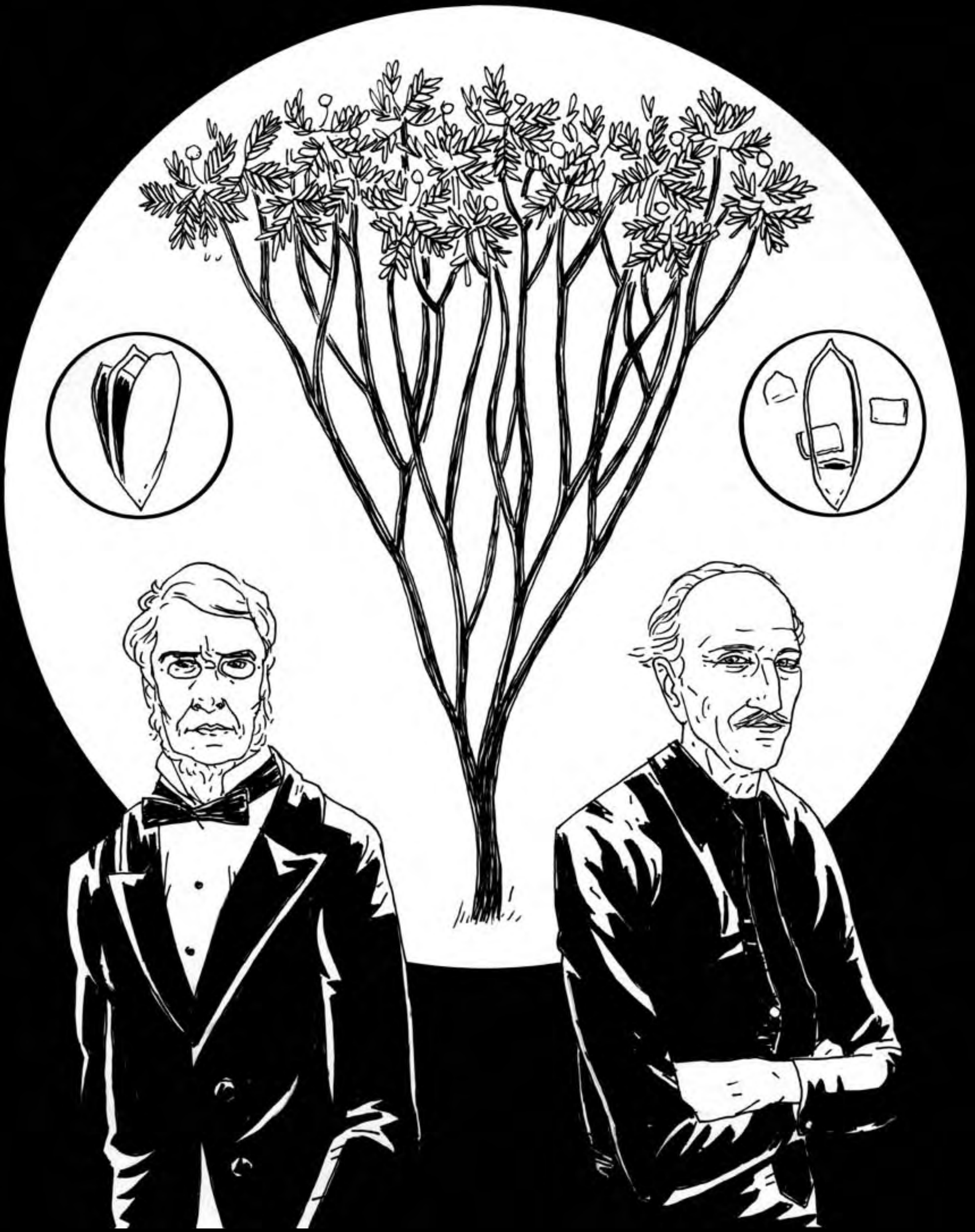

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FILOGENIA E SISTEMÁTICA DE *MIMOSA* L.: *M.* SER. *PACHYCARPAE* BENTH. E *M.* SER. *SETOSAE* BARNEBY

PHYLOGENY AND SYSTEMATICS OF *MIMOSA* L.: *M.* SER. *PACHYCARPAE* BENTH. AND *M.* SER. *SETOSAE* BARNEBY

Leonardo Maurici Borges

Tese apresentada ao Instituto de Biociências da Universidade de São Paulo para a obtenção de Título de Doutor em Ciências Biológicas na Área de Botânica.

Orientador

José Rubens Pirani

Co-orientador

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Aos que participaram disso

Que é mais que um produto

É um processo

Don’t worry about doing research. Just search.

Austin Kleon

Steal like an artist

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Valeu!

— Leonardo Maurici Borges

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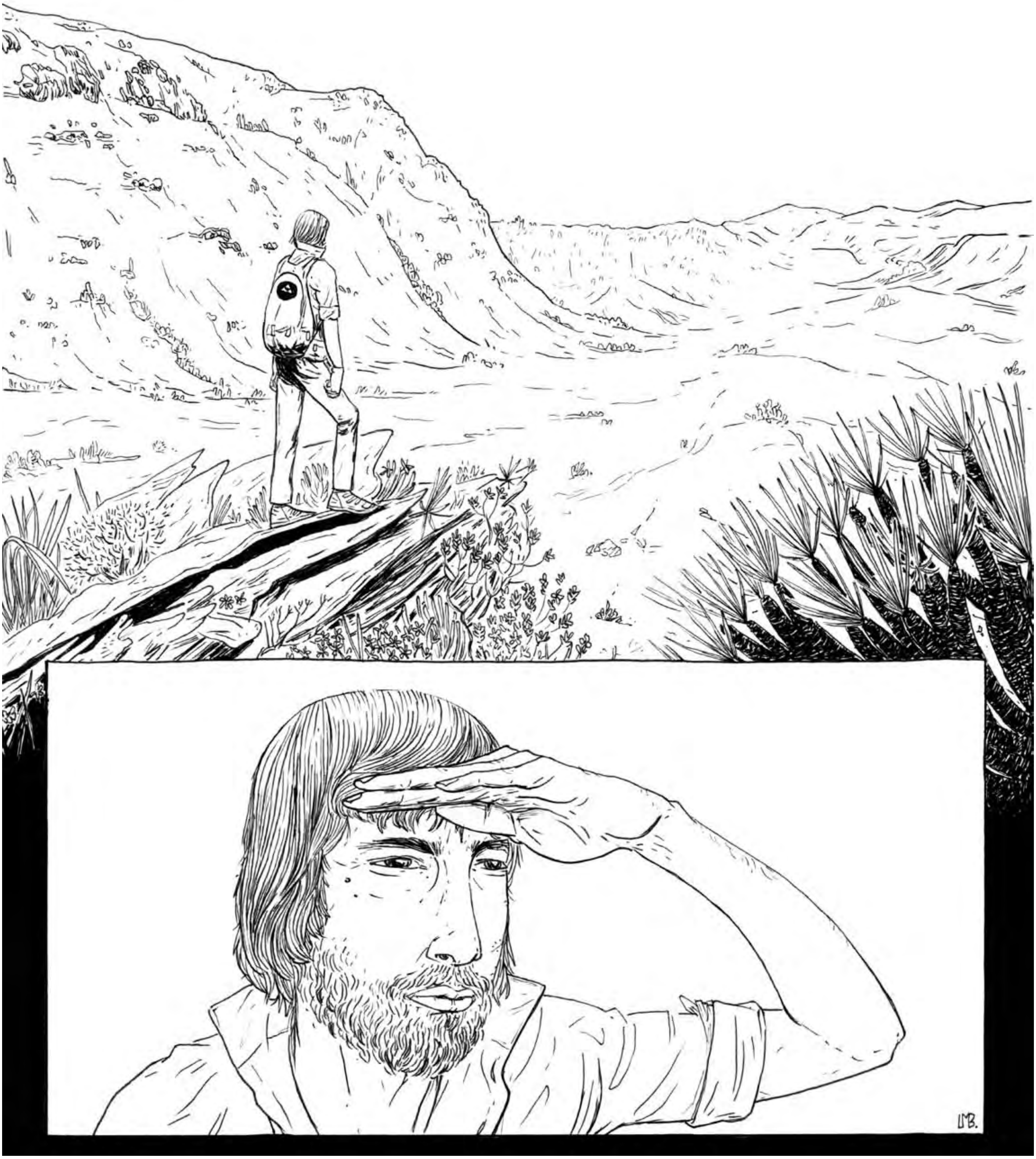
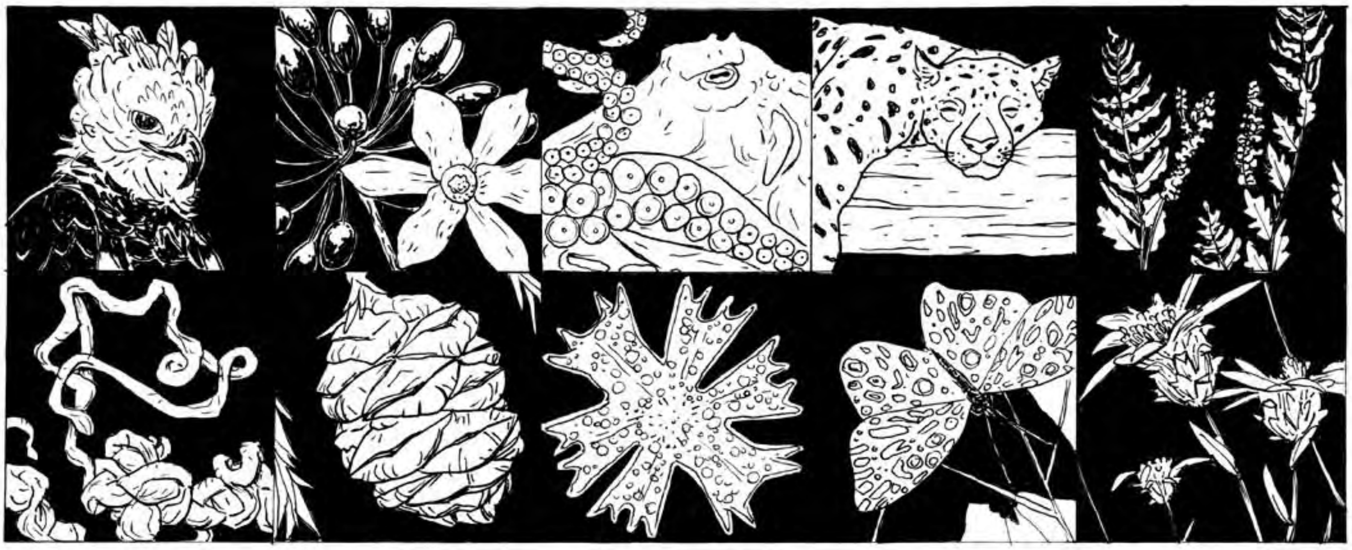
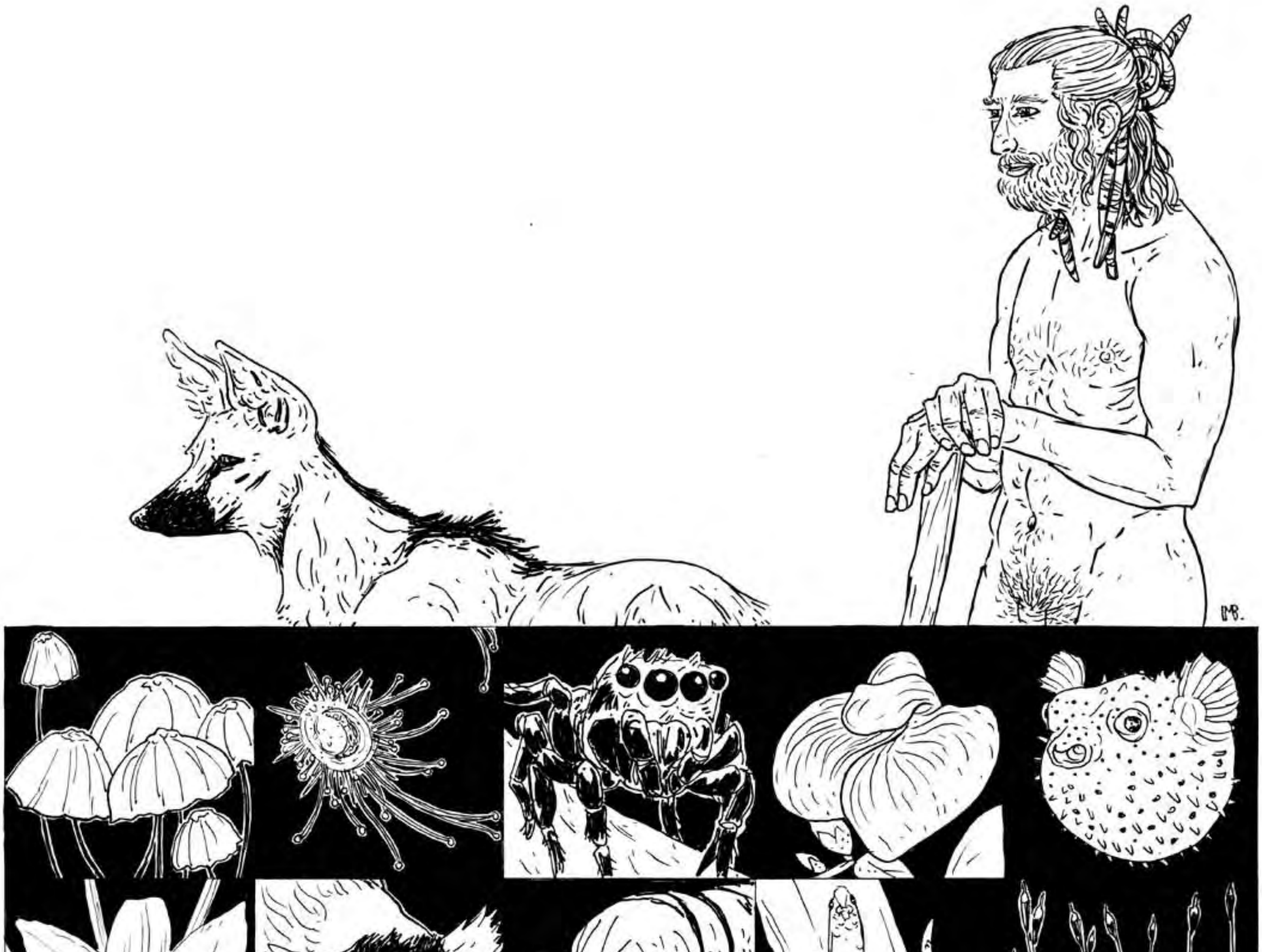
PROLOGUE

Esta é uma jornada





Uma que começou há muito tempo



após Thomas Ender, c.1817.


Você encontrará o que não procurava
e fará amigos
mas também ficará perdido
e sozinho


Tudo em busca de nomes
Qual é a desses nomes?
Eles nos ligam uns aos outros
Homo sapiens
e ao mesmo tempo, nomes nos fazem


Únicos

ABSTRACT

ABSTRACT

Mimosa, one of the largest genera in Leguminosae, has an infrageneric classification arranged in sections with subtended series. Two of the latter, *M.* ser. *Pachycarpae* and *M.* ser. *Setosae,* are endemic to the Brazilian Cerrado Domain. The current infraspecific classification of both series id complex and reflect in part their large morphological diversity. Although fruit morphology has been used to segregate these two series, previous phylogenetic analyses indicate that they should be merged. Aiming to contribute to a better understanding of that problem, we performed a phylogenetic analysis based on molecular and morphological data of a wide taxa samplig. Our results show that *M.* ser. *Pachycarpae* and *M.* ser. *Setosae* must be merged and that part of the species belonging to the latter is actually more related to another series. Also, the current infraspecific classification is not corroborated by our tree topology. Diversification of the group may be related to a key innovation and to phenotypic recombination. Hence, *M.* ser. *Pachycarpae* is reorganized to accommodate part of *M.* ser. *Setosae*. The infraspecific classification of the series is also updated and replaced as much as possible. *M.* ser. *Pachycarpae* presents 72 species and six infraspecific taxa, all but one (*M. paludosa*) endemic to the Brazilian Cerrado Domain, where they occur chiefly in altitudinal areas. The comprehensive circumscription of *M.* ser. *Pachycarpae* avoids delimitation based on a single or few characters, due to its wide morphological diversity, but an unjointed craspedium occurs in most species. Taxonomic updates include diagnostic characterization, notes on morphology and taxonomy, information on distribution and habitats, as well as a list of selected specimens from each taxon, and some illustrative photographs. For the *M. setosa* complex, a full taxonomic treatment is provided. Also, two new species are described, typification problems are solved and the recognition of two problematic taxa is resolved. Different approaches to rank choice in *Mimosa* may be related to usage of different species concepts. Efforts are needed to promote species studies based on explicit concepts in order to achieve not only testable species circumscriptions, but also robust, informative and predictive classification systems.

RESUMO

Mimosa, um dos maiores gêneros de Leguminosae, apresenta uma complexa classificação infraespecífica estruturada em seções incluindo series. Das últimas, *M.* ser. *Pachycarpae*, e *M.* ser. *Setosae são endêmicas e diversas no Domínio do Cerrado.* Ambas apresentam uma complexa classificação infraespecífica que reflete em parte sua ampla diversidade morfológica. Embora a morfologia dos frutos tenha sido utilizada para diferenciá-las, an*á*lises filogenéticas indicam que elas devem ser fundidas. A fim de verificar essas afirmações, realizamos uma análise filogenética incluindo uma vasta amostragem de táxons e baseada em caracteres moleculares e morfológicos. Conclu*í*mos que *M.* ser. *Pachycarpae M.* ser. *Setosae* devem, de fato, ser fundidas e que parte das espécies da última é, na verdade, mais relacionada a outra série do gênero. Além disso, evidenciamos que a classificação infraespecífica aplicada às series não é refletida na topologia obtida e, portanto, deve ser aprimorada tanto quanto possível. A diversificação do grupo aparentemente está ligada *à* aquisição de uma inovação-chave e a processos de recombinação fenotípica. Portanto, a circunscrição de *M.* ser. *Pachycarpae* é aqui reorganizada para incluir parte das espécies de *M.* ser. *Setosae*, bem como sua classificação infraespecífica. *M.* ser. *Pachycarpae* apresenta 72 espécies e seis táxons infraespecíficos, todos, exceto um (*M. paludosa*), endêmicos ao Domínio do Cerrado, onde ocorrem preferencialmente em áreas montanhosas. Uma circunscrição abrangente de *M.* ser. *Pachycarpae* não permite delimitação baseada em um ou poucos caracteres, dada a ampla variação morfológica dos táxons. Entretanto, o fruto do tipo craspédio não-articulado ocorre na maioria das espécies. Atualizações taxonômicas no grupo incluem caracterização diagnóstica, notas morfológicas e taxonômicas, informação sobre distribuição e habitat, bem como uma lista de espécimes selecionados de cada táxon, juntamente com algumas fotos ilustrativas . Um tratamento taxonômico completo do complexo *M. setosa* é apresentado. Além disso, duas novas espécies são descritas, problemas com tipificação, corrigidos e o reconhecimento problemático de duas espécies, resolvido. Reconhecimento distinto de hierarquia taxonômica em *Mimosa* pode estar relacionado com a preferência por conceitos de espécie diferentes. É necess*á*rio promover o estudo de espécies baseado em conceitos explícitos a fim de produzir circunscrições testáveis, e também sistemas de classificação robustos, informativos e preditivos.

GENERAL INTRODUCTION

Leguminosae is the third largest family of flowering plants with around 727 genera and 19325 species distributed in three subfamilies: Papilionoideae, Mimosoideae and Caesalpinioideae (Lewis et al. 2005). The family has a cosmopolitan distribution and occurs in many formations, probably due to its ability to fixate free nitrogen by symbiotic association with endobacteria in radicular nodules (Sprent 2001; Lewis et al. 2005).

Mimosoideae presents ca. 3270 species in 78 genera, one of the largest being *Mimosa*, with around 500 species, the majority Neotropical, many of them restrict endemics. Around 350 species of the latter are restricted to the extra-Amazonic South America (Lewis *et al*. 2005), with the *cerrado*, *caatinga* and *campo rupestre* areas of Central Brazil concentrating one of its diversity centers (Simon & Proença, 2000).

Species of *Mimosa* show a wide morphological variation, but the craspedial fruit is almost constant within the genus, which may also present derivate forms such as a non-articulated craspedia.
Bentham (1875) organized the genus *Mimosa* in two sections: *M.* sect. *Eumimosa* DC, containing all the isostemonous species, and *M.* sect. *Habbasia* DC, comprising the diplostemonous ones. Barneby (1991) rearranged this infrageneric classification recognizing a new section including plants with extrafloral nectaries (*M.* sect. *Mimadenia* Barneby), dividing *M.* sect. *Euminosa* in two sections (*Mimosa* sect. *Mimosa* and *M.* sect. *Calothamnos* Barneby), and also splitting *M.* sect. *Habbasia sensu* Bentham into *M.* sect. *Habbasia* sensu strictu and *M.* sect. *Batocaulon* DC, besides reorganizing series, subseries and describing many new species.

Amongst the series reorganized by Barneby (1991), *Mimosa* ser. *Pachycarpae* Benth. presents 38 species and many infraspecific taxa with a total of 69 species and *M.* ser. *Setosae* Barneby groups seven species, one of them with eight varieties in a total of 15 taxa. Both groups share the *cerrados* and *campo rupestres* in areas of Central Brazil as their center of diversity and present many morphological and ecological ecological affinities, as well as high diversity of life forms, including subshrubs with xylopodia, rosulate trees, plants with thickened barks, mostly associated with adaptations to fire regimes (Barneby 1991, Simon *et al.* 2009, Simon & Pennington 2012). Distinction between these two series of *Mimosa* relies mainly upon fruit morphology: the typical craspedium is present in species of *M.* ser. *Setosae* while an unjointed craspedium is found in species of *M.* ser. *Pachycarpae* (Barneby 1991).

However, the occurrence of both types of fruits in a few species and some taxa from *M.* ser. *Pachycarpae* is common, because some species whose collections lacked fruits when studied by Barneby (1991), actually produce regular craspedia, instead of the unjointed form (Simon et al. 2010). Also, phylogenetic analysis of the genus indicate that both series are monophyletic only if treated as a single group (Bessega *et al.* 2008, Simon *et al.* 2011).

Problems on taxa delimitation are not restricted to the series themselves, and there is doubt about the validity of the infraspecific classification adopted by Barneby (1991), considered by him as “exploratory” and in need of comprehensive field studies to allow a better understanding of some taxa. Simon (2011) also highlights that varieties of *Mimosa setosa* Benth., the type species of *M.* ser. *Setosae*, do not cluster together in a monophyletic group.

Therefore, we present phylogenetic and taxonomic studies focused on *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* in order to promote a more accurate classification for those series and to improve the assessment of its diversity.

In order to evaluate the limits and evolution of the group, a widely sampled phylogeny is shown in chapter one. Chapter two presents a new circumscription for s *M.* ser. *Pachycarpae*, as well as an update to its infraspecific classification. Chapter three deals with the taxonomy update of *M. setosa*, a polytypic species currently with nine varieties. Three different taxonomic results are presented in Chapter four: description of two new species, resolution of problems related to typification of species described by Taubert based on specimens collected by Ule, and elucidation of the identity of two particular species. Finally, Chapter Five discuss how species concepts choice influences taxa recognition in *Mimosa* and classification systems as a whole.

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CHAPTER ONE

TO RECOMBINE AND TO CONQUER: PHYLOGENY OF *MIMOSA* SER. *PACHYCARPAE* AND *M.* SER. *SETOSAE* (LEGUMINOSAE)

Leonardo Maurici Borges, Marcelo Fragomeni Simon & José Rubens Pirani

Abstract

Mimosa, one of the largest genus in Leguminosae, has an infrageneric classification arranged in sections with subtended series. Two of the latter, *M.* ser. *Pachycarpae* and *M.* ser. *Setosae* are endemic to the Brazilian Cerrado Domain, with around 94 taxa currently recognized. The complex infraspecific classification of both series reflect in part their large morphological diversity. Although fruit morphology has been used to segregate the two series apart from each other, previous phylogenetic analysis indicate that they should be merged. In order to contribute to a better understanding of that problem, we performed a phylogenetic analysis based on molecular and morphological data from a wide taxa sampling of both series. We show that *M.* ser. *Pachycarpae* and *M.* ser. *Setosae* must be merged and that part of the species belonging to the latter is actually more related to another series. Also, the current infraspecific classification is not corroborated by the tree topology here obtained. Morphological characters show a high level of homoplasy, but the presence of a xylopodium is inferred as a synapomorphy for the clade comprising *M.* ser. *Pachycarpae* and part of *M.* ser. *Setosae*. The xylopodium is hypothesized as a key innovation that allowed incursion and diversification of the clade into the Cerrado Domain. The high level of homoplasy, associated with lack of genetic differences between taxa, indicates that diversity of forms may have been originated by phenotypic recombination.

Keywords

Fabaceae, campos rupestres, key innovation, developmental recombination

Introduction

Mimosa is the fifth largest genus in Leguminosae, with almost 550 species, the large majority native to Tropical America, while 31 are endemic to Madagascar and just a few occur in Asia and continental Africa (Luckow 2005, Simon *et al.* 2011, Villiers 2002). A wide morphological variation is found within the genus, but it may be broadly defined by the presence of a craspedium-like fruit, although a few variations may occur in certain minor groups within it. This particular fruit morphology may indeed be viewed as putatively synapomorphic for the genus, which was demonstrated as monophyletic in molecular based studies (Bessega *et al.* 2008, Jobson & Luckow 2007, Simon *et al.* 2011).

Currently, the genus is subdivided in many infrageneric groups arranged within five sections (Barneby 1991). The foundations of this classification were set by Candolle (1825) and Bentham (1842, 1875), but it really bloomed on the hands of Barneby (1991), who also developed a complex infraspecific system. How-

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Figure 1. Fruit morphology used to distinguish between *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae*. A. Unjointed craspedium. *M. nitens*. B. Craspedium. *M. caliciadenia.*

ever, Simon *et al.* (2011) have shown that some of those infrageneric groups are, in fact, not monophyletic, although there is still need to increase sampling of both species and data in order to properly evaluate and review this classification. Nonetheless, Simon *et al.* (2011) have pointed 24 well supported clades within *Mimosa* and amongst them is a group formed by the aggregation of *M.* ser. *Pachycarpae* Benth. and *M.* ser. *Setosae* Barneby.

Roughly, *Mimosa* ser. *Pachycarpae* was circumscribed by Bentham (1842, 1875, 1876) to accommodate diplostemonous species with unjointed craspedia, but some of those, whose fruits were not known by him, were later transferred by Barneby (1991) to *M.* ser. *Setosae*, which was created only to fit species that resembled those of M. ser. *Pachycarpae* but that turned out to have the typical craspedia of the genus (Fig. 1.; see further information on the taxonomic history of the series in Borges *et al.* Chapter 2). However, recent taxonomic findings (Simon *et al.* 2010) portraying the occurrence of intermediate forms between a typical craspedium and a unjointed craspedium in the same species, as well as the phylogenetic analysis of Simon *et al.* (2011), which shows that neither series are individually monophyletic, cast doubt on the validity of fruit morphology as an useful character to distinguish between *M.* ser. *Pachycarpae* and *M.* ser. *Setosae*.

Together the series comprise a total of 94 taxa, of which 38 are infraspecific (not accounting for autonyms), all being natural to South America and particularly diversified in altitudinal areas of Central Brazil, with few extensions over the borders with Bolivia and Paraguay, where they occur in *cerrado* and *campo rupestre* vegetation within the Cerrado Biome (Barneby 1991, 1993, 1997, Dutra & Garcia 2012, Simon *et al.* 2010). This abundance of infraspecific taxa within these series is the result of Barneby's (1991) tendency to group closely similar, but still distinguishable morphotypes, as varieties of the same species, probably supposing the occurrence of interbreeding between them (see Chapter 5). The morphology of some species (e.g. *Mimosa foliolosa* Benth.), however, does not necessarily support this approach and, also, the molecular phylogeny of Simon *et al.* (2011) showed that the two sampled varieties of *M. setosa* do not cluster together.

Besides being relatively rich in taxa the clade formed by *Mimosa* ser. *Pachycarpae* and *M.* ser. *Se-*

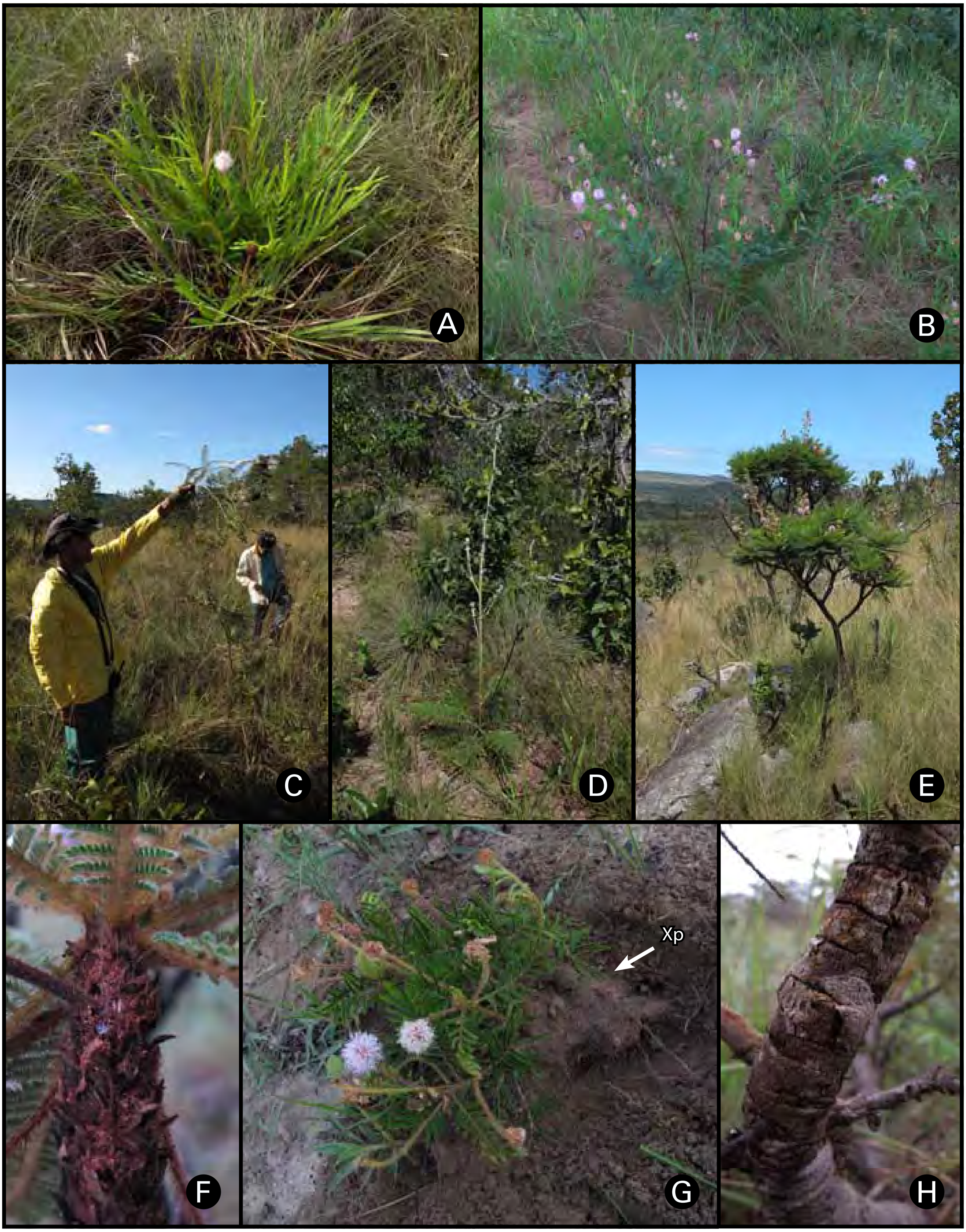

Figure 2. Morphological diversity in *Mimosa* ser. *Pachycarpae*. A–E. Different habit types. A. Rosette-like shrub. *M. speciosissima*. B. Shrub with fasciculate branches at base. *M. foliolosa* var. *foederalis*. C. Humifuse subshrub. *M. chiliomera*. D. Wand-like shrub. *M. eriorrhachis* E. Trelet with congested leaves. *M. regina*. F. Persistent stipules. *M. manidea*. G. Xylopodium (Xp). *M. diminuta*. H. Trunk with developed suber. *M. claussenii* var. *prorsiseta*. A, E. Different inflorescence organization. A. racemes, when axilar to fully expanded leaves, are nested in the foliage. E. racemes, when axilar to partially developed leaves, or lacking associated leaf are organized in a exserted synflorescence.

tosae (hereinafter MPS) is also marked by a wide variation in life forms, such as virgate shrubs, humifuse subshrubs, rosette-like shrubs, shrubs or treelets (Fig. 2) (Barneby 1991), and in morphological adaptations supposedly associated with fire regimes (Simon *et al.* 2009, Simon & Pennington 2012), such as the presence of a xylopodium, persistent stipules, thickened bark or congested leaves (Fig. 2). Moreover, it is not uncommon for different species with distinct habits to occur sympatricaly, what happens prominently in one of the major centers of diversity for the group at mountain ranges of central Goiás state, markedly at Chapada dos Veadeiros.

This high number of taxa and morphological diversity are probably also associated with the increased species diversification rate pointed for the clade (Koenen *et al.* 2013), which is peculiar for a relatively recent lineage, whose crown node age was estimated as being around four Mya (Simon *et al.* 2009).

Although the phylogeny of Simon *et al.* (2011) defined MPS as a monophyletic group and provided few insights on the relationships between taxa belonging within it, the sampling of the group was not ideal. Despite being rich in elements from *M.* ser. *Pachycarpae* native to central highlands of the Goiás state, it lacked taxa occurring in other parts of the series distribution area, as well a thorough sampling of *M.* ser. *Setosae* and of series that share affinities with some of its species (e.g. *M.* ser. *piresianae* Barneby). Also, an improvement on sampling of infraspecific taxa of both series is also necessary. Besides, in Simon *et al.* (2011), the MPS lacks internal resolution, what may be related to the use of a single DNA fragment (*trnD-T*). Hence, it is expected that increase in character sampling to provide a better understanding on the relationship between taxa nested within the clade.

The goal of this study is to build a widely sampled phylogeny using both morphological and molecular data in order to proper evaluate the circumscription of *M.* ser. *Pachycarpae* and *M.* ser. *Setosae*, as well as the validity of infraspecific classification of species within them.

Material & Methods

Taxa sampling and rooting

Leaf samples of specimens obtained in multiple field expeditions through the geographical range of MPS and dried in silica-gel were used as source for DNA samples. We also included in our dataset sequences generated by Simon et al. (2011). Our molecular dataset comprises a total of 166 specimens. Of those, 91 belong to *Mimosa* ser. *Pachycarpae* (61 unique and 9 indeterminate taxa), 17 to *M.* ser. *Setosae* (13 unique taxa), 54 to other species of *Mimosa* (all unique), one to *Anadenanthera*, one to *Stryphnodendron* and one to *Piptadenia*. Morphological data was scored for a subset (82 taxa) of the total set of studied taxa and focus on the ones belonging to *M.* ser. *Pachycarpae*, *M.* ser. *Setosae* and other series previously pointed as related to the first two (Simon *et al.* 2011), as well as *M.* ser. *Piresianae*, sampled for the first time here. Appendix 1 presents detailed information on taxa, morphology and DNA fragments sampled.

Anadenanthera colubrina was used to root threes in phylogenetic analysis following previous re-

Table 1. List of primers sequences used for amplification and sequencing of DNA fragments.

Fragment	Primer name	Sequence (5'–3')
trnD-T	trnD2	GTG TAC AGC ATG CAT ATT CTT ACG
	trnEuuc	AGG ACA TCT CTC TTT CAA GGA G
	trnYgua	CCG AGC TGG ATT TGA ACC A
	trnTggu	CTA CCA CTG AGT TAA AAG GG
trnL-F	c	C GAT TTT CAG TCC TCT GCT CTA C
	f	CG AAA TCG GTA GAC GCT ACG
matK	trnK2R	CCCGGAAC TAGTCGGATG
	1100F	TTCAGTGGTACGGAGTCAAATG
ITS	ITS1	GTA GGT GAA CCT GCA GAA GGA
	ITS4	TCC TCC GCT TAT TGA TAT GC
	ITS5p	GGA AGG AGA AGT CGT AAC AAG
	ITS8p	CAC GCT TCT CCA GAC TAC A

sults obtained for mimosoid legumes (Luckow *et al.* 2005, Simon *et al.* 2009).

Data acquisition

Molecular data

Total DNA was isolated from silica-dried or herbarium specimens leaf samples using a modified version of the Cetyl trimethylammonium bromide (CTAB) protocol of (Doyle & Doyle 1987) or the DNeasy Plant Mini Kit (Qiagen, Crawley, UK). Three plastid DNA fragments (trnD-T intergenic spacer, trnL-F intron and intergenic spacer, and part of matK gene) and one nuclear (internal transcribed spacer of 18S-26S nuclear ribosomal DNA [ITS]) were used as source of molecular data. Polymerase chain reactions (PCR) of plastid fragments were performed in 10 µL solutions containing 5 µL of Top Taq DNA Polymerase (Qiagen, Crawley, UK), 3.7 µL of ddH2O, 0.15 µL of each primer (at 15 µM) and 1 µL of template DNA. The trnD-T fragment was amplified using primers trnD2 (Simon et al. 2011) and trnTggu (Shaw et al., 2005), and in order to maximize results when necessary, also the internal primers trnEuuc and trnYgua (Shaw et al., 2005). Amplification of the trnL-F region was done with modified primers c and f of Taberlet et al. (1991). The matK partial region studied was amplified with primers 1100F (Wojciechowski et al. 2004) and trnK2R (Lavin et al. 2000). ITS amplification was performed with two PCRs in order to maximize amplification of DNA and to avoid amplification of non-specific products. The first reaction was conducted using primers ITS5p and ITS8p (Möller & Cronk 1997), and the second reaction, using internal primers ITS1 (modified from White et al. 1990). Solutions of the first PCR reaction contained 0.25 µL Taq DNA polymerase (Phoneutria, Belo Horizonte, Brazil), 1.5 µL of Buffer (10x Platinum HF), 1.2 µL of dNTP mixture (2.5 mM), 1.2 µL of bovine serum albumin (BSA), 0.45 µL of each primer (5 µM), 0.45 µL of MgCl2 (50 mM), 3.9 µL of betaine (5 M), 4.5 µL ddH2O, 1 µL of template DNA. Solution of the second reaction followed the composition of the first, but the DNA template was replaced by 1 µL of the first reaction's product. Primers sequences and are shown in table 1. PCR conditions for trnD-E were 94°C for 3 min; 30 cycles of 94°C for 50 sec, 55°C for 1 min, 72°C for 1.5 min and a final extension of 5 min at 72°C; for trnY-T they were 80°C for 10 min; 35 cycles of 94°C for 1 min, 49°C for 1 min, 65°C for 5 min and a final extension of 4 min at 65°C; for trnL-F were 95°C for 2 min; 35 cycles of 94°C for 1 min, 56°C for 50 sec, 72°C for 2.5 min and a final extension of 5 min at 72°C; for matK 94°C for 5 min; 40 cycles of 94°C for 50 sec, 55°C for 50 sec, 72°C for 50 sec and a final extension of 6 min at 72°C; for ITS both reactions were set to 95°C for 2 min; 30 cycles of 95°C for 20 sec, 50°C for 30 sec, 72°C for 1.5 min and a final extension of 7 min at 72°C.

PCR products were purified using polyethylene glycol (PEG) or shrimp alkaline phosphatase and exonuclease 1 (ExoAP; USB Corp., Cleveland, Ohio, USA) and sequenced with a modified protocol for use of Big Dye 3.1 Terminator (Applied Biosystems, Foster City, California, USA) on a ABI 3730XL DNA sequencer (Applied Biosystems) at the Laboratório de Genética Vegetal (Embrapa Recursos Genéticos e Biotecnologia). Alternatively, PCR products were sent to for purification and sequencing at Macrogen Inc. Plastid regions were sequenced with the same primers used on PCRs, and for *trnD-T* all four primers were used in order to avoid problems with regions of mononucleotide repeats (poly A/T). Sequencing of ITS fragments was done with the same primers used in the second PCR. Sequenced strands for each region were assembled using Geneious 6.1 (Biomatters Ltd.).

Morphological data

We analyzed herbarium specimens held on CEN, K, NY, SPF, UB (acronyms according to Thiers 2014), as well as living specimens observed in the field for the occurrence of 75 characters (Appendix 2) in order to compile a morphological matrix for each taxon present in the morphological data set. When necessary, selected specimens from the following herbaria were also studied: A, ALCB, B, BHCB, BM, CEN, CESJ, DIAM, ESA, F, G, HB, HBG, HRCB, HTO, HUEFS, HUFU, IAN, IBGE, K, LE, M, MG, MO, NY, OUPR, P, PAMG, R, RB, RFA, S, SP, SPF, UB, UEC, US, VIC, W. Absence of features in specimens was complemented by information provided in Barneby (1991), when necessary. Since morphological data was obtained by taxon, not individuals, the same scores were used for different accessions of the same taxon in the total evidence analysis. Only fully developed structures from mature plants were used for morphological analysis. Floral features were obtained from both rehydrated and dried flowers. When necessary, a microscope with 10–63 # magnification was used.

Some morphological features were subdivided in the smallest possible unity during character coding procedure. For instance, the rosette-like shrub habit, which could be considered a single character, is decompound here in three different parts: congested leaves (character 24: state 1) in a shrub (2: 0) with developed suber (16: 1).

Molecular and morphological partitions are available from: https://www.dropbox.com/sh/5pdt7214dqr6zqt/AAAQLpo_ELTJvW2aIcCR9Ir8a?dl=0

Phylogenetic inference

Pre-aligment of DNA fragments

Sets of sequences for each fragment were aligned using the Muscle plugin of Geneious 6.1. Resulting alignments of all fragments had their tips trimmed and were partitioned in order to avoid problems with lacunar data, as well as to improve computational performance during dynamic homology analysis (Giribet 2001).

Parsimony analysis

Phylogenetic inference was conducted in a total evidence approach using parsimony as the optimality criterion. Analysis were conducted in POY 5.1.1 (Varón *et al.* 2012). The pre-aligned molecular matrices are cleared of gaps when imported into POY to allow direct optimization of sequences (DO; Wheeler 1996, 2003). The morphological matrix, which, in the case of our dataset, is not feasible to dynamic homology analysis, was not subjected to this procedure and hence, treated as a set of static homology characters. Ten rounds of DO search were performed in order to produce candidate trees that were subsequently submitted to a refinement search using the iterative pass (IP) optimization implemented in POY. IP results consisted of an implied alignment (IA; Wheeler 2003), tree topologies and tree scores. For both analyses indel opening cost was set to zero and indel extensions, transversions, and transitions were treated with equal weights (1:1:1). DO and IP search scripts were based on Pinto-da-Rocha *et al.* (2014) and are presented below. “*.fas” files are the molecular matrices, “morpho.tnt” file is the morphological and “m0111” is the transformation cost matrix.

DO (10 consecutive rounds. "trees_do_search.tre" – pool of trees generated; “score_do_m0111.sts" – scores for the trees found; "search_statiscs.txt" – description of the procedures executed during each round of search):

```
read("its.fas","matk.fas","trndt.fas","trnlf.fas","morpho.tnt")
transform((names:("its.fas","matk.fas","trndt.fas","trnlf.fas),(tcm:("m0111"),gap_opening:0)))
set(root:"cendna_00427")
search(max_time:0:02:00, min_time:0:02:00)
search(max_time:0:02:00, min_time:0:02:00)
search(max_time:0:02:00, min_time:0:02:00)
select(unique)
report("trees_do_search.tre",trees:(nomargin),"score_do_m0111.sts",treestats,"search_statiscs.
txt",searchstats)
wipe()
```

IP (Exact search. "trees_do_search.tre" – pool of trees generated during DO; “scores_unique_from_do.sts” – scores of the trees generated during DO with unique topology; “ia_ip.ia” – IA generated for the tree(s) found; “statistics_ip.sts”– score(s) found of tree(s); “trees_ip.tre” – found tree(s); “matrix_static.ss” – matrix of static homology characters in Hennig86 format):

```
read("its.fas","matk.fas","trndt.fas","trnlf.fas","morpho.tnt")
transform((names:("its.fas","matk.fas","trndt.fas","trnlf.fas","morpho.tnt"),(tcm:("m0111"),gap_opening:0)))
set(root:"427")
read("trees_do_search.tre")
select(unique)
report("scores_unique_from_do.sts",treestats)
set(iterative:exact)
fuse()
select()
report("ia_ip.ia",ia,"statistics_ip.sts",treestats,"trees_ip.tre",trees:(nomargin))
transform (all, (static_approx))
report ("matrix_static.ss", phastwinclad)
exit()
```

Branch lengths of the found trees were modified to reflect the number of characters of the IA supporting each branch with the command “report(trees:(branches))”. A strict consensus of trees with equal cost found under IP was obtained using the POY command “report(consensus)”. Bootstrap support (1000 replications) was calculated in TNT (Goloboff *et al.* 2008) using the consensus tree and the static character matrix (matrix_static.ss).

Figure 3. A. One of the most parsimonious trees found with IP search with branches scaled to reflect number of transformations supporting each clade. B. Strict consensus of trees found with IP search. Numbers above nodes indicate bootstrap values above 50%.

MORPHOLOGICAL CHARACTER STATES RECONSTRUCTION

Optimization of all morphological characters (Appendix 2) was performed in Mesquite v. 2.75 (Maddison & Maddison 2011) using the Parsimony Ancestral States reconstruction method to investigate occurrence of synapomorphies and to understand evolution of ten particular characters: xylopodium, habit, stem disposition, developed suber, peridermal exfoliation associated with orange underbark, aculei, leaves congestion, heterochronic development of leaves on the synflorescence axis and fruit's valves segmentation and time of segmentation. The strict consensus tree was used for this procedure.

RESULTS

PHYLOGENETIC INFERENCE

During DO search a pool of 463 trees with costs ranging from 5276 to 5280 steps was generated. The pool of trees was reduced to the ones with unique topology, which were them used as initial trees for the search with IP. Nine trees with cost of 5248 steps where obtained after IP search and one of those, with nodes reflecting number of characters states supporting each clade is showed in figure 3. A. The strict consensus of those trees is presented in figures 4 to X.

The tree topology is in accordance with results of Bessega *et al.* (2008) and Simon *et al.* (2011) and elements of *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* form a highly supported monophyletic group (MPS hereinafter), which is, by its turn, nested within a clade formed by different series belonging to *M.* sect. *Habbasia* (Fig. 3. B.). MPS appears as sister to *M. corynadenia* and the clade formed by them is sister to a group containing members of *M.* ser. *Leiocarpae*, *M.* ser. *Glandulosae*, *M.* ser. *Bipinnatae*, *M.* ser. *Neptunioides*, *M.* ser. *Rojasianae*, *M.* ser. *Habbasia*, and *M.* ser. *Piresianae* (Figs. 3–4). The latter, however, is polyphyletic in relation to some species of *M.* ser. *Setosae* that do not cluster within the MPS but are placed in a well-supported clade (PIR hereinafter) with all sampled members of *M.* ser. *Piresianae* (Fig. 4).

Relationships within the MPS are mostly unresolved and lack support both from resampling (Fig. 4) and from character states distribution, the latter denoted by the overall short branches of the tree (Fig. 3. A). Nonetheless, six clades placed in the most basal politomy are noteworthy. Clade A comprises *Mimosa leiocephala* and *M. diminuta*, species not morphologically resembling, but occurring in areas to the northern most distribution of the series. Two varieties of *M. setosa* both synonymized by Borges *et al.* (Chapter 3) form clade B. Clade C is compound by varieties of the same species, including two paraphyletic accessions of *M. albolanata* var. *paucipinna* and *M. albolanata* var. *brasiliana*. Taxa endemic to the Southern Espinhaço Range, in Minas Gerais state form clade D. The majority of taxa forming the latter group also belong to *M.* ser. *Setosae*, the only exceptions being *M. maguirei* and *M. perplicata*. The latter, however, was conservatively described in *M.* ser. *Pachycarpae*, despite having features of the former series (Borges *et al.* 2014). On the other hand, fruits of *M. acroconica*, proved to be unjointed craspedia (Borges *et al.* Chapter 2). The type species of both *M.* ser. *Pachycarpae* and *M.* ser. *Setosae*, *M. foliolosa* var. *pachycarpa* and *M. setosa* var. *setosa*, respectively, are placed within clade E. *M. setosa* var. *setosa* appears nested in a subclade with two monophyletic accessions of *M. paludosa* and *M. foliolosa* var. *pachycarpa* in another containing morphologically dissimilar species both from the Southern Espinhaço Range and Chapada dos Veadeiros. Also, one of its subclades includes almost all humifuse species sampled (*M. chiliomera*, *M. humivagans* and *M. prorepens*), the remaing two occurring in clades B and F.

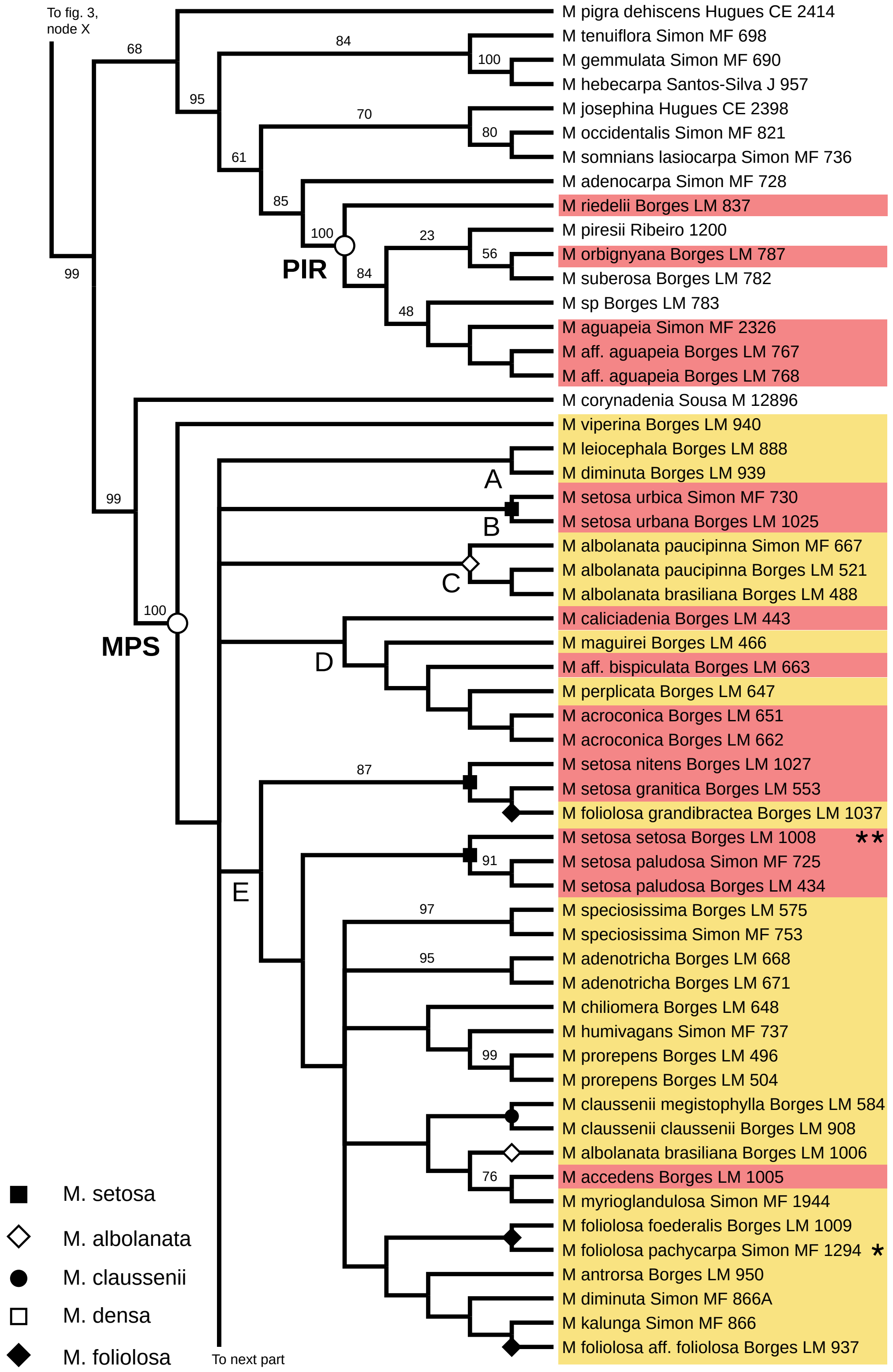

Figure 4. Strict-consensus of most parsimonious trees found croped at node X of figure 3. Names marked in yellow indicate taxa belonging to *Mimosa* ser. *Pachycarpae*, and names marked in red, taxa belonging to *Mimosa* ser. *Setosae*. *. type of *Mimosa* ser. *Pachycarpae*. **. type of *M.* ser. *Setosae*. Numbers above branches indicate bootstrap values. Numbers above nodes indicate bootstrap values above 50%.

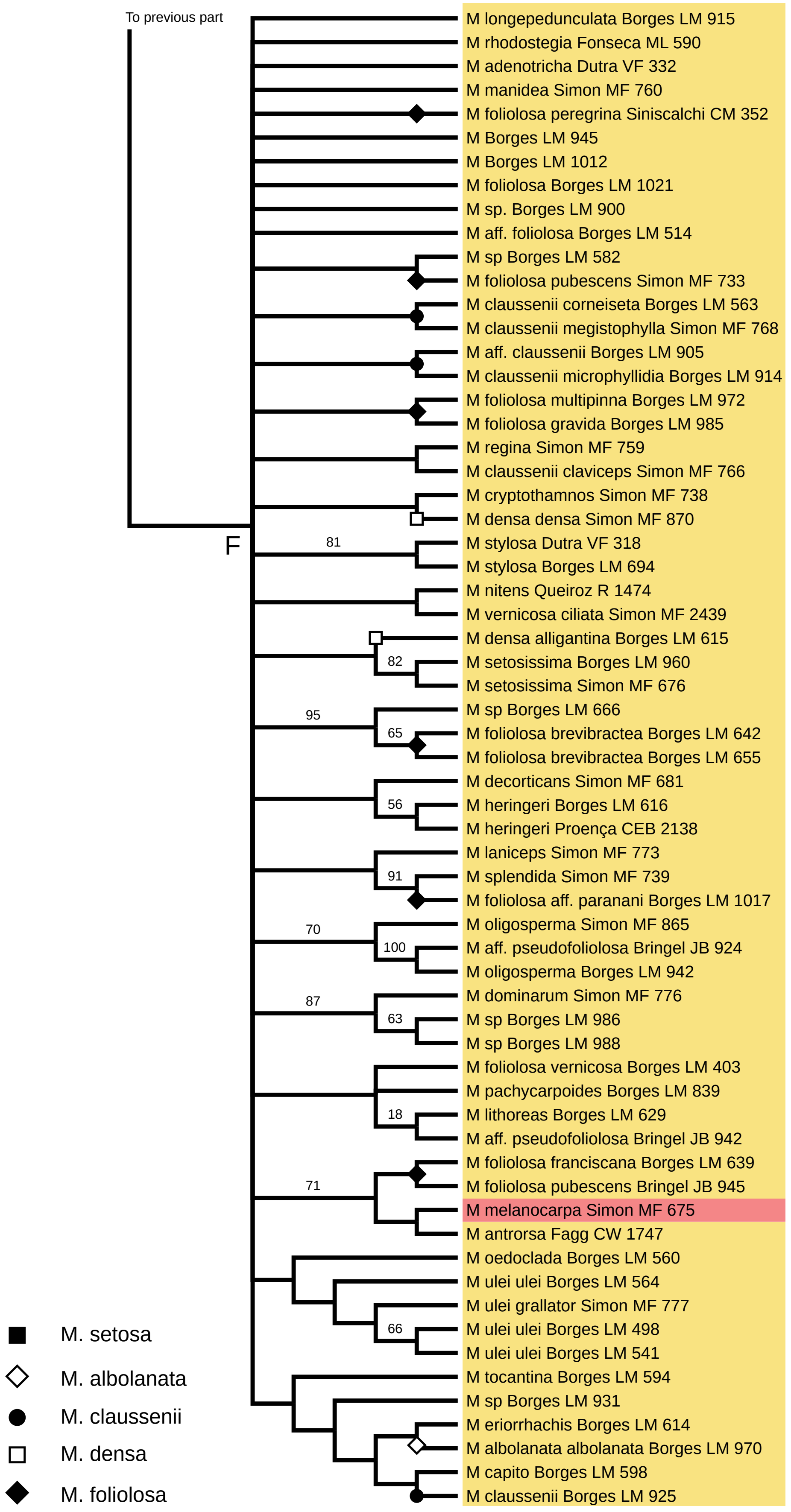

Figure 4. continued. Strict-consensus of most parsimonious trees found croped at node X of figure 3. Names marked in yellow indicate taxa belonging to *Mimosa* ser. *Pachycarpae*, and names marked in red, taxa belonging to *Mimosa* ser. *Setosae*. Numbers above nodes indicate bootstrap values above 50%.

Clade F, by its turn, comprises most of the species diversity of *M.* ser. *Pachycarpae* and only one species belonging to *M.* ser. *Setosae* (*M. melanocarpa*). As a consequence of its size, it is also the most morphologically diverse clade and contains shrubby or treelet species with or without congested leaves, exfoliating peridermis, developed suber, and inflorescences either exserted or nested in between the leaves. At the same time, internal relationships of the clade are poorly resolved and most taxa are placed on its basal polytomy, or in small clades with two or three taxa, those also arranged in the polytomy. Two subclades are better resolved, though. One includes *M. oedoclada*, *M. ulei* var. *grallator* and multiple accessions of *M. ulei* var. *ulei*. The other comprises prostrate shrubs, treelets and one rosette-like shrub with excerpt synflorescence.

In general, internal relationships of MPS indicate that species with infraspecific taxa (*e.g. Mimosa claussenii*, *M. foliolosa*, *M. setosa*) are not monophyletic (Fig. 4), but exceptions do exist (*M. ulei*; clade F, Fig 4). On the other hand, some clades are formed by different varieties of the same species, as exemplified by a group containing both *M. setosa nitens* and *M. setosa granitica* (clade E, Fig 4). Multiple accessions of a same species tend to group in highly supported clades, as is seen for *M. acroconica, M. heringeri*, *M. prorepens* and *M. speciosissima*. However, samples of *M. antrorsa* and of *M. diminuta* do not form monophyletic groups, and from the three accessions of *M. adenotricha*, only two nest together.

Morphological character states reconstruction

All characters sampled, if not plesiomorphic in relation to the MPS, are homoplastic within it. Two character states were inferred as unambiguous synapomorphies of the clade: presence of xylopodium (character 1:1, see Appendix 2) and filiform setae with bulbous base (7: 1), both showing multiple reversals within it (Fig. 5).

Aculei are nor present in most species of the MPS and absence of this character (15:0) is inferred as synapomorphic for the clade, with multiple reversals to presence in clades D, E and F (Fig. 5). For clade D, presence of aculei (15:1) is synapomorphic.

Character reconstruction indicates that the shrubby habit (2:0) is plesiomorphic for the MPS and that transitions for subshrubs and treelets happened multiple times (Fig. 6). Within clade E there were two or three changes from shrubs to subshrubs (2:1), depending on how the polytomies are resolved. Transitions to subshrubby habit are also observed in one taxon belonging to clade B (*Mimosa setosa* var. *urbana*) and another in clade F (*M. lithoreas*). Change from shrub to treelets (2:2) occurs multiple times both in clades D and F and is inferred as ambiguous for both due to polymorphic taxa and lack of resolution.

Prostrate (3:1) and humifuse (3:2) habits are inferred as apomorphic within the MPS, but are also homoplastic, appearing multiple times in different subgroups of clades C, E and F, as well as at the sister group to all the remaining species (Fig. 6).

Presence of developed suber (16:1) is a derivate condition that occurs in clade C, E and F (Fig. 6). For clade C, formed by two varieties of *Mimosa albolanata*, it is synapomorphic. On clade E, it is present in two distinct subclades, one also containing a sample of *M. albolanata* var. *albolanata* and varieties of *M. claussenii*, which typically have this character state. On clade F, it occurs spread through five subclades, but since all those are placed in the clade's polytomy, presence of developed suber could be a synapomorphy without posterior change for a clade including most pachycaul treelets and also some rosette-like shrubs.

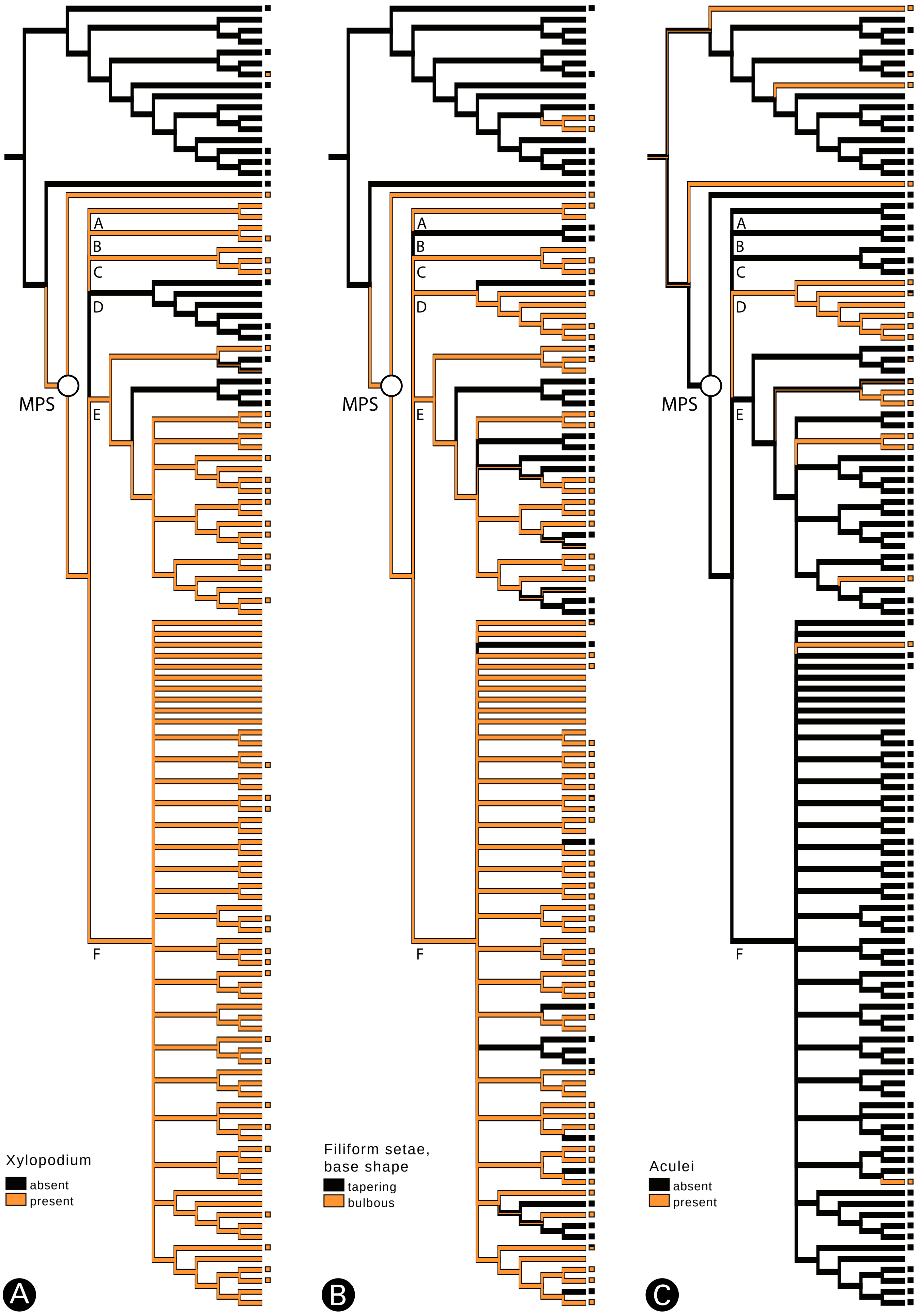

Figure 5. Selected morphological charactes optmized on the strict consensus tree. A. Xylopodium. B. Filiform setae, base shape. C. Aculei.

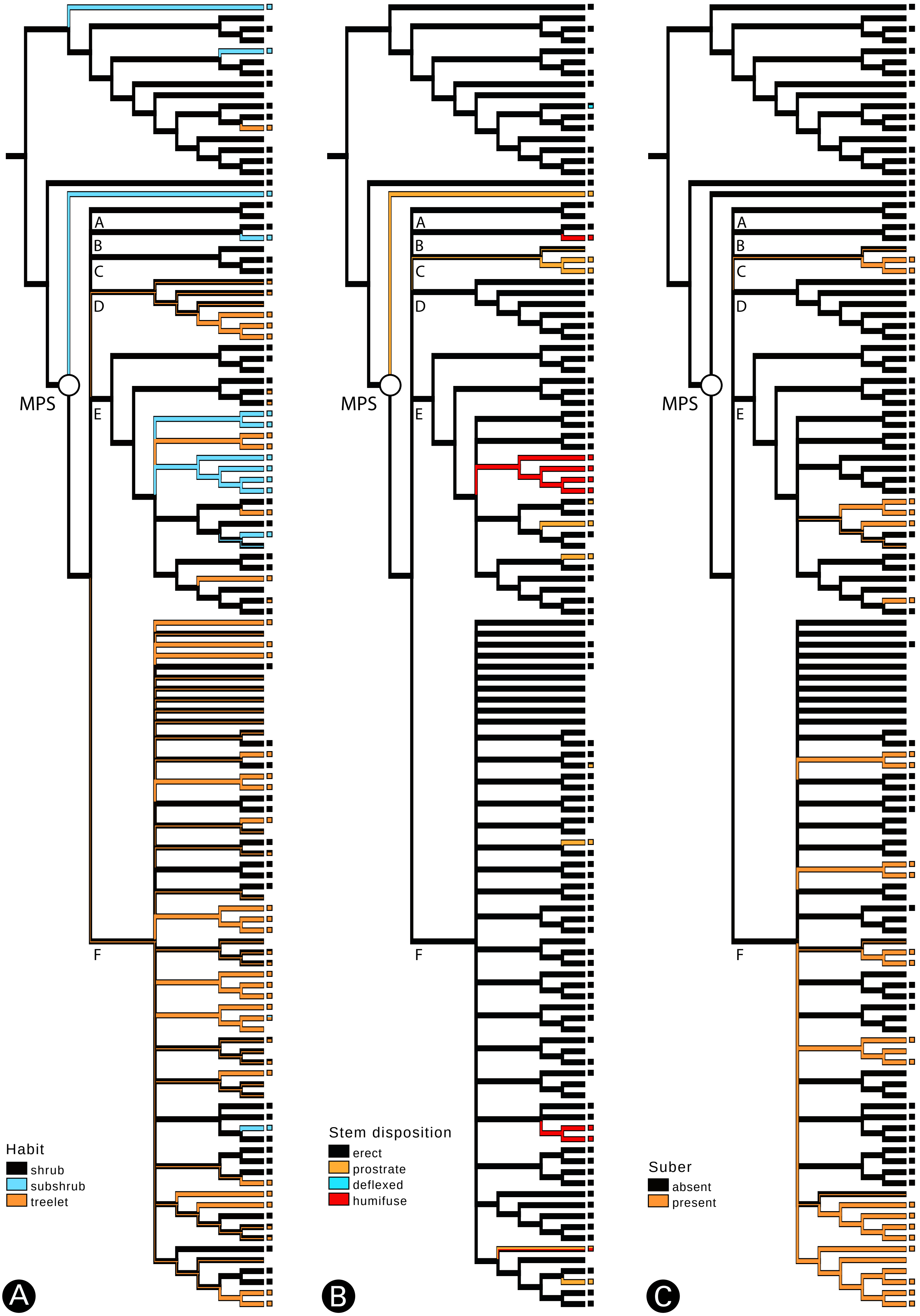

Figure 6. Selected morphological charactes optmized on the strict consensus tree. A. Habit. B. Developed suber. C. Peridermis exfoliation.

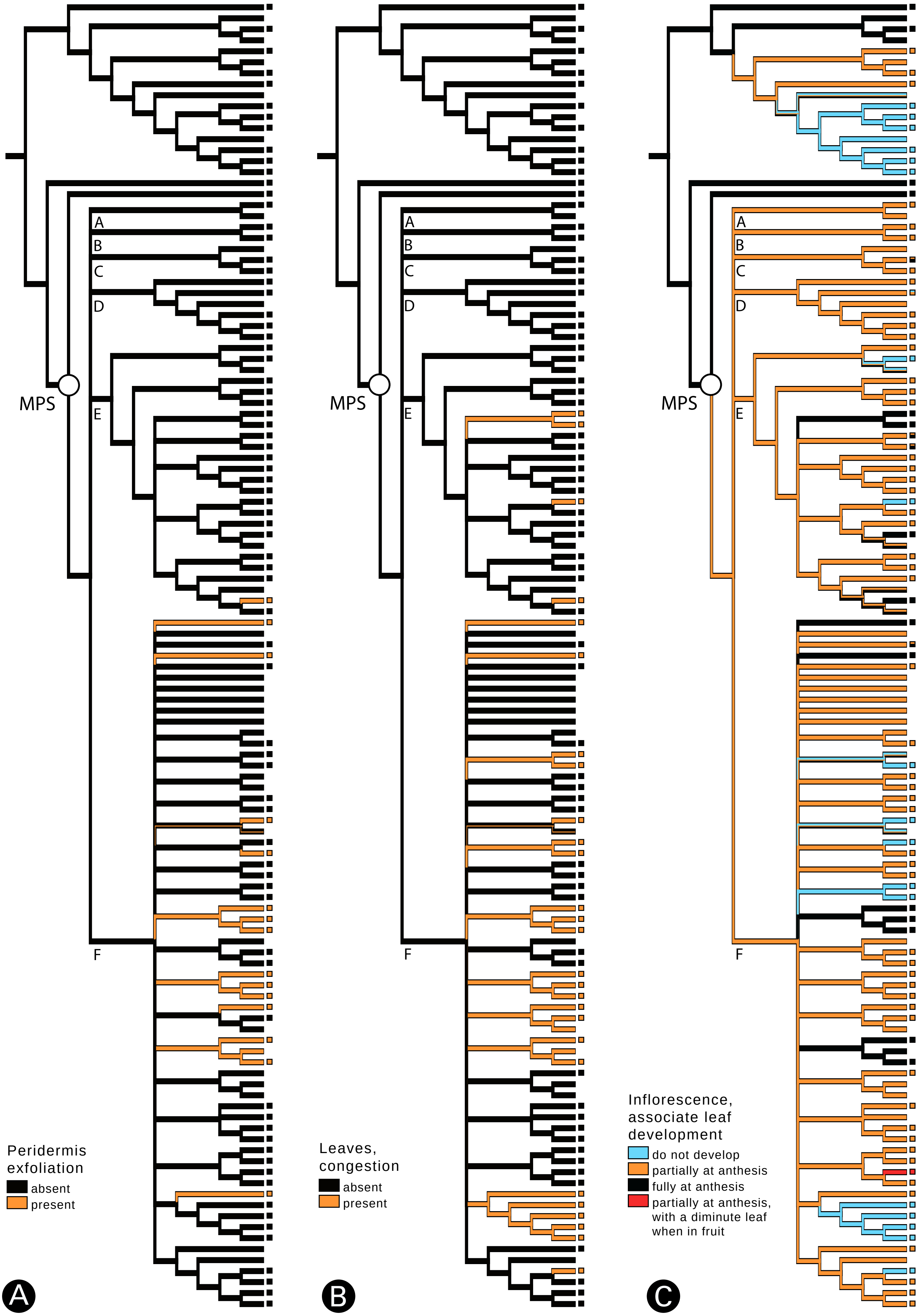

Figure 7. Selected morphological charactes optmized on the strict consensus tree. A. Leaves, congestion. B. Inflorescence, associate leaf development.

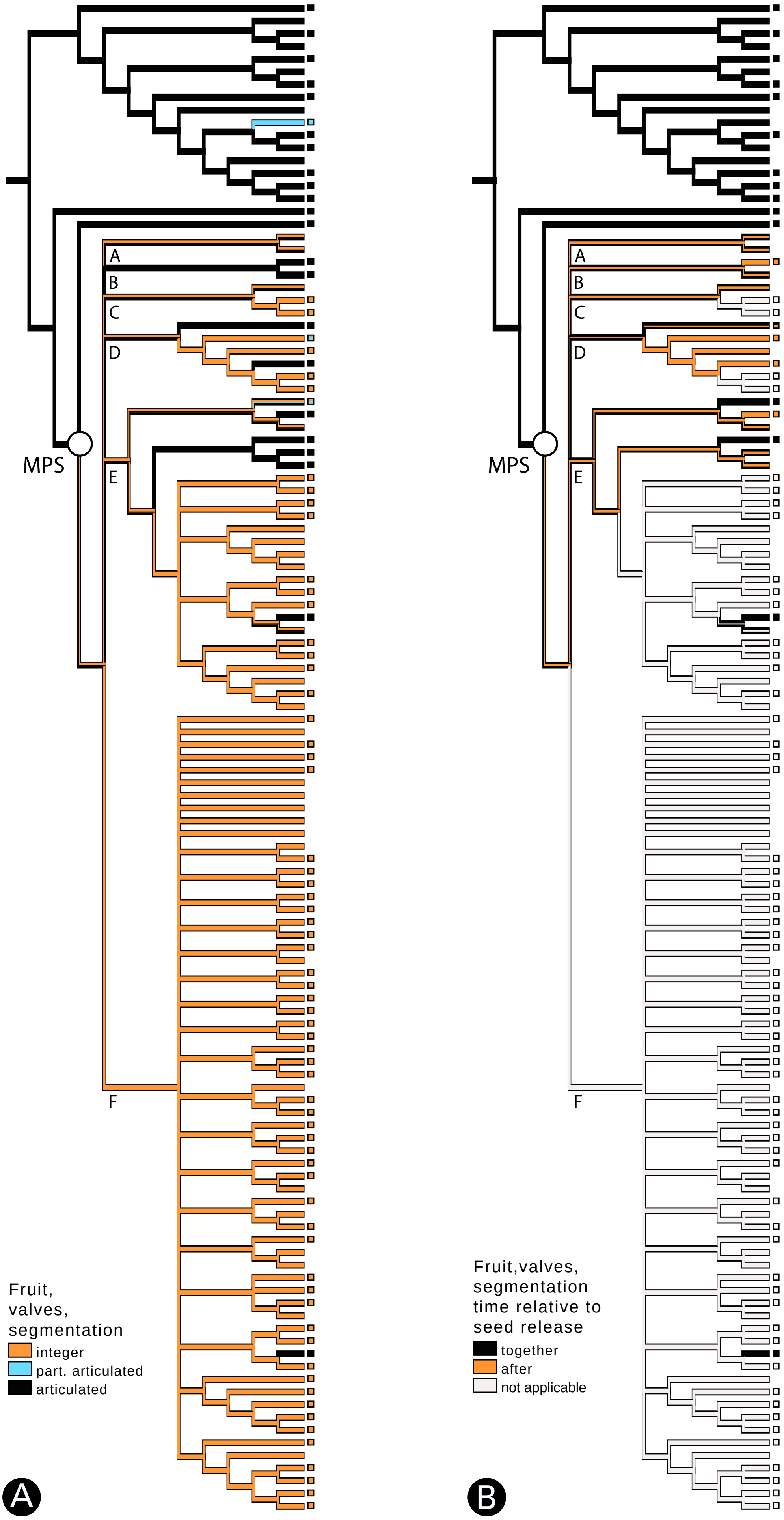

Figure 8. Selected morphological charactes optmized on the strict consensus tree. A. Fruit, valves, segmentation. B. Fruit, valves, segmentation time relative to seed release.

Peridermal exfoliation (18:1) occurs only in clade F and one species of clade E (Fig. 7). Besides the parallel evolution in those two groups, it could be also synapomorphy for a subclade of clade F, depending on the resolution of its polytomy, but with subsequent multiple reversals.

Presence of congested leaves is also a homoplastic character state, and has originated three times on clade E and multiple times on clade F (Fig. 7).

Full or almost complete expansion of leaves subtending inflorescences (43:2) is plesiomorphic to the MPS (Fig. 7). The charater state shifts to a heterochronic development of leaves, which are partially expanded during anthesis, becoming fully expanded together with fruit's maturation (43:1) on the clade comprising all taxa except the most basal branch (*Mimosa viperina*). Reversals to the plesiomorphic condition occurs different times in clades E and F. Also on those clades, independent transitions to absence of leaf development (43:0) are observed and one species of clade F is autapomorphic for delayed development of subtending leaves, which are still not expanded when fruits are mature (43:3).

Unjointed craspedium fruit type (60:0) is an apomorphic, but homoplastic character state that has reverted to typical craspedium, the plesiomorphic condition (60:2), multiple times within almost all clades where it is present within the MPS (Fig. 8). The partially articulated condition (60:2) is homoplastic and autapomorphic for two taxa, one in clade D, the other on clade E.

For taxa presenting craspedia, splitting of the valves together with seed release (60:0) is inferred as the plesiomorphic state for the MPS (Fig. 8), with subsequent changes to posterior separation between articles (60:1).

Discussion

Circumscription of the series

Our analysis reinforce findings (Bessega *et al.* 2008, Simon *et al.* 2011) that the current circumscription of *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* do not fit a clade based taxonomy (see Hennig, 1968). Hence, in order to reflect the hierarchies present in our results, both series must be fused as earlier indicated (Bessega *et al.* 2008). Since the types of both series (*M. foliolosa pachycarpa* and *M. setosa* var. *setosa*) are nested within the MPS, the earlier circumscription adopted by Bentham (1842, 1875, 1876), which included species from both series, may be reinstated with minor modifications related to segregation of some species belonging to *M.* ser. *Setosae* that are placed outside of the MPS (see below). That way, species conservatively described within *M.* ser. *Pachycarpae* (Borges *et al.* 2014, Simon *et al.* 2010) will have been correctly placed.

Another result in line with Simon *et al.* (2011) is the placement of *M. corynadenia* Britton & Rose as the sister group to the MPS. Although this makes *M.* ser. *Glandulosae* (Benth.) Barneby, to where *M. corynadenia* presently belongs, polyphyletic, it is in accordance with observations by Barneby (1991, p. 350), who noted morphological similarities between this particular species and *M. calycina* Barneby. Despite the reinforcement of this relationship we suggest that transfer of *M. corynadenia* to *M.* ser. *Pachycarpae* should wait for further corroboration, in particular by sampling of Brazilian populations of the species and even of other from Central America, like the one used by us, in order to confirm these results.

We stress that fruit morphology cannot be used to distinguish between *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae*, as already noted before (Simon *et al.* 2010) and contrary to Barneby's (1991) view. Independently of the resolution of the most basal polytomy of the MPS, multiple transitions between the craspedial and unjointed craspedial conditions would still be observed in the topology (Fig. 8), avoiding recognition of two groups based on this character. Definition of *M.* ser. *Pachycarpae* is difficult on the lack of the taxonomic significance of fruit morphology, used both by Bentham (1842, 1875) and Barneby (1991). Barneby (1991: 366) already commented on the problems to delimit the series due to its wide morphological variation, and the segregation of taxa with craspedial fruits to *M.* ser. *Setosae* done by him was probably an effort to minimize this problem. Even the two morphological synapomorphies that support the MPS (presence of xylopodium and filiform setae with bulbous base) are homoplastic and show multiple reversions inside the clade. Moreover, presence of xylopodium is not confirmed for most treelet species. Although this organ is not presence in some to those species (e.g. *M. decorticans*, see Borges *et al.* Chapter 2), other do present it at least during early developmental phases (Borges *et al.* Chapter 2). Diagnose of members of the MPS, hence, must be made on a one to one comparison with groups belonging to *M.* sect. *Habbasia* and some series of *M.* sect. *Batocaulon* (e.g. *M.* ser. *Glandulosae*) (see Barneby 1991). As a whole, however, taxon belonging to the MPS may be recognized by indumentum composed by simple trichomes, filiform and glandular setae, triangular stipules, infundibuliform flowers with setulose lobes, usually completely concealing their surface. Taxa bearing craspedia in general also have interpinnal projections and aculei, as well as some of the features just mentioned. The ones having unjointed craspedial, may be more readily placed in the series, since this feature is also present only in markedly distinct taxa within *Mimosa* that differeither number of stamens, or reduction on the pinnae pairs number and disposition of leaflets (e.g. *M. brachycarpa*, *M.* sect. *Mimosa* and *M.* ser. *Stipellares*; see Barneby 1991: 366).

All species from *Mimosa* ser. *Setosae* that do not belong to the MPS appear related to elements of *M.* ser. *Piresianae*, a group sampled for the first time and recovered as a strongly supported clade here. A distinction between those particular species and other members of *M.* ser. *Setosae*, based on characteristics of the indumentum and venation pattern, was already made by Barneby (1991), who, although noting this, did not perceive that those features are indeed shared with members of *M.* ser. *Piresianae*, probably due to the paucity of specimens of the later available at the time. Putative placement of *M.* ser. *Piresianae* was uncertain due to the morphological peculiarities of the group, and even though Barneby (1991, p. 486) postulated a relationship with *M.* ser. *Pachycarpae*, he at the same time refuted it based on the same fruit character used to set *M.* ser. *Setosae* apart of it. However, he was not able to establish a clear hypothesis of relationship of *M.* ser. *Piresianae* with other members of *Mimosa*. We show here that *M.* ser. *Piresianae* belongs to the grade amalgamating *M.* sect. *Batocaulon* and *M.* sect. *Habbasia* (Bessega *et al.* 2008, Simon *et al.* 2011) and that Barneby was right in using the presence of a craspedium as an evidence of lack of relationship to *M.* ser. *Pachycarpae*. Therefore, a new circumscription of ser. Piresianae should include three species previously placed in *M.* ser. *Setosae* (*M. aguapeia* Barneby, *M. orbigyniana* Benth., and *M. riedelii* Benth.), two of whom where previously treated in *M.* ser. *Pachycarpae* (Bentham 1846, 1875), in addition to the five species currently assigned to this series (Atahuachi & Hughes 2006, Barneby 1991, Silva & Secco 2000).

INFRASPECIFIC CLASSIFICATION

We have shown that the infraspecific classification adopted by Barneby (1991) for *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* is not reflected in the phylogeny obtained (Fig. 4). For instance, varieties of *M. foliolosa* are dispersed in many distinct clades, as well as the ones belonging to *M. setosa*, which appear in at least three distinct groups. The same pattern is seen for almost all polymorphic species of the MPS, such as *M. albolanata*, *M. claussenii* and *M.densa*, although in different degrees. Moreover, *M. foliolosa* is arranged in a complex hierarchy with subspecies subtending varieties (Barneby, 1991, p. 368), but this pattern is also not seen in our results, although there is a chance that improvements in the resolution may show that Barneby (1991) was at least partially right in his hierarchical scheme, even if not in rank choice.

Although monophyly has being used as a criterion for delimitation of species, it should not necessarily be applied at this level of the hierarchy (Hennig 1968). More over, it is very likely that multiple samples of widespread species will not cluster together in phylogenetic analysis if those are acting as diversification pumps via divergence in marginal populations (Knapp, 2011; see also discussion in Borges *et al.*, 2014 [Chapter 4.1]). Anyhow, paraphyly in those cases may be a good indicative that species hypothesis have not been strongly formulated, particularly if there are also other sources of evidence reinforcing that.

In the case of the MPS, most of its taxa are diagnosable by the presence of different character distributions (see Borges *et al*. Chapter 2, Chapter 3 and also Borges & Pirani Chapter 5 for a discussion on Barneby's species concept), despite have being treated by Barneby (1991) as subspecies or varieties. For instance, *Mimosa foliolosa* var. *brevibractea* shows different habit, as well as features on indumentum and flower when compared to other taxa recognized within *M. foliolosa* and in our analyses, multiple accessions of it cluster together, but are not related to other infraspecific taxa of the species. The same can be said about the varieties of *M. setosa* (see also Borges *et al*. chapter 3) and *M. claussenii*, although our sampling of varieties of the later is not as thorough as it would be necessary to shed more light on the knowledge about the species with the most intricate variation of forms within the MPS (chapter 2). On the other hand, varieties of *M. ulei*, which share similar, but not strictly the same habit, and are markedly distinct in some aspects (see chapter 2), form a monophyletic group (Fig. 4, clade F).

Similarly to results found with different methods for other taxa studied by Barneby (e.g. *Chamaecrista*; Conceição *et al.*, 2008) we have shown that even though the relationship between some taxa is not clear (*e.g. Mimosa foliolosa* varieties), the current infraspecific classification of Barneby (1991) for *M.* ser. *Pachycarpae* and *M.* ser. *Setosae* should be reviewed and recognition of taxa bellow species rank abandoned as much as possible.

Morphological evolution

As noted above and elsewhere (Barneby 1991), the high morphological diversity of the MPS make it hard to establish a clear definition for it. The widely occurrence of homoplasy within the clade, associated with the many polytomies of the tree and overall lack of support, also difficult the delimitation of inner groups and the understanding of morphological evolution, but some character's distribution patterns are noteworthy.

Particularly, the treelet habit type, although not exclusive or synapomorphic for clade F, is more common within it. Many taxa within this clade are scored as polymorphic for this character and although the treelet habit is prevalent in the individuals, some can also occur as shrubs. However, it is possible for the shrubby condition of those taxa to be induced by damage to the plants on early stages of the development, which promotes basal ramification. This case is very likely to be present on the fire prone environment where the plants are occur. If this is the case, treelet habit would be predominant in clade F and could become a synapomorphy for it, or for a larger group merging clades D and F, depending on how politomies are resolved.

Even if treelet habit is not restricted to clade F, peridermal exfoliation is almost confined to it, occurring outside of the group only once, in clade E (*Mimosa kalunga*). Moreover, this character is directly associated with treelets and occurs only in species showing this habit type. Also, *M. kalunga*, which was described as a small shrub, may also occur as treelets in particular areas (L.M. Borges and M.F. Simon, pers. obs.). Another association between habit type and other characters is seen in subshrubs, which are in general humifuse (e.g. *M. prorepens*) and the concomitant occurrence of developed suber in prostrate shrubs (e.g. *M. tocantina*). This indicates that may exist a developmental link between some character states and that expression of a few of them is hierarchically conditioned.

Due to ambiguity at the base of the clade to which we have compiled morphological data it is not possible to infer if absence of aculei is synapomorphic for the MPS, or if it is just the maintenance of a plesiomorphy. Whichever the case, it is interesting to note that most armate species also do not possess xylopodia, particularly taxa belonging to clade D and some of the aculeate species of clade F. Moreover, the majority of those taxa occur in soils with higher levels of humidity, near streams, specially the ones belonging to clade D (e.g. *Mimosa setosa* var. *paludosa* and *M. acroconica*). It may be that absence of xylopodium and presence of aculei is related to evolution in those particular kinds of environments.

On the other hand, presence of congested leaves may not be directly associated with other characters and occurs homoplasticaly both in shrubby or treelet species, although it is not present in subshrubby taxa. Within the context of clade F, it is possible for it to be a synapomorphic character depending on the resolution of the group's politomy. Congestion of leaves is commonly observed in other taxa (e.g. Compositae Lychnophorinae; Velloziaceae) also occurring in *cerrado* or *campos rupestres* and may be related to evolution in those phytophysiognomies as earlier suggested for the MPS (Simon *et al.* 2009, 2012).

Heterochronic development of leaves subtending inflorescences, the most common condition in the MPS, promotes exserption of the synflorescence axes above the foliage and may facilitate pollination. However, reversals to the fully expanded leaves condition are observed in derivate groups and, in particular cases when leaves are also long, the racemes may be completely nested and concealed amongst them (e.g. *M. pycnocoma* [not sampled] and some individuals of *M. kalunga*). This is somewhat contra sensual in respect to promotion of availability of flowers to pollinators. A detailed study of those species is needed to investigate if changes in inflorescences exhibition also influence reproductive success.

The equivocal reconstruction of the ancestral state related to fruit's valves segmentation do not allow us to understand if unjointed craspedium is a synapomorphy with posterior reversions or if its presence in different clades reflect independent acquisitions. Uncertainty about the reconstruction of the time of splitting of valves also difficult interpretation of the evolution of this character, but the pattern observed on Clade D indicates that craspedium with late breakage of valves may be intermediate step in a transition from craspedium to unjointed craspedium.

Xylopodium and diversification

The MPS presents a number of characteristics that permit us to infer that it was subject to an explosive radiation. Amongst those is the fact that it is a monophyletic group with a high number of taxa recently originated by an increase in the rate of species diversification (see introduction and Barneby 1991, Koenen *et al.* 2013; Simon *et al.*, 2009). Such radiations are usually associated with the presence of a key innovation, a feature that either decreases extinction or increases speciation rates for a group(Crepet & Niklas 2009, Simpson 1953). According to (Bond & Opell 1998), in order to be considered a key innovation, a feature must present four characteristics: be a synapomorphy; have functional advantage; increase the diversification rate of the group; and promote a change on the group's occupation area.

We have shown that the MPS presents two morphological synapomorphies: presence of xylopodium and filiform setae with bulbous base (see above). Of those, the xylopodium is the only one that can be seen as conferring a functional advantage to the plants, since it may be a water storage organ, important in the usually hydric stressful Cerrado Biome, as well as a promotor of resprout after damage to the aerial parts, usually by fire (Rizzini & Heringer 1962). It is important to stress, though, that up to now there are no comprehensive studies on the morphology and ontogeny of this organ for *Mimosa*, as there are for other groups of plants (Appezzato-da-glória *et al.* 2000, Appezzato-da-Glória *et al.* 2008, Hayashi & Appezzato-da-glória 2007). Hence, this term is here applied in a broad sense. Nonetheless, the lack of this character in taxa associated with humid environments (see previous section) is maybe related to its water storing capacities and to lower occurrence or intensity of fire on those sites. Presence of the xylopodium may also be associated to the incursion of the MPS clade into the Cerrado Domain, as evidenced by Simon *et al.* (2009).

Hence, the xylopodium meets all criteria necessary to be considered a key innovation. A similar condition is observed for *Chamaecrista* ser. *Coriaceae*, a recently diversified group with the same organ as one of its synapomorphies, restricted to *campo rupestre* and *cerrado* areas and with similar dating estimates (Rando *et al.*, unpublished data).

Even though the xylopodium can a key innovation that promoted establishment of the MPS lineage in the Cerrado Domain, it does not explain the morphological diversity observed in the MPS. This diversity, however, is not expressed by the existence of multiple different morphological character states, but by different combinations of the same features in distinct taxa. This is stressed by the high level of homoplasy observed in the character states reconstruction analysis. Those two conditions are expected to occur in groups that were, or are, subjected to developmental recombination of phenotypes (West-Eberhard 2005).

In developmental recombination, particular phenotypes are originated by changes in developmental pathways of preexisting features, either by changes in alleles frequencies or by activation of deactivation of developmental switches. This process does not require does not requires mutation, but only shifts in the frequencies of preexisting alleles linked to developmental pathways or different gene-expressions (West-Eberhard 2003), which can be induced by the heterogeneous environment where they occur. This is expected and at the same time explains how so many taxa can be originated in a relative small amount of time and how a signature of intense morphological evolution is not present in the DNA fragments used in our study (Fig. 3).

Also, particular morphological features such as exhibition of the inflorescences are directly associated with developmental processes. Species showing exserted synflorescences (e.g. *M. decorticans*) achieve that condition by a temporary suppression on the development of the leaf associated to each raceme that do not occurs in species with inflorescences nested in the foliage (e.g. *M. kalunga*). The extreme of this condition is observed in species such as *M. regina*, which completely lacks expansion of leaves on synflorescence axes.

Moreover, the unjointed craspedium can be clearly seen as the end product of a modification in the latter stages of a developmental pathway that culminates in fully articulation of the valves.

CONCLUDING REMARKS

Although our results have shown that Barneby's infraspecific classification should be updated, the placement of most of his polytypic species in the most morphologically variable group of the MPS (clade F) indicates that he had a glimpse on the recombinatory pattern present in the group and how it makes difficult to establish a clear distinction between species. Even more when, in the context of phenotipic recombination, morphological differences may appear before reproductive isolation (West-Eberhard 2005), a condition tentatively taken in account by Barneby (1991) during rank selection (see Borges *et al.* Chapter 5).

Even though there is still uncertainty on tree topology obtained by our analysis due to low support of branches, it is already possible to infer that diversification of *Mimosa* ser. *Pachycarpae* may be linked to two different biological processes. At first, a key innovation allows establishment of a lineage on a new environment, which, by its turn, promotes selection of a developmentally plastic group. In order to corroborate those ideas, development of further studies with *M.* ser. *Pachycarpae* are necessary. An integrative approach merging different aspects of biological science may allow us to frame a more comprehensive picture of the evolution of one of the most diverse plant clades of the Cerrado Domain.

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Appendix 1. List of taxa, vouchers, infrageneric group and characters partitions sampled. * samples merged in a single entry

taxon + voucher info	Infrageneric	morphology	trnD-T	trnL-F	matK	ITS
M. adenotricha Borges LM 668	ser. Pachycarpae	+	+	+	+	+
M. adenotricha Borges LM 671	ser. Pachycarpae	+	+	+	+	-
M. adenotricha Dutra VF 332	ser. Pachycarpae	+	+	+	-	+
M. a! . bispiculata Borges LM 663	ser. Pachycarpae	-	+	+	+	+
M. a! . foliolosa Borges LM 514	ser. Pachycarpae	-	+	+	-	-
M. a! . pseudofoliolosa Bringel JB 924	ser. Pachycarpae	-	+	+	+	+
M. albolanata albolanata Borges LM 970	ser. Pachycarpae	+	+	+	+	+
M. albolanata Borges LM 1006	ser. Pachycarpae	+	+	+	+	+
M. albolanata brasiliana Borges LM 488	ser. Pachycarpae	+	+	-	+	-
M. albolanata paucipinna Borges LM 521	ser. Pachycarpae	+	+	+	-	+
M. albolanata paucipinna Simon MF 667	ser. Pachycarpae	-	+	-	-	-
M. antrorsa Borges LM 950	ser. Pachycarpae	+	+	+	+	+
M. antrorsa Fagg CW 1747	ser. Pachycarpae	+	+	+	+	+
M. capito Borges LM 598	ser. Pachycarpae	+	+	+	+	+
M. chiliomera Borges LM 648	ser. Pachycarpae	+	+	+	+	+
M. claussenii Borges LM 908	ser. Pachycarpae	+	+	+	+	+
M. claussenii Borges LM 925	ser. Pachycarpae	+	+	+	+	+
M. claussenii claviceps Simon MF 766	ser. Pachycarpae	-	+	+	+	+
M. claussenii corneiseta Borges LM 563	ser. Pachycarpae	+	+	+	+	+
M. claussenii megistophylla Borges LM 584	ser. Pachycarpae	+	+	+	+	+
M. claussenii megistophylla Simon MF 768	ser. Pachycarpae	+	+	+	+	+
M. claussenii microphyllidia Borges LM 905	ser. Pachycarpae	+	+	+	+	+
M. claussenii microphyllidia Borges LM 914	ser. Pachycarpae	+	+	+	+	+
M. cryptothamnos Simon MF 738	ser. Pachycarpae	+	+	+	+	+
M. decorticans Simon MF 681	ser. Pachycarpae	+	+	+	+	-
M. densa alligantina Borges LM 615	ser. Pachycarpae	+	+	+	+	+
M. densa densa Simon MF 870	ser. Pachycarpae	+	+	+	+	+
M. diminuta Borges LM 939	ser. Pachycarpae	-	+	+	+	+
M. diminuta Simon MF 866A	ser. Pachycarpae	-	+	+	+	-
M. dominarum Simon MF 776	ser. Pachycarpae	+	+	+	+	+
M. eriorrhachis Borges LM 614	ser. Pachycarpae	+	+	+	+	+
M. foliolosa a! . paranani Borges LM 1017	ser. Pachycarpae	-	+	-	-	-
M. foliolosa a! . foliolosa Borges LM 937	ser. Pachycarpae	+	+	+	+	-
M. foliolosa Borges LM 1021	ser. Pachycarpae	-	+	+	+	-
M. foliolosa brevibractea Borges LM 642	ser. Pachycarpae	+	+	+	+	+
M. foliolosa brevibractea Borges LM 655	ser. Pachycarpae	+	+	+	+	-
M. foliolosa cf. gravida Borges LM 985	ser. Pachycarpae	+	+	+	+	+
M. foliolosa foederalis Borges LM 1009	ser. Pachycarpae	+	+	-	+	+
M. foliolosa franciscana Borges LM 639	ser. Pachycarpae	+	+	-	+	+
M. foliolosa grandibractea Borges LM 1037	ser. Pachycarpae	-	+	+	+	-
M. foliolosa multipinna Borges LM 972	ser. Pachycarpae	+	+	+	+	+
M. foliolosa pachycarpa Simon MF 1294	ser. Pachycarpae	+	+	-	-	-
M. foliolosa peregrina Siniscalchi CM. 352	ser. Pachycarpae	+	+	-	+	+
M. foliolosa pubescens Bringel JB 945	ser. Pachycarpae	+	+	-	-	+
M. foliolosa pubescens Simon MF 733	ser. Pachycarpae	+	+	+	+	+
M. foliolosa vernicosa Borges LM 403	ser. Pachycarpae	+	+	+	+	-
M. heringeri Borges LM 616	ser. Pachycarpae	+	+	+	+	+
M. heringeri ProenÃ§a CEB 2138	ser. Pachycarpae	+	+	+	+	+
M. humivagans Simon MF 737	ser. Pachycarpae	+	+	+	+	+
M. kalunga Simon MF 866	ser. Pachycarpae	+	+	+	+	+
M. laniceps Simon MF 773	ser. Pachycarpae	+	+	+	+	+
M. leiocephala Borges LM 888	ser. Pachycarpae	+	+	+	+	+
M. lithoreas Borges LM 629	ser. Pachycarpae	+	+	+	+	+
M. longepedunculata Borges LM 915	ser. Pachycarpae	+	+	+	+	+

taxon + voucher info	Infrageneric	morphology	trnD-T	trnL-F	matK	ITS
M. maguirei Borges LM 466	ser. Pachycarpae	+	+	+	+	+
M. manidea Simon MF 760	ser. Pachycarpae	+	+	+	+	+
M. myrioglandulosa Simon MF 1944	ser. Pachycarpae	-	+	-	-	-
M. nitens Queiroz R 1474	ser. Pachycarpae	+	+	+	+	-
M. oedoclada Borges LM 560	ser. Pachycarpae	+	+	+	+	-
M. oligosperma Borges LM 942	ser. Pachycarpae	+	+	+	+	-
M. oligosperma Simon MF 865	ser. Pachycarpae	+	+	+	-	+
M. pachycarpoides Borges LM 839	ser. Pachycarpae	+	+	-	-	-
M. perplicata Borges LM 647	ser. Pachycarpae	+	+	+	+	+
M. prorepens Borges LM 496	ser. Pachycarpae	+	+	+	+	-
M. prorepens Borges LM 504	ser. Pachycarpae	+	+	-	+	-
M. pseudofoliolosa a! . Bringel JB 942	ser. Pachycarpae	+	+	+	+	+
M. regina Simon MF 759	ser. Pachycarpae	+	+	+	+	+
M. rhodostegia Fonseca ML 590	ser. Pachycarpae	-	+	-	-	+
M. setosissima Borges LM 960	ser. Pachycarpae	+	+	+	+	+
M. setosissima Simon MF 676	ser. Pachycarpae	+	+	+	+	+
M. speciosissima Borges LM 575	ser. Pachycarpae	+	+	+	+	+
M. speciosissima Simon MF 753	ser. Pachycarpae	+	+	+	+	+
M. splendida Simon MF 739	ser. Pachycarpae	+	+	+	+	+
M. stylosa Borges LM 694	ser. Pachycarpae	+	+	+	+	+
M. stylosa Dutra VF 318	ser. Pachycarpae	+	+	+	+	+
M. tocantina Borges LM 594	ser. Pachycarpae	+	-	+	+	+
M. ulei grallator Simon MF 777	ser. Pachycarpae	+	+	+	+	+
M. ulei ulei Borges LM 498	ser. Pachycarpae	+	+	+	+	+
M. ulei ulei Borges LM 541	ser. Pachycarpae	+	+	+	+	-
M. ulei ulei Borges LM 564	ser. Pachycarpae	+	+	+	+	+
M. vernicosa ciliata Simon MF 2439	ser. Pachycarpae	+	+	-	-	-
M. viperina Borges LM 940	ser. Pachycarpae	+	+	+	+	+
M. sp Borges LM 582	ser. Pachycarpae	-	+	+	+	+
M. sp Borges LM 666	ser. Pachycarpae	-	+	-	-	-
M. sp Borges LM 783	ser. Pachycarpae	-	+	-	-	+
M. sp Borges LM 931	ser. Pachycarpae	-	+	+	+	+
M. sp Borges LM 986	ser. Pachycarpae	-	+	+	-	+
M. sp Borges LM 988	ser. Pachycarpae	-	+	+	+	+
M. sp Borges LM 1012	ser. Pachycarpae	-	+	-	+	+
M. sp Borges LM 900	ser. Pachycarpae	-	+	-	+	-
M. sp Borges LM 945	ser. Pachycarpae	-	+	-	+	+
M. accedens Borges LM 1005	ser. Setosae	-	+	+	+	+
M. acroconica Borges LM 651	ser. Setosae	+	+	+	+	+
M. acroconica Borges LM 662	ser. Setosae	+	+	+	+	+
M. aguapeia Borges LM 767	ser. Setosae	+	+	+	+	+
M. aguapeia Borges LM 768	ser. Setosae	+	-	+	+	+
M. aguapeia Simon MF 2326	ser. Setosae	+	+	-	-	-
M. caliciadenia Borges LM 443	ser. Setosae	+	+	+	+	+
M. melanocarpa Simon MF 675	ser. Setosae	+	+	+	+	+
M. orbignyana Borges LM 787	ser. Setosae	+	+	+	+	+
M. riedelii Borges LM 837	ser. Setosae	-	+	-	+	+
M. setosa granitica Borges LM 553	ser. Setosae	+	+	+	+	+
M. setosa nitens Borges LM 1027	ser. Setosae	+	+	+	+	+
M. setosa paludosa Borges LM 434	ser. Setosae	+	+	-	+	-
M. setosa paludosa Simon MF 725	ser. Setosae	+	+	+	+	+
M. setosa setosa Borges LM 1008	ser. Setosae	+	+	-	-	+
M. setosa urbana Borges LM 1025	ser. Setosae	+	+	+	+	-
M. setosa urbica Simon MF 730	ser. Setosae	+	+	+	+	+
M. delicatula Sutherland JM. 262		-	+	+	+	+
M. latispinosa Sutherland JM. 206		-	+	+	+	+

taxon + voucher info	Infrageneric	morphology	trnD-T	trnL-F	matK	ITS
M. menabeensis menabeensis Southerland JM. 209		-	+	-	-	+
M. aurivillus aurivillus Dutra VF 348	sect. Calothamnos	-	+	+	+	+
M. pilulifera pseudoincana Simon MF 878	sect. Calothamnos	-	+	+	+	+
M. montana montana Hugues CE 2225	ser. Andinae	-	+	-	-	-
M. montana sandemanii Eastwood RJ 125	ser. Andinae	-	+	-	-	+
M. weberbaueri Hugues CE 2043	ser. Andinae	-	+	-	-	-
M. bimucronata Simon MF 301	ser. Bimucronatae	-	+	+	+	+
M. pseudosepiaria Simon MF 712	ser. Bimucronatae	-	+	+	+	+
M. somnians lasiocarpa Simon MF 736	ser. Bipinnatae	+	+	+	+	-
M. boliviana Hugues CE 2426	ser. Bolivianae	-	+	+	+	+
M. depauperata Simon MF 801	ser. Boreales	-	+	-	-	+
M. texana filipes Simon MF 845	ser. Boreales	-	+	-	-	+
M. cordistipula Simon MF 693	ser. Cordistipulae	-	+	+	+	+
M. minarum Nascimento JG 550	ser. Cordistipulae	-	+	+	+	+
M. discobola Simon MF 744	ser. Discobolae	-	+	+	+	+
M. benthamii Simon MF 848	ser. Distachyae	-	+	+	+	+
M. palmeri Simon MF 823	ser. Distachyae	-	+	-	-	+
M. echinocaula Simon MF 679	ser. Echinocaulae	-	+	+	+	+
M. adenocarpa Simon MF 728	ser. Glandulosae	+	+	+	+	-
M. corynadenia Sousa M. 12896	ser. Glandulosae	+	+	-	-	+
M. pigra dehiscens Hugues CE 2414	ser. Habbasia	+	+	+	+	+
M. goldmanii AMB 921	ser. Lactifluae	-	+	-	+	+
M. acutistipula Simon MF 705	ser. Leiocarpae	-	+	+	+	+
M. arenosa leiocarpa Martínez-Bernal A 923	ser. Leiocarpae	-	+	+	+	+
M. gemmulata Simon MF 690	ser. Leiocarpae	+	+	+	+	+
M. hebecarpa Santos-Silva J 957	ser. Leiocarpae	-	+	+	+	+
M. tenuiflora Simon MF 698	ser. Leiocarpae	-	+	+	+	+
M. ursina Simon MF 704	ser. Modestae	-	+	+	+	+
M. myriadenia punctulata Acevedo-Rodriguez P 7483	ser. Myriadeniae	-	+	+	+	+
M. callidryas Cruz JM. 94	ser. Myriophyllae	-	+	-	-	+
M. occidentalis Simon MF 821	ser. Neptunioides	-	+	+	+	+
M. diplotricha diplotricha Simon MF 600	ser. Paucifoliatae	-	+	+	+	+
M. gracilis invisiformis Simon MF 762	ser. Paucifoliatae	-	+	+	+	+
M. piresii Ribeiro 1200	ser. Piresianae	+	+	+	+	+
M. suberosa Borges LM 782	ser. Piresianae	+	+	+	+	+
M. invisa invisa Simon MF 715	ser. Plurijugae	-	+	+	+	+
M. candollei Hugues CE 2394	ser. Quadrivalves	-	+	+	+	+
M. josephina Hugues CE 2398	ser. Rojasianae	+	+	+	+	+
M. dolens dolens Dutra VF 352	subser. Dolentes	-	+	+	+	+
M. dutrae Dahmer N 5	subser. Dutranae	-	+	-	+	+
M. vestita Simon MF 769	subser. Hirsutae	-	+	+	+	+
M. coniflora Ribas OS 3060	subser. Microcarpae	-	+	-	-	+
M. sensitiva sensitiva Almeida D 4	subser. Mimosa	-	+	-	-	-
M. velloziana velloziana Simon MF 721	subser. Mimosa	-	+	+	+	+
M. flagellaris Queiroz LP 12545	subser. Pedunculosae	-	+	-	-	+
M. adamantina adamantina Dutra VF 459	subser. Pogocephalae	-	+	-	-	+
M. polycarpa subandina Hugues CE 2462	subser. Polycarpae	-	+	+	+	+
M. radula imbricata Simon MF 731	subser. Polycephalae	-	+	+	+	+
M. verecunda Simon MF 749	subser. Pudicae	-	+	+	+	+
M. xanthocentra subsericea Hugues CE 2403	subser. Pudicae	-	+	+	+	+
M. orthacantha Barros JC SN	subser. Ramosissimae	-	+	-	-	+
M. fachinalensis Dahmer N 16 *	subser. Reptantes	-	+	-	+	-
M. fachinalensis Dahmer N 20 *	subser. Reptantes	-	+	-	-	+
Piptadenia viridiflora Hugues CE 1681	outgroup	-	+	+	+	+
Stryphnodendron adstringens Scalon VR 260	outgroup	-	+	-	+	+
Anadenanthera colubrina Hugues CE 2308	root	-	+	+	+	+

Appendix 2. List of morphological characters and states scored for *Mimosa* ser. *Pachycarpae*, *M.* ser. *Setosae* and closely related taxa.

1. xylopodium
0 absent
1 present
2. habit
0 shrub
1 subshrub
2 treelet
3. stem, disposition
0 erect
1 prostrate
2 deflexed
3 humifuse
4. Branching system
0 regular
1 fasciculate
2 dicotomic
3 wandlike
5. trichomes
0 absent
1 present
6. filiform setae
0 absent
1 present
7. filiform setae, base, shape
0 tapering
1 bulbous
8. filiform setae, base, calcar
0 absent
1 present
9. filiform setae, base, fusion
0 absent
1 present
10. filiform setae, ornamentation
0 absent
1 projections
11. filiform setae, color
0 ocraceous
1 whitish to grey
2 orange-red
12. glandular setae
0 absent
1 present
13. glandular setae, shape
0 clavate
1 capitate
14. glandular setae, stipe
0 stipitate
1 sessile
15. prickles
0 absent
1 present
16. branch, greyish cork
0 absent
1 present
17. branch, peridermis, wax
0 absent
1 present
18. branch, periderm, peeling
0 absent
1 present
19. branch, prickles
0 absent
1 patent (or slightly inclined)
2 antrorse
3 retrorse
20. branch, trichomes
0 absent
1 present
21. branch, filiform setae
0 absent
1 present
22. branch, filiform setae orientation
0 patent
1 incurved
2 forwardly appressed
3 retrorse
4 antrorse (but not appressed)
5 inclined
23. branch, glandular setae
0 absent
1 present
2 clavate
3 capitate
24. leaves, congestion
0 absent
1 present
25. leaves, indumentum, distribution along primary axis
0 homogeneously distributed
1 concentrated on pulvinoles
26. leaves, stipules, shape
0 lanceolate/triangular
1 linear
2 ovate-lanceolate
3 ovate
4 broadly-ovate-acuminate
6 triangular
7 broadly triangular
27. leaves, stipules, base, fusion
0 absent
1 present
28. leaves, stipules, dimorphism
0 absent
1 present
29. leaves, dimorphic stipules shape
0 lanceolate/triangular
1 linear
2 ovate-lanceolate
3 ovate
4 broadly-ovate-acuminate
6 triangular
7 broadly triangular
30. leaves, stipules, persitency
0 caducous
1 persistent
31. leaves, petiole, stipels
0 absent
1 present
32. leaves, rachis, interpinnal projection
0 absent
1 present
2 spiculate
3 laminar
4 glandular
33. leaves, rachis, prickles
0 absent
1 present
34. leaves, rachis, filiform setae
0 absent
1 present
35. leaves, rachis, glandular setae
0 absent
1 present
36. leaves, rachilla, paraphyllidia
0 absent
1 present
37. leaves, rachilla, filiform setae
0 absent
1 present
38. leaves, rachilla, glandular setae
0 absent
1 present
39. leaves, leaflets, overall shape
0 oblong
1 elliptic
2 oblong-falcate
3 ovate
4 lanceolate
5 linear
40. leaves, leaflets, secondadry veins promination in relation to primary veins
0 not or less prominent
1 equally prominent

41. leaves, leaflets, margin, glandular setae
0 absent
1 present
42. inflorescence, exhibition
0 excerpt from foliage
1 nested in the foliage
43. inflorescence, associated leaf, development
0 do not develop
1 partially at anthesis, fully when in fruit
2 fully or almost so at anthesis
3 partially at anthesis, with a diminute leaf when in fruit
44. inflorescence, secondary arrangement
0 absent
1 frondose paniculate
2 bracteose paniculate
45. floral bract, filiform setae
0 absent
1 present
46. floral bract, glandular setae
0 absent
1 present
47. flower, calyx, shape
0 cupulate
1 campanulate
2 shallowly cupulate
3 tubular
48. flower, calyx, lobes
0 absent
1 fringed
2 very shallowly triangular
3 ovate
4 triangular
5 present
49. flower, calyx, pedicel, filiform setae
0 absent
1 present
50. flower, calyx, rim, filiform setae
0 absent
1 present
51. flower, calyx, lobes, plane setae
0 absent
1 present
3 ovate
52. flower, calyx, plane setae, fusion
0 absent
1 present
53. flower, calyx, plane setae, location
0 troughout rim
1 present just in half or less of rim
54. flower, calyx, rim, glandular setae
0 absent
1 present
55. flower, corolla, shape
0 infundibuliform
1 campanulate
2 narrowly infundibuliform
56. flower, corolla, lobes, trichomes
0 absent
1 present
57. flower, corolla, lobes, filiform setae
0 absent
1 present
58. flower, corolla, lobes, glandular setae
0 absent
1 present
59. flower, corolla, lobes, indument coverage
0 do not conceals surface
1 conceals suface
60. fruit, valves, segmentation
0 integer
1 partially articulated
2 completely articulated
61. fruit, articles, time of separation relative to dehiscence of valves and liberation of seeds
0 together
1 after
62. fruit, stipe, relative lenght to width
0 less then 4x
1 5x or more
63. fruit, shape
0 oblong
1 rounded
2 narrowly oblong
3 elliptic
4 linear
64. fruit, apex, projection
0 absent
1 present
65. fruit, margin, ondulation
0 no
1 present
66. fruit, valves, trichomes
0 absent
1 present
67. fruit, valves, filiform setae
0 absent
1 present
68. fruit, valves, glandular setae
0 absent
1 present
69. fruit, margin, trichomes
0 absent
1 present
70. fruit, margin, filiform setae
0 absent
1 present
71. fruit, margin, glandular setae
0 absent
1 present
72. fruit, indumentum, setae orientation
0 patent
1 incurved
2 forwardly appressed
3 retrose
4 antrorse (not appressed)
73. fruit, indumentum, concenctric pattern of organization
0 absent
1 present
74. fruit, valves, indument coverage
0 do not conceals surface
1 conceals surface
75. fruit, valves, separation between exo and endocarp
0 absent
1 present

CHAPTER TWO

SOME NOTES ON *MIMOSA*: A TAXONOMIC SYNOPSIS OF *M.* SER. *PACHYCARPAE*

Leonardo Maurici Borges, Marcelo Fragomeni Simon & José Rubens Pirani

Abstract

Mimosa ser. *Pachycarpae* Benth. is one of the most diverse infrageneric taxa of *Mimosa* L. According to recent phylogenetic results, the series needs to be recircumscribed to become monophyletic. Also, the same results indicate that its current infraspecific classification must be revisited. Here, *M.* ser. *Pachycarpae* is reorganized to accommodate part of *M.* ser. *Setosae*. The infraspecific classification of the series is also updated and replaced as mucha as possible. *M.* ser. *Pachycarpae* presents 72 species and six infraspecific taxa, all but one (*M. paludosa*) endemic to the Brazilian Cerrado Domain, where they occur chiefly in altitudinal areas. The comprehensive circumscription of *M.* ser. *Pachycarpae* avoids delimitation based on a single or few characters, due to its wide morphological diversity, but an unjointed craspedium occurs in most species. Diagnostic characterization, notes on morphology and taxonomy, information on distribution and habits, as well as a list of selected specimens is presented for each taxon, together, when possible, with illustrative photographs.

Introduction

Mimosa Linnaeus 1753: 516 is one of the largest genera in Leguminosae Mimosoideae, with more than 500 species, the majority occurring in Tropical America, many of which are restrict endemics. Around 350 species are exclusive to extra-Amazonic South America (Lewis *et al*. 2005), with the *cerrado*, *caatinga* and *campo rupestre* areas of Central Brazil concentrating one of the diversity centers of the genus (Simon & Proença 2000).

Even though species of *Mimosa* present a wide morphological variation, the craspedial fruit is constantly present and may indeed be the main morphological synapomorphy of the genus. Craspedia are characterized by the transversal fragmentation of the valves into monospermic articles concomitant with maintenance of margins integrity. However, this type of fruit may appear in modified forms in particular groups (Barneby 1991), such as the unjointed craspedia, whose valves separate from the margins but do not break up into segments, and the *sacelo*, which is reduced to a single article with dehiscence restricted to the fruit apex (terminology of this particular forms follows Barroso *et al.* 1999).

Bentham (1875) considered two sections in *Mimosa*: *M.* sect. *Eumimosa* Candolle (1825: 425), containing all the isostemonous species, and *M.* sect. *Habbasia* Candolle (1825: 428), comprising the diplostemonous ones. Barneby (1991) rearranged this infrageneric classification by describing *M.* sect. *Mimadenia* Barneby (1991: 25) to accommodate plants with extrafloral nectaries; by dividing *M.* sect. *Eumimosa* in sections *M.* sect. *Mimosa* and *M.* sect. *Calothamnos* Barneby (1991: 313) and also by splitting *M.* sect. *Habbasia* (*sensu* Bentham) into sections *M.* sect. *Habbasia* (sensu Barneby) and the previously described *M.* sect. *Batocaulon* Candolle (1825: 429), besides reorganizing series, subseries and describing many new species.

In *Mimosa* sect. *Habbasia*, Barneby (1991) recognized nine series. Two of these are noteworthy for having a

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center of diversity located in the *cerrados* and *campo rupestres* in Central Brazil: *M.* ser. *Pachycarpae* Bentham (1875: 439), with 38 species and many infraspecific taxa adding up to ca. 75 taxa, and *M.* ser. *Setosae* Barneby (1991: 350), with seven species, one of them with eight varieties, in a total of 15 taxa. Both series share several morphological and ecological affinities, as well as wide diversity of life forms, from subshrubs with xylopodia to rosulate shrubs and trees with congested leaves and thickened barks, usually associated with adaptations to fire regimes (Barneby 1991, Simon *et al.* 2009). According to Barneby (1991) the distinction between the series relies mainly in fruit morphology: species of *M.* ser. *Pachycarpae* would present an unjointed craspedium and the ones belonging to *M.* ser. *Setosae*, the typical craspedium of the genus. In fact, *M.* ser. *Setosae* was created to accommodate species showing many morphological features of *M.* ser. *Pachycarpae*, but lacking its particular fruit type (Barneby 1991: 350).

Nowadays there is growing evidence that the limits between these series may not be as sharp as defined by Barneby, since some species belonging in *M.* ser. *Pachycarpae* actually present regular craspedia, instead of the unjointed ones, or intermediate forms (Simon et al., 2010). Moreover, a comprehensive phylogenetic analysis of the genus indicates that both series in fact constitute a single monophyletic group (Simon et al., 2011). The analysis particularly focused on the series here performed (Chapter 1) confirms that proposition.

Problems on taxa delimitation are not restricted to the series themselves, and there is doubt about the validity of the infraspecific classification adopted by Barneby (1991), considered by him as in need of comprehensive field studies and, in particular cases, as “exploratory”. For instance, *Mimosa ulei* Taubert (1896: 432–433) presents two varieties with similar habit and occurring sympatrically in a relatively small area, but those can be clearly distinguished by features of leaves, flowers and fruits. Also, *M. claussenii* Bentham (1842: 405) comprises ten varieties, a few of which have marked diagnostic features that would justify a specific rank, whereas others, which vary only in size of particular structures, may represent extreme examples of clinal variation or of phenotypic plasticity.

A reappraisal of Barneby’s approach to *Mimosa setosa* Bentham (1842: 404–405), considered by him as an assembly of three subspecies, two of them further divided in varieties, shows that the majority of current infraspecific taxa can actually be recognized at species level (Chapter 3). This is in accordance with the findings of Simon *et al.* (2011) and ourselves (Chapter one), which revealed that some varieties do not form monophyletic groups. Other authors reviewing Barneby’s works (e.g. (Conceição *et al.* 2008, Grether 2000, Rando *et al.* 2013, Särkinen *et al.* 2011) have arrived to a similar reappraisal, and elevated to species rank taxa recognized by Barneby as varieties or subspecies. We believe that to some species of *M.* ser. *Pachycarpae* need to be reevaluated likewise, particularly the ones with multiple infraspecific taxa, such as *M. claussenii* and *M. foliolosa* Bentham (1842: 406).

MATERIALS & METHODS

SPECIES CONCEPT

The Phylogenetic Species Concept, which defines 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), is here adopt for *Mimosa* ser. *Pachycarpae*. Contrary to suggestions by McDade (1995) followed by Henderson (2004, 2005a, 2005b, 2011) species are treated as the least inclusive hierarchical level and thus, infraspecific taxa are not recognized in this treatment. Exceptions were made when current available information about the taxa was considered insufficient to support taxonomic changes and, hence, nomenclatural stability was preferred.

Species delimitation

Species circumscription was achieved through an adaptation of the "population aggregation analysis" method of Davis & Nixon (1992: 430–432). Instead of using populations, however, the initial clusters of individuals were the currently accepted taxa within *Mimosa* ser. *Pachycarpae* and closely related species of *M.* series *Setosae*.

Source of data and morphological analysis

We analyzed herbarium specimens, including types, held in A, ALCB, B, BHCB, BM, CEN, CESJ, DIAM, ESA, F, G, HB, HBG, HRCB, HTO, HUEFS, HUFU, IAN, IBGE, K, LE, M, MG, MO, NY, OUPR, P, PAMG, R, RB, RFA, S, SP, SPF, UB, UEC, US, VIC, W (Thiers, 2014). We used the Global Plants portal (plants.jstor.org) to check types stored in herbaria collections not studied. The taxonomic treatment presents a list of selected specimens of each taxon, which is complemented by a complete list of analyzed and identified specimens.

Field expeditions were conducted the known distribution areas of *Mimosa* ser. *Pachycarpae* species in order to observe overall population structure and variation of morphological features between individuals, as well as to improve habit and site of occurrence information.

Selected studied specimens and, when possible, also living plants observed in the field, were used as sources of the morphological features employed to evaluate taxa's delimitation. Only fully developed structures from mature plants were used for morphological analysis. Floral characters were studied in both dry and rehydrated flowers. When necessary, a microscope with 10–63 # magnification was used. Phenological, distributional and habitat data were obtained from the same material, both from above cited herbaria and living plants.

Morphological analysis follow the terminology of Radford *et al.* (1976) and of Harris & Harris (2001), as well as Barneby & Grimes (1996) for venation patterns, Weberling (1989) for inflorescence typology, and Barroso *et al.* (1999) for fruit morphologies. Features peculiar to *Mimosa* follow Barneby (1991). Most morphological features studied are qualitative (Appendix 1), but some of them may be quantitative features coded by relational proportions (e.g. "Leaves, medial rachilla, length relative to the rachis").

Taxonomic information

Species protologues are given following original publications. When necessary, additional information present on type specimens, but lacking at the publication, and/or corrections (except for isotypes not originally cited) are indicated or briefly explained inside brackets. Corrections were not made in cases where the original protologues information differs without prejudice from the one present on types. As an example, for *Mimosa accedens* Barneby, the specimen label says "along road to rio Corumba, 30 km from Gama, Goiás" and the original protologue "Distrito Federal: 30 km from Gama on road to rio Corumbá". Here we have corrected "Distrito Federal" for "Goiás" using brackets, but we have kept the protologue location unchanged since it adapts but do not change the sense of the original information.

Mapping

The distribution map was produced with QGIS version 1.8.0 (Quantum GIS Development Team 2012). Extent of Occurrence was inferred with the GeoCAT Tool (Bachman et al. 2011).

TAXONOMIC TREATMENT FOR *MIMOSA* SER. *PACHYCARPAE* BENTH.

Here we present a taxonomic synopsis of *Mimosa* sect. *Habbasia* ser. *Pachycarpae*, updating its circumscription in order to reflect the phylogeny presented by Simon *et al.* (2011) and recently refined by Borges *et al.* (Chapter one). We also review the limits and rank of some taxa at or below species level.

TAXONOMIC HISTORY

Species currently belonging in *Mimosa* sect. *Habbasia* ser. *Pachycarpae* were firstly described by Bentham (1842) in different groups: *M. paludosa* Bentham (1842: 400) was included in *M.* sect. *Habbasia* ser. *Asperatae* Bentham (1842: 399), while *M. antrorsa* Bentham (1842: 403–404) was treated in *M.* sect. *America* ser. *Antrorsae* Bentham (1842: 403), and the majority (eleven species and one variety) were ascribed in *M.* sect. *Ameria* ser. *Pachycarpae* Bentham (1842: 404) (*M. nitens* Bentham [1842: 404], *M. vernicosa* Bongard ex Bentham [1842: 404], *M. leiocephala* Bentham [1842: 404], *M. setosa, M. gardneri* Bentham [1842: 405], *M. claussenii*, *M. pycnocoma* Bentham [1842: 405], *M. densa* Bentham [1842: 405], *M. foliolosa, M. foliolosa* var. *pubescens* Bentham [1842: 406], *M. platyloma* Bentham [1842: 406] and *M. pachycarpa* Bentham [1842: 406]). In 1846, Bentham complemented his treatment by adding *M. adenotricha* Bentham (1846: 91) and *M. riedelii* Bentham (1846: 91–92) to *M.* ser. *Antrorsae* and to *M.* ser. *Pachycarpae*, respectively.

Later on, Bentham (1875) described new species and rearranged the infrageneric classification of *Mimosa*, recognizing only two series (see Introduction), and thus, combining *M.* sect. *Ameria* ser. *Pachycarpae* into *M.* sect. *Habbasia* ser. *Pachycarpae* Bentham (1875: 439). The series still presented eleven species, but with modifications: *M. multipinna* Bentham (1875: 440) is described as a new species, *M. foliolosa* var. *pubescens* is omitted, and *M. platyloma* and *M. pycnocoma* respectively equated to *M. densa* and *M. claussenii*. *M. paludosa* was transfered to *M.* ser. *Asperatae* *** *Glandulosae* Bentham (1875: 437), together with the new *M. melanocarpa* Bentham (1875: 437) and other species. Moreover, worried with the use of the word *antrorsus*, he considered *M. antrorsa* as a "*nomen vitiosum*" and replaced it by *M. adversa* Bentham (1875: 439), and, consequently, also changed the name of *M.* ser. *Antrorsae* to *M.* ser. *Adversae* Bentham (1875: 439). This was, however, an unnecessary procedure, and those additional names provided by Bentham are superfluous (Barneby 1991).

The *Mimosa* treatment in Martius' Flora Brasiliensis (Bentham 1876), follows Bentham (1875), except for *M. paludosa* and *M. melanocarpa*, which appear in *M.* sect. *Habbasia* ser. *Asperatae*. Here, *M.* ser. *Pachycarpae* presents a larger number of taxa, with the description of five varieties, namely *M. setosa* var. *nitens* Bentham (1876: 387), *M. gardneri* var. *paucipinna* Bentham (1876: 388), *M. gardneri* var. *brevipinna* Bentham (1876: 388), *M. multipinna* var. *microphylla* Bentham (1876: 388), *M. foliolosa* var. *macrocephala* Bentham (1876: 389). The synonymizations adopted in 1875 are followed and *M. foliolosa* var. *pubescens* appears named *M. foliolosa* var. *strigosa* Bentham (1876: 388), which is also a superfluous name.

After Bentham's approach to the taxonomy of *Mimosa*, a few authors also published taxa belonging to *M.* ser. *Pachycarpae*. Taubert (1896) described eight species: *M. speciosissima* Taubert (1896: 431), *M. tocantina* Taubert (1896: 431–432), *M. longepedunculata* Taubert (1896: 432), *M. ulei* Taubert (1896: 432–433), *M. formosoana* Taubert (1896: 433), *M. albolanata* Taubert (1896: 433–434), *M. setosissima* Taubert (1896: 434), and *M. tomentosa* Taubert (1896: 434) (*nom. illeg.*). The first, however, was referred only as belonging to *M.* sect. *Habbasia*. Glaziou's (1906) list on collections made at Central Brazil presents ten new species that would belong to *M.* ser. *Pachycarpae*, but with no reference to the series. Those names, however, are to be considered invalidly published. Malme (1931) described *Mimosa pachycarpoides* Malme (1931: 53), which would be the last taxon of the series to be published as new before Rupert C. Barneby started his studies on the genus.

Barneby's works (Barneby 1991, 1993, 1997) are surely a landmark on the study of *Mimosa* as a whole, but particularly on *M.* ser. *Pachycarpae*, since it is largely based on specimens obtained during the New York Botanical Gardens Planalto Expeditions, which, under the leading of H.S. Irwin and subsequently W.R. Anderson, focused on botanical exploration of Central Brazil areas, including the Central Brazilian Plateau, the main diversity center for the series. Barneby (1991) provided valid publication of the taxa already pointed as new in Glaziou's list, description of several new taxa, and the reformulation of the series classification. His approach to the genus taxonomy involved increase in infraspecific taxa, either by description of new ones or by subsuming taxa previously published at species level (for an evaluation of Barneby's infraspecific classification, see Chapter 5). Besides, he also segregated a few taxa to the newly created *M.* ser. *Setosae* (see Introduction).

Recently, the series was amplified by addition of eight new species and one variety (Borges *et al.* 2014, Dutra & Garcia 2012, Simon *et al.* 2010)

CIRCUMSCRIPTION

Following recent phylogenetic analysis (Simon *et al.* 2011; Chapter 1) we circumscribe *Mimosa* ser. *Pachycarpae* as a group containing all species previously treated within it by Barneby (1991) plus all taxa included in *M.* ser. *Setosae* (Barneby 1991), except for three species (*M. aguapeia* Barneby, *M. orbigyniana* Benth., and *M. riedelii* Benth.), which are, in fact, related to *M.* ser. *Piresianae* and shall be transfer to it.

As an outcome of the methods here applied to evaluate limits and rank of species and infraspecific taxa, *Mimosa* ser. *Pachycarpae* comprises a total of 72 species plus six varieties, in a total of 78 taxa. Taxa were accepted at infraspecific rank mainly due to lack of information supporting either their synonymization or rank raising.

DISTRIBUTION AND HABITAT

Mimosa ser. *Pachycarpae* is mostly endemic to the *Cerrado* Domain, chiefly distributed in Central Brazil, where it ishows an extent of occurence of 981,031.812 km^2 (Fig. 1). The single exception is *M. paludosa*, which is widespread in South America, also occurring in the Amazon and Atlantic Rain Forest Domains. This is a ruderal or invasive species in some areas in Brazil.

Distribution of the group within the *Cerrado* is strongly associated with sandstone or quartzite montanous areas above 700 m of elevation (Fig. 1). Hence, key areas for diversity of *Mimosa* ser. *Pachycarpae* are the Southern Espinhaço Range (just one taxon occurs on its northern portion) and the Goiás Central Highlands (sensu (Simon *et al.* 2000). The later area includes the Chapada dos Veadeiros, where some treelet species are major components of the landscape and where several species of the series occur sympatrically.

Mimosa ser. *Pachycarpae* are frequent associated to *cerrado* environments and thought to be adapted to fire regimes commonly occurring in tropical savannas (Simon *et al.* 2009, Simon & Pennington 2012). The group indeed is present in this kind of vegetation formation, mainly at the Federal District, where it is abundant, but many of its species occur in sandy and rocky substracts, while typical *cerrados* prevail on deep, lateritic soils. Hence, *Mimosa* ser.

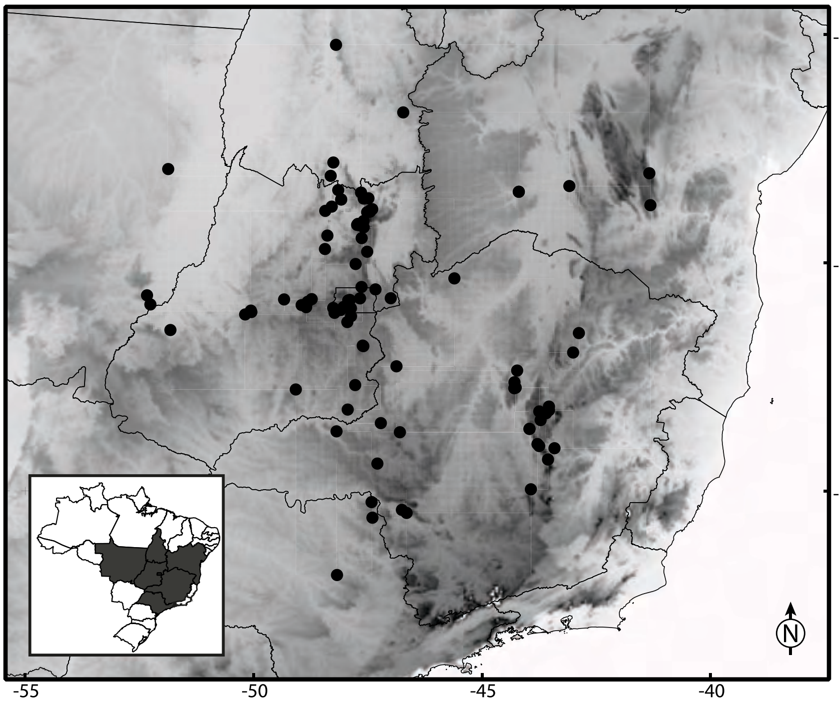

Figure 2. Habit variation in *Mimosa* ser. *Pachycarpae*, excluding the pervasive *M. paludosa*.

Pachycarpae occurrence is apparently more associated with *campos rupestres*, the vegetation type that prevails in the highlands of the Espinhaço Range and the Goiás Central Plateau. The *campo rupestre* is characterized as open grasslands with scattered evergreen shrubs and subshrubs on poor, sandy, rocky soils with rock outcrops, hosting high levels of plant endemism (Giulietti *et al.* 1997).

It is worth to point out that at the Goiás Central Highlands, mainly at Chapada dos Veadeiros, rock outcrops are not as common as in the Espinhaço Range, where the delimitation of areas with *campos rupestres* is straightforwardly done. Hence, in Goiás it is usually difficult to distinguish *campos rupestres* from several open physiognomies of *cerrado* as *campo limpo*, *campo sujo*, *campo cerrado* and *cerrado rupestre*. Details on substratum composition may help for the distinction of specimen's occurrence, but that information is not always indicated in collection labels. Nonetheless, species also occur in transitional areas between *cerrado* and *campo rupestre,* and the presence of such interfaces increases environmental heterogeneity, which may be linked to the species richness of *Mimosa* ser. *Pachycarpae* (Chapter 1).

MORPHOLOGY

HABIT

One of the most remarkable features of *Mimosa* ser. Pachycarpae is its diversity of life forms. Species may be typical shrubs (e.g. *M. setosa*); fasciculate shrubs (e.g. *M. foliolosa*); rosulate shrubs (e.g. *Mimosa speciosissima*) that, if restricted to just one or few branches and with a long exsert synflorescence, may also be wand-like (e.g. *M. grallator* and *M. eriorrhachis*); prostrate shrubs (e.g. *M. albolanata* and *M. tocantina*); trailing subshrubs (e.g. *M. chiliomera* and *M. lithoreas*); and treelets, the later usually with congested leaves (e.g. *M. manidea* and *M. rheiptera*) (Fig. 2).

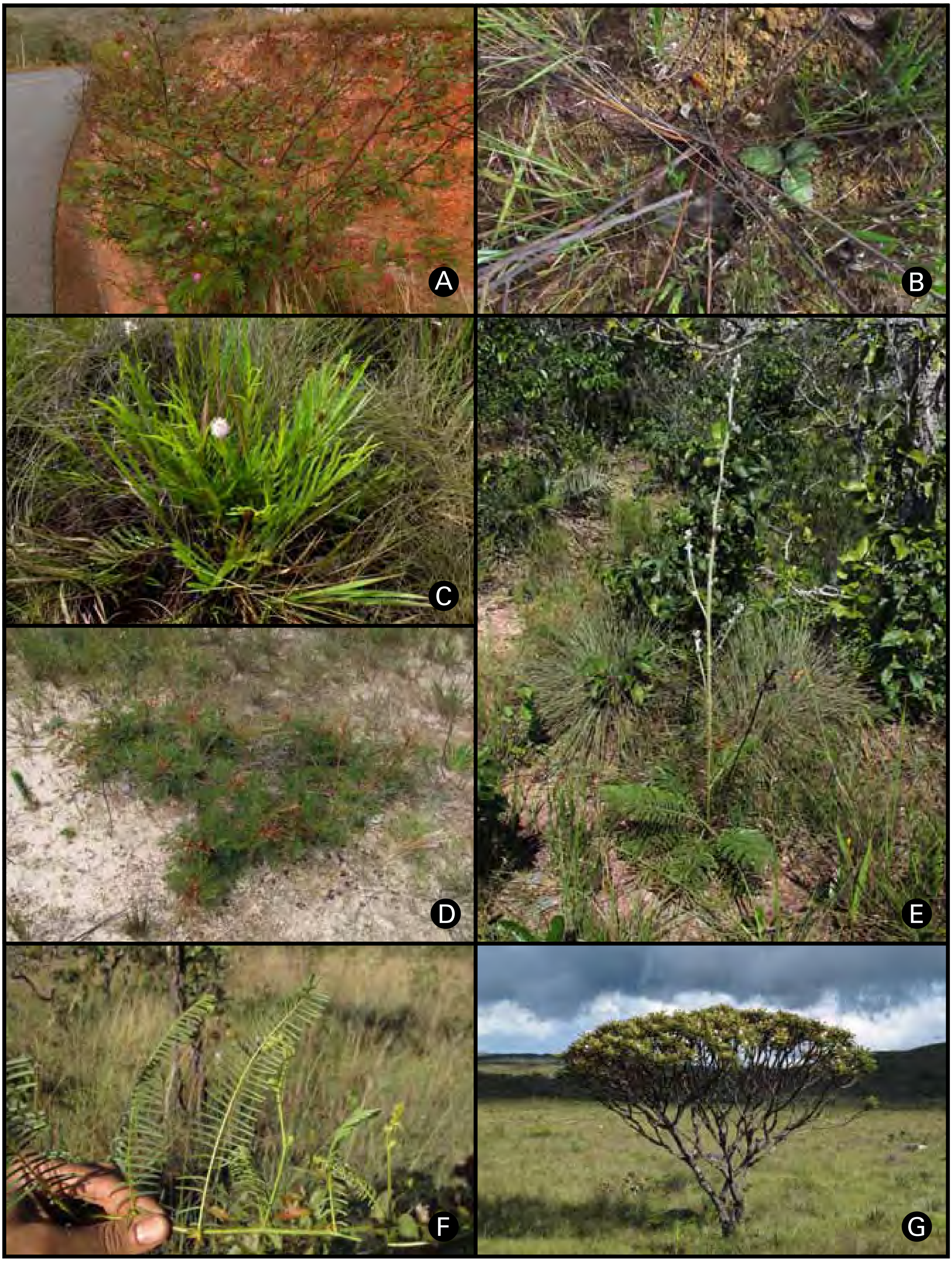

Figure 2. Habit variation in *Mimosa* ser. *Pachycarpae*. A. *M. paludosa*. Shrub. B. *M. pubescens*. Shrub with branches fasciculate at base. C. *M. speciosissima*. Rosulate shrub. D. *M. tocantina*. Prostrate shrub. E. *M. eriorrhachis*. Wand-like shrub with congested leaves. F. *M. chiliomera*. Humifuse subshrub. G. *M. manidea*. Treelet.

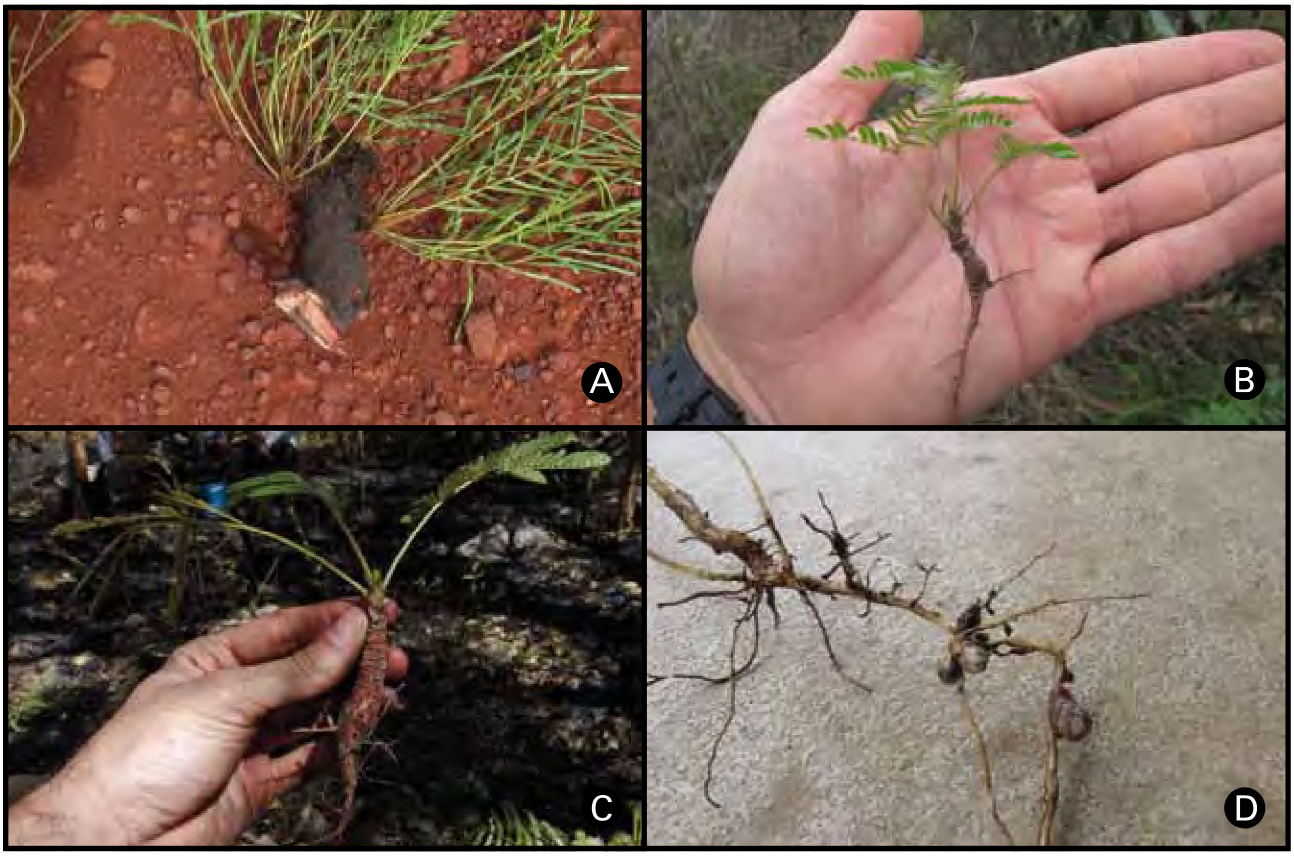

Figure 3. Xylopodium in different species of *Mimosa* ser. *Pachycarpae*. A. *M. speciosissima*, a rosulatte shrub. B. Young individual of *M. foliolosa* var. *grandibractea*, a prostrate shrub. C. Young individual of *M. sp.*, a treelet. D. Young individual of *M. decorticans*, a treelet, without xylopodium.

Figure 4. Dicotomic ramification in different treelet species of *Mimosa* ser. *Pachycarpae*. A. *M. regina*. B. *M. oedoclada*. C. *M. setosissima*.

Many of those different habits (including some treelets) are associated with the presence of a massive xylopodium, which promotes survival of the individuals after damage or complete removal of aerial parts by fire, a frequent disturbing factor in the *cerrados*. Observation of young individuals indicates that it is present in shrubby species as well as in treelets and that the initial development of the plants concentrates at the formation of the xylopodium, and secondarily at expansion of branches and leaves, and (Fig. 3). Occurrence of this organ in treelet species, however, is not constant and must be further investigated. For instance, study of the roots of a young individual of *M. decorticans* show that it lacks xylopodium, but that it bears radicular nodules (Fig. 3). Nodules have not been observed in species with enlarged xylopodia, but this may be related to the difficulty in fully access the radicular system of the plants.

A common feature amongst treelet species of *Mimosa* ser. *Pachycarpae* is their particular branch architecture. A precise study should be carried on but apparently they fit the model of Schoute (Bell 2008, Hallé *et al.* 1978), and present a dichotomic (sometimes trichotomic) branching pattern with, resulting in a peculiar architecture that make these plants remarkable in the landscape (Figs. 2. G; 4). The model of Leeuwenberg may also be used to describe those species architecture and is more common in Eudicotiledons, but on that model suppression of the apical meristem is done by a terminal flower (or inflorescence), a condition that, to the best of our knowledge, is not present in the series.

It is important to note that some of the different habit types listed have, in fact, the same basic architecture, and differ only on degree of development. Rosulate shurbs are defined by their low stature and congested leaves and are essentially different form treelets with congested leaves only due to suppression of trunk development. Also, wand-like shrubs acquire this shape due to prolonged elongation of synflorescences axes. Hence, careful examination of the species habit is necessary conducted to avoid over emphasizing taxonomic usefulness of forms that are superficially different, but essentially the same (for an example, see notes about the relationship between *Mimosa spendida* and *M. irwinii* under the first).

Indumentum and armature

Three types of epidermical projections compose the indumentum of species within *Mimosa* ser. *Pachycarpae*: simple trichomes, filiform setae and glandular setae (Fig. 5). The distinction between those three types of projections were already establish by Barneby (1991: 10–11), who discussed the theme at length. It is stressed here that the main difference between simple trichomes and setae is based on the number of cells they are compound of: simple trichomes are made of a single elongated cell, usually whitish in specimens (Fig. 5), while setae are build up of many fasciculate cells, have a bristle-like appearance and are usually ochraceous in color, although they can be white to grayish in a few species (e.g. *M. eriorrhachis*) (Fig. 2). Glandular setae are similar to the filiform ones, but they are charged at the tip with a multicellular glandular clavate or capitate head (Fig. 5).

Simple trichomes are commonly present in at least part of the organs of most species, usually at young branches and adaxial surface of leaves axes, when not also on leaflets. The occurrence of both filiform and glandular setae, though, has a wider span of variation and species lacking glandular setae on vegetative organs may to bear them in flowers, commonly at the calyx rim, where filiform setae may show a different morphology (see below).

Besides the indumentum, species may also posses aculei on branches and less often also on leaves (e.g.

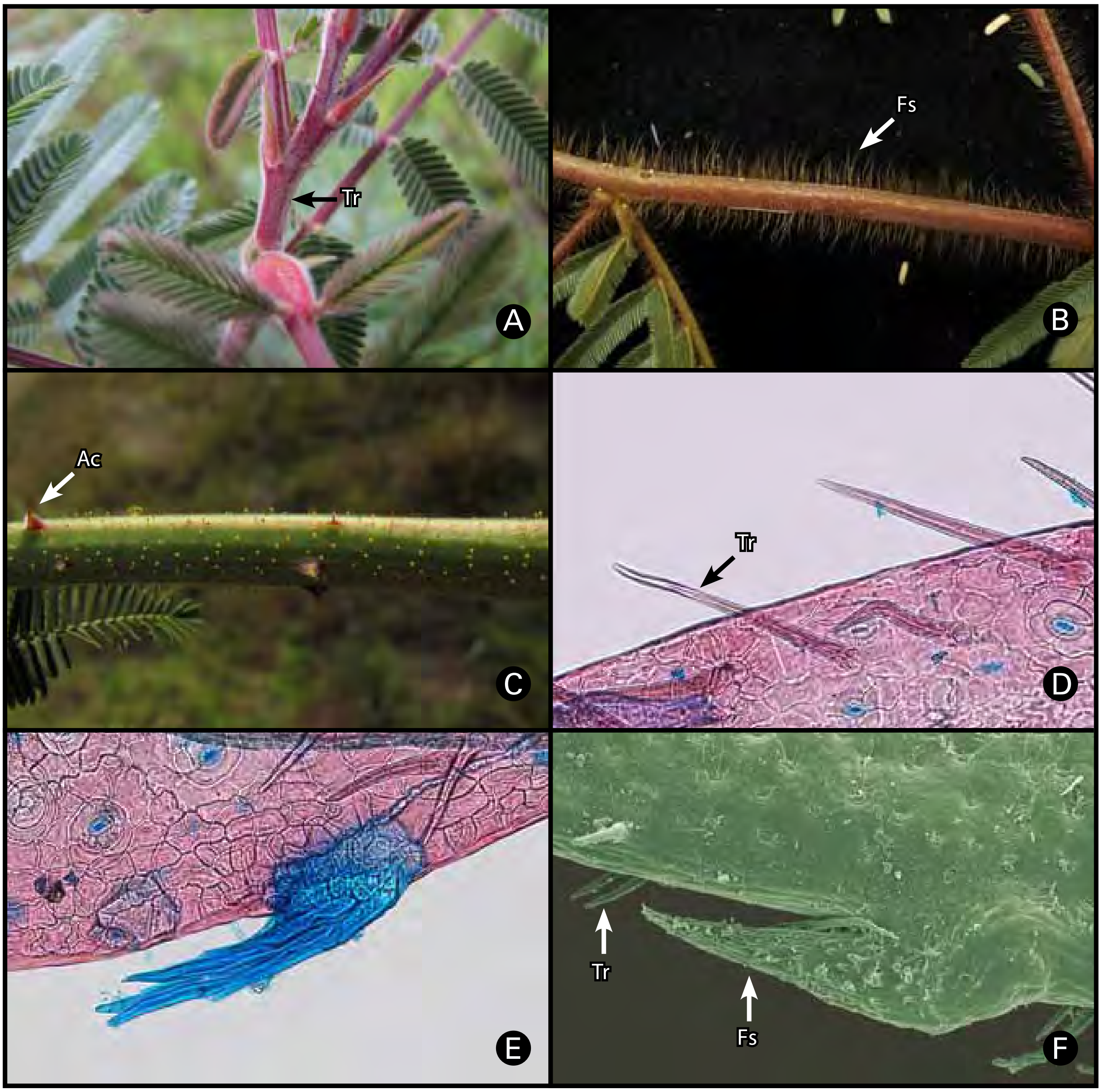

Figure 5. Morphology of epidermical projections in *Mimosa* ser. *Pachycarpae*. A. Abundant simple trichomes (Tr) in *M. granitica*. B. Filiform setae (Fs) in *M. prorepens*. C. Aculei (Ac) and glandular setae (Gs) in *M. acroconica*. D. Simple trichomes (Tr) on a leaflet of *M. setosa*. E. Filiform setae (Fs) on a leaflet of *M. setosa*. F. Simple trichomes (Tr) and filiform setae (Fs) on a leaflet of *M. claussenii*.

Mimosa paludosa and *M. adenotricha*). Aculei are usually triangular in profile, straight and with a longitudinally fusiform base, but in particular taxa they can become slightly cylindrical and/or be antrorse.

Within *Mimosa* ser. *Pachycarpae*, indumentum and armature features play an important role in species delimitation (see also discussion in Chapter 3) either by differences in composition, presence in particular organs or orientation.

BRANCHES

Two distinct patterns of branch morphology, directly related to the degree of stem elongation, of secondary

Figure 6. Branch morphology in *Mimosa* ser. *Pachycarpae*. A. Slender branch of *M. multipinna*. B. Thick branch of *M. manidea*. C. Peridermal exfoliation on the thin branch of *M. oligosperma*. D. Peridermal exfoliation on the thick branch of *M. oedoclada*.

growth and production of a thick periderm, may be distinguished within *Mimosa* ser. *Pachycarpae*. In the first, usually present in shrubby species (e.g. *M. foliolosa*, *M. setosa*), but also in treelets (e.g. *M. densa*, *M. rheiptera*), lignification starts only later in development, thick suber is not produced and the secondary growth rate is apparently restrict; as a consequence, branches tend to be slender (Fig. 6). In the second, lignification starts earlier and culminates on the production of a homogeneous thin, grey bark. Also, for the later, secondary growth rate may be higher and branches are thick from their tips (e.g. *M. manidea*, *M. capito*; Fig. 6). Treelets species may present either the first, or the second condition, and also shedding of the periderm, revealing in most cases an orange to reddish underbark, which will give origin to the just mentioned suber. The degree of peridermal exfoliation may vary amongst species, beginning early in development, usually concomitantly with leaves abscission, as is common in *M. densa* and *M. oligosperma*, or only later and much after fall of leaves, as it happens in *M. dominarum* and *M. oedoclada*. Those later species were not previously accounted as presenting this feature (Barneby 1991), because herbaria specimens are usually restricted to the very distal portion of branches bearing the densely clustered leaves.

Hence, the first developmental pattern relies mostly on elongation, while the second on thickening.

STIPULES

Stipules mostly triangular in shape are another peculiar feature of *Mimosa* ser. *Pachycarpae*, although not diagnostic. Variation amongst species does occur and the shape varies between lanceolate or narrowly triangular to

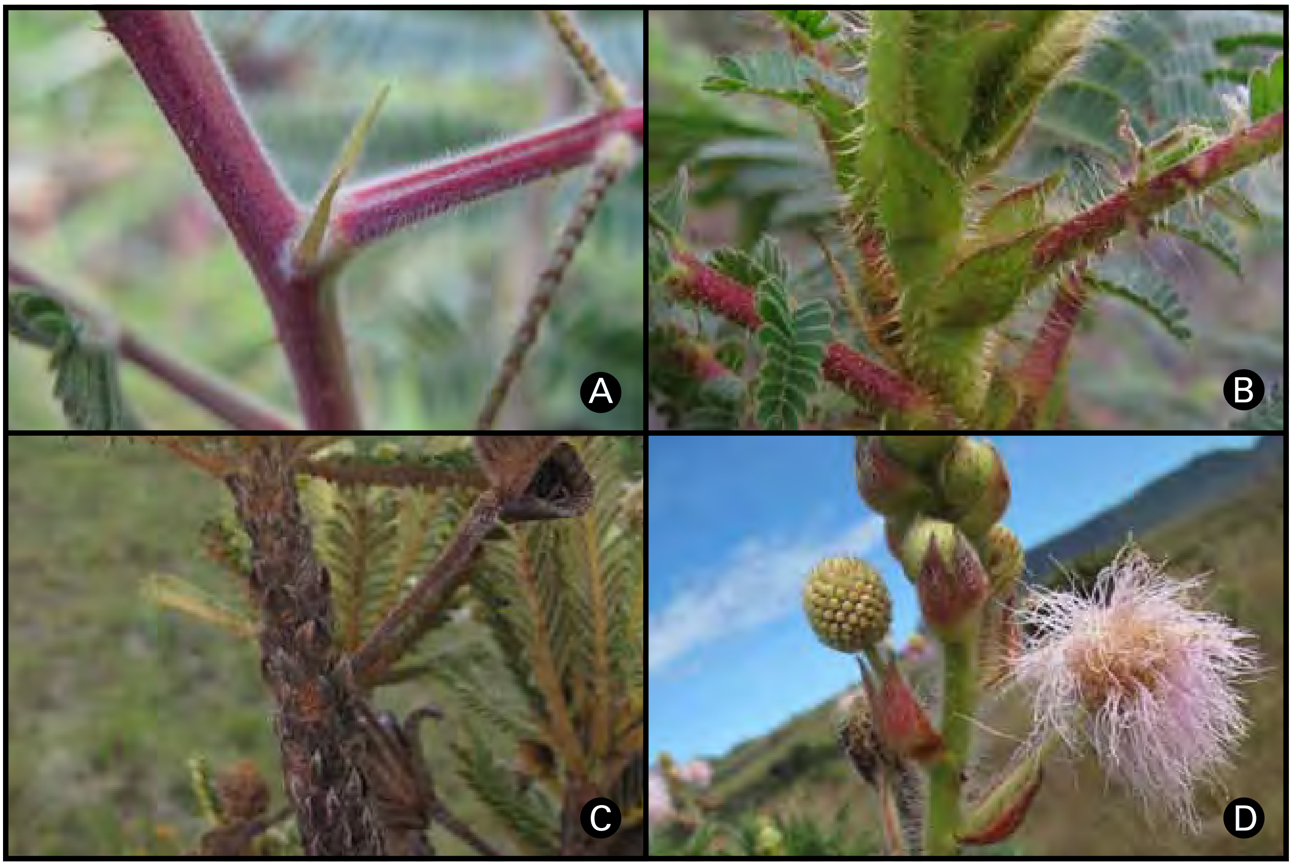

Figure 7. Stipule morphology in *Mimosa* ser. *Pachycarpae*. A. Narrowly triangular stipule of *M. granitica*. B. Ovate-acuminate stipule of *M. oedoclada*. C. Triangular stipules of *M. manidea*. D. Enlarged and fused stipules of *M. regina*.

broadly triangular with apex being acute or acuminate (Fig. 7). An extreme case of variation is seen in species (e.g. *M. regina* and *M. acroconica*) presenting broadly ovate-acuminate stipules. Particularly *M. regina* shows triangular stipules during vegetative development that become larger, reddish, broadly ovate-acuminate and fused at base in the synflorescence axis (Fig. 7). Other species, such as *M. bispiculata* and *M. rhodostegia* are provided with similar stipules during the reproductive phase, but since these are caducous, so far there is still no evidence that they also shape-shift.

Stipules can be either persistent or caducous and in species such as *Mimosa splendida* and *M. manidea*, besides being persistent, they form a clustered patch around the branches just below the leaves, but are caducous after all. A few other species (e.g *M. albolanata*) may have stipules persistent for longer times and still present when the periderm is already established.

LEAVES

Leaves of *Mimosa* ser. *Pachycarpae* are multipinnate, as occurs in *M.* sect *Habbasia* as a whole. The number of pinnae, however, presents a large variation span: from 2 in *M. nitens* to 40 pairs in *M. chiliomera*. An interpinnal projection (referred by Barneby [1991] as interpinnal spicule), either spiculate or laminate, may be present on rachides, between pinna pairs (Fig. 8).

Leaflets are generally numerous, small, oblong and ciliate. Venation is palmate and usually primary veins are prominent on abaxial surface, but in a few taxa secondary veins may be as thick as the primaries.

Within the series, the leaves are commonly congested at the apex of branches, mainly in treelet species, but also occuring in rosulate and wand-like shrubs (see notes under habit). The density degree of leaves is variable and species like *Mimosa manidea*, *M. oedoclada* and *M. splendida* have very short internodes (Fig. 8), while *M. longepedunculata* and *M. claussenii* have long and, even though congested, leaves are set way apart from each other.

FLOWERS

Flowers of *Mimosa* ser. *Pachycarpae* present low levels of variation and closely related species tend to share almost identical flower morphology. Despite that, informative floral characters are useful for identification of, at least, groups of species.

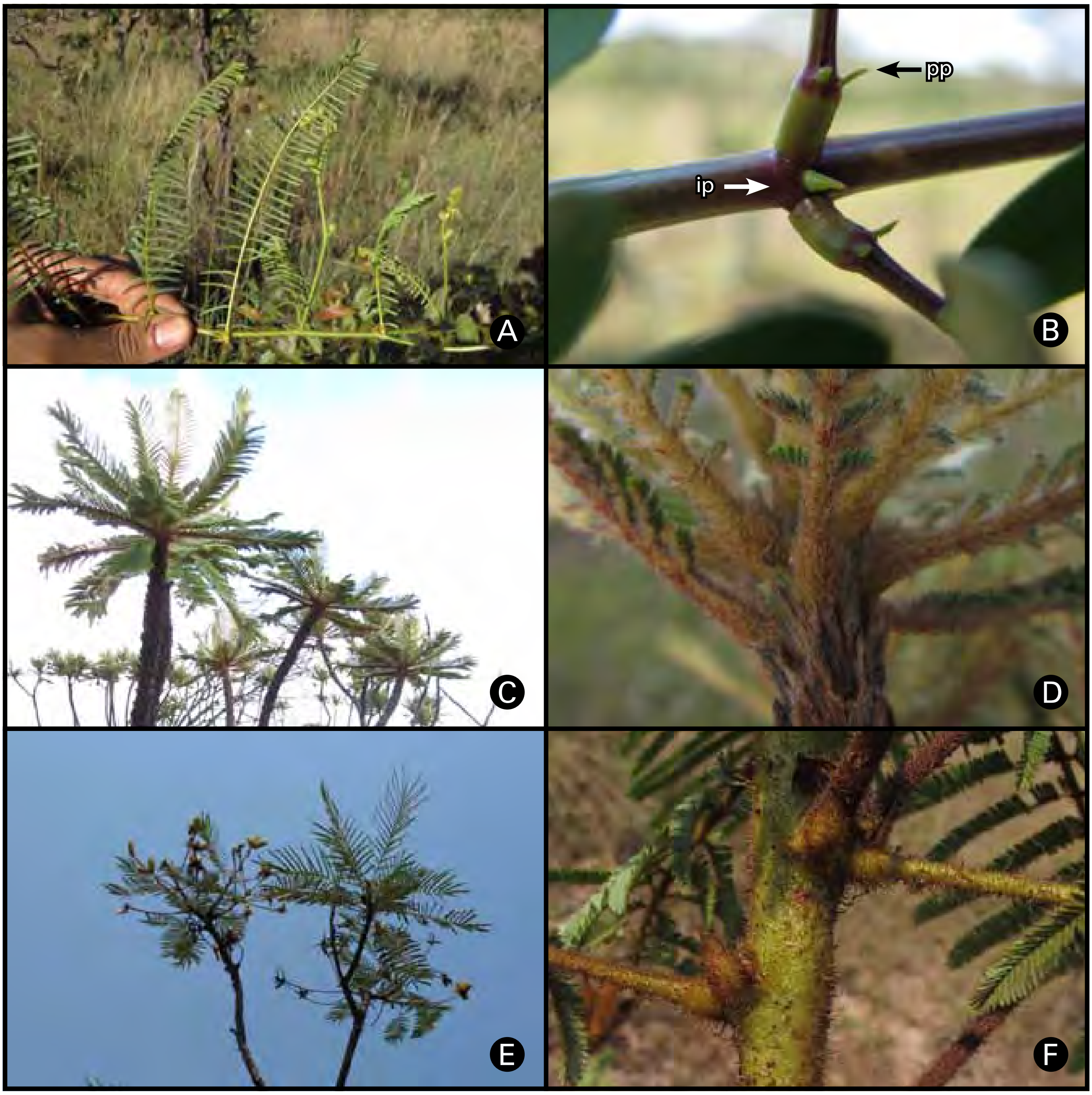

Figure 8. Leaf morphology in *Mimosa* ser. *Pachycarpae*. A. Leaves of *M. chiliomera* with more than 30 pinnae pairs. B. Detail of a leaf of *M. ulei* showing its spiculate interpinnal projection (ip) and paraphyllidium (pp). C–D. *M. manidea*. C. Leaves closely congested at the apex of branches. D, F. Detail of a branch showing the distance between the leaves. E–F. *M. longepedunculata*. E. Leaves laxly congested at the apex of branches.

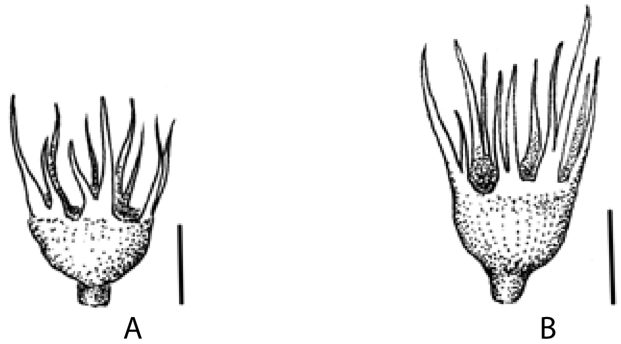

Figure 9. A–B. Calyces with plane setae laterally fused. A. *Mimosa granitica* B. *M. setosa*. Scale bar: 0.5 mm.

Following the pattern observed in the genus, plants are usually andromonoecious, bearing either bisexual or masculine flowers, the later usually slightly smaller and narrow due to the absence of the ovary, as well as more numerous. Bisexual flowers are always located at the apex of the inflorescences.

Flowers of most species have a small pedicel (around 0.2 mm long) and a cupulate calyx. Calyx lobes are present in some species and, when regular, are triangular or very shallowly triangular. The calyx indumentum is generally restricted to the rim and is composed either by filiform and/or glandular setae, but sometimes it occurs also at the distal portion of the tube. A change in shape of both types of setae is striking in the calyx, where they may be plane (Fig. 9) and even become laterally fused as is clearly seen in the flowers of *Mimosa setosa* and other species.

Corollas are infundibuliform or campanulate and a tube that opens into four lobes at the top composes most part of it. The lobes are oval and may lack or have different combinations of the triple indumentum, but they are mostly completely covered by antrorsely appressed filiform setae.

Both the androecium and gynoecium of *Mimosa* ser. *Pachycarpae* fit the common pattern of *M.* sect. *Habbasia*. Flowers are diplostemonous and the filaments may be shortly connate at base, usually not much more than half of the ovary length. Gynoecium is uniform within the series and variation is restricted to the number of ovules and composition of the indumentum, which may also vary in length.

Inflorescence

The basic inflorescence unit of *Mimosa* is a raceme (Barneby 1991, Grimes 1999, Prenner *et al.* 2009), which may be globose or cylindrical and less commonly, intermediate between those shapes. Different terms have been used to name those inflorescences such as spike for the cylindrical racemes (Barneby 1991, Bentham 1875, Savassi-Coutinho *et al.* 2012) and capitulum (Barneby 1991, Bentham 1875, Simon *et al.* 2010, Taubert 1896) or glomerule (Borges, Simon *et al.* 2014, Borges & Pirani 2013). We argue here that in order to avoid confusion and to reflect homology relationships, terminology should be unified and the inflorescence unit of *Mimosa* named simply raceme. The distinction between different forms may be simply done by further reference to its shape, such as cylindrical raceme. Although a capitulum may be considered a derivation of a raceme (Prenner *et al.* 2009), it usually presents remarkable distinguishing features such as disc and involucral bracts, none of which occur in *Mimosa.* So, we also stress that the use of this term or should be abandoned in descriptions of species of the genus.

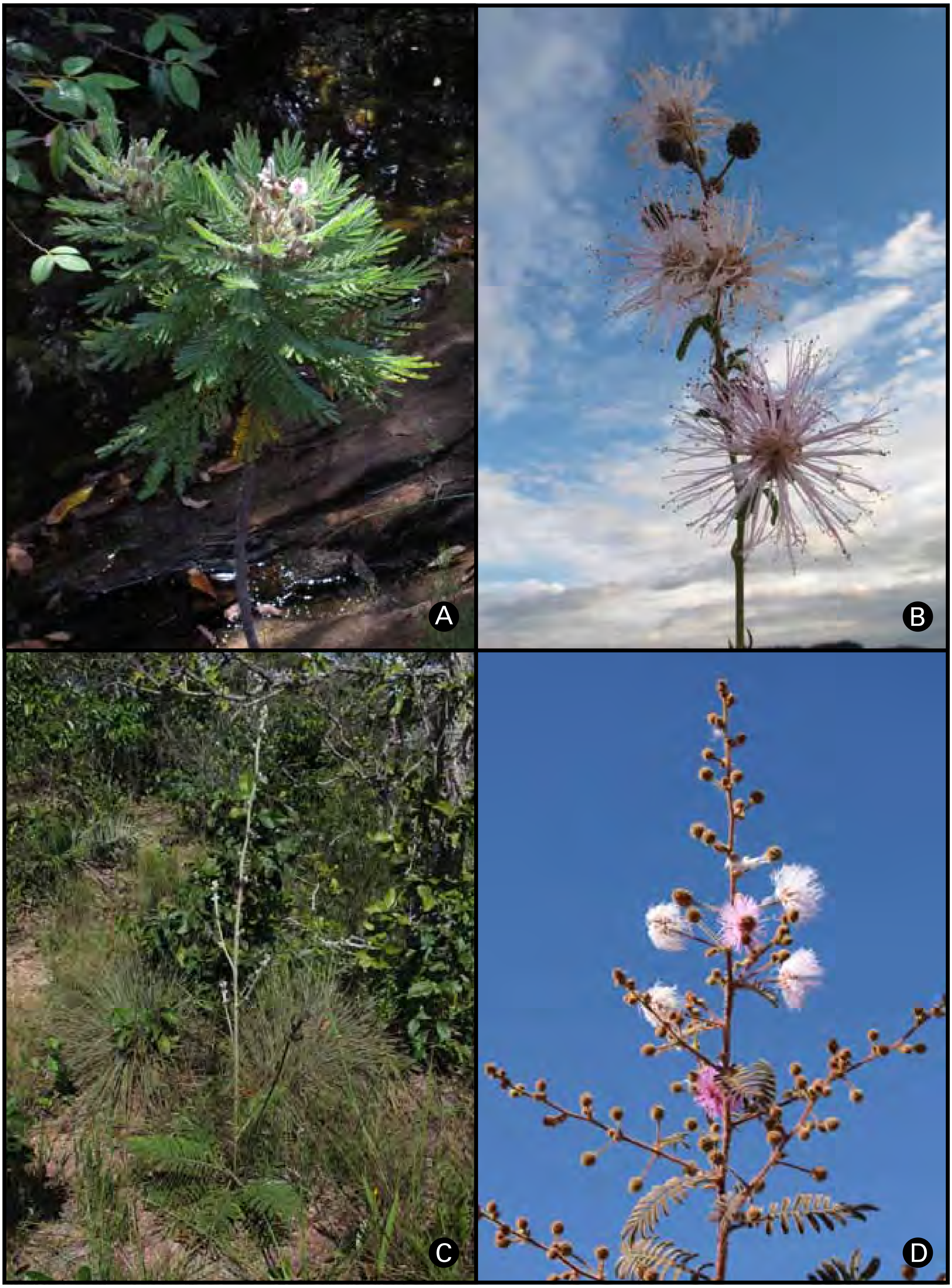

Figure 10. Inflorescence morphology in *Mimosa* ser. *Pachycarpae*. A. Racemes are subtended by fully developed axillar leaves in *M. kalunga*. B. Racemes subtended by leaves with suppressed development in *M. neonitens*. C. Double-raceme in *M. cryptothamnos*. D. Paniculate synflorescence in *M. serpensetosa*.

Species in *Mimosa* ser. *Pachycarpae*, hence, have globose (sometimes elliptical) racemes. In the majority of species, development of leaves is suppressed during racemes maturation and anthesis, and those become fully expanded only after fruit maturation. When the reproductive phase is over, branch development continues by production of leaves only. The consequence of this heterochronic behavior is that the racemes are exposed above the foliage during anthesis in what appears to be an exserted double-raceme (Fig. 10). This pattern is also perceived in species producing persistent fruits (e.g. *Mimosa claussenii*), which may show fruits of the later reproductive period below the current present leaves (Fig. 10). Some species, however, do present real double-racemes that are produced during the flowering period and that do not continue vegetative development (e.g. *Mimosa eriorrhachis*, *M. regina* and *M. ulei*.; Fig. 10). Commonly groups of axes bearing racemes to form a compound paniculate synflorescence (Fig. 10).

FRUITS

The typical fruit of *Mimosa* ser. *Pachycarpae* species is an unjointed craspedium (Fig. 11). Some species, however, present the typical craspedia of the genus. Simon *et al.* (2010) have also shown that intermediate forms, in which the valves do not break up regularly, may occur in particular taxa and we have also showed that unjointed craspedia are not synapomorphic for *M.* ser. *Pachycarpae* and also homoplastic within it (Borges *et al.* Chapter 1). Other taxa, such as *M. caliciadenia* Barneby (1991: 360–361) may have regular craspedia which are functionaly unjointed, since the valves break up only after release of the seeds (Fig.11). Dutra *et al.* (2012) have erroneously described the fruit of taxa belonging in the series as a "*sacelo*". This type of fruit indeed occurs in a few species of the genus (e.g. *M. dolens* Vellozo [1825: pl. 34]), but it is very different from the unjointed craspedium (see Barroso *et al.* 1999) and do not

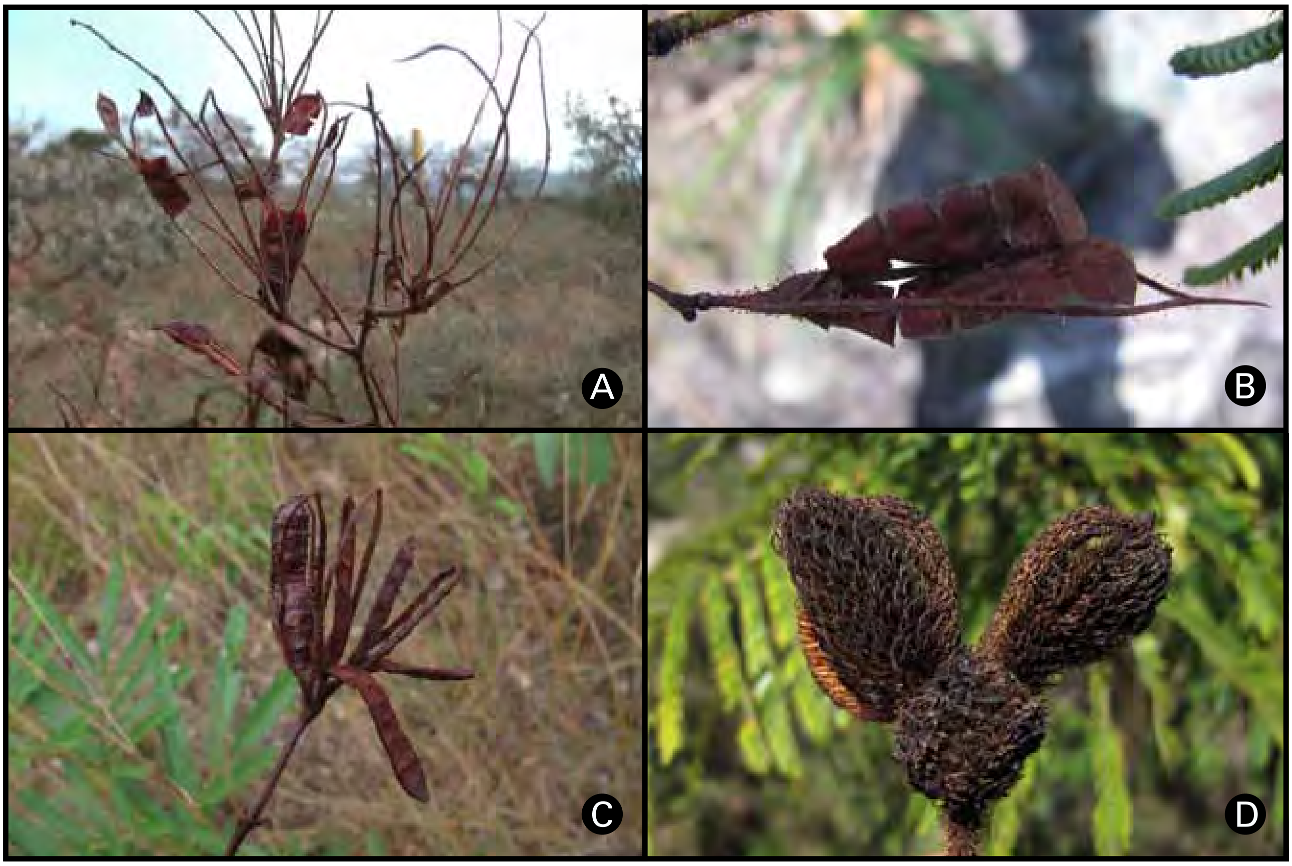

Figure 11. Fruit morphology in *Mimosa* ser. *Pachycarpae*. A. Craspedium in *M. paludosa*. B. Functinally unjointed craspedial of *M. caliciadenia*. C–D. Unjointed craspeda. C. *M. nitens*. D. *M. claussenii*.

occur at all in *M.* ser. *Pachycarpae*.

Although variation on fruit morphology may occur within the series, as noted above, they are taxonomically informative and may help on the distinction of, at least, groups of closely related species. Species related to *Mimosa claussenii* usually present oblong to ovate coriaceous unjointed craspedia with long setae completely covering its surface and arranged in a concentric pattern; *M. foliolosa*, as *M. nitens*, and similar taxa tend to have oblong to narrowly oblong unjointed craspedia with short, appressed and sparse indumentum; and taxa morphologically related to *M. setosa* have regular craspedia.

Description of *Mimosa* series *Pachycarpae* Benth.

Prostrate or erect shrubs, sometimes with branches fasciculate at the base, humifuse sub-shrubs, and treeletes with or without congested leaves that give to shrubs and treelets a rosette-like appearance. Stems sometimes with a developed grey suber. Branches gradually increasing in thickness, or already thick at the tips; sometimes showing peridermal exfoliation that reveals an orange to reddish underbark in some treelet species. Unarmed or aculeate with patent, antrorse or recurved aculei. Indumentum composed by different combinations of trichomes, filiform setae sometimes with broad base and glandular setae with clavate or capitate heads; the setae patent, incurved, antrorse, but not appressed, forwardly appressed or retrorse. Leaves 2–40-jugate. Stipules narrowly triangular or lanceolate to triangular or broadly ovate acuminate, fused at the base in few species, persistent or early caducous, 1–pluri-veined. Petiole sulcate or not; sometimes restricted to the pulvinous. Rachis usually multiple times longer than the petiole; with or without a laminar or spiculate interpinnal projection. Rachillas isometric or crescent towards the apex; paraphyllidia present or not before the first pair of leaflets. Leaflets usually oblong, sometimes oblong-falcate, lanceolate or linear; ciliate with some combination of the indumentum and rarely also pubescent on the surface; venation palmate with primary veins, sometimes also the secondaries, usually prominent on abaxial surface. Inflorescences racemose, globose to shortly ellipsoid, either subtended by a fully expanded or by a heterochornic leaf, the latter fully developing only after fruit maturation or axilar leaves absent; inflorescences are exserted from the foliage in the latter two cases in an axis which, if branched, may form a paniculate compound synflorescence. Flowers 4-merous, diplostemonous, bisexual or masculine, the latter restricted to the base of the raceme. Calyx campanulate or tubular with lobes varying from absent to triangular, usually ciliate with a combination of plane, filiform and glandular setae, sometimes also with simple trichomes; plane setae may be laterally fused or free from each other. Corolla campanulate or narrowly infundibuliform to infundibuliform, tube glabrous, lobes ovate, glabrous or pubescent with filiform and/or glandular setae, which may fully conceal the lobe's surface. Ovary narrowly oblong, usually compressed, shortly stipitate, glabrous or tomentose with filiform and/or glandular setae. Stamens exserted, glabrous, shortly fused at base. Fruit a craspedium, which breaks up in articles together with seed release, or only after that; or an unjointed craspedium, whose valves remain integer after dehiscence, papery to coriaceous, usually persistent long after reproductive phase, sub-glabrous to tomentose with some combination between simple trichomes, filiform setae and glandular setae; setae sometimes organized in a concentric pattern. Seeds ovate, brown to dark brown, pleurogram present.

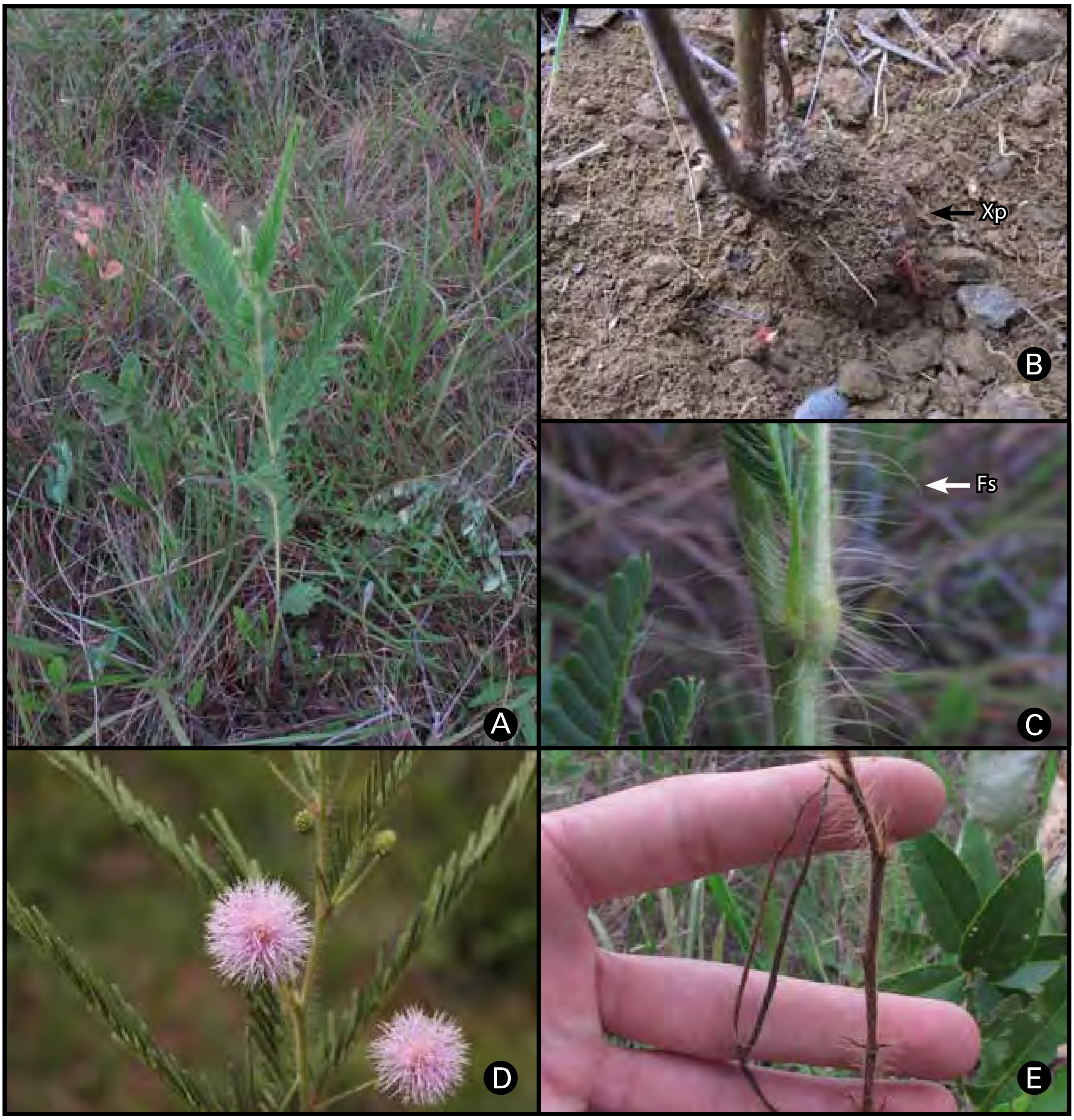

Figure 12. *Mimosa accedens*. A. Habit. B. Xylopodium (Xp). C. Detail of the leaf base showing narrowly triangular stipule and long filiform setae (Fs). D. Racemes subtended by a fully expanded leaf. D. Fruit replum.

1. ***Mimosa accedens*** Barneby (1991: 362–363). Type: Brazil. Distrito Federal [Goiás]: 30 km from Gama on road to rio Corumbá, 16 October 1963, fr., *B. Maguire et al. 57110* [collected by J. Murca Pires (Barneby 1991)] (holotype: UB!, isotype: NY!).

Fig. 12.

DIAGNOSTIC CHARACTERIZATION: *Mimosa accedens* is broadly defined by the following combination of characters: erect virgate subshrubs with xylopodium, patent filiform setae, and racemes axillar to fully expanded leaves, not organized into an exserted double-raceme, which has the expansion of leaves suppressed during anthesis. *M. prorepens*, which shares some affinities with this species, is distinguished for being a prostrate subshrub with unjointed craspedia. *M. setosa*, on its turn, is profusely branched shrub lacking a xylopodium and bearing leaves with interpinnal projections, those absent in *M. accedens*.

NOTES: Fruits of *Mimosa accedens* are usually fully articulated craspedia. However, one specimen shows valves breaking up irregularly and remaining partially integer (*Delforge s.n.* [RB 108679]). Even though the indumentum of *M. accedens* is marked by patent filiform setae, usually more striking than the presence of simple trichomes, *Burchell 7507* (P) shows a large amount of the later ones.

DISTRIBUTION AND HABITAT: *Mimosa accedens* occurs in *cerrados* of Brasília and Goiás, Central Brazil.

SELECTED SPECIMENS: Brazil. Distrito Federal: Brasília, Rodovia DF-250, morro após rio São Bartolomeu, cerca de 1,4 km do entroncamento com a DF-130, 15°43'58'' S, 47°40'20'' W, 935 m elev., *J.B.A. Bringel 853* (CEN!, UB!). Goiás: Cristalina, Serra dos Cristais, 75 km N. of Cristalina, on road to Brasília, [16°07'26'' S, 47°52'09'' W] 1000 m elev., 6 November 1965, *H.S. Irwin 10020* (K!, NY!, R!, UB!).

2. Mimosa acroconica Barneby (1991: 361–362). Type: Brazil. Minas Gerais: Joaquim Felício, [Serra do Cabral, descida da serra] in campo rupestre, 1000 m, 17°42'S, 44°14'W, 12 February 1988, fl., *J.R. Pirani et al. 2225* (holotype: SPF!, isotypes: NY!, SP!).

DIAGNOSTIC CHARACTERIZATION: The main distinguishing feature of *Mimosa acroconica* is the presence of early caducous ovate stipules, loosely imbricated at tip of sinflorescences, which appear together with the presence of prickles, trichomes and glandular setae on branches, and an unjointed craspedium. *M. paludosa* is distinct from it by the presence of filiform setae, armate leaf rachides, lanceolate stipules and craspedial fruits. The close and sympatrically endemic *M. bispiculata* (see notes under the species) may be distinguished by its filiform setae and a bifid interpinnal projection, which is simple in *M. acroconica*.

NOTES: The fruits of *Mimosa acroconica* were unknown to Barneby (1991), who placed the species in *M.* ser. *Setosae* and hence assumed them to be the typical craspedia found in members of the series. Recent collections (*L.M Borges et al. 651; 656; 662*), however, show that they are unjointed craspedia with papery valves, characteristic of *M.* ser. *Pachycarpae*. The same collections indicate that the plants possess elongated petioles, instead of the "true sessile leaves" of Barneby's (1991) description, based solely on the type. The later condition is commonly found, particularly in younger apical leaves, but the basal and fully developed ones may have petioles up to twice as long as the pulvinus. Although this would invalidate the use of petiole morphology to distinct *M. acroconica* from *M. caliciadenia*, as done by Barneby (1991) in the diagnosis of the first, the fruit morphology here provided balances that, since *M. caliciadenia* has typical craspedial fruits.

DISTRIBUTION AND HABITAT: *Mimosa acroconica* is endemic to *campos rupestres*, also occuring in *veredas* at 1000–1182 m of Serra do Cabral in Minas Gerais, Southeastern Brazil. It grows in sandy or sandy and rocky soils, usually wet or swampy, but is also found in well-drained areas.

Figure 13. *Mimosa adenotricha*. A. Habit. B. Branches with exserted synflorescences. C. Branch with antrorse aculeus (Ac) and glandular setae (Gs). D. Raceme. E. Unjointed craspedium.

Selected specimens: Brazil. Minas Gerais: Joaquim Felício, Serra do Cabral, Estrada Joaquim Felício–Várzea da Palma, 18,6 km de Joaquim Felício, 1168 m, 17°41'51.3"S, 44°15'40.0"W, 26 April 2012, fl., fr., L.M. Borges et al. 651 (NY!, SPF!); idem, Estrada Joaquim Felício–Várzea da Palma, 21,3 km de Joaquim Felício, Estrada Joaquim Felício–Francisco Dumont, 400 m do início da estrada, 1182 m, 17°41'24.3"S, 44°17'07.6"W, 27 April 2012, fr., L.M. Borges et al. 662 (NY!, SPF!); Lassance, Serra do Cabral, Morro do Tigre. Estrada Joaquim Felício–Várzea da Palma, 26,4 km de Joaquim Felício, 1 km em ramal à esquerda entre cultivo de Eucalipto, 1093 m, 17°42'34.1"S, 44°19'25.2"W, 27 April 2012, fl., fr., L.M. Borges et al. 656 (NY!, SPF!).

3. ***Mimosa adenotricha*** Bentham (1846: 91). Lectotype (designated by Barneby 1991: 392): Brazil. [Minas Gerais]: Serra da Lapa, November 1824, fl., fr., *L. Riedel 582* (lectotype: K!, isotype: LE!).

=*Mimosa heterotricha* Burkart (1974: 425–429). Type: Brazil. Minas Gerais: [Diamantina], Serra do Espinhaço, 16 February 1973, fl., fr., *G. Hatschbach & Z. Ahumada 31639* (holotype: SI, isotypes: MBM, NY!, US!) ”]); synonymized by Barneby (1991).

Fig. 13.

Diagnostic characterization: The combined occurence of antrorse aculei, glandular setae, corolla lobes concealed by the indumentum and unjointed craspedia provide a sharp circumscription of *Mimosa adenotricha*. The sympatric *M. paludosa* is distinguished by its straight to slightly incurved aculei, corolla lobes not concealed by the indumentum and typical craspedial fruits. *M. antrorsa*, which also presents antrorse prickles, stands out by its branches forwardly appressed setosae, but not glandular indumentum.

Distribution and habitat: *Mimosa adenotricha* is endemic to the southern part of the Espinhaço Range, where it occurs in *campos rupestres*, usually in areas near streams or on humid soils. Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Contagem, Fazenda Galheiros, de Júlio Caetano Rodrigues (vulgo Júlio Barbalho), ca. 3 km em estrada vicinal saindo a leste da rodovia Gouveia–Curvelo (BR 259, ao sul da fazenda Contagem, sopés da extremidade norte da Serra do Indaial, base de inselberg próximo ao Ribeirão da Contagem, 7 February 2009, R. *Mello-Silva 3162* (K!, NY!, SPF!); Joaquim Felício, Serra do Cabral, 14 March 1997, G. *Hatschbach 66212* (MBM, SPF!); Mendanha, Parque Estadual do Biribiri, Barris, 18°06'15'' S, 43°32'16'' W, 723 m elev., 12 January 2011, *C.O.Andrino 106* (DIAM!, SPF!); Santana do Pirapama, Serra do Cipó, Acesso pela Faz. Inhame, Trilha da Senhorinha, primeiro platô, 18°58'07'' S, 43°45'08'' W, 1087 m elev., 8 March 2009, *D.C. Zappi 1894* (SPF); São Gonçalo do Rio Preto, Parque Estadual do Rio Preto, Próximo ao heliporto e a Lapa do Tatu, 9 February 2012, *I.M. Araújo 17* (DIAM!, SPF!).

4. Mimosa albolanata Taubert (1896: 433–434). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: Serra Dourada, January 1893, fl., *E. Ule 2872* (lectotype: HBG! [also annotated as “415”], isotype: R! [two sheets only annotated as “415”].

≡ *Mimosa albolanata* var. albolanata, ***syn. nov.***

= *Mimosa albolanata* var. *brasiliana* Barneby (1991: 394–395), ***syn. nov.*** Type: Brazil. Distrito Federal: road to Paranoá, 10 km s.-e. of Brasília, 1000 m [elev.], 21 September 1965, fl, fr., *H.S. Irwin et al. 5570* (holotype: UB!, isotypes: G!, K!, LE!, NY!, P!, R!, S!, US!).

Fig. 14.

Diagnostic characterization: *Mimosa albolanata* is broadly defined as a prostrate shrub with a thick gray bark, indumentum composed of branches composed by incurved filiform setae, and lacking glandular setae, exserted synflorescences and unjointed craspedia. From *M. brevibractea*, which is an erect shrub, it differs by the incurved (vs. appressed indumentum of branches), petioles 1–2 times longer than the pulvinus (vs. 4 times or more), and simple double-raceme, not forming a paniculate synflorescence (vs. paniculate synflorescence). *M. prorsiseta* is clearly distinguished from *M. albolanata* for being an erect shrub or treelet and for having fruits with incurved filiform setae (vs. antrorse but not appressed).

Figure 14. *Mimosa albolanata*. A. Habit. B. Xylopodium (Xp). C. Raceme. D. Unjointed craspedium.

Notes: Barneby (1991) established the distinction between *M. albolanata*, considered endemic to the Serra Dourada environs, in the Central Western part of the Goiás state, and *M. albolanata* var. *brasiliana*, occurring in Central South areas of Goiás, including the Distrito Federal region and adjacent areas of Minas Gerais, based on the number of leaflet pairs and presence of trichomes on their surfaces. The first would present 45–55 leaflet pairs pubescent overall; and the later 40–44 pairs, but only ciliate. Analyzed specimens show that ciliate leaflets occur in leaves with up to 50 pairs of specimens from Minas Gerais (e.g. *M.L. Fonseca et al. 1860* [IBGE, NY]; *R.C. Mendonça et al. 3457* [IBGE, NY]), and the ciliate form can also be found in specimens from Serra Dourada (*e.g. Burchell 6700-15*). Thus, the geographic and morphologic limits between these taxa are not as consistent as Barneby (1991) thought and, hence, we synonymize *M. albolanata* var. *brasiliana* under *M. albolanata*. Although morphology allow us to opt for this merging, it is important to note that multiple accessions of *M. albolanata var. brasiliana* do not group with *M. albolanata* var. *albolanata*, but appear dispersed in the inferred tree in association with different taxa, including *M. albolanata* var. *paucipinna* (see Chapter 1 and notes under *M. paucipinna*). *M. claussenii* var. *pumila*, restricted to areas surrounding the municipality of Niquelândia, in the Goiás State may be an extreme of variation of the species, but additional data about this variety are necessary to establish its affinities.

One specimen, *Simon 332*, from the Grande Sertão Veredas National Park, northwestern Minas Gerais state, presents conspicuously large leaves with unusually longer setae, and, by that, being also similar to *M. eriorrhachis*. Further exploitation of this area is needed to properly access the identity of this particular specimen as well as others from populations of that same region.

Distribution and habitat: *Mimosa albolanata* occurs in *cerrados* and transitions to *campos rupestres* from the Federal District, Goiás and Minas Gerais state, between

Selected specimens: Brazil. Distrito Federal: Brasília, Córrego Capao da Erva, 15°46'47'' S, 47°55'46'' W, 10 November 1981, A. *Atta 14* (NY!). Goiás, Campo Alegre de Goiás, BR 050, 16 km N de Pires Belo (entre Catalao y Cristalina), 17°37'59'' S, 47°46'42'' W, 850 m elev., 30 January 1990, *M.M. Arbo 3078* (NY!); Serra Dourada, ca. 20 km SE of Goias Velho, 15°56'04'' S, 50°08'25'' W, 800 m elev., 20 January 1966, *H.S. Irwin 11842* (NY!). Minas Gerais: Itacambira, Ponto 6, 2 March 1993, M. *Brandão 22047* (PAMG!, SPF!); Serra do Cabral, de Jiquitahí para Burity Grande, 1 May 1963, *A.P. Duarte 7730* (NY).

4.1. Mimosa albolanata var. ***grossiceps*** Barneby (1991: 395–396). Type: Brazil. Goiás: Serra do Facão in Contraforte Geral [Contraforte Central], ±25 km n.-e. of Catalao, [900 m elev.,] 24 January 1970, fl., *Irwin et al.* 25263 (holotype: UB!, isotypes: C!, G!, K!, LE!, NY!, P!, R!, S!, US!.

Diagnostic characterization: *M. albolanata* var. *grossiceps* was defined by Barneby (1991) as having the habit of *M. paucipinna* (treated by him as *M. albolanata* var. *paucipinna*), but with much larger racemes (15–16 mm long, not 10–14) and floral bracts (5–6 mm long, not 3–5(–6)).

Notes: Barneby (1991) suggested that *M. albolanata* var. *grossiceps* could be related to *M. prorsiseta*, which has similar racemes, and that study of fruits was necessary to better establish the taxon identity. We believe that this is more accurate than to consider it as belonging into *M. albolanata* and even that it may be related to *M. soderstromii*, which is also a prostrate shrub. However, the few known recent collections of *M. albolanata* var. *grossiceps* also lack fruits and do not improve our knowledge about the morphological features of this variety. Thus, it is kept here in order to secure nomenclature stability and to highlight the need for further examination of its status.

Distribution and habitat: *Mimosa albolanata* var. *grossiceps* is known only from *cerrado* areas from Serra do Facão, near the municipality of Catalão in southeastern Goiás state, Central Brazil

Selected specimens: Serra do Facão, Área de influência do AHE, 3 April 2008, *A.A. Arantes SF949* (HUFU!).

5. Mimosa alligantina (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa densa* var. *alligantina* Barneby (1991: 411–412). Type: Brazil. Goiás: [Água Fria de Goiás, Serra Geral do Paranã,] 13 km s. of S. João da Aliança, [1120 m elev.,] 21 March 1973, fl., *W. R. Anderson et al. 7593* (holotype: UB!, isotypes: G!, K!, LE!, NY!, R!, US!).

Fig. 15.

Diagnostic characterization: *Mimosa alligantina* is similar to *M. densa* and *M. oligosperma*, but differs from the second by the presence of glandular setae on branches (vs. absence; *M. densa* is wholly eglandular) and by oblong fruits with incurved setae (vs. narrowly oblong antrorse, but not appressed setae); from the third, it differs by the cla-

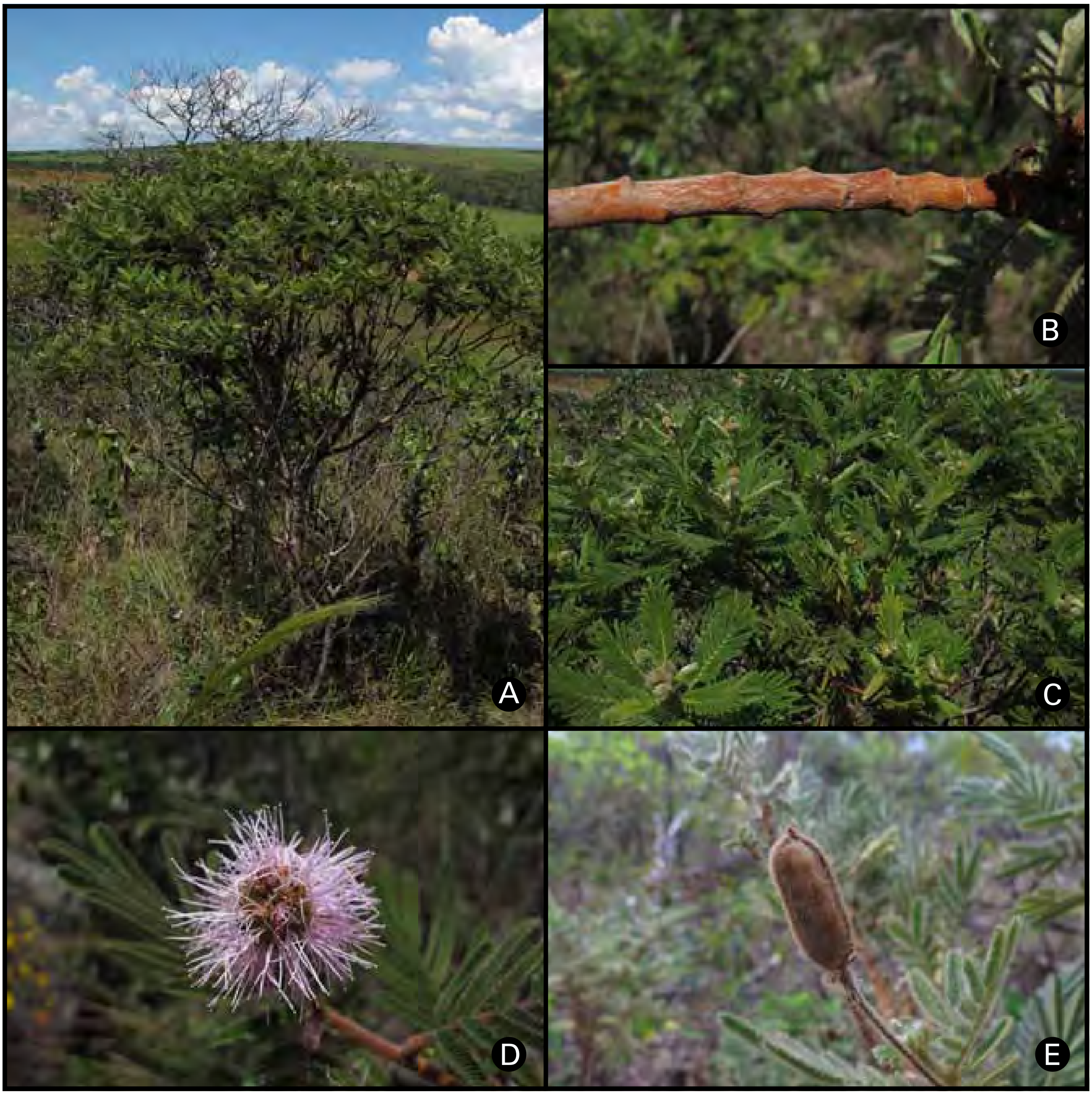

Figure 15. *Mimosa alligantina*. A. Habit. B. Branch with orange underbark revealed after peridermis exfoliation.

vate glandular setae (vs. capitate). Additionally, *M. alligantina* differs from both by the laterally fused plane setae on the calyx rim (vs. free plane setae).

Notes: Barneby (1991) considered *Mimosa alligantina* as a variety of *M. densa*, but, as shown above, there is enough evidence to allow their recognition as two distinct species. This is reinforced by findings of Borges *et al.* (Chapter 1) showing that a polytypic circumscription of *M. densa* makes it polyphyletic. Another species that may be considered akin to *M. alligantina* is *M. setosissima*, which also presents glandular setae on branches and racemes subtended by a fully or almost so leaf, besides being sister group to *M. alligantina* (Borges *et al*. Chapter one). The later, however, has shallowly cupulate calices without plane setae on the rim (vs. cupulate calices with ciliate with plane setae). See also notes under *M. decorticans* for more comments on other taxonomic affinities.

Distribution and habitat: *Mimosa alligantina* occurs in rocky *cerrado* and *campo rupestre* with outcrops at elevations of Serra do Geral do Paranã, particularly surrounding the municipality of Água Fria de Goiás, located to the south of Chapada dos Veadeiros in the Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Água Fria de Goiás, Serra Geral do Paraná, ca. 20 km S. of São João de Aliança, 17 March 1971, fl., H.S. Irwin et al. 32098 (NY!, UB!); Água Fria de Goiás, Rod. GO-118, 20–30 km ao Sul de São João da Aliança, 14 October 1990, fl., G. Hatschbach et al. 54520 (MBM, NY!); Água Fria de Goiás, Serra Geral do Paranã, Rodovia BR 010, Alto Paraíso de Goiás–Teresina de Goiás, ca. de 101 km do trevo de Alto Paraíso, ca. de 32 km de São João d'Aliança, elevação à esquerda da estrada, 14°59'07,9"S, 47°36'17,0"W, 1126 m elev., 25 September 2012, fl., fr., L.M. Borges et al. 896 (SPF!).

6. Mimosa antrorsa Bentham (1842: 403). Lectotype (designated by Barneby 1991): Brazil. [Minas Gerais: ad Pedro Pereira (indicated later on Bentham, 1876)], fl., fr., *J.B.E. Pohl d. 1426* [=*2891*] (lectotype: K!, isolectotypes: †B photo!, F!, K! M! [not numbered, but probably a duplicate], NY!, US!, W! [F, NY, US and W specimens also numbered "2891"). *Mimosa adversa* Bentham (1875: 439), nom. subst. illeg.

Fig. 16.

Diagnostic characterization: *Mimosa antrorsa* is one of the most distinct species in *M.* ser. *Pachycarpae*, mainly by its slender ascending branches covered by a golden appressed indumentum. From *M. paludosa*, it is dintinct also by the non-articulate craspedia and flowers with corolla lobes concealed by the indumentum. From *M. adenotricha* it differs by the forwardly appressed filiform setae (vs. patent), persistent stipules (vs. caducous), absence of aculei on rachis and of plane setae on calyx rim (vs. presence), as well as by the fruits' surface completely concealed by the indumentum (vs. not concealed).

Notes: Populations from Northern Goiás state, on the surroundings of Serra da Mesa, present a small number of prickles, usually absent in the distal portion of stems and branches, when compared to populations from Minas Gerais State. Hence, herbarium collections from Goiás usually completely lack aculei and, in the absence of precise label information, may give the impression that the plant is unarmed. In those cases, the other main characters defining the species are constant and can be used to properly identify specimens.

Distribution and habitat: *Mimosa antrosa* occurs in *cerrado*, *campo sujo*, and *brejos* usualy with sandy soils at the Espinhaço Range, Minas Gerais state, and near Serra da Mesa, in Goiás, Central and Southerneast Brazil.

Selected specimens: Brazil. Goiás: Colinas do Sul, RPPN Cachoeira das Pedras Bonitas, 14°11'35'' S, 48°03'31'' W, M.L. *Fonseca 5390* (RB!, UB!). Minas Gerais: Grão Mogol, contrafortes a leste da trilha da tropa, que vai da cidade até Periperi passando pelo alto da serra, nas encostas à esquerda do Ribeirao do Inferno, altos da serra, 16°33'34'' S, 42°53'22'' W, 1100 m elev., 27 September 1997, R. *Mello-Silva 1438* (HUEFS!, NY!, SPF!); Grão Mogol, Estrada Grão Mogol - Montes Claros, ca. 6km de Grão Mogol, 16°35'33'' S, 42°54'50'' W, 11 July 2001, *V.C. Souza 25709* (ESA!); Joaquim Felício, Serra do Cabral, ca. 8km W de Joaquim Felício, 17°41'34'' S, 44°11'56'' W, 1018 m elev., 30 March 2005, *E.B. Souza 1064* (HUEFS!).

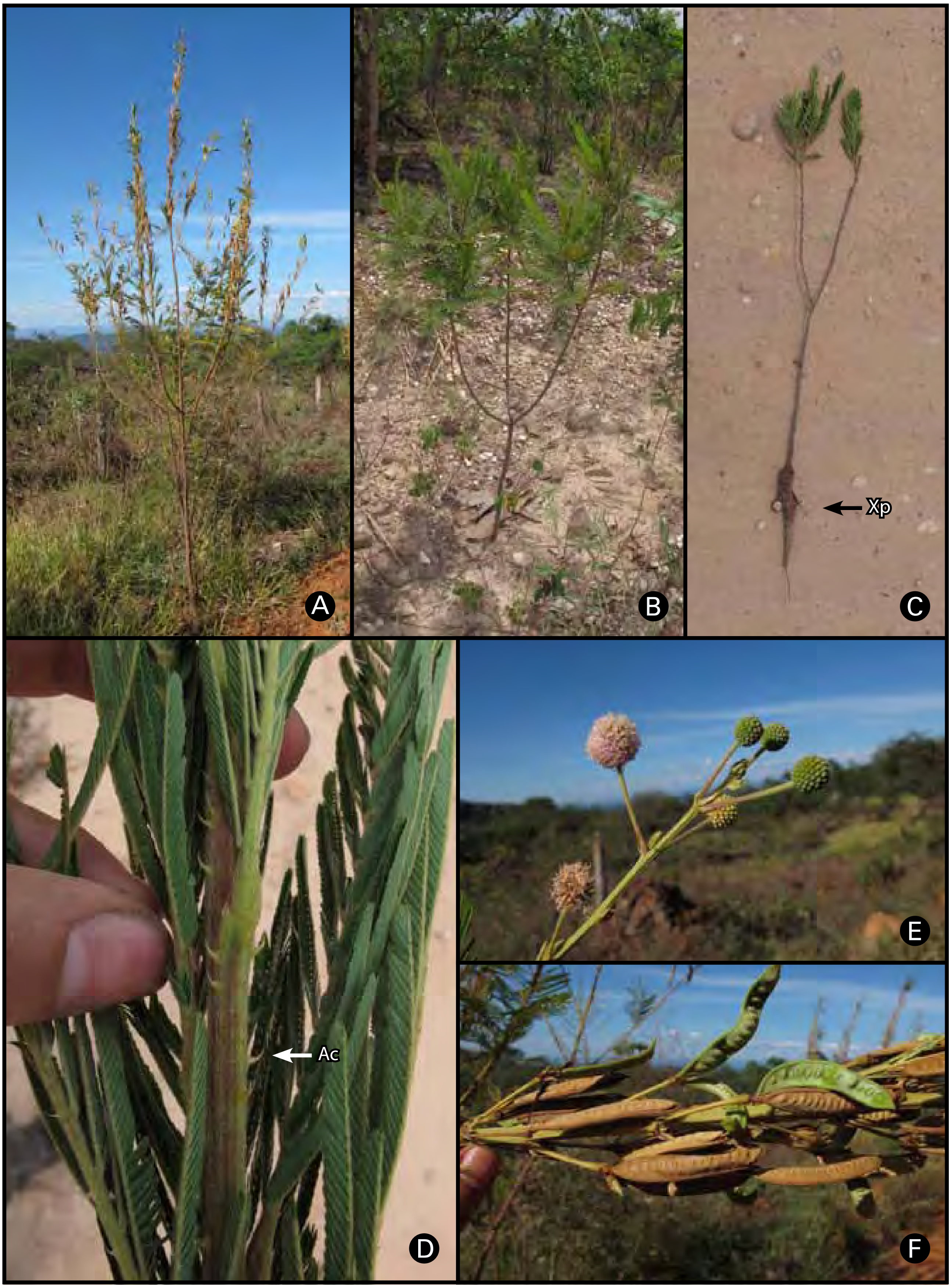

Figure 16. *Mimosa antrorsa*. A–B. Habit. A. Individual from Minas Gerais state with up to 4 m tall. B. Individual from northern Goiás with up to 1.5 m tall. C. Young individual with xylopodium (Xp). D. Branch with antrorse aculei (Ac). E. Globose racemes. F. Fruits.

7. Mimosa auriberbis Barneby (1991: 385). Type: Brazil. Distrito Federal: dry hills, ca. 55 km E. of Brasília near road to Planaltina, 13 September 1964, fl., *H.S. Irwin & T.R. Soderstrom 6174* (holotype: UB!, isotypes: C, COL, F!, IAN!, LIL, MO!, NY!, U).

Diagnostic characterization: According to Barneby (1991), *Mimosa auriberbis* may be differentiated from *M. setosissima* for its shrubby (vs. a treelet), absence of glandular setae (vs. presence), setose-ciliate calyx (vs. glabrous) and absence of peridermal exfoliation (vs. presence, but see below).

Notes: The type of *Mimosa auriberbis* in NY actually shows presents peridermal exfoliation, although this is not as prominent as in *M. setosissima* and other species such as *M. densa* and *M. oligosperma*. Hence, this character may not be used to diagnose *M. auriberbis* in the context of the taxa related to it by this feature.
Barneby (1991) established *Mimosa auriberbis* by comparison with the sympatric *M. rava*, which, despite the area of occurrence, actually has not much in common with it, and *M. setosissima*, distinct by the characters listed above. *M. auriberbis* has, in fact, a closer relationship with *M. oligosperma*, particularly the same kind of indumentum, both in branches and calyx, the peridermal exfoliation, although in lower degree, and some metric characteristics, such as the length of flowers, petioles, peduncles, pinna and rachis. Our analysis suggests that *M. auriberbis* may be the southern most occurrence of *M. oligosperma*, but a study of fruits is necessary to confirm this hypothesis. However, even after unfruitful intensive search in the field, *M. auriberbis* is still only known by the flower bearing type specimen and is hence kept here as a distinct species in await for further evaluation upon additional data.

Distribution and habitat: *Mimosa auriberbis* is only known by the type specimen, collected in dry hills of *cerrado* in the eastern Federal District, Central Brazil.

8. Mimosa bispiculata Barneby (1993: 454–456). Type: Brazil. Minas Gerais: Várzea da Palma, Serra do Cabral, Agroindustrial Serra do Cabral, 16 April 1996, fl., *G. Hatschbach et al. 64875* (holotype: MBM, isotypes: BAB, BHCB!, C, CTES, GH!, K!, MEXU, NY!).

Diagnostic characterization: The most distinctive feature of *Mimosa bispiculata* is the presence of two projections between pinnae pairs, not found in any other species of *M.* ser. *Pachycarpae*.

Notes: Besides varying in number, the laminar interpinnal projections found in the leaves of *Mimosa bispiculata* are also larger than the ones regularly present in other species of *M.* ser. *Pachycarpae*. They were chiefly observed in mature leaves, but some specimens show these structures fused at the base, indicating that the double projections may appear by longitudinal fissure of a single laminar projection during development of the leaves. Particularly, the isotype at G presents just one small, lanceolate projection between pinnae pairs at the apex of the rachis, suggesting that, indeed, the bifid condition is acquired during leaf development.
Although Barneby (1997) established *M. bispiculata* against *M. regina* and *M. rhodostegia*, it is actually more similar to the sympatric *M. acroconica*, which was described by Barneby (1991) in *M.* ser. *Setosae*. The difference between

those two species is supported only by the presence of two interpinnal projections (vs. one) and filiform setae in the branches (vs. absence) of *M. bispiculata*. We see this differences as informative to distinguish those species, but, as *M. bispiculata* was not sampled in the phylogenetic study of Borges *et al.* (Chapter 1), further studies should be carried out at Serra do Cabral in order to investigate whether or not they can represent intraspecific variations (particularly the doubled number of interpinnal projections), as well as to improve our knowledge about this poorly collected species.

Distribution and habitat: *Mimosa bispiculata* is endemic to *campos rupestres* of Serra do Cabral, a 3000 km^2 plateau of the Espinhaço Range in central Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Várzea da Palma, Serra do Cabral, Agroindustrial Serra do Cabral, 17°35'53'' S, 44°43'52'' W, 20 May 2001, G. *Hatschbach 64875* (G!, HBG!, MBM, NY!, W!); Serra do Cabral, Agroindustrial Serra do Cabral, 20 May 2001, G. *Hatschbach 72246* (ALCB!, ESA!, G!, HUEFS!, MBM, W!)

9. Mimosa brevibractea (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basyonim: *Mimosa foliolosa* subsp. *brevibractea* Barneby (1991: 382). *M. foliolosa* subsp. *brevibractea* var. *brevibractea*. Type: Brazil. Distrito Federal: [Ca. de 1 km] n. of Barragem Paranoá, [DF–9, ca. 1000 m elev.,] 27 February 1970, fl., *H.S. Irwin et al. 26700* (holotype: UB!, isotypes: BR, K!, LE!, MO!, NY!, R!, S!, US!).

=*Mimosa foliolosa* subsp. *brevibractea* var. *antana* Barneby (1991: 383), ***syn. nov.*** Type: Brazil. Minas Gerais: [Paracatu,] Serra da Anta, ±7 km w. of Paracatu, [850 m elev.,] 4 February 1970 (fr), *H.S. Irwin et al. 26034* (holotype: UB!, isotypes: G!, K!, LE!, NY!, R!, US!).

Fig. 17.

Diagnostic characterization: *Mimosa brevibractea* differs from typical *M. foliolosa* by having thick, suberose and greyish pachycaul stems (vs. slender stems, at base with fasciculate branches), triangular stipules (vs. narrowly triangular), and glandular indumentum absent from floral bracts (vs. present). From *M. paranani* it differs by the fruits with forwardly appressed filiform setae (vs. incurved), which may be also used to set it apart from *M. prorsiseta*, the later also having this same indumentum orientation on branches (vs. forwardly appressed in *M. brevibractea*).

Notes: Within the context of its closest species, a remarking feature of *Mimosa brevibractea* is the orientation of the indumentum both on branches and fruits. On fruits the forwardly appressed short setae get to make them coarse to touch.

Recognition of *M. brevibractea* at species level is reinforced by the grouping of multiple samples of the species in a clade not related to many taxa previously recognized within *M. foliolosa* (Borges *et al.* Chapter 1) and by the presence of the suberose and thick trunk, which clearly sets it apart from other species related to *M. foliolosa*. This feature is usually not represented on herbarium specimens and also not described in collection labels, but for those cases, the species indumentum and spherical racemes with short floral bracts are useful to set it apart from other taxa. Barneby (1991: 383) established *M. foliolosa* var. *antana* apart from *M. foliolosa* var. *brevibractea* based on raceme's length and foliar formula, features that are not taken into account by the species delimitation method applied here and

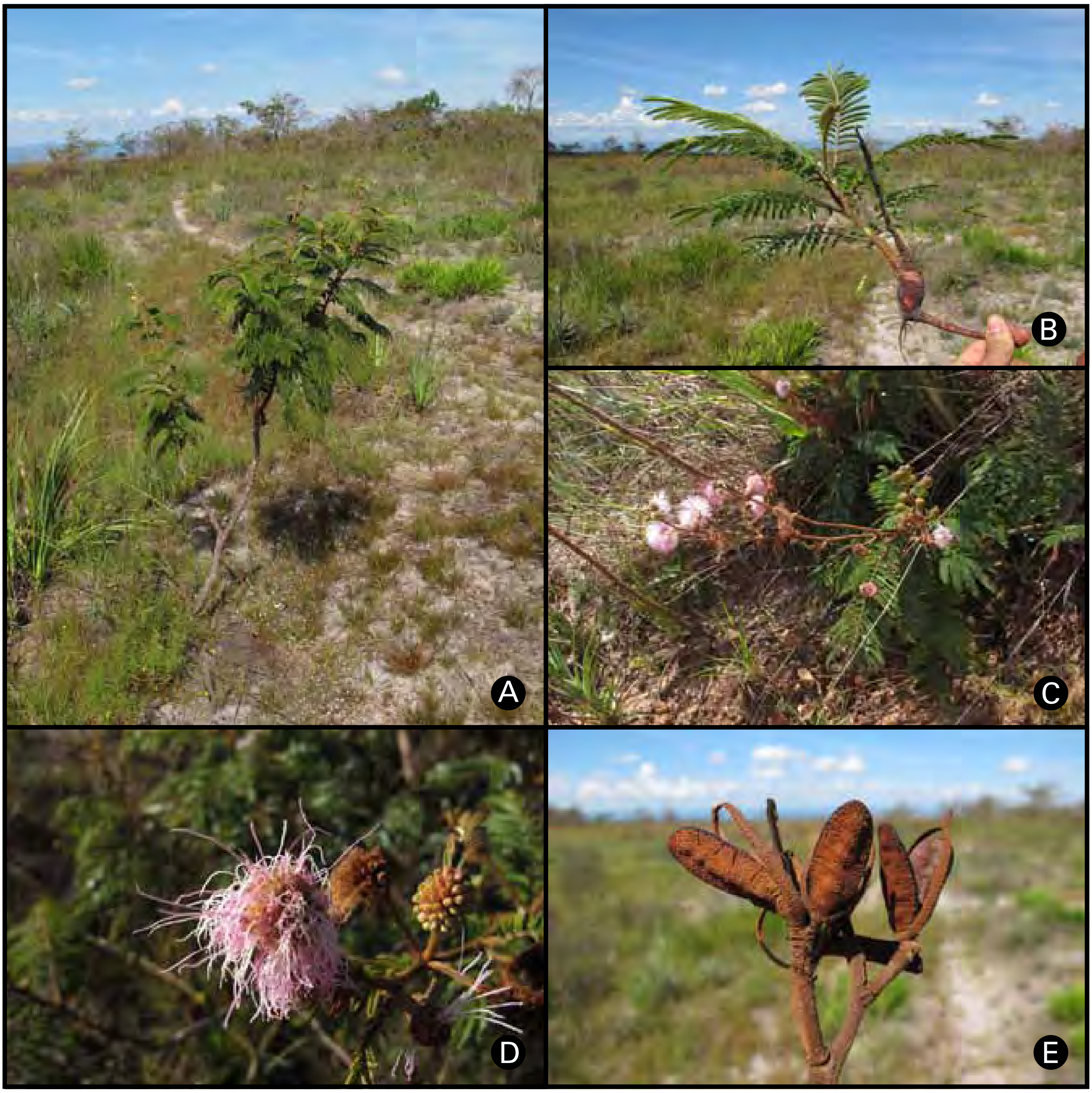

Figure 17. *Mimosa brevibractea*. A. Habit. B. Young individual with xylopodium (Xp). C. Synflorescence. D. Racemes. E. Fruits.

which nonetheless are prone to variation within species. Thus, *M. foliolosa* var. *antana* is considered a synonym of *M. brevibractea*.

Distribution and habitat: *Mimosa brevibractea* occurs in *cerrados* and *campos rupestres* in the states of Goias, Minas Gerais and the Federal District, Central Brazil.

Selected specimens: Brazil. Distrito Federal: Sobradinho, APA do rio São Bartolomeu, Assoc. Euler Paranhos, Chácara Angaturama, 15°44'03'' S, 47°44'17'' W, 1100 m elev., *C.A.S. Correia 185* (UB!); Goiás: Estrada de terra Vicinal GO-237 (Niquelândia-Colinas), Estrada a 600 m da ponte sobre Bagagem; 2,5 km desta, 14°21' S, 48°12' W, 470 m elev., 13 April 1992, *B.M.T. Walter 1221* (CEN!). Minas Gerais: Delfinópolis, , Cachoeirinhas, 2 May 2001, *A.C.B. Silva 893* (SPF!, SPFR!); Joaquim Felício, Serra do Cabral, Estrada para Várzea

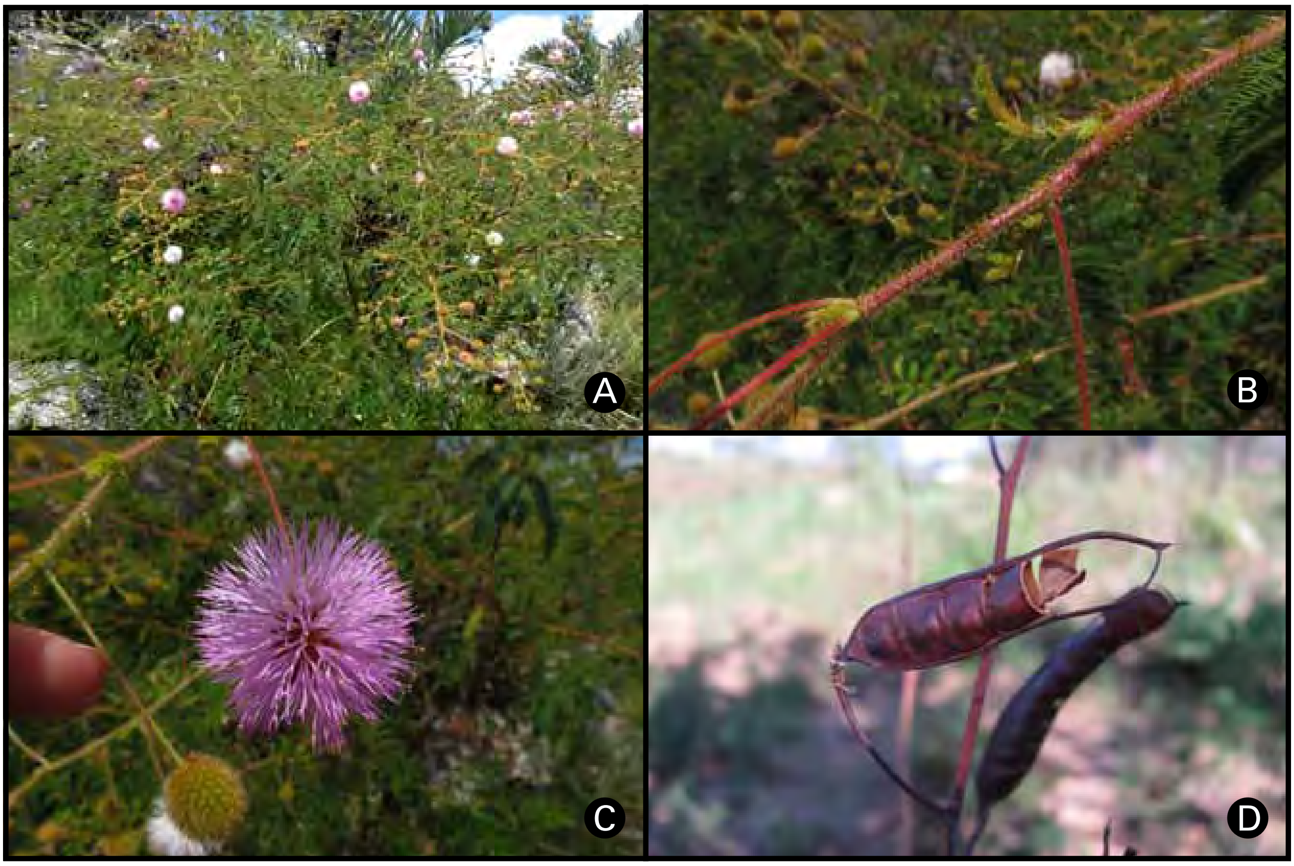

Figure 18. *Mimosa caliciadenia*. A. Habit showing the intermingled branches. B. Branch with glandular setae (Gs) and aculei (Ac). Photo A–C by C. Andrino.

da Palma, pelo alto da Serra, Fazenda Serra do Cabral Agro-Industrial S/A, 17°34'16" S, 44°17'32" W, 1100 m elev., 11 January 1998, *J.R. Pirani 3880* (NY!, SPF!).

10. Mimosa caliciadenia Barneby (1991: 360–361). Type: Brazil. Minas Gerais: [Diamantina], ca. 18 km E. of Diamantina, 900 m, 16 March 1970, fl., *H.S. Irwin et al. 27700* (holotype: UB!, isotypes: C, G!, GH!, K!, LE!, NY!, P!, R!, S?, US!)
Fig. 18.

Diagnostic characterization: In the context of *Mimosa* ser. *Pachycarpae* species occurring in the Espinhaço Range, in central Minas Gerais state, *M. caliciadenia* differs from *M. paludosa* by its capitate glandular setae (vs. clavate), glabrous corolla lobes (vs. pubescent), and antrorse (not appressed) indumentum of fruits (vs. patent). The sibling *M. perplicata* also has clavate glandular setae, and lacks aculei on the leaves primary axis, the later present in *M. caliciadenia*.

Morphological Notes: Fruits of *Mimosa caliciadenia* present an intermediate condition between the typical craspedium found in the genus and the unjointed craspedium observed in the majority of *M.* ser. *Pachycarpae* species. During dehiscence, the valves keep entire, but after release of seeds, they break up into as many segments as the number of seeds present in the fruit (Fig. 18). A good example of this condition is found in *Saint-Hilaire 2025* (P).

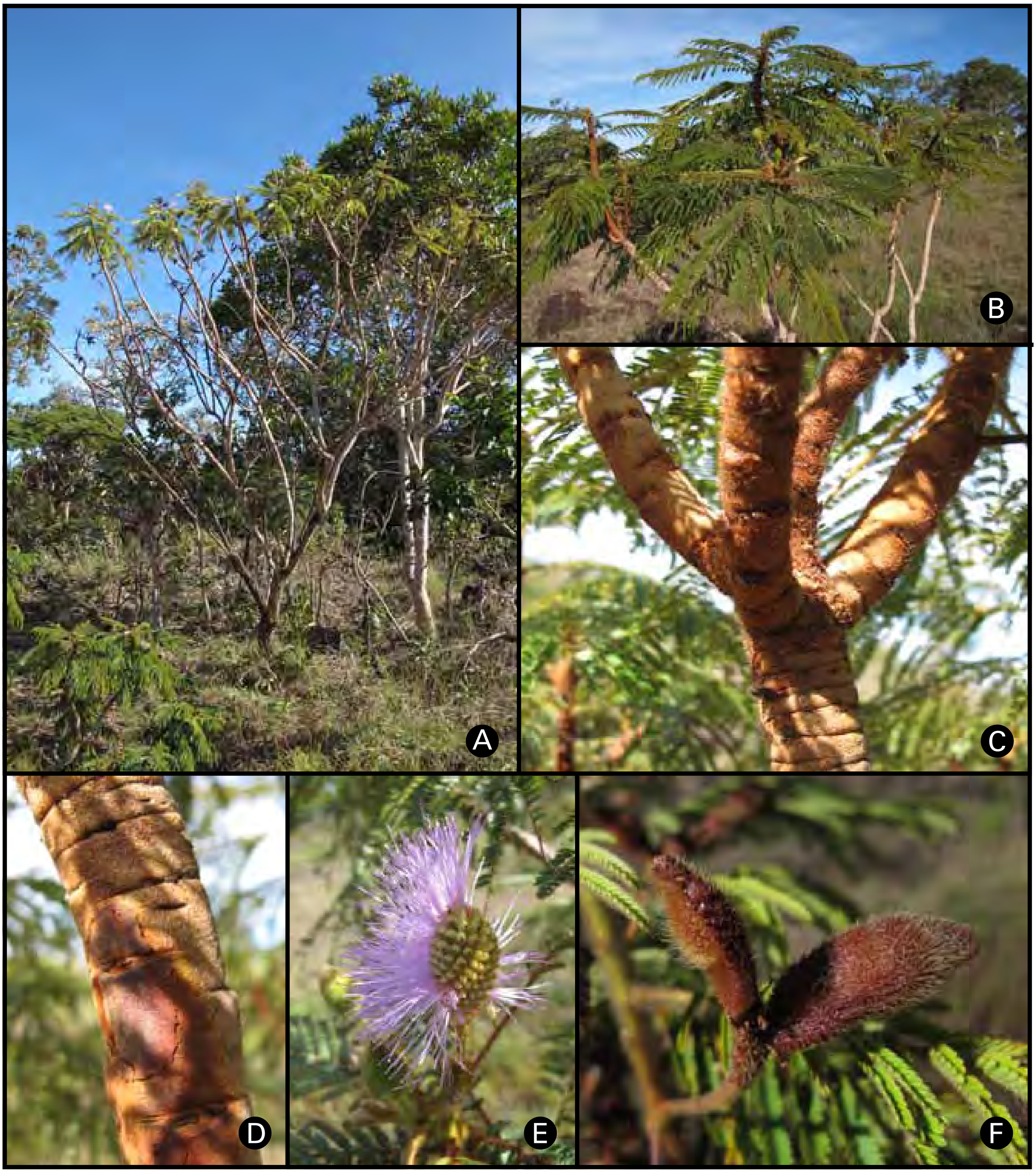

Figure 19. *Mimosa capito*. A. Habit. B. Congeste leaves. C. Branches with peridermis exfoliation and developed suber. D. Detail of the peridermis exfoliation revealing the reddish underbark. E. Raceme. F. Fruits.

Distribution and habitat: The species is endemic to *campos rupestres* of the Diamantina Plateau, located at the Southern Espinhaço Range, in central Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Diamantina, Estrada Diamantina–Extração, próximo da ponte, 28 January 1986, D.C. *Zappi CFCR 9290* (F!, K!, NY!, SPF!); Diamantina, Serra do Espinhaço, Ca. 18 km E. of Diamantina, 900 m elev., 16 March 1970, H.S. *Irwin 27700* (G!, LE!, NY!, P!, UB!, US!).

11. *Mimosa capito* Barneby (1991: 418–419). Type: Brazil. Goiás: Serra dos Veadeiros, Palmital, 29 October 1965, fl., *E. Pereira 10974 (= A.P. Duarte 9463)* (holotype: HB! []; isotypes: NY! [E. Pereira 10974], RB! [A.P. Duarte 9463]).

Fig. 19.

Diagnostic characterization: *Mimosa capito* stands out from morphologically related treelets of Chapada dos Veadeiros, such *M. oedoclada*, *M. manidea* and *M. regina*, by the absence of glandular setae on branches (vs. presence). From the closely similar *M. prorsiseta* it may be differentiated by the patent orientation of filiform setae on branches (vs. incurved) and the exfoliation of the branches' periderm (see note below). Also, amongst all the species cited

Figure 20. *Mimosa chiliomera*. A. Individual rose from soil level to reveal its full length. B. Xylopodium. C. Leaves. D. Paniculate synflorescence. E. Racemes.

above, *M. capito* is the only one with corolla lobes not concealed by the indumentum (vs. concealed) and varying from puberulous to glabrous.

NOTES: Barneby (1991) described the species as having glabrous corolla lobes, but analysis of a larger number of specimens revealed that those may be also be sparsely pubescent with trichomes and/or filiform setae, although those do not conceal the lobes surface. *M. capito* was not considered by Barneby (1991) as having peridermal exfoliation, but it presents this feature, indeed. The periderm tends to persist for a longer time than in *M. densa* or *M. oligosperma*, so the exfoliation is not commonly observed in herbaria specimens (see *Sheperd 3791* and *Borges 598* for counterexamples).

DISTRIBUTION AND HABITAT: *Mimosa capito* is known from a few specimens collected in *cerrados* with sandy soils at Chapada dos Veadeiros in the Goiás Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, 9 km W de Alto Paraiso de Goias, camino a Niquelandia, 14°07'57'' S, 47°30'35'' W, 1200 m elev., 4 February 1990, *M.M Arbo 3629* (HRCB!, NY!); Cavalcante, Parque Nacional da Chapada dos Veadeiros, Alto do Cruzeiro, 13°56'38'' S, 47°41'46'' W, 1320 m elev., 15 April 2009, *Martinelli, G. 16451* (K!, RB!).

12. Mimosa chiliomera Barneby (1993: 329–330). Type: Brazil. Minas Gerais: Joaquim Felício, Serra do Cabral, ca. de 15 km W de Joaquim Felício, camino a Várzea da Palma, aprox. 17°42' S, 44°17' W, 1180 m, 20 May 1990, fl., *M.M. Arbo et al. 4582* (holotype: CTES, isotypes: NY!, SPF!)

Fig. 20.

DIAGNOSTIC CHARACTERIZATION: *Mimosa chiliomera* differs from the *M. lithoreas* by the branches with patent filiform setae (vs. forwardly appressed), glandular setae present on branches and leaves axes (vs. absent), plane setae on calices rim (vs. setae absent), and tomentose corolla lobes (vs. glabrous). From *M. serpensetosa*, it clear stands out by lacking prickles and a projection between pinna pairs.

NOTES: *Mimosa chiliomera* is part of a clade with most humifuse species of *Mimosa* ser. *Pachycarpae* (Borges *et al.* Chapter 1), including *M. humivagans* and *M. prorepens*. *M. chiliomera* shares with those the patent indumentum of branches, but it is differentiated by the corolla lobes concealed by their indumentum (vs. not concealed). Fruits of *Mimosa chiliomera* are still unknown, but the overall character states of the species allow us to predict them as unjointed craspedia. As highlighted by Barneby (1993), the total number of leaflets per leaf, which surpasses 4000, has no match in other species of *M.* ser. *Pachycarpae*.

DISTRIBUTION AND HABITAT: *Mimosa chiliomera* is endemic to grassy *cerrado* formations with rock outcrops at 1000–1200 m elevation in Serra do Cabral, a 3000 km^2 plateau located at the Espinhaço Range in central Minas Gerais state, Central and Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Joaquim Felício, Serra do Cabral, Estrada Joaquim Felício–Várzea da Palma, 17.6 km de Joaquim Felício, 17°41'49.3"S, 44°15'10.7"W, 1168 m elev., 26 April 2012, fl., L.M. Borges et al. 648 (SPF!); Serra do Cabral, 17°41'55" S, 44°15'07" W, 16 May 1999, *V.C. Souza 22523* (ESA!).

13. Mimosa claussenii Bentham (1842: 405). Lectotype (designated by Barneby 1991): Brazil. Minas Gerais: 1839, fl., fr. imm., *P. Claussen & B. Delessert 19* (lectotype: K!, isolectotype: F!).

≡*Mimosa claussenii* var. *claussenii*

= *Mimosa claussenii* var. *claviceps* Barneby (1991: 403), ***syn. nov.*** Type: Brazil. Goiás: Chapada dos Veadeiros ±6 km e. of Alto Paraiso, 1500–1700 m, 15 February 1979, fl., *M. S. G. Ferreira & F. Cardoso* 57 (holotypus UB! [2 sheets]).

=*Mimosa claussenii* var. *dolichopoda* Barneby (1991: 403), ***syn. nov.*** Type: Brazil. Goiás: dans la belle vallee de Chico Costa [near 15°40'S, 48°10'W, close to w. boundary of Distrito Federal (Barneby 1991)], sur les collines, 10 October I894, fl., fr., *A.F.M. Glaziou* 21093 (holotype: P!, isotypes: †B photo!, C, F!, K! LE! M! S!).

Fig. 21.

Diagnostic characterization: *Mimosa claussenii* stands out among other species of *M.* ser. *pachycarpae* by the presence of thick retrorse setae on stems, usually also present on petioles and rachides. Several of its features, such as overall aspects of leaves, flower and fruit morphology are shared with *M. prorsiseta*, which differs mainly by having indumentum with incurved filiform setae.

Notes: The robustness of the caulinae setae of *M. claussenii* is usually well marked, as shown in FIG, but some specimens may present more delicate ones, generally with slender tips partially recurved. This would be indicative of a closer connection between *M. claussenii* and *M. prorsiseta*, but extensive observation of natural populations of both species did not reveal intermediate individuals. Although there is a chance for this taxonomic connection to really exist, probably this issue is associated with the collection method, which clearly cannot embrace all the information about the whole plant. Extreme elongation of racemes, used to define *M. claussenii* var. *dolichopoda* and *M. claussenii* var. *claviceps* (Barneby 1991) is apparently an abnormality occurring in particular individuals. For instance, *Moura 25* presents both spherical and ellipsoid racemes and *Irwin 31931*, ellipsoid racemes of intermediate size. Fruits in general have incurved indumentum, but retrorse setae may occur in a few specimens such as *Irwin 18106*, which bears fruits with both orientations.

Mimosa claussenii var. *claviceps* and *M. claussenii* var. *dolichopoda* were establish apart from *M. claussenii* var. *claussenii* essentialy by its longer racemes and the later also by its fruit shape (Barneby 1991), but besides those features, they are extremely similar to *M. claussenii* and share the same thick and retrorse setae on branches. Apparently, elongation of the racemes is a recurrent abnormality (see above) and may not be used as a distinguishing feature. Fruits are different mainly for being narrowly oblong instead of oblong to elliptic, and also for not having valves completely covered by the indumentum. The later, however, is considered another variation of the fruit indumentum (see also abore) and, hence, *M. claussenii* var. *dolichopoda* is here considered a synonym of *M. claussenii*. Further examination of natural populations in the field may demonstrate that this features is in fact resilient, allowing to raise *M. claussenii* var. *dolichopoda* may be raised to species level.

It is important to note that the lectotype chosen by Barneby (1991) is a jointed collection by Claussen and Delessert,

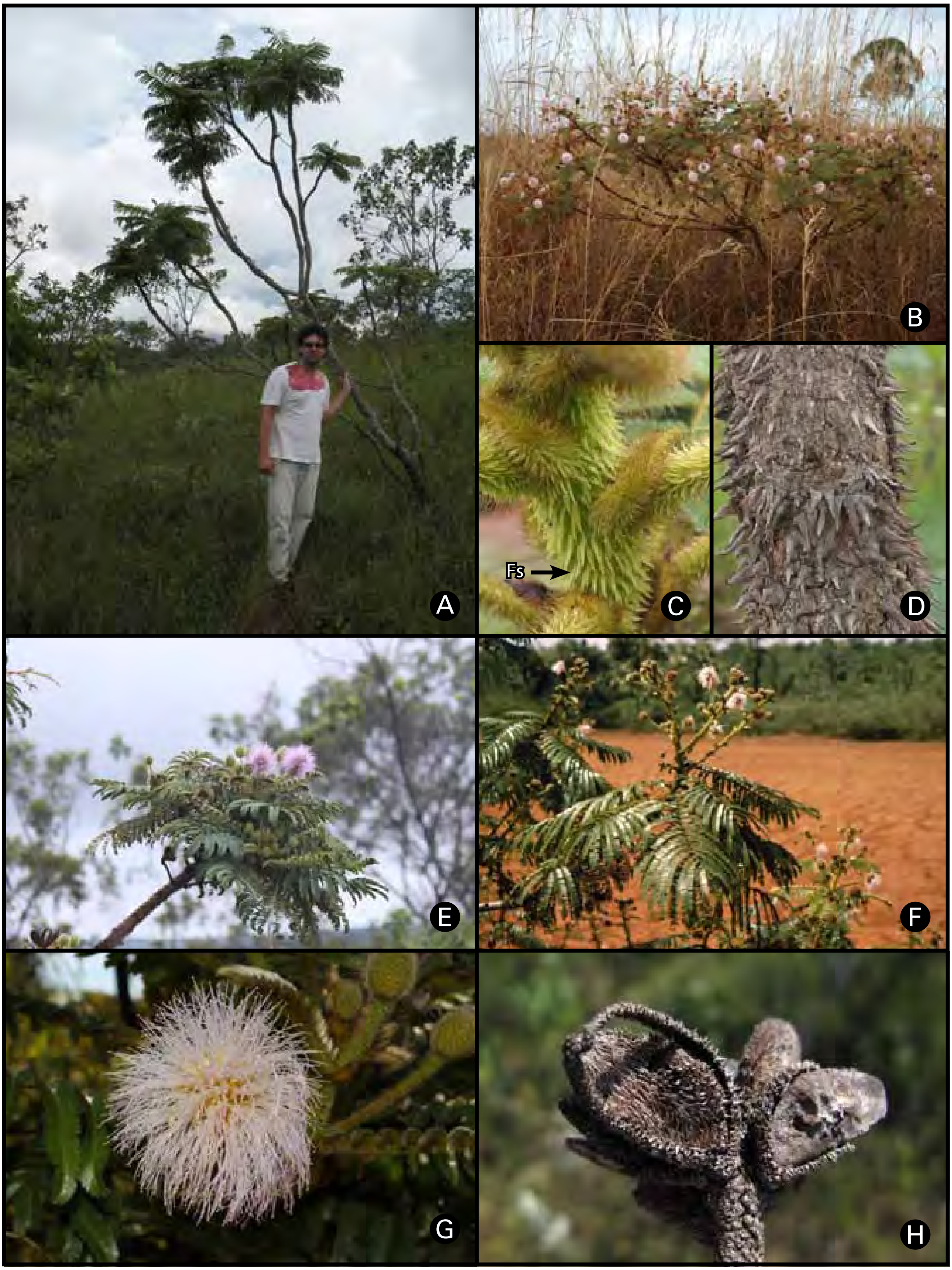

Figure. 21. *Mimosa claussenii*. A–B. Habit. Tall individual and M.T.C. Watanabe. B. Small individual. C. Young branch with thick filiform setae (Fs). D. Old branch still bearing the filiform setae. E. Individual with shortly exsert synflorescence. F. Individual with compound and exsert synflorescence. G. Raceme. H. Fruits. Photo F by J. Ratter.

and must not be cited only as "Claussen 19". In 1839, Claussen's own numbering sequence was larger than 800.

Distribution and habitat: *Mimosa claussenii* is one of the most widespread shrubby/treelet species of *M.* ser. *Pachycarpae*, occurring in *cerrados* and associated *campos rupestres* of Goiás and adjacent Minas Gerais states, Central and Southeastern Brazil.

Selected specimens: Brazil. Distrito Federal: Brasília, Fazenda Sucupira (FAZ), atrás da Mata do Riacho Fundo, próximo a sede da Caprinocultura, 15°52' S, 48°00' W, 1100 m elev., 28 March 2000, *E.S.G Guarino 49* (CEN!, HUEFS!, UB!); Parque Ecológico Norte Burle Marx, 12 March 2004, *J.R. Santos 175* (CEN!). Minas Gerais: Perdizes, Estação Ambiental Galheiro, EPDA–Galheiro–Macega, 12 March 2004, *E.K.O. Hattori 309* (HUFU!, SPF!); Goiás: Niquelândia, Estrada Vicinal A GO-237. (Niquelândia/Colinas), Entrada a 600 m da ponte sobre R. Bagagem; 32 km desta. M. Direita, 14°09' S, 48°13' W, 450 m elev., 14 April 1992, *B.M.T. Walter1314* (CEN!). Tocantins: Dianópolis, Bacia do Tocantins, Sub-bacia do Rio Palma (T-4, área 14) Ponto 9-A, 11°39'33'' S, 46°43'36'' W, 581 m elev., 1 July 2009, M.L. *Fonseca 5974* (CEN);

13.1 Mimosa claussenii var. ***pumila*** Barneby (1991: 402–403). Type: Brazil. Goiás: [Niquelândia,] 15 km s. of Niquelândia, gravelly hills in *cerrado*, 1000 m [elev.], 21 January 1972, fl., *H.S. Irwin et al. 34614* (holotype: UB!, isotypes: G!, K!, LE!, P!, NY!, R!, S!, US!).

Diagnostic characterization: *Mimosa claussenii* var. *pumila* is similar to *M. prorsiseta*, but differs from it by being a subshrub of 50 cm tall, not a taller than 1 m tall shrub or treelet (Barneby 1991).

Notes: The single character distinguishing *M. claussenii* var. *pumila* from *M. prorsiseta* is its habit. We are not sure, however, if individuals of *M. prorsiseta* may not remain small due to limitations for growth, probably associated with fire regimes or soil conditions. Further field and population studies are required for a better understanding of this scenario and to allow decision on the synonymization of this variety under *M. prorsiseta* or on its raising to species level.

Distribution and habitat: The distribution of *Mimosa claussenii* var. *pumila* is restricted to *cerrado*s located in the nickel rich areas surrounding the municipality of Niquelândia in the Goiás state, Central Brazil.

14. Mimosa cryptothamnos Barneby (1991: 397). Type: Brazil. Goiás: Chapada dos Veadeiros, ca. 20 km South of Alto Paraíso (formely Veadeiros), 1000 m, 20 March 1969, fr., *H.S. Irwin et al. 24674* (holotype: UB!, isotypes: G!, K!, LE!, MBM, NY!, P! [2 sheets], R!, S?, US!).

Fig. 22.

Diagnostic characterization: *Mimosa cryptothamnos* is a shrub with congested radical leaves and exserted, virgate and efoliate synflorescences, characters shared with *M. eriorrhachis*, *M. grallator* and *M. ulei* (but see notes under *M. ulei*). From *M. eriorrhachis* it is distinguished by the antrorse filiform setae of fruits (vs. incurved; see notes below) and from *M. grallator* and *M. ulei*, by the absence of glandular setae and interpinnal projections (vs. presence), fruits surface concealed by the indumentum (vs. not concealed).

NOTES: *Mimosa cryptothamnos* shows strong affinity to *M. eriorrhachis*, as highlighted by Barneby (1991) on the diagnosis of each species. The main differences between them, pointed by the author, are the presence of trunks in the first, which also would have longer petioles, and leaflets, as well as small racemes with long petioles and floral bract smaller than its associate flower. However, analysis of specimens indicate that only the size of floral bracts still remain as a marked feature of *M. cryptothamnos* (see notes under *M. eriorrhachis*), which could be understood as an intraspecific metric variation, a condition also seen in other species, such as *M. prorsiseta*. On the other hand, the orientation of indumentum in fruits, which is antrorse in *M. cryptothamos* and incurved in *M. eriorrhachis*, comes out as a novel distinguishing character. Moreover, phylogenetic analysis place *M. cryptothamnos* as sister to *M. densa*, while *M. eriorrhachis* appears as sister to a sample of *M. albolanata* and nested in a clade with four other species. Increase in sampling of *M. cryptothamnos*, however, may shed light on its close relationship with *M. eriorrhachis*.

DISTRIBUTION AND HABITAT: *Mimosa cryptothamnos* is known only from *cerrados* at Serra Geral do Paranã, located in between the Federal District and the Chapada dos Veadeiros at the Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Chapada dos Veadeiros, 1800 m elev., 21 December 1968, fl., G. Barroso et al. 584 (NY!, UB!);

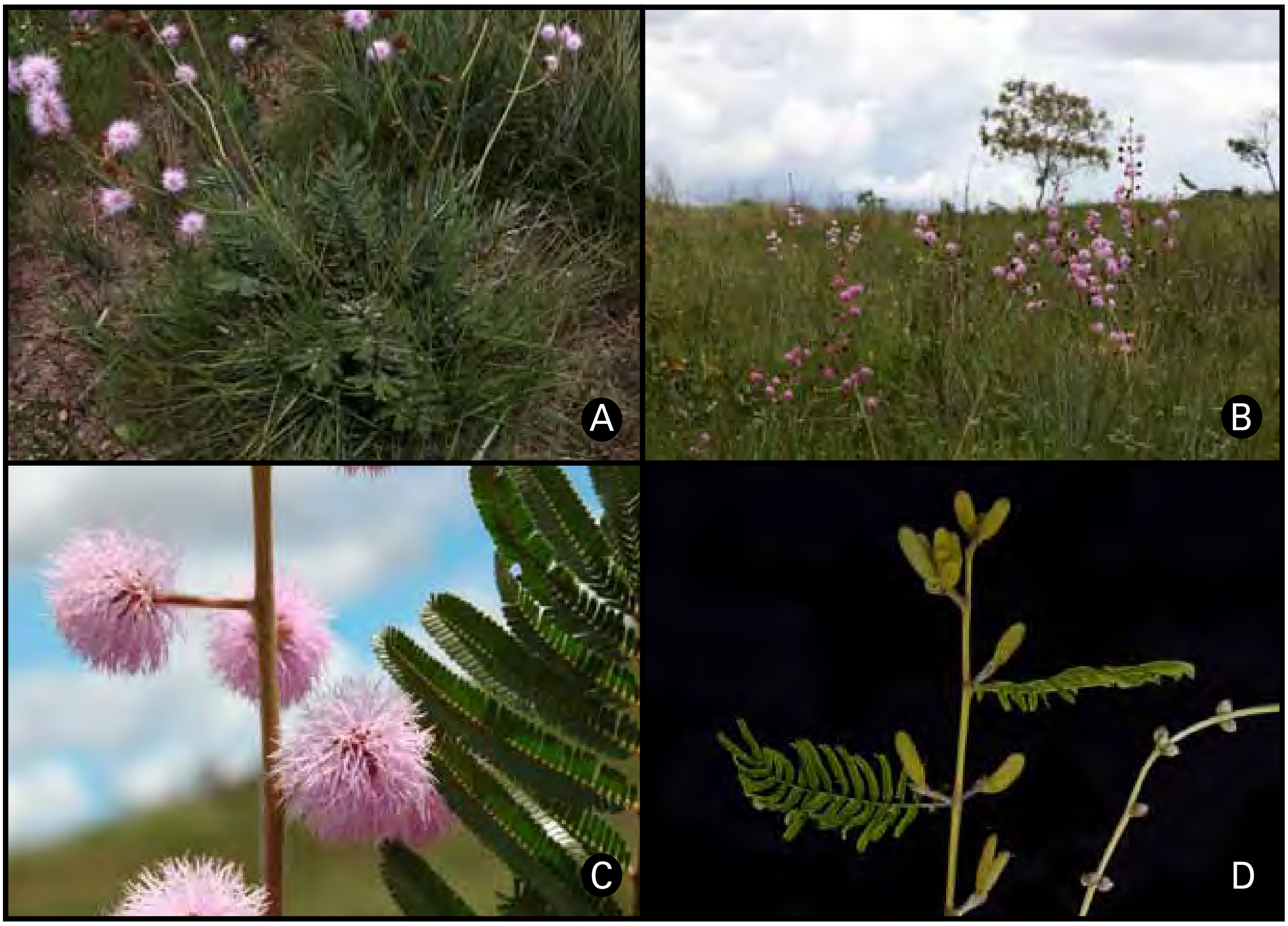

Figure. 22. *Mimosa cryptothamnos*. A. Habit. B. Synflorescences exserted above the grass level. C. Racemes and leaflets. D. Synfrutescence.

15. Mimosa decorticans Barneby (1991: 409). Type: Brazil. Goiás: Cristalina, BR 7, Km 620, 27 Mar 1963, fl., *E. Pereira 7341* (holotype: HB!, isotypes: GH!, NY!).

=*Mimosa heringeri* Barneby (1991: 410), ***syn. nov.*** Type: Brazil. Distrito Federal: Parque Municipal do Gama, ±20 km s. of Brasília, [1100 m elev.,] 28 August 1965, fr., *H.S. Irwin et al. 7918* (holotype: UB!, isotypes: G!, K!, LE!, NY!, P!, R!, US!).

Fig. 23.

Diagnostic characterization: *Mimosa decorticans* is related to other treelet species with reddish underbark exposed after exfoliation of the periderm and glandular setae present on branches, such as *M. rheiptera*, *M. setosissima* and *M. struthionoptera* (see *M. densa* for similar species but with eglandulose brances). From *M. setosissima*, it differs by the exserted synflorescences (vs. nested in the foliage) with development of leaves suppressed until fruit maturation (vs. leaves expanded or almost so during flower anthesis). From the poorly known *M. struthionoptera* it differs for bearing clavate glandular setae (vs. capitate) and from *M. rheiptera* by corolla lobes lacking glandular setae (vs. bearing them).

Notes: *M. decorticans* and *M. heringeri* were set apart from each other based on the number of leaflets and size of peduncles (Barneby 1991), both of which show, in fact, a continuous variation. Other features that could be used to segregate these taxa is the presence of lobes and plane setae on the calyx, which randomly occur in *M. heringeri*, but not on *M. decorticans*, and the abundance of glandular setae on stem and leaves of the first, making them more viscous than those of the later. However, since the floral features are variable in the *M. heringeri*, and the difference in viscosity is just a consequence of a larger number of glandular setae, they may not be used as distinguishing characters. Also, additional evidence about their relationship comes from phylogenetic results showing that they form a clade (Borges *et al.* Chapter 1). Hence, we propose here to synonymize those species and, since there is no priority between the names, select the one that makes reference to a remarking feature of the plants.

Distribution and habitat: *Mimosa decorticans* occurs in *cerrados* with sandy soils of Serra dos Cristais, at the Goiás state and in the environs of Gama, at the Federal District, where it is common in remnant vegetation. Central Brazil.

Selected specimens: Brazil. Distrito Federal: Brasília, Parque Recreativo e Reserva Ecológica do Gama, 16°02' S, 48°03' W, *C.E.B. Proença 2138* (UB!).Goiás: Cristalina, RPPN Linda Serra dos Topazios, 16°44' S, 47°41' W, *Simon, M.F. 681* (UB); Cristalina; ramal a ca. 2km SE da BR-040, 16°48'00'' S, 47°33'50'' W, 1085 m elev., October, *L.P. Queiroz 15085* (HUEFS!). Minas Gerais: Patrocínio, Fazendas da Terra, Fazendas da Terra: Boa Vista, 14 July 1998, *F.T. Farah, 278* (ESA!, RB!, UEC!).

16. Mimosa densa Bentham (1842: 405). Lectotype (designated by Barneby 1991): Brazil. Goiás: in summitate montium [de] S. Feli[x] ad Santa Anna [n.-w. of Cavalcante (Barneby 1991)] , July 1819, fl., *J.B.E. Pohl d. 1425* (lectotype: K!, isolectotypes: NY [also annotated as 1974]!, W!)

Fig. 24.

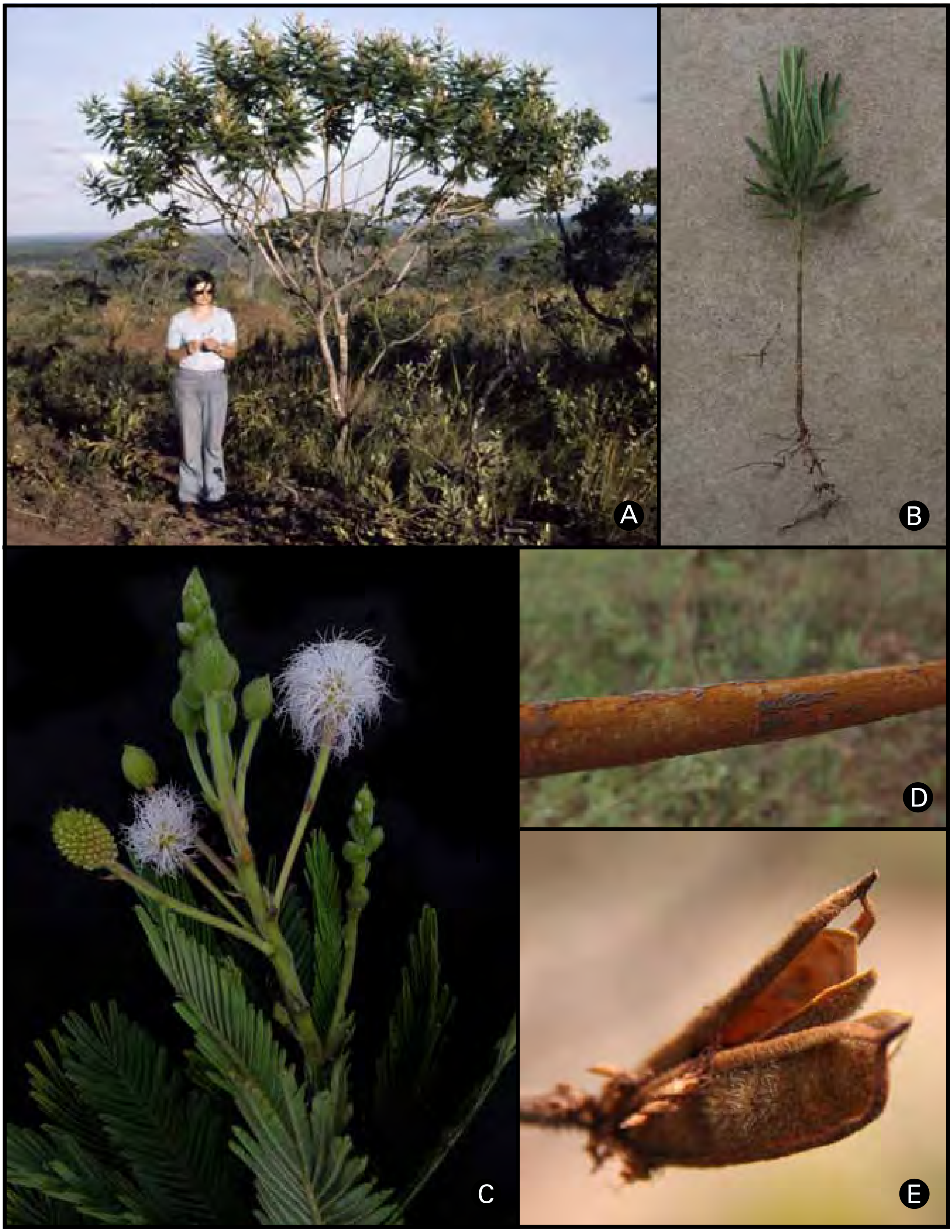

Figure. 23. *Mimosa decorticans.* A. Habit. B. Young individual lacking xylopodium and bearing radicular nodes. C. Exserted synflorescence. D. Orange underbark. E. Fruits.

São João d'Aliança, ao longo da estrada Brasília–Alto Paraíso, 14°52'38'' S, 47°34'26'' W, 1109 m elev., M.F. *Simon 738* (UB!).

Figure 24. *Mimosa densa*. A. Habit. B. Branch after shedding of the peridermis. C. Fruits from previous reproductive period below congested leaves. D. Fruits.

Diagnostic characterization: *Mimosa densa* is similar to *M. laniceps*, *M. oligosperma* and *M. pycnocoma*, all of which are shrubs to treelets with reddish underbark exposed after exfoliation of the periderm and with filiform setae of vegetative organs becoming laterally fused. From *M. laniceps*, *M. densa* differs by the absence of interpinnal projections (vs. presence) and fruits with antrorse indumentum (vs. incurved), the latter character also distinguishes it from *M. oligosperma*, together with the narrowly oblong (vs. oblong) shape of the fruits and antrorse setae of branches (vs. incurved) and indumentum of petioles concentrated on pulvini (vs. homogenously distributed). From *M. pycnoma*, *M. densa* it is distinguished by the triangular stipules (vs. broadly ovate-acuminate) and plane projections of the calyx not laterally fused (vs. fused).

Notes: Another feature that distinguish *M. densa* and above mentioned related species from other species with dehiscent periderms, but more related to *M. decorticans*, is the organization of the inflorescence. Racemes of the first group are axillar to fully or almost fully expanded leaves, while on the later group, they are axillar to heterochronic leaves, which get fully expanded only during fruit maturation. Hence, inflorescences of the *M. densa* and related species appear to be nested on the foliage, while those of *M. decorticans* and similar species are exserted from the foliage in an almost bracteose double-raceme.

The name *Mimosa densa* was commonly used for a different array of taxa from the central highlands of the Goiás state, Central Brazil. This problem was partially solved by Barneby (1991), but it is still common to find specimens of *M. rheiptera*, a sympatric species, identified as such. For a clarification of this problem, see notes under the latter.

Distribution and habitat: *Mimosa densa* is endemic to the Chapada dos Veadeiros, Goiás state, Central Brazil, where it occurs in transitions between *cerrado* and *campo rupestre*, above 1000 m elev.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Entre Alto Paraíso e Teresina de Goiás, a 10 km de Alto Paraíso, 23 May 1994, *C.E.B. Proença 1195* (CEN!, IBGE!, SPF!, UB!); Cavalcante, Vila Engenho, 13°32' S, 47°29' W, *M.F. Simon 449* (UB!); Teresina de Goiás, Chapada dos Veadeiros, 24 km by road S of Terezina, 13°55'47" S, 47°25'18" W, 1250 m elev., 16 March 1973, *W.R. Anderson 7196* (NY!, UB!, US!).

17. Mimosa diminuta Marc. F. Simon & C. E. Hughes in Simon *et al.* (2010: 285). Type: Brazil. Goiás, Cavalcante, cerca de 30 km ao norte de Cavalcante, caminho entre Vila Engenho e cachoeira Santa Bárbara. Campo sujo sob solo arenoso escuro, 13°32'27" S, 47°29'17" W, 1,060 m [elev.], 5 January 2007, fl., fr., *M.F. Simon 866A* (holotype: UB!, isotype: FHO). Fig. 25.

Diagnostic characterization: *Mimosa diminuta* stands amongst other species of *Mimosa* ser. *Pachycarpae* with humifuse habit, particularly *M. prorepens*, *M. humivagans* and *M. pseudofoliolosa* by the incurved filiform setae on the branches (vs. patent) and by the peduncles subtented by an almost expanded leaf during anthesis (vs. subtended by a slightly developed leaf).

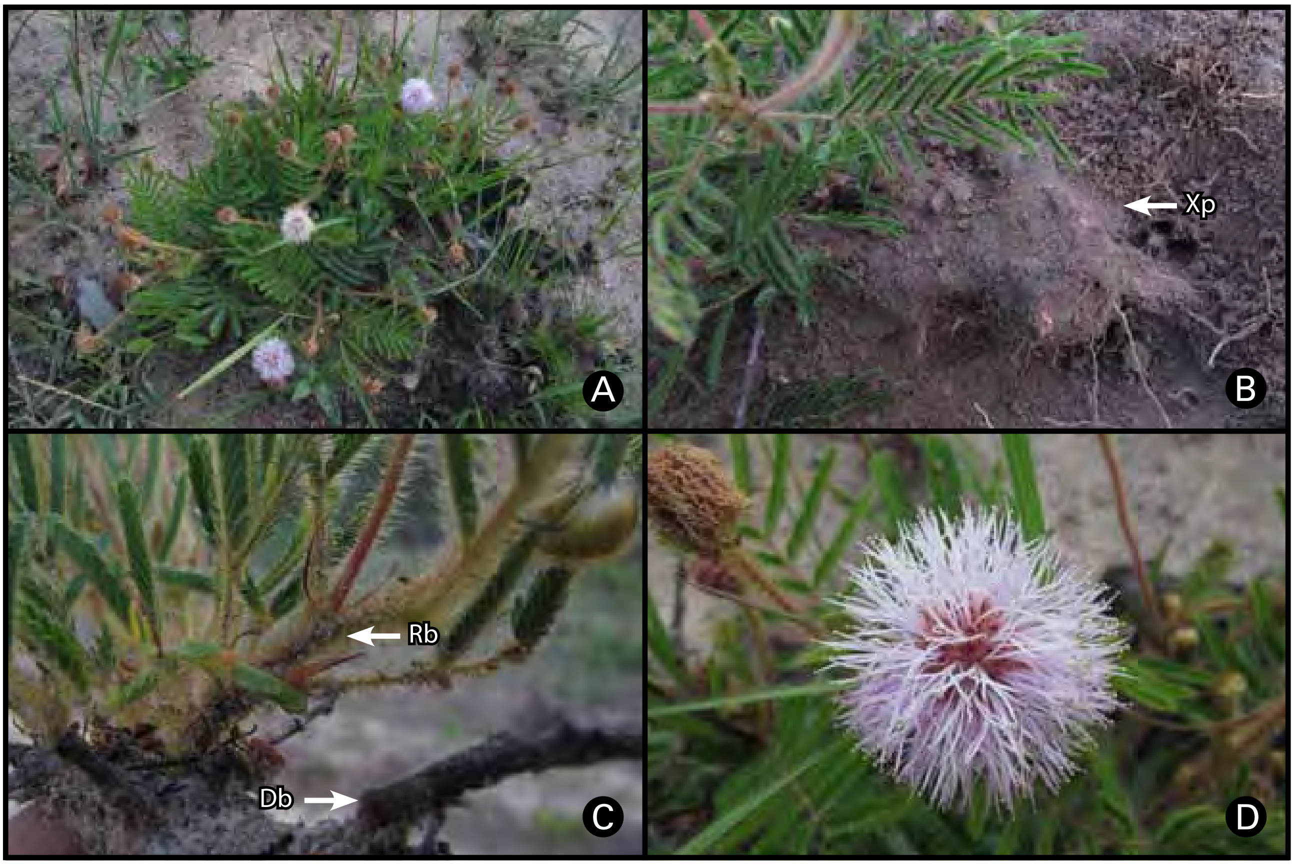

Figure 25. *Mimosa diminuta.* A. Habit. B. Xylopodium (Xp). C. Resprout (Rb) and dead branches (Db). D. Raceme.

Notes: *Mimosa diminuta* is a remarkable species, one of the most extreme examples of reduction in aerial parts and intense development of the massive xylopodium within *Mimosa* ser. *Pachycarpae*. Individuals remain almost completely concealed by surrounding grasses and are probably able to develop new leaves and to bloom very shortly after a fire event, which will burn the grasses and allow inflorescences to be exposed.

Distribution and habitat: *Mimosa diminuta* is know only from sandy soils associated with open formations of *cerrado* and *campos rupestres* in the northern Chapada dos Veadeiros, near the municipality of Cavalcante, at Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Cavalcate, estrada Cavalcante–Prata, a 32.5 km de Cavalcante, margem esquerda da estrada, 13°33'49" S, 47°31'30" W, 1218 m elev., 2 November 2012, *L.M. Borges 939* (SPF!).

18. Mimosa dominarum Barneby (1991: 420–421). Type: Brazil. Goiás: Chapada dos Veadeiros, caminho para S. Joao da Aliança, 22 December 1968, fl., *Graziela* [*Barroso*] *et al. 583* (holotypus: NY! [2 sheets], isotypus: UB!).

Fig. 26.

Diagnostic characterization: The combined presence of peridermal exfoliation, indumentum composed by patent filiform and glandular setae, interpinnal projetions and an exserted synflorescence segregates *Mimosa dominarum* from other treelets belonging to *M.* ser. *Pachycarpae* occurring at Chapada dos Veadeiros, Goiás. Particularly from *M. longepedunculata*, which also bears interpinnal projections, it differs by the leaves of the synflorescence axis

Figure 26. *Mimosa dominarum*. A. Habit. B. Synflorescence.

not expanded during anthesis (vs. almost fully expanded), calyx lacking plane setae (vs. present) and fruits with patent indumentum (vs. incurved). From *M. regina* and *M. rhodostegia*, which have similar indumentum, it differs by the presence of interpinnal projections and stipules of the synflorescence narrowly triangular or ovate-acuminate (vs. broadly ovate-acuminate

Notes: Barneby (1991) also noted the similarity of *Mimosa dominarum* to *M. manidea* and *M. oedoclada*, which are different by their racemes included within the foliage (not exserted in a long synflorescence) and fruits with incurved indumentum (vs. patent), besides the absence of interpinnal projections (vs. presence).

Distribution and habitat: The species occurs in *cerrado* and *campo rupestre* between 1000 and 1500 m elev. at Chapada dos Veadeiros, in between the municipalities of Alto Paraíso de Goiás and São João d'Aliança, in the Goiás state, Central Brazil. One record (*Glaziou 21095*) extends its occurrence to the border with the Federal District (Barneby 1991).

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, ao longo da estrada Alto Paraiso–Brasilia, 14°11'46'' S, 47°29'45'' W, 1220 m elev., *M.F. Simon 776* (UB!); Alto Paraíso, Chapada dos Veadeiros, PARNA, cachoeira do Rio Preto, 22 October 1996, *A.F. Vaz, 1151* (RB!); Alto Paraíso de Goiás, Fazenda Juliana, GO 118, a 7 km do trevo para Niquelândia e Colinas do Sul, 14°11'43'' S, 47°29'50'' W, 1155 m elev., 22 January 2005, J. *Paula-Souza 4335* (ESA!, HUEFS!, K!).

19. Mimosa eriorrhachis Barneby (1991: 396–397). Type: Brazil. Goiás: pres du rio Tocantins, *A.F.M. Glaziou 21101* (holotype: P [2sheets, P 02943753 annotated "prés du rio Tocantins"; P 02943752 annotated "entre Jatobasinho et Lajedo"]; isotypes: †B photo! K!, S! [B and S isotypes labeled "entre Jatobasinho et Lajedo"].

Fig. 27.

Diagnostic characterization: *M. eriorrhachis* differs from *M. cryptothamnos* by the incurved setae of fruits (vs. antrorse filiform; see notes below and under the later)

Notes: *Glaziou 21101*, the type of the species, is represented at P by three specimens, two (P 02943754, P 02943753) are annotated as collected "Près du Rio Tocantins" while the remaining one's label indicates the collection site as "Entre Jatobasinho et Lagedo" (P 02943752, with duplicates at K and S). This last specimen differs from the other ones by the presence of petioles 4–5 cm long and, and by having shorter indumentum, similar to the one present in *M. cryptothamnos*, on older stipules and at the base leaf rachides, although the typical lanate indumentum of the species is found at the apex of leaf rachides and throughout the inflorescence axis. Raceme size of this specimen (8–11 mm diam.) is also slightly different from the variation establish by Barneby (1991) for *M. eriorrhachis* (11–14 mm diam.), and falls into the one of *M. cryptothamnos* (ca. 10 mm diam.). It may be that this particular specimen is, in fact, an exemplar of the later species, or that it is an intermediate between those two taxa, which are kept apart here based on fruit's indumentum orientation until further evidence about their relationship is acquired. Occurrence of hybrids in *Mimosa* ser. *Pachycarpae* have never been reported. Field observations are necessary in order to improve the knowl-

Figure 27. *Mimosa eriorrhachis*. A. Habit. B. Detail of the stem with subradical leaves. C. Synflorescence axis with immature racemes (Ir) and whitish filiform setae (Fs). D. Fruits.

edge on the close relationship between *Mimosa eriorrhachis* and *M. cryptothamnos*, but is important to note that those species are not closely related in a phylogenetic study of the series (Borges *et al.* Chapter 1; see also notes under *M. cryptothamnos*).

DISTRIBUTION AND HABITAT: *Mimosa eriorrhachis* occurs on *cerrados* above 1000 m elev. of Serra Geral do Paranã, Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Près du Rio Tocantins, 20 January 1895, *A.F.M. Glaziou 21101* (P!); São João d'Aliança, São João d 'Aliança, [14°42'20" S, 47°31'29" W,] *G.M. Barroso 578* (UB!); São João d'Aliança, ca. 10 km N of São João da Aliança, on highway GO-12, [14°36'35" S, 47°32'00" W,] 1200 m elev., 19 February 1975, W.R. *Anderson 11455* (K!, NY!, US!).

20. Mimosa foederalis (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa foliolosa* subsp. *pachycarpa* var. *foederalis* Barneby (1991: 379). Type: Brazil. Distrito Federal: Brasília, Brazlândia, 2 November 1976, fl., *E. P. Heringer 16178[-B]* (holotype: UB!, isotypes HB!, NY!).

=*Mimosa foliolosa* subsp. *pachycarpa* var. *cercadoënsis* Barneby (1991: 378–379), ***syn. nov.*** Type: Brazil. Goiás: Fazenda Cercado e. of Corumbá de Goiás, January 1819, fl., *J.B.E. Pohl 1365* (holotype: K! [2 sheets], isotypes: F! [annotated "1365 d." and "1205"], NY! [two sheets annotated "1365 d." and "1205"], W!)

Fig. 28.

Diagnostic characterization: *Mimosa foederalis* is closely related to *M. multipinna*, from which it differs by the absence of glandular setae on branches (vs. presence, persistent stipules (vs. caducous) and fruits with cuneate base (vs. rounded to obtuse). The latter two characters listed and also the leaves of the synflorescence axis expanding after or during fruit maturation (vs. not developing) and glandular setae present on fruits (vs. absent) allow its differentiation from *M. nitens*. Particulaly in relation to *M. foliolosa* it differs by the branches with forwardly appressed or antrorse filiform setae (vs. patent) and infundibuliform corollas (vs. campanulate).

Notes: We agree with Barneby (1991) that the distinction between *Mimosa foliolosa* var. *foederalis* and *M. foliolosa* var. *cercadoensis* is related to developmental steps of a single species. The collection *Carvalho 2231* may be used as an

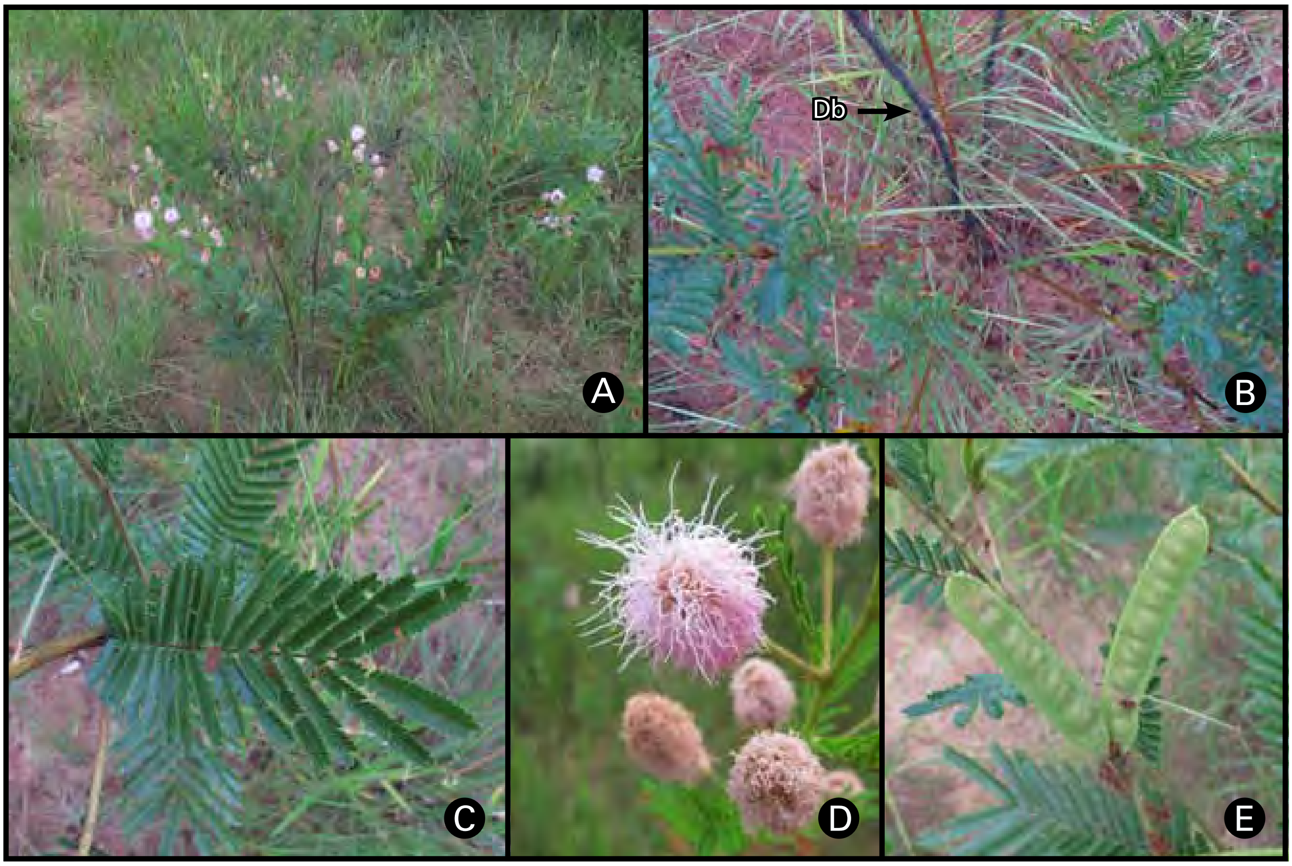

Figure 28. *Mimosa foederalis*. A. Habit. B. Base of an individual showing fasciculate branches, one of them, already dead (Db). C. Leaf. D. Raceme. E. Immature fruits.

example of that since the specimen at NY has leaves with up to 18 pinnae pairs (diagnostic of *M. foliolosa* var. *cercadoensis*), but its duplicate at UB has at most 14 pairs (typical of *M. foliolosa* var. *foederalis*). Those varieties are, hence, considered here as a single taxon at species level. Phylogenetic analysis place *M. foederalis* as sister to *M. foliolosa* var. *pachycarpa* (here *M. pachycarpa*). Those species are differentiated by the presence in *M. foederalis* of persistent stipules (vs. absence), and fruits with cuneate base (vs. rouded).

Distribution and habitat: *Mimosa foederalis* is present in *cerrado* and *campo sujo* of the Federal District and adjacent areas in the Goiás state, Central Brazil.

Selected specimens: Brazil. Distrito Federal: Brazília, Chapada da Contagem, Rodovia para Brasilândia, ca. 1 km do trevo com a BR 060, 15°35' S, 47°57' W, 10 February 1988, *J.R. Pirani 2136* (NY!, SPF!). Goiás: Serra Geral de Goiás, Rio Paranã, ca. 35 km N of formosa on road to São Gabriel, 14°00' S, 46°00' W, 950 m elev., 29 March 1966, *H.S. Irwin 14223* (NY!, SPF!). Goiás: Anápolis, Ramal no km 8 da estrada de Anápolis para Corumbá de Goiás, 2-4 km no ramal adentro, 16°19'37'' S, 48°57'10'' W, 8 February 1986, *A.M.V. Carvalho 2231* (G!, K,! NY!, UB!);

21. Mimosa foliolosa Bentham (1842: 406). Type: Brazil. Goiás: ad Santa Luzia versus Ponte Alto [a fork of rio Corumba in s.-e. Goias (Barneby 1991)], fl., *J.B.E. Pohl d. 1407* (lectotype: K!, isolectotypes: F!, M 0218523! [not numbered but probably an isolectotype], NY!, W! [F, NY and W specimens also labeled "1203"]).

Diagnostic characterization: *Mimosa foliolosa* is symmetrically related to all taxa presenting thin branches fasciculately arising from a xylopodium, and with strigose corolla lobes associated with narrowly oblong fruits with forwardly appressed filiform setae that do not fully cover the surface of valves and are not organized in a concentric pattern. From the sympatric and closely related *M. pubescens* it is readily distinguished by the patent filiform setae of branches (vs. forwardly appressed or antrorse), clavate glandular setae (vs. capitate) and persistent stipules (vs. absent). From *M. franciscana* it stands apart by the patent filiform setae of branches (vs. incurved) and campanulate corollas (vs. infundibuliform).

Notes: Barneby considered *Mimosa foliolosa* a polytypic taxa with three subspecies, each one with subtended varieties in a total of 17 least inclusive taxa. Amongst the subspecies, *M. foliolosa* subsp. *brevibractea* is prominently distinct from the core formed by the other two subspecies, particularly by its indumentum, overall morphology of inflorescences and fruits, as well as the remarkable presence of thick branches with a greyish bark, similar to the one occurring in species related to *M. claussenii*. Also, individuals tend to present just a low number of ramifications at the base, usually not more than five, but of course this is related to particular life history. Hence, *M. foliolosa* subsp. *brevibractea* and its varieties are here treated as two species: *M. brevibractea* and *M. paranani*. On the other hand, individuals of the other two varieties have thin virgate branches, usually fasciculate at the base and without a grayish bark. *M. foliolosa* subsp. *foliolosa* and *M. folilosa* subsp. *pachycarpa*, each subtending five and eight varieties respectively, were established as distinct taxa based on the size of pinnae, up to 2.5 cm in the first and more than that on the second (Barneby 1991: 374–375). Taxa belonging to either variety indeed show a tendency to have shorter or longer rachillas, but this limit is not as robust as Barneby hypothesized, and cannot be used to segregate those polytypic subspecies; moreover varieties belonging to a subspecies sometimes may show more affinities to infraspecific taxa of the other. Besides, even if the limits between a few varieties may be fuzzy, other have remarkable features that deeming then recognition at species level. Adding to that, phylogenetic analysis shows that even though few varieties of *M. foliolosa* are sister taxa (e.g. *M. foliolosa* var. *pachycarpa* and *M. foliolosa* var. *foederalis*), the tree topology do not reflect the hierarchical arrangement proposed by Barneby (1991) for the species (Borges *et al.* Chapter 1). Here we present a first approach to reorganize the classification of those taxa, but a more detailed study must be carried out to improve the knowledge on the limits between the eight species plus three varieties here recognized to accommodate the morphological variation accommodated by Barneby within *M. foliolosa* subsp. *foliolosa* and *M. foliolosa* subsp. *pachycarpa*.

Fruits of *Mimosa foliolosa* are still unknown and their collection may enlighten the intrincate relationship among taxa mentioned above.

Distribution and habitat: *Mimosa foliolosa* occurs at the Federal District and Goiás state, Central Brazil on *cerrado* areas.

Selected specimens: Brazil. Distrito Federal: Reserva da Ecopousada Terraviva, 15°35'08'' S, 48°03'53'' W, *L.B. Felizola 5* (UB!); Goiás: Caldas Novas, Parque Estadual da Serra de Caldas Novas, J.O.V. *Iglesias 148* (UB!); Santo Antônio do Descoberto, Divisa com Distrito Federal, 15 January 1976, *E.P. Heringer 15345* (HB!, IBGE!, UB!, UEC!).

21.1. ***Mimosa foliolosa*** subsp. ***foliolosa*** *var.* ***brevipinna*** (Benth.) Barneby (1991: 377).

Basionym: *Mimosa gardneri* var. *brevipinna* Bentham (1876: 388). Lectotype (designated by Barneby 1991): Brazil. Tocantins: Almas, [October 1839, fl.,] *G. Gardner 3134* (K!).

Diagnostic characterization: *Mimosa foliolosa* var. *brevipinna* was established by Bentham (1896) based on its smaller leaves and inflorescences, as well as thinner branches, in comparison to the assemblage of taxa that formed *M. gardneri* (see Barneby 1991: 404). According to Barneby (1991) it is in fact related to *M. foliolosa*, both sharing patent filiform setae at branches, but distinguished from the latter mainly due to the filiform setae with 5–6 mm long (vs. 2–3.3 mm) and absence of glandular setae on branches (vs. presence).

Notes: *Mimosa foliolosa* var. *brevipinna* is notable for the abundant indumentum of branches and leaves and by the leaves almost fully expanded during raceme anthesis. Efforts should be made to improve field work on the southern Tocantins state, where *M. gardneri*, another poorly know species of *M.* ser. *Pachycarpae*, also occurs.
We were not able to find any modern collection of *Mimosa foliolosa* var. *brevipinna* in the studied herbaria. The type presents features that allow its distinction from other taxa related to *M. foliolosa*, but we believe that a better understanding of the affinities of this taxon may be achieved after a thorough survey of its area of occurrence. We conservatively maintain the circumscription and rank established by Barneby (1991).

Distribution and habitat: *Mimosa foliolosa* var. *brevipinna* is known only from the municipality of Almas, in Tocantins state, Central Brazil, where it was probably collected in *cerrado* or in *campos rupestres* associated with altitudinal areas surrounding the municipality.

21.2. Mimosa foliolosa subsp. ***foliolosa*** var. ***franciscana*** Barneby (1991: 376–377). Type: Brazil. Minas Gerais: Gouveia, rocky *cerrado* slopes near Gouveia, ± 33 km s.-w. of Diamantina, 19 January 1969, fl., fr., *H.S. Irwin et al. 22287* (holotype: UB!, isotypes: G!, GH!, K!, LE!, MBM, NY!, P!, R!, S!, US!).

> =? *Mimosa platyloma* Bentham (1842: 406). Type: Brazil. Minas Gerais [?]: *F. Sello 1385* (†B); Putatively synonymized by Barneby (1991), who was not able to surely identify the taxon represented on the Field Museum Berlin Negatives collection.

Fig. 29.

Diagnostic characterization: *Mimosa foliolosa* var. *franciscana* differs from other taxa related to *M. foliolosa* (see under it) by the incurved filiform setae of fruits, a feature shared with *M. peregrina*. However, the valves surface of the first is not concealed by the indumentum, while they are in the latter.

Notes: Corollas of *Mimosa foliolosa* var. *franciscana* are infundibuliform and have setose lobes, which in specimens from the main Espinhaço Range have a surface completely concealed by the indumentum. On the other hand, specimens from Serra do Cabral, where the species has been repeatedly collected, show lobes with surface visible below the filiform setae. Moreover, collections from those two areas also differ in the presence of a concentric pattern of organization of filiform setae on fruits, which is present on specimens from Serra do Cabral, but is randomly observed on plants collected at the Diamantina Plateau, where the type was collected. While the ones occurring at Serra do Cabral can be readily distinguished from other species (e.g. *Borges 639*), there is doubt whether specimens from the Diamantina plateau cannot be seen as variants of *M. pachycarpa*. Moreover, collections from the environs of Paracatu (e.g. *Arbo 3208*, *Riedel 2523*), in western Minas Gerais, show affinities with *M. pubescens*. This overall uncertainty about the true identity of *M. foliolosa* var. *franciscana* led us to keep it apart from synonymy and also not to raise it to species level, awaiting for further information that may allow accurate reevaluation of its status.

Distribution and habitat: *Mimosa foliolosa* var. *franciscana* occurs on rocky *cerrados* with sandy and rocky soils from center-west Minas Gerais, Southeastern Brazil, particularly at the Diamantina Plateau and Serra do Cabral at the Espinhaço Range, and from altitudinal areas near the municipality of Paracatu.

Selected specimens: Brazil. Minas Gerais: Itacambira, estrada Juramento–Itacambira, à direita, no alto da Serra de Itacambira, 17°06’47.2” S, 43°30’88.9” W, 1250 m elev., 30 September 1997, R. Mello-Silva 1488 (NY!, SPF!); Joaquim Felício, Serra do Cabral, Estrada Joaquim Felício–Várzea da Palma, a 5,7 km de Joaquim Felício, 17°43'34.0"S, 44°10'58.7"W, 924 m elev., 26 April 2012, fl., L.M. Borges et al. 639 (SPF!); Paracatu, November 1834, fr., L. Riedel 2523 (K!, LE!, US!); Paracatú, MG 188, 20 km al S de Paracatu, cerca del Rio Escurinho, camino a Guarda Mor, 600 m elev., 31 January 1990, fl., M.M. Arbo et al. 3208 (CTES, K!, NY!, SPF!)

21.3. Mimosa foliolosa var. ***grandibractea*** V. F. Dutra & F. C. P. Garcia Type: Brazil. Minas Gerais: Delfinópolis, Serra

Figure 29. *Mimosa foliolosa* var. *franciscana*. A. Habit. B. Fasciculate branches and xylopodium (Xp). C. Branch infected by *Pilostyles*. D. Synflorescence.

Preta, trilha Escada de Pedra, 1 April 2008, fl., fr., *Dutra & Fernandes 589* (holotype: VIC!).

Fig. 30.

Diagnostic characterization: *Mimosa foliolosa* var. *grandibractea* was established in comparison to *M. foliolosa* var. *brevibractea* by the floral bracts longer than the flowers (vs. shorter than the flowers) (Dutra & Garcia 2012).

Notes: Dutra & Garcia (2012) did not included *Mimosa foliolosa* var. *grandibractea* in any of the subspecies described by Barneby (1991) for *M. foliolosa*. The floral character used to delimit the variety (see above) would not allow inclusion within *M. foliolosa* subsp. *brevibractea* and other morphological features also set it apart from the remaining subspecies. Hence, this particular variety should have been described as a subspecies in order to correctly follow Barneby's (1991) scheme, similarly to what was done to *M. setosa* subsp. *granitica* (Barneby 1991: 351). Nonetheless, we

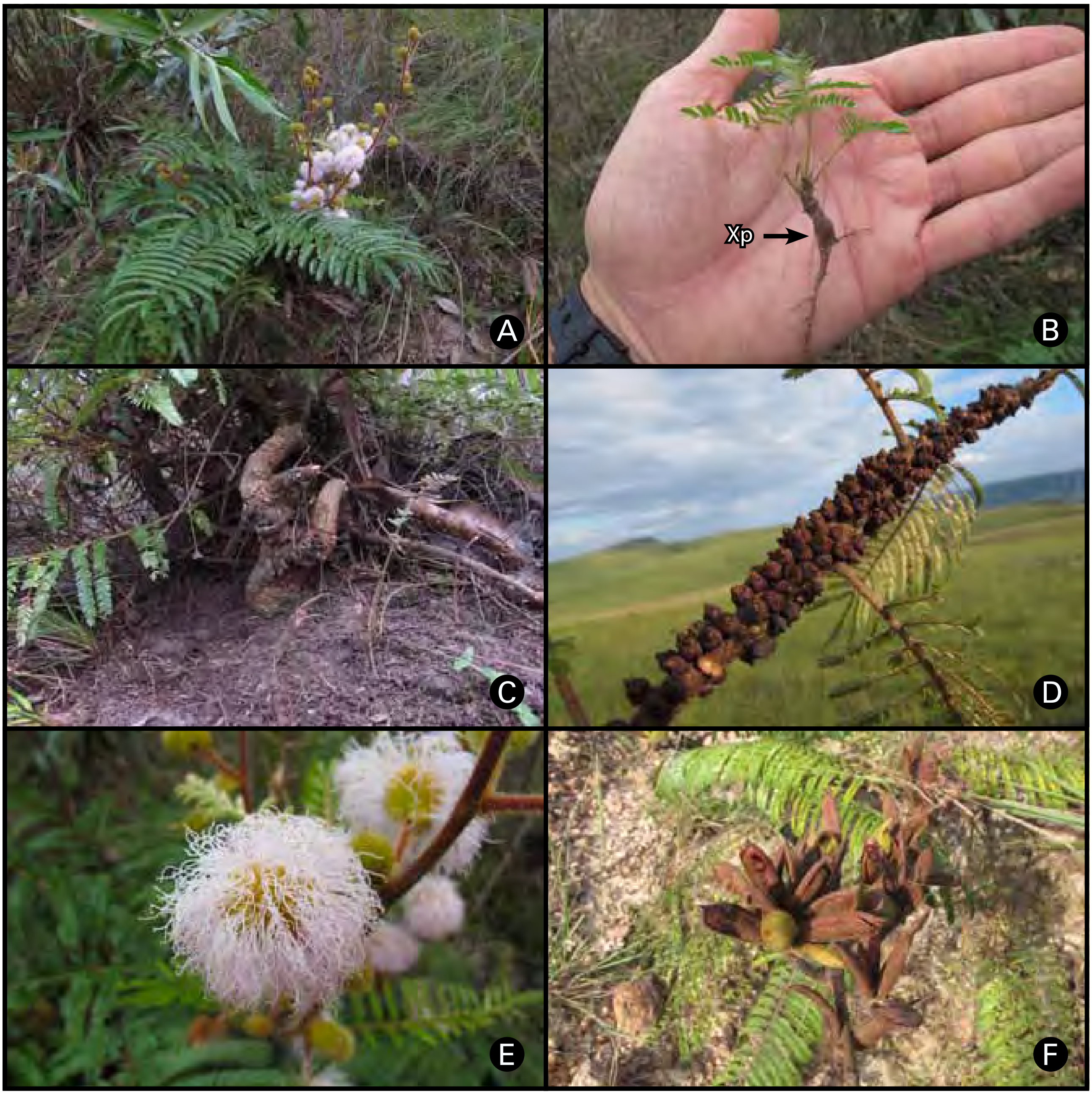

Figure 30. *Mimosa foliolosa* var. *grandibractea*. A. Habit. B. Young individual with xylopodium (Xp). C. Base of stems showing the corky branches. D. Branch infected by *Pilostyles*. E. Racemes. F. Fruits.

have doubts that *M. foliolosa* var. *grandibractea* should be treated within *M. foliolosa*, since its prostrate stems and fruit morphology resemble *M. paucipinna*. Moreover, according to Borges *et al.* (Chapter 1) this variety is more closely to elements previously belonging to *M. setosa*. A detailed study is necessary in order to investigate the status and recognition of *M. foliolosa* var. *brevibractea* as a biological unity.

DISTRIBUTION AND HABITAT: *Mimosa foliolosa* var. *grandibractea* is endemic to *campos rupestres* of Serra da Canastra, Minas Gerais state, Southeastern Brazil.

SELECTED SPECIMENS: Brazil. Minas Gerais: Delfinópolis, Estrada para Casa Branca, Fazenda Paraíso, Sete Cidades, 20°21'64'' S, 46°44'83'' W, 1178 m elev., 10 April 2002, R. *Romero 6281* (HUFU!, VIC); Delfinópolis, estrada para Gurita, 14 May 2003, R.A. Pacheco

554 (HUFU!, VIC); Delfinópolis, Trilha "Escada de Pedra", Fazenda José Antunes, 20°26'04'' S, 46°38'72'' W, 841 m elev., 10 March 2003, R.L. Volpi 483 (HUFU!, VIC).

21.4. Mimosa foliolosa subsp. ***brevibractea*** var. ***rigens*** Barneby (1991: 383–384). Type: Brazil. Goiás: Chapada dos Veadeiros ±20 km s. of Alto Paraiso, 20.III. 1969, fl, fr., *H.S. Irwin 24681* [misprinted 24641] (holotype: UB!, isotypes: G!, GH!, K!, LE!, NY!, P!, R!, S!, US!).

Diagnostic characterization: *Mimosa foliolosa* var. *rigens* was established by Barneby (1991) based on its intermediate phenotype between *M. foliolosa* and *M. claussenii* var. *prorsiseta* (here *M. prorsiseta*), having the narrow and sub-apressed setose fruits of the former and the coarse indumentum and broad coriaceous stipules of the latter.

Notes: Due to lack of novel information after Barnebys'(1991) treatment, we were not able to reevaluate the status of *M. foliolosa* var. *rigens*, and we keep it here hoping that further field work at the southern portion of Chapada dos Veadeiros may shed light on this poorly known taxon.

Distribution and habitat: *Mimosa foliolosa* var. *rigens* is known only from Chapada dos Veadeiros, at the municipality of Alto Paraíso de Goiás, Central Brazil, where it occurs in *campos rupestres* around 1000 m of elevation.

Selected specimens: Brazil. Goiás: Luziânia, BR 7, [16°15'10'' S, 47°57'01'' W,] 30 March 1963, *Pereira E. 7461* (HB!, NY!, RB!).

22. Mimosa gardneri Bentham (1842: 405). Lectotype (designated by Barneby 1991): Brazil. Goiás [actually Tocantins]: ad Serra da Natividade, December 1839, fl., *G. Gardner 3136* (lectotype: K 000532577!, isolectotypes: †B photo!, BM!, F frag.!, G!, K 000532578!).

Diagnostic characterization: *Mimosa gardneri* and *M. megistophylla* are very closely related and share an overall similarity in most characters, but particularly on the long exserted synflorescences and indumentum of leaves concentrated on pulvini. *M. gardneri* differs in its treelet habit (vs. shrub) without glandular setae on rachillas (vs. presence).

Notes: Delimitation of *Mimosa gardneri* defies our present knowledge about the diversity of *Mimosa* ser. *Pachycarpae* on northern Goiás and southern Tocantins states altitudinal areas. It has the large leaves of *M. claussenii* and related species combined with a long exserted synflorescence not common in those except in *M. megistophylla*. However, the species is perfectly known only by the type specimen; other recent collections from Terezina de Goiás municipality (Barneby 1991) clearly belong to *M. megistophylla* or cannot be certainly ascribed to *M. gardneri*. Moreover, labels of some of the type specimens differ on the information regarding to the plant habit and date of collection, despite bearing the same collection number. One lectotype sheet at K indicates the collection date as 1839 and that the plant is a "small tree", the other is annotated as being collected in 1841. The isolectotype at BM indicates the collection date as 1840 and that it is "a shrub 6–8 ped". If it is properly shown that, besides occurring as treelets, the species can also be a shrub, or if *M. megistophylla* can be a treelet, those will probably be synonymized. Fieldwork is still needed to clarify this problem.

DISTRIBUTION AND HABITAT: *Mimosa gardneri* is endemic to granitic areas of *cerrado* of Serra da Natividade, at Natividade municipality in Tocantins state, Central Brazil.

23. ***Mimosa granitica*** (Barneby 1991: 358–359) L.M. Borges in Borges & Pirani (Chapter 3). *Mimosa setosa* subsp. *granitica* Barneby. Type: Brazil. Goiás: Chapada dos Veadeiros, 20 km W. of Veadeiros, granitic mountain at 1000 m [elev.], 16 February 1966, fl., *Irwin 12944* (holotype: UB!; isotypes: G!, GH!, K!, LE!, NY!, P!, R!, US!).

Fig. 31.

Figure 31. *Mimosa granitica*. A. Habit. B. Habit showing a branch that died by fire (Db) and a resprouted branch (Rb). C. Detail of the root system (R) evidencing lack of xylopodium. D. Leaf. E. Detail of a leaf base showing one stipule (Stp) and the sulcate petiole (Sp). F. Fruits.

Diagnostic characterization: *Mimosa granitica* is similar to *M. paludosa*, but differs from it mainly by leaflet secondary veins equally prominent to the primary ones (vs. less than the primaries); calyx rim with plane projections fused laterally (vs. free from each other); corolla lobes with filiform setae concealing its whole surface (vs. a combination of triple indumentum not concealing the surface); fruits with a stipe at least 5 #longer than wide (vs. less then 4 #longer than wide or just a small projection of the base).

Notes: *Mimosa granitica* encompasses a large infraspecific variation on the indumentum composition and presence of aculei, but it is otherwise well circumscribed, particularly in the context of its area of occurrence. See also Borges *et al.* (Chapter 3) for further notes on the species and comments on its recognition at species level, reinforced by phylogenetic results (Borges *et al.* Chapter 1).

Distribution and habitat: *Mimosa granitica* occurs on *campos rupestres* distributed over Chapada dos Veadeiros in northern Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, Rodovia GO-118, Brasília - Monte Alegre de Goiás, ca. 7 km após Alto Paraíso, saída para o Hotel Fazenda Água Fria, 14°04’23.3” S, 47° 30’36.6” W, 1348 m elev., 15 December 2010, fr., L.M. Borges et al. 511 (NY!, SPF!); Entroncamento entre a estrada GO 239 e a estrada para as Sete Lagoas, passando a leste do Morro da Baleia e pelo Peito de Moça, 14°09'44.2" S, 47°37'47.5" W, 1146 m elev., 20 March 2012, fl., fr., L.M. Borges et al. 553 (NY!, SPF!); Ca. 12 km NW of Veadeiros, 1200 m elev., 19 October 1965, fr., H.S. Irwin et al. 9276 (NY!, SPF, UB!); Ca. 20 km N of Alto Paraíso, ca. 1250 m elev., 19 March 1971, fl., H.S. Irwin et al. 32231 (NY!, SPF!, UB!).

24. Mimosa grallator (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa ulei* var. *grallator* Barneby (1991: 425). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] Chapada dos Veadeiros, ±12 km s. of Alto Paraíso, 1000 m [elev.], 22 March 1969, fl., *H.S. Irwin et al. 24880* (holotype: UB!, isotypes: K!, LE!, NY!, P!, R!, S!, US!).

Fig. 32.

Diagnostic characterization: *Mimosa grallator* is similar to other species with subradical congest leaves, but it is mainly related to *M. ulei*. Those two species are established as different by the presence in *M. grallator* of simple trichomes in branches and of filiform setae on rachillas and floral bracts (vs. absence), corolla lobes concealed by the indumentum (vs. not concealed), fruits with a stipe at least 5 #longer than wider (vs. less than 4 #longer).

Notes: *Mimosa grallator* fits the same scenario of other taxa originally described at infraspecific level (Barneby 1991), but which we consider as better treated at species level, based on the above-mentioned characters segregating it from *M. ulei*.

Distribution and habitat: The species is endemic to *campo cerrado* and *campos rupestres* of Chapada dos Veadeiros, at the state of Goiás.

Figure 32. *Mimosa grallator*. A. Habit. B. Xylopodium. C. Fruit.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, 14°07' S, 47°31' W, *C.E.B. Proença 1175* (UB); Alto Paraíso de Goiás, ao longo da estrada Alto Paraíso - Brasília, 14°00'00'' S, 47°29'45'' W, 1220 m elev., M.F. *Simon 777* (UB!); Alto Paraíso de Goiás, Chapada dos Veadeiros. Ca 12 km S of Alto do Paraíso (formerly Veadeiros), , 1000 m elev., 22 March 1969, *H.S. Irwin 24880* (NY!).

25. Mimosa humivagans (Barneby 1991: 389). Type: Brazil. Goiás: Serra Geral do Paranã, ± 3 km s. of São João [da] Aliança, [850 m elev.,] 16 March 1971, fl., fr., *H.S. Irwin et al 31939* (holotype: UB!; isotypes: K!, NY!, R!, US!).

Diagnostic characterization: *Mimosa humivagans* is most closely related to *M. prorepens*, and differs from the latter by the lack of glandular setae (vs. presence) and absence of paraphyllidia (vs. presence).

Notes: *Mimosa humivagans* is know from just a few collections, which clearly set it apart from other species with humifuse habit, such as *M. viperina*, *M. lithoreas* and *M. prorepens*. However, as remarked by Barneby (1991), it does present a close relationship with the latter. Both species are also closely related in a phylogenetic analysis (Borges *et al.* Chapter 1). Although they may be viewed as developmental variants (Barneby 1991), we still have doubts about merging those species and keep them separate here.

Distribution and habitat: The species is known from *campo* and *cerrado* areas at Serra Geral do Paranã, particularly at the São João da Aliança municipality, at Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: São João d'Aliança, Serra Geral do Paraná. Ca. 3 km S of Sao Joao da Aliança, 850 m elev., 14°42'21" S, 47°31'28" W, 16 March 1971, *Irwin H. S. 31939* (NY! , UB!, US!); ao longo da Estrada Brasília-Alto Paraíso, 14°52'38" S, 47°34'26" W, 1109 m elev., 20 March 2006, *Simon, M.F. 737* (HUEFS!, UB!).

26. Mimosa kalunga M. F. Simon & C. E. Hughes in Simon *et al.* (2010: 278–279). Type: Brazil. Goiás: Cavalcante, Vila Engenho, caminho para cachoeira Santa Bárbara, campo-sujo, solo arenoso, 13°32' S, 47°29' W, 1070 m [elev.], 12 October 2002, fl., fr., *M. F. Simon 456* (holotype: UB!; isotypes: CEN!, FHO, K)

Fig. 33.

Figure 33. *Mimosa kalunga*. A–C. Habit of individuals of different sizes. A. Individual ca. 50 cm tall. B. Individual ca. 1 m tall. C. Individual ca. 2.5 m tall. D. Branches with lanate indumentum. E. Glomerules subtended by fully expanded leaves. F. Immature fruits. G. Mature fruit releasing the seeds.

Diagnostic characterization: *Mimosa kalunga* differs from *M. densa*, *M. laniceps* and *M. oligosperma*, all sharing branches with antrorse or incurved indumentum and lacking glandular setae, by the craspedium like fruits (vs. unjointed craspedium). From *M. pycnocoma*, it differs by the filiform setae not laterally fused (vs. fused), narrowly triangular stipules (vs. broadly ovate-acuinate) and calyx tube glabrous (vs. pubescent with filiform setae).

Notes: *Mimosa kalunga* was described as being a prostrate shrub with ascending stems up to 50 cm tall. Our field observations indicate that it can grow taller, forming erect shrubs or treelets, and the size of the plants seem to be related to soil conditions. Observation of *Mimosa kalunga* occurring as treelets blurs the boundaries between it and *M. pycnocoma*, known from the same environments and with same area of occurrence. Moreover, other characters used to distinguish those species, such as exfoliation of periderm and racemes nested in the foliage (Simon *et al.* 2010) are also present in *M. kalunga*. Although, our current knowledge on *M. kalunga* has increased since its description, *M. pycnocoma* is still known only by two collections including the type specimen. Since one population site of occurrence is known, we prefer to await collection and study of more specimens before synonymizing *M. kalunga* under *M. pycnocoma*.

Distribution and habitat: *Mimosa kalunga* is endemic of *campo cerrado* and *campo rupestre* of the north portion of Chapada dos Veadeiros, at Cavalcante municipality, in Goiás state and from Serra do Tombador, located further north at the municipality of Cavalcante, Central Brazil

Selected specimens: Brazil. Goiás: Cavalcante, Cerca de 30km ao norte de Cavalcante, caminho entre vila Engenho e cachoeira Santa Barbara, 13°32' S, 47°29' W, 1070 m elev., M.F. *Simon 451* (UB!); Cavalcante, Cerca de 30km ao norte de Cavalcante, caminho entre vila Engenho e cachoeira Santa Barbara, 13°32'27'' S, 47°29'17'' W, 1060 m elev., M.F. *Simon 866* (UB!).

27. Mimosa laniceps Barneby (1991: 412)

Basionym: *Mimosa tomentosa* Taubert (1896: 434), nom. illeg. (non *M. tomentosa* Humbold & Bonpland ex Willdenow [1806: 1033], nec *M. tomentosa* Rottler [1803: 208]). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: Valle rivi Vargem Grande, September 1892, fl., *E. Ule 2832* (lectotype: HBG! [also annotated as "9"], isolectotype: P! [2 sheets; only annotated as "9"]).

Fig. 34.

Diagnostic characterization: As discussed before under *Mimosa densa*, *M. laniceps* is distinct for as the only species possessing interpinnal projections within similar taxa. It also stands out for having narrowly triangular stipules (vs. triangular or broadly ovate-acuminate). Particularly from *M. densa*, it differs also for having filiform setae homogenously distributed on petioles (vs. concentrated on petioles) and cupulate calices (vs. shallowly cupulate).

Notes: Barneby (1991: 412) indicated that *Mimosa laniceps* lacks interpinnal projections ("interpinnal spicules 0"). Those are in fact present, but are small and easily concealed by the profuse indumentum of the leaves. Hence, this character, although diagnostic, must be used with care during specimen identification. Even though we did not use

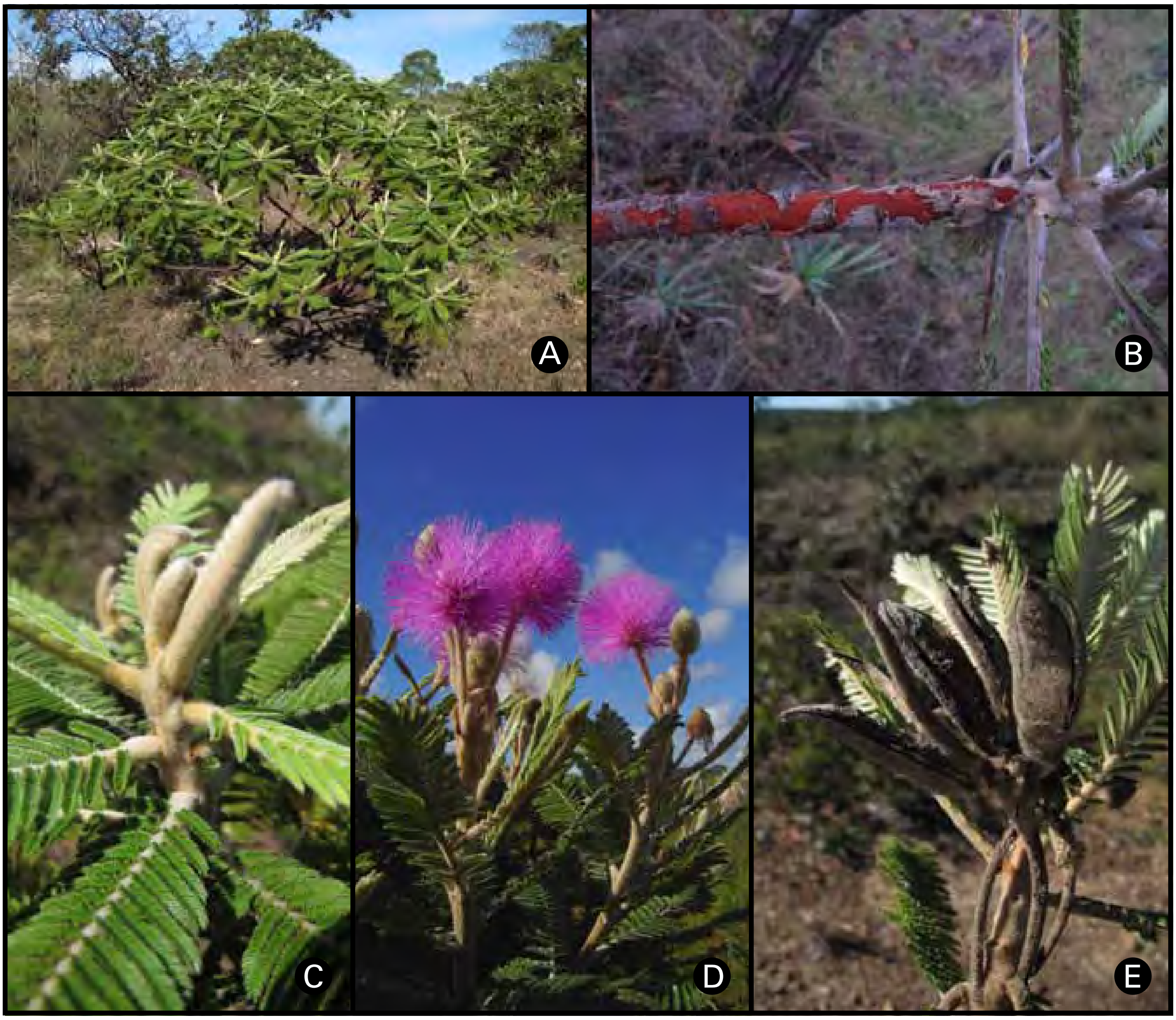

Figure 34. *Mimosa laniceps*. A. Habit. B. Branch with shedding peridermis revealing the reddish underbark. C. Detail of a branch evidencing the lanate indumentum. D. Synflorescences. E. Fruits.

the lanose indumentum of branches and fruits, even though not used by us to circumscribe this species, it is a remarking feature, explicit in its epithet.

DISTRIBUTION AND HABITAT: *Mimosa laniceps* forms clustered populations of individuals on sandy soils of *campos rupestres* and *cerrados* with rock outcrops at Chapada dos Veadeiros, Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros. 10 km oeste de Alto Paraíso, 14°10' S, 47°35' W, 1200 m elev., M.F. *Simon 315 B* (UB!); Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 25 km N of Alto Paraíso, 13°53'27" S, 47°31'00" W, 1250 m elev., 23 March 1971, *H.S. Irwin 33019* (NY, P, R, UB, US); Alto Paraíso de Goiás, ao longo da Estrada Alto Paraíso-Brasília, 14°12'42" S, 47°29'20" W, 1190 m elev., 22 March 2006, M.F. *Simon 773* (HUEFS!, UB!)

28. Mimosa leiocephala Bentham (1842: 404). Lectotype (designated by Barneby 1991): Brazil. Goiás: Natividade, February 1840, fl., *G. Gardner 3706* (lectotype: K!, isotypes: †B photo!, BM!, G!, P!, W!)

Diagnostic characterization: *Mimosa leiocephala* is similar to *M. nitens*, but is distinguished from the latter by the branches with appressed setae (vs. patent or antrorse, but not appressed), medial rachillas as long as the rachis (vs. two times longer than the rachis), leaves of the synflorescence expanding only during or after maturation of fruits (vs. not developing) and campanulate corollas (vs. infundibuliform). The campanulate corollas (vs. infundibuliform) without filiform setae (vs. present) also distinguish *M. leiocephala* from *M. foederalis*.

Notes: *M. leiocephala*, *M. nitens* and *M. vernicosa* var. *ciliata* are marked by the presence of distinct characters that segregate one from each other, mainly related to indumentum of branches and flowers, as well as fruit morphology (see further notes under *M. nitens*). There is, however, doubt if those cannot be seen as variation of a single species, but evidence accumulated up to know do not allow their merging.

Distribution and habitat: *Mimosa leiocephala* is known only from *campos rupestres* at Serra de Natividade, located at the municipality of Natividade in southern Tocantins state, Central Brazil. Together with *M. gardneri* it forms one of the northern most points of distribution of *M.* ser. *Pachycarpae*.

Selected specimens: Brazil. Tocantins: Natividade, Serra de Natividade, Topo da Serra de Natividade, morro da torre, 11°41'38'' S, 47°42'06'' W, 822 m elev., 24 July 2007, R.C. *Forzza 4655* (HUEFS!, K!, RB!); Natividade, Início da subida da Serra da Natividade em direção à antena, 11°39'39'' S, 47°42'24'' W, 17 July 2000, V.C. *Souza 24013* (ESA!, UB!).

29. Mimosa lithoreas Barneby (1991: 388–389). Type: Brazil. Minas Gerais: [Patrocínio], Morro das Pedras ±25 km n.-e. of Patrocinio, in wet campo, 1050 m [elev.], 28 January 1970, fl., *H.S. et al. 25461* (holotype: UB!, isotype: G!, K!, LE!, NY!, P!, R!, S!, US!).

Fig. 35.

Diagnostic characterization: Amongst other *Mimosa* ser. *Pachycarpae* with humifuse habit, *M. lithoreas* may be compared to *M. chiliomera*, *M. prorepens* and *M. viperina*. From all of those, it differs by the forwardly appressed setae (vs. patent), stipules fused at base (vs. free) and by the glabrous campanulate corollas (vs. infundibuliform with pubescent to strigose lobes).

Distribution and habitat: *M. lithoreas* is known only from sandy soils on grassy fields associated to *campos rupestre* with rock outcrops around 1200 m of elevation, between the municipalities of Coromandel and Patrocínio, in western Minas Gerais state, Southeastern Brazil.

Selected specimens: BRASIL. Minas Gerais: Coromandel, Morro das Pedras, Rodovia MG 188, Patrocínio-Coromandel, 16,5 km a partir do trevo na BR 365; estrada de terra para o povoado de Pântano, via Tabuões, 9,5 km da MG 188, estrada de acesso à proprie-

Figure 35. *Mimosa lithoreas*. A. Habit. B. Tortuous branches and xylopodium (Xp). C. Racemes. D. Immature fruits. E. Fruits from previous reproductive period.

dade particular à esquerda, logo antes de uma bifurcação, 18°43'22.5"S, 46°52'12.3"W, 1229 m elev., 13 April 2012, fr., L.M. Borges & L.F. Bacci 621 (SPF).

30. Mimosa longepedunculata Taubert (1896: 432). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: [Alto Paraíso de Goiás], "Habitat in valle fluvii Passa Tempo in ditione Maranhao superioris", Sept 1892, fl., fr., *E. Ule 2830* (lectotype: HBG! [also annotated as "7"; "Kleiner Baum im Thale des Passa Tempo"]; isotypes: P! [only annotated as "N° 7"; "Serra dos Viadeiros; no Valle do Passa Tempo"]; R! [two sheets annotated only as "N° 7"; one indicates: "im Thale des Passa Tempo obere Paranangebiet"; the other: "Serra dos Viadeiros; no Valle do Passa Tempo"].

Fig. 36.

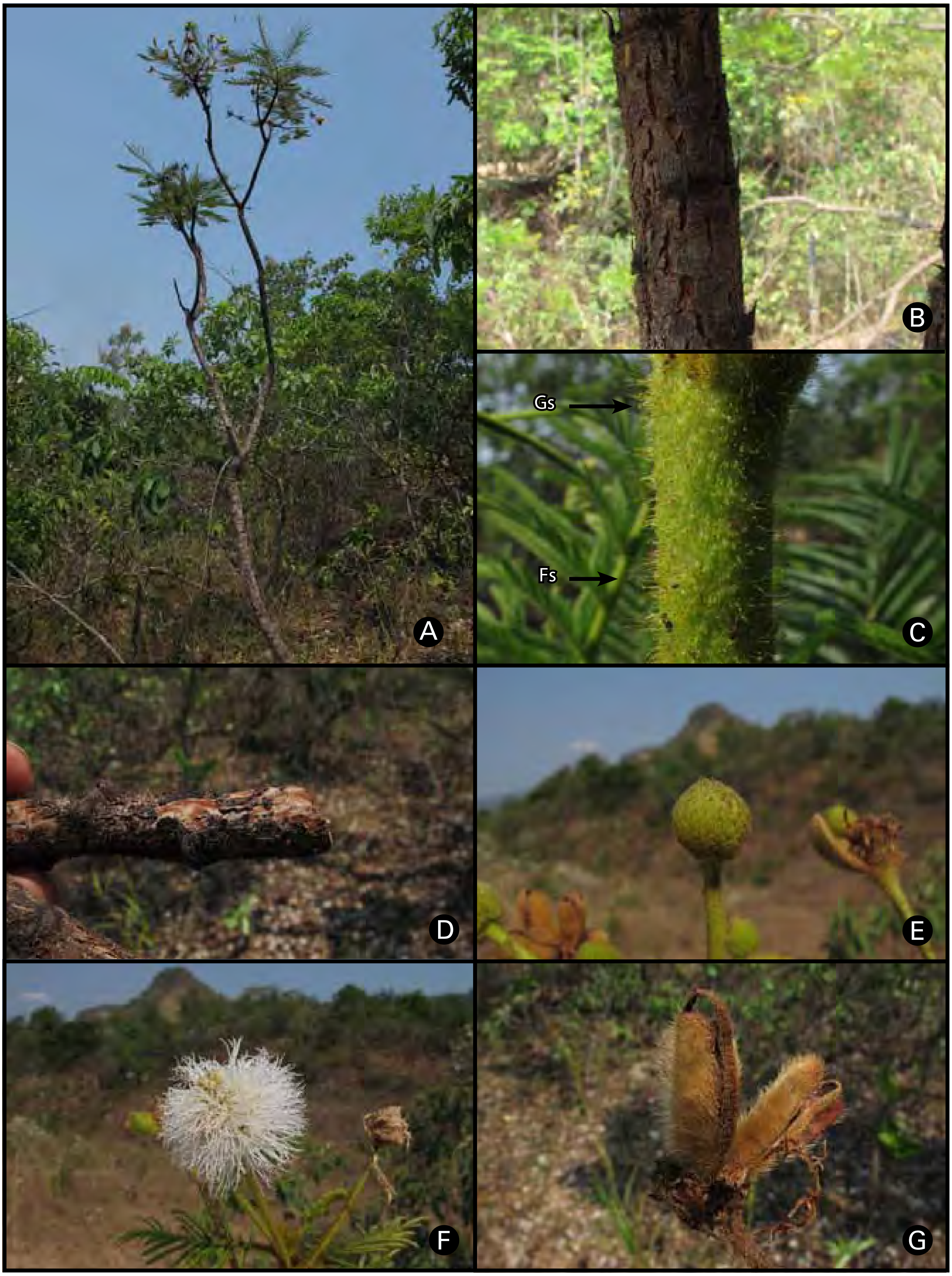

Figure 36. *Mimosa longepedunculata*. A. Habit. B. Trunk with persistent stipules. and developed suber. C. Branch with glandular (Gs) and filiform setae (Fs). D. Branch with shedding periderms. E. Immature raceme. F. Raceme. G. Fruits.

Diagnostic characterization: *Mimosa longepedunculata* may be distinguished from *M. prorsiseta* by the random presence of glandulara setae on branches and interpinnal projections (vs. absence of both structures). Within other treelets with glandular indumentum on branches, patent filiform setae and interpinnal projections it differs from *M. dominarum* by the racemes axillar to leaves fully expanded or almost so during anthesis (vs. only partially developed), presence of plane setae on the calyx rim (vs. absence) and by the fruits with incurved indumentum (vs. patent). In the same context, it differs from *M. oedoclada* by indumentum of leaves concentrated on pulvini (vs. homogenously distributed), racemes axillar to leaves fully expanded or almost so during anthesis (vs. only partially developed), by the cupulate calyx (vs. tubular) and absence of glandular setae on corolla lobes (vs. presence).

Notes: *Mimosa longepedunculata* does not fit any groups of species sharing a particular feature or character, particular none of the groups established by Barneby (1991: 368–369) (see Borges & Pirani 2014b). Even though its leaves are congested at the apex of branches (Fig. 36), internodes of *M. longepedunculata* are long and similar to the ones occurring in species associated with *M. claussenii*, not with the very short ones of species like *M. oedoclada*.
Barneby (1991) mistakenly equated *Mimosa tocantina* and *M. longepedunculata* (Borges & Pirani 2014b). *M. longepedunculata* sensu Barneby, a procumbent shrub with orange-red setae abundant in developing leaves, without glandular setae on leaves and branches is actually *M. tocantina* Taub. *M. longepedunculata* sensu Taubert, on the other hand, is a tree with indumentum composed of markedly glandular setae and ochraceous filiform setae. Both species also do not appear as closely related to each other in a phylogenetic analysis of *M.* ser. *Pachycarpae* (Borges *et al.* Chapter 1).

Distribution and habitat: *Mimosa longepedunculata* occurs at altitudinal *cerrados* on sandy soils around 1100 m in elevation at Chapada dos Veadeiros, particularly at the hills surrounding the Passatempo Stream and São Bartolomeu River near the municipality of Alto Paraíso de Goiás, Goiás state, Central Brazil.

Selected 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).

31. Mimosa maguirei Barneby (1991: 425–426). Type: Brazil. Minas Gerais: [Santana do Riacho], Serra do Cipó, km 112–118 on road from Hotel Chapéu do Sol, [1200–1300 m elev.,] 7 August 1960, fl., *B. Maguire et al. 49051* (Holotype: NY!, isotype: US!).

Fig. 37.

Diagnostic characterization: *Mimosa maguirei* is readily distiguished from other species of *M.* ser. *Pachycarpae* by its slender, glaucous, glabrate stems. Moreover, it can be set apart from the morphologically similar *M. neonitens* by the spiculate interpinnal projection (vs. laminar) and from *M. rupigena* by the presence of glandular setae on floral bracts (vs. absence) and absence of filiform setae on fruits (vs. present).

NOTES: *Mimosa maguirei* is commonly unarmed, but one specimen (*Lombardi 437*) was observed with antrorse aculei on rachides. We believethese may be an abnormal development of filiform setae, since no other aculeate collection was found in all herbaria studied,neither extensive fieldwork have reported any aculeate specimens so far (see Borges & Pirani 2013) . Nonetheless, our key accounts for the occurrence of this feature in the species. Fruits of *M. maguirei* are commonly unjointed craspedia with papery valves. Field observations and two specimens (*Arbo 4204*; *Duarte 2065*) indicate that they can break up in irregular articles, but only after seed release. The species is a common host for *Pilostyles blanchetii* (Gardner) R.Br., which alters normal development of xylematic vessels, reducing overall size of cells, but increasing their number (Amaral & Ceccantini 2011), as well as the architecture of infected plants by decreasing apical dominance and, thus, promoting lateral branching (Gomes & Fernandes 1994, Groppo *et al.* 2007).

DISTRIBUTION AND HABITAT: The species is endemic to *campos rupestres* with rock outcrops of the Southern Espinhaço Range, particularly occurring at Serra do Cabral, Serra do Cipó and the Diamantina Plateau.

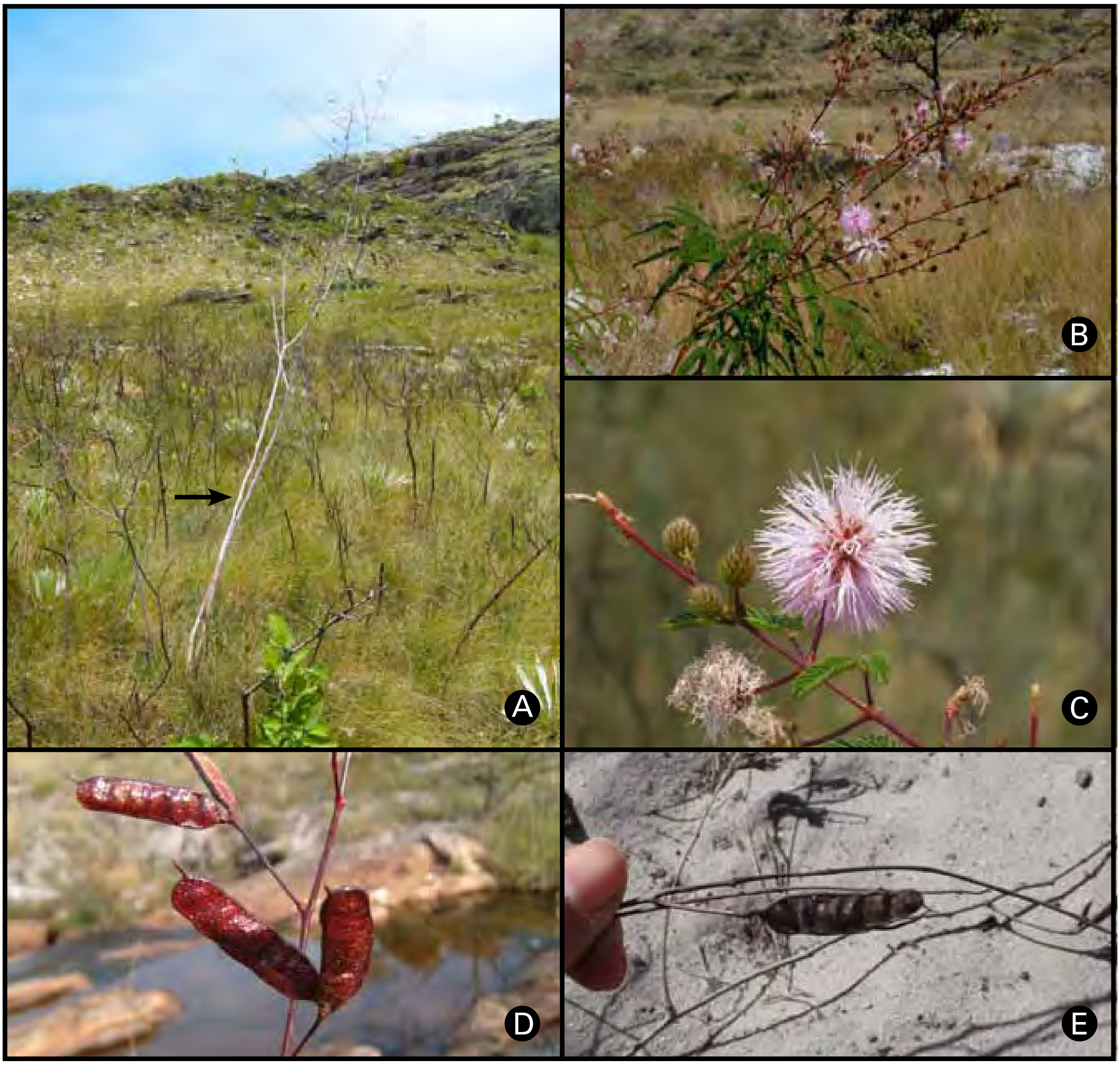

Figure 37. *Mimosa maguirei*. A. Habit. B. Synflorescences. C. Racemes. D. Immature fruits. E. Old fruit. Photo B by D.A. Chaves.

Selected specimens: Brazil. Minas Gerais: Augusto de Lima, Estrada para a Fazenda Santa Helena e para Joaquim Felício, a ca. 21 km da Igreja e do coreto de Augusto de Lima, 18°06'34'' S, 44°16'00'' W, 25 March 2000, *Pirani, J.R. 4671* (ESA!, G!, K!, NY!, SPF!, W!); Diamantina, Estrada Diamantina- Conselheiro Mata, 18°17'47'' S, 43°50'26'' W, 1227 m elev., 23 September 2008, *J.N. Nakajima 5002* (HUFU!); Santana do Riacho, Serra do Cipó, Distrito de Cardeal Mota, sede da Fazenda Monjolos, 19°20'30'' S, 43°38'35'' W, 27 September 2002, *L.S. Kinoshita 02/141* (UEC!).

32. Mimosa manidea Barneby (1991: 417). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] Chapada dos Veadeiros, ± 12 km n.-w. of Veadeiros, 1200 m [elev.], 19 December 1965, fr., *H.S. Irwin et al. 9282* (holotype: UB!, isotypes: K!, LE!, NY!, R!, S!, US!).

Fig. 38.

Diagnostic characterization: *Mimosa manidea* is similar to *M. oedoclada*, which is also a treelet with thick branches showing periderm exfoliation, indumentum partially composed by glandular setae, triangular persistent stipules and congested leaves. The former is set apart by the incurved (vs. patent) filiform setae of branches that may become laterally fused (vs. free) and absence of interpinnal projections (vs. presence).

Notes: The persistent stipules of *M. manidea* form a cluster around the branches just below the leaves, which is an additional character of this species. This feature is also present in *M. splendida*, but it differs from *M. manidea* by the presence of orange setae (vs. ocherous) and of interpinnal projections (vs. absence). Exfoliation of the periderm was not referred to this species by Barneby (1991). It is indeed present, but herbaria specimens often lack that feature because only the very tip of branches is collected, being usually cut above the region of expression of this feature.

Distribution and habitat: *Mimosa manidea* is a major component of the landscape of Chapada dos Veadeiros, at Goiás state, Central Brazil, where it occurs in rocky *cerrado* and *campo rupestre* forming dense populations.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Entrada do Belvedere Paraíso, a cerca de 4 km N de Alto Paraíso de Goiás, 14°08' S, 47°27' W, 1380 m elev., 14 March 1995, *T.B. Cavalcanti 1345* (CEN!, UB!); Alto Paraíso de Goiás, Estrada para a Vila de São Jorge, ca. 7km do trevo da GO-118, próximo à entrada da Fazenda Capão do Negro, 14°09'49'' S, 47°37'00'' W, 1110 m elev., 23 January 2005, *J. Paula-Souza, 4508* (ESA!); Alto Paraíso de Goiás, ca. 10 km W de Alto Paraíso de Goiás, na estrada para Colinas, 14°07'57'' S, 47°30'35'' W, 900 m elev., 7 February 1987, *Pirani, J.R. 1763* (K!, NY!, SPF!).

33. Mimosa megistophylla (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa claussenii* var. *megistophylla* Barneby (1991: 401). Type: Brazil. Goiás: [Cavalcante,] Chapada dos Veadeiros, ±10 km s. of Cavalcante, [1000 m elev.,] 8 March 1969, fl., *H.S. Irwin et al. 24073* (holotype: UB!, isotypes: CAS photo!, K!, LE!, MEXU photo!, NY!, P!, R!, S!, TEX photo! US!).

Fig. 39.

Diagnostic characterization: *Mimosa megistophylla* differs from *M. prorsiseta* by being itsshrubby habit with

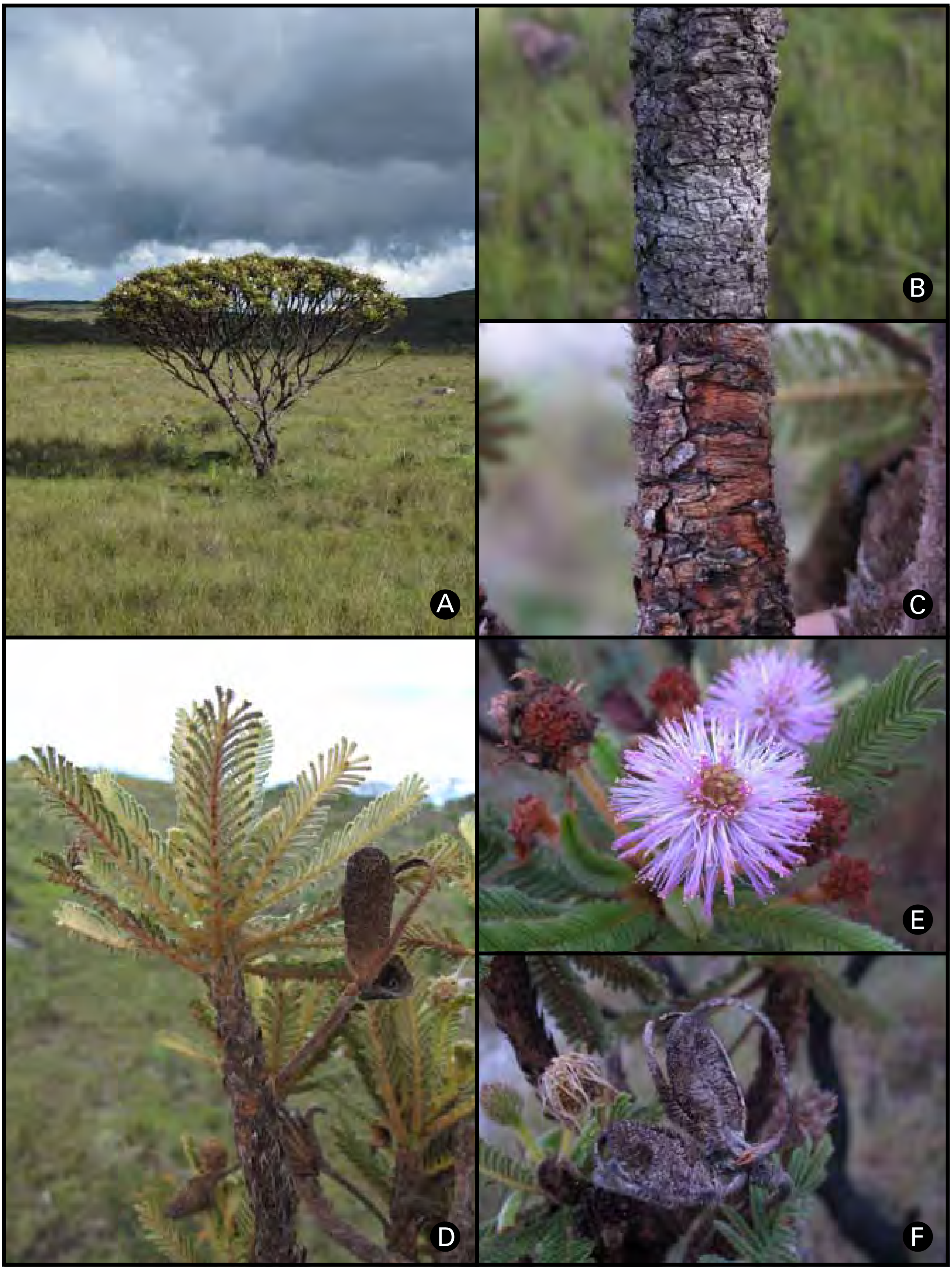

Figure 38. *Mimosa manidea*. A. Habit. B. Trunk with developed suber. C. Detail of a branch with peridermis exfoliation. D. Branch bearing persistent, clustered stipules and a fruit from the previous reproductive period. E. Raceme. F. Fruits.

erect or prostrate stems (vs. erect shrub or treelet), and by the indumentum of primary leaf axes concentrated on pulvini (vs. homogenously distributed).

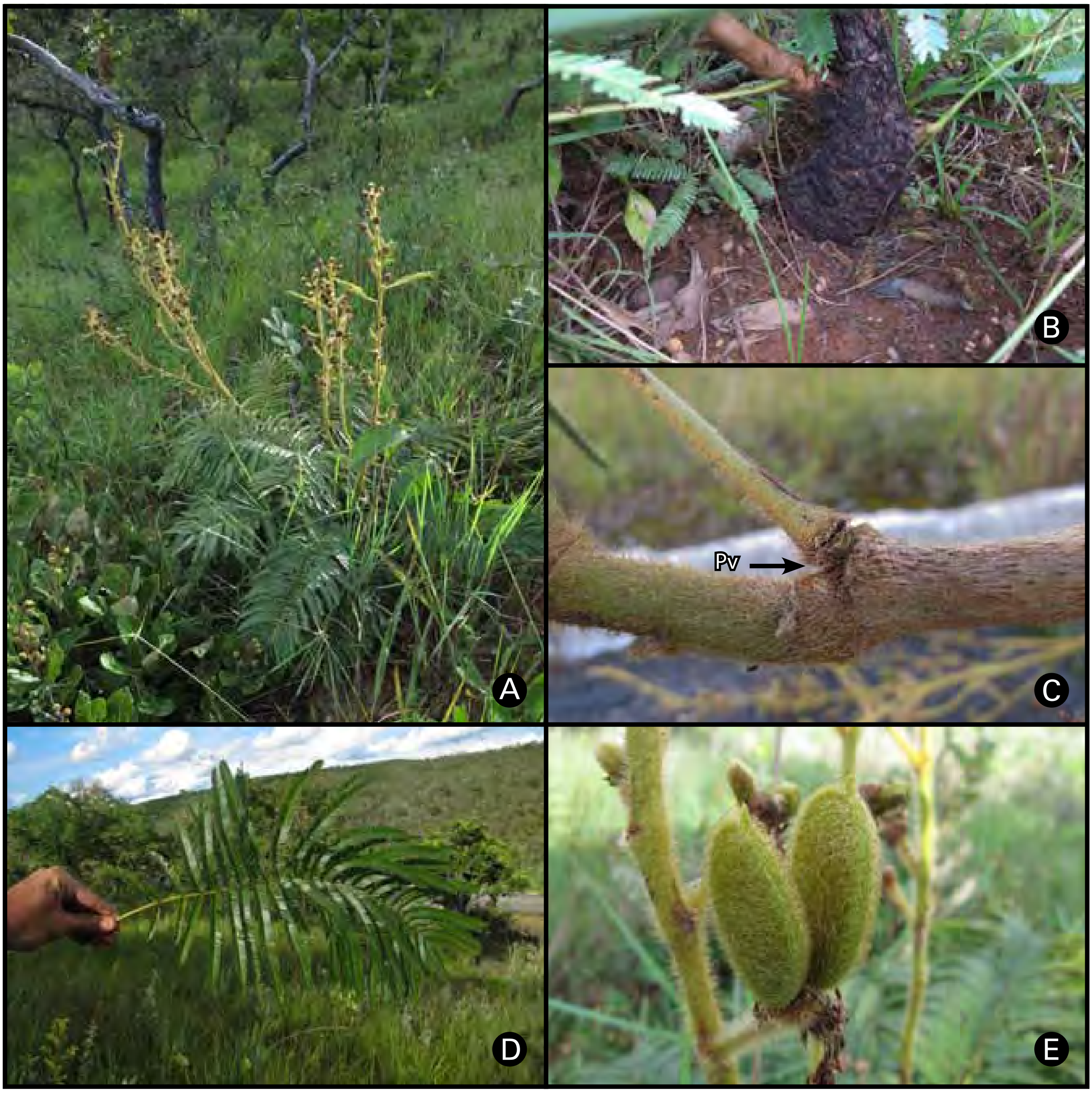

Figure 39. *Mimosa megistophylla*. A. Habit. B. Stem base showing the presence of developed and fire resitent suber. C. Petiole with indumentum concentrated on the pulvinus (Pv). D. Leaf. E. Immature fruits.

Notes: Taxa related to or previously considered as part of *Mimosa claussenii* by Barneby (1991) usually show large and multipinnate leaves up to 30 or more pinnae pairs. Amongst those, *M. megistophylla* is one of the most extreme examples of elongation and proliferation of parts and sometimes leaves are lacking or not fully represented in herbaria specimens. This is unfortunate, since the concentration on indumentum on the pulvini is a remarkable feature of this species when associated with its extended synflorescence and habit. See also notes on taxonomic affinities under *M. gardneri*.

Distribution and habitat: *Mimosa megistophylla* occurs in open formations of the northern portion of Chapada dos Veadeiros surrounding the municipality of Cavalcante, at the Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Cavalcante, Fazenda Forquilhinha, 600 m elev., *M.B. Botelho 127* (UB!); Cavalcante, estrada 60km ao norte de Cavalcante em direção a cachoeira do Prata, rio do Prata, 13°25' S, 47°39' W, 1077 m elev., M.F. *Simon 460* (UB!); Teresina de Goiás, Chapada dos Veadeiros, 9 km by road S of Terezina, [13°51'28'' S, 47°15'53'' W,] 1100 m elev., 19 March 1973, W.R. *Anderson 7474* (F!, K!, MO!, NY!, UB!, US!).

34. Mimosa microphyllidia (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa claussenii* var. *microphyllidia* Barneby (1991: 402). Type: Brazil. Goiás: [São João da Aliança, Serra Geral do Paraná] 7 km by road n. of São João da Aliança, [ca. 1070 m elev.,] 25 March 1973, fl., *W.R. Anderson et al. 7937* (holotype: UB!, isotype: NY!).

Fig. 40.

DIAGNOSTIC CHARACTERIZATION: Amongst species within *Mimosa* ser. *Pachycarpae* showing a shedding periderm and clavate glandular setae, *M. microphyllidia* is mostly similar to *M. rheiptera* and is distinguished from the latter by having branches with incurved filiform setae (vs. antrorse, but not apressed), absence of paraphyllida (vs. presence), corollas lacking glandular setae (vs. present), and oblong fruits with indumentum organized in a concentric pattern (vs. narrowly oblong with indumentum randomly distributed). Also, from *M. prorsiseta* it is distinguished by the shedding periderm and the indumentum composed in part by glandular setae (vs. not present).

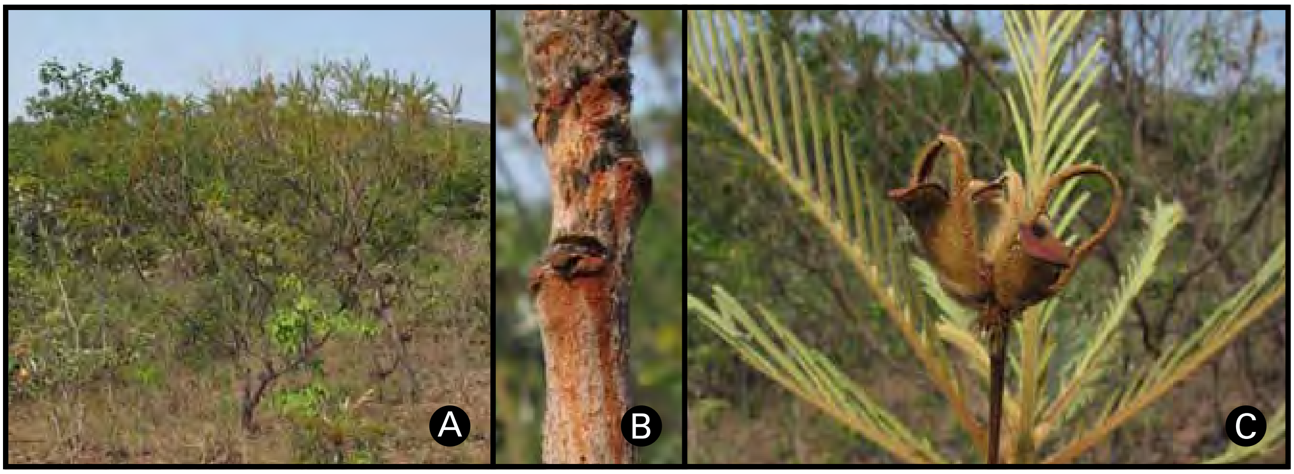

Figure 40. *Mimosa microphyllidia*. A. Habit. B. Detail of a branch with peridermis exfoliation. C. Fruits.

NOTES: Peridermal exfoliation associated with reddish underbark occurs in *Mimosa microphyllidia*, but not as early in development as is observed in *M. densa* or *M. oligosperma*, and it is not usually present in herbarium specimens. Absence of this feature in the material analyzed by Barneby (1991), associated with the incurved indumentum and lack of paraphyllidia made him establish an association with *M. claussenii* var. *prorsiseta* (here *M. prorsiseta*) and circumscribe them under a variety of *M. claussenii*, even though his first impression was towards a relationship with *M. rheiptera*, indicated by his application of a never published variety of it to some of those specimens. However, the character states listed above allow a sharp distinction between *M. prorsiseta*, *M. rheiptera* and *M. microphyllidia*. Besides those and as the last epithet indicates, *M. microphyllydia* has smaller pinnae and leaflets in comparison to the ones occurring in *M. prorsiseta*, a feature that despite not used by us as a diagnostic character is useful for its identification amongst the many treeletes belonging to *M.* ser. *Pachycarpae* and occurring at Chapada dos Veadeiros, Goiás.

Distribution and habitat: *Mimosa microphyllidia* is endemic to the Chapada dos Veadeiros, Goiás state, Central Brazil, where it occurs in *cerrados* with rocky soils.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 6-7 km E of Alto Paraíso on road to Nova Roma, 14°04'32'' S, 47°28'31'' W, 1400 m elev., 7 March 1973, *W.R. Anderson 6532* (G!, K!, LE!, NY!, R!, UB!, US!); Region of the Chapada dos Veadeiros, 20 km N of São João da Aliança, 14°30' S, 47°30' W, 13 April 1956, *E.Y. Dawson 14156* (NY!, RSA photo!).

35. Mimosa melanocarpa Bentham (1875: 437). Lectotype (designated by Barneby 1991): Brazil. Goiás. ad Rio Tocantins [LOCALITY from Burchell notes], 1828, fl., fr., *W.J. Burchell 8048* (K! [= NY neg. 1899]).

Fig. 41.

Diagnostic characterization: *Mimosa melanocarpa* is similar to *M. setosa*, but differs from it by the presence of filiform setae on flower pedicels (vs. absence), corolla lobes concealed by the indumentum (vs. not concealed), fruits with apiculate apex (vs. rounded or obtuse, but with a projection) and undulate margin (vs. straight).

Notes: Contrary to statements by Barneby (1991), the calyx tube of *M. melanocarpa* is glabrous on the majority of its

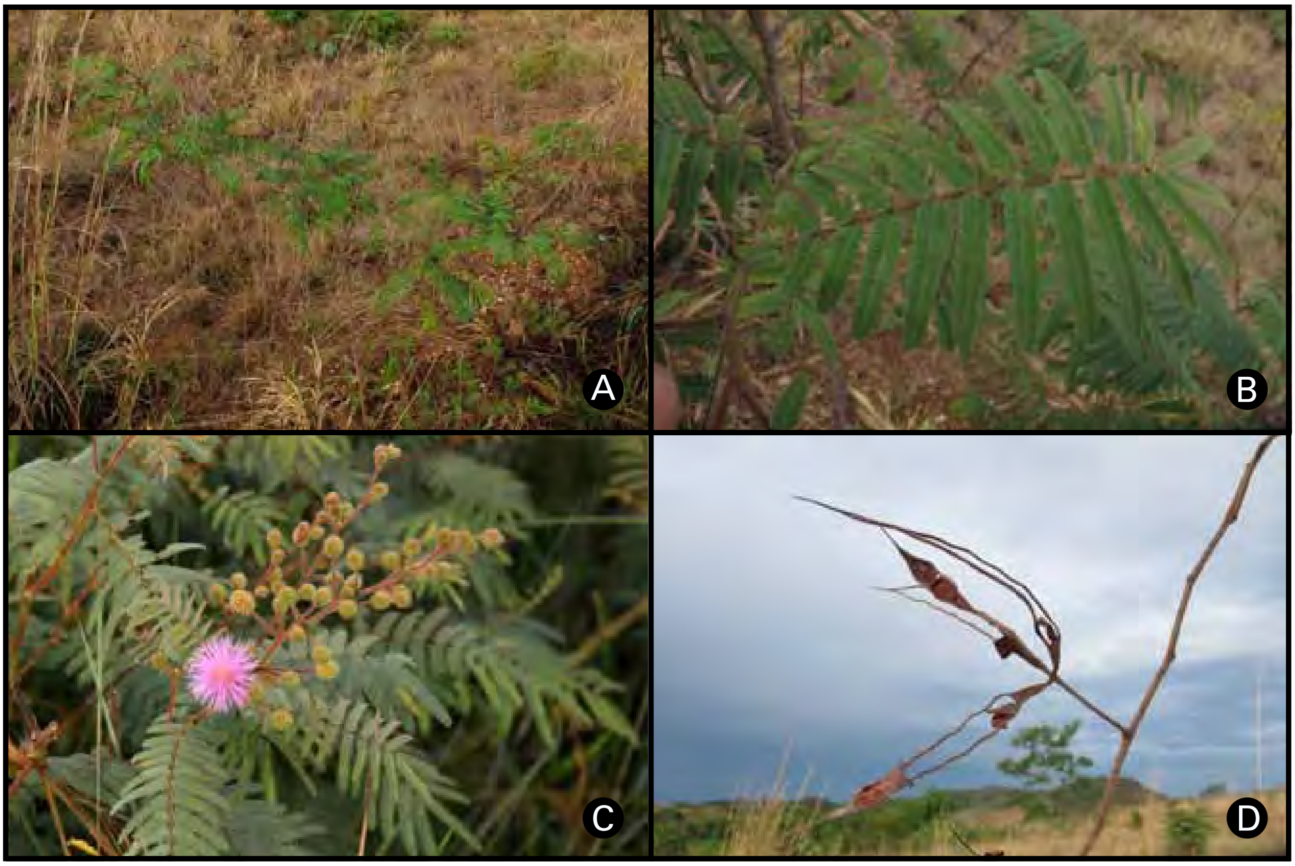

Figure 41. *Mimosa melanocarpa*. A. Habit. B. Leaf. C. Synflorescence. D. Fruits.

extension and just randomly a few filiform setae may be present on its apex. However, the abundant filiform setae present on the flower pedicels are long enough to cover the whole calyx tube, giving the impression that it is pubescent.
For a discussion on the relationships of *Mimosa melanocarpa*, *M. setosa* and *M. setosa* var. *pseudomelas*, see Borges *et al*. (Chapter 3).

Distribution and habitat: *Mimosa melanocarpa* occurs on *cerrado*, at the states of Goiás, Mato Grosso and Minas Gerais, Central Brazil.

Selected specimens: Brazil. Goiás: Cavalcante, ao longo da estrada entre Cavalcante - Colinas do Sul, 13°48'42" S, 47°27'16" W, 800 m elev., M.F. *Simon 770* (UB!); Niquelândia, Rodovia GO-532, km 20, 14°28'27" S, 48°27'34" W, 28 May 1996, M.A. *Silva 2925* (CEN!, IBGE!, NY!, RB!); Piranhas, Caiaponia-Aragarças road, about 75 km. from Araguarças, 16°25'37" S, 51°49'19" W, 600 m elev., 21 June 1966, D.R. *Hunt 6109* (K!, NY!, P!). Mato Grosso: Cocalinho, estrada para Cocalinho/Barra do Garças. Folha SD-22-YB, onto de coleta # 26, 14°25'48" S, 51°04'12" W, 310 m elev., 14 September 1996, *S.S Silva 79* (K!, NY!, RB!). Minas Gerais: Uberaba, 57 km south of Uberlândia on highway BR-106, R. *Goodland 3561* (UB!). Tocantins: Palmas, Reserva Estadual do Lajeado, 10°10'45" S, 48°11'53" W, 11 December 2001, *E.A. Soares 1455* (HTO!).

36. Mimosa multipinna Bentham (1875: 440). Lectotype (designated by Barneby 1991): Brazil. [Goiás.] Between Goiás Velho and Aldeia S. José [Goyaz, along the first 3 leagues of the road to Aldeia de S. Joze (Smith & Smith 1967)], 17 February 1828, *W.J. Burchell 6700-14* (type: K!).

= *Mimosa foliolosa* (?) var. *macrocephala* Bentham (1876: 389), ***syn. nov.*** Lectotype (designated here): Brazil. fl., *Pohl s.n.* (lectotype: M! [M 0218521, a small label attached to the specimen indicates "579"], isolectotype: M 0218521, W(not found))
= *Mimosa multipinna* var. *microphylla* Bentham (1876: 388). Lectotype (designated by Barneby 1991): Brazil. ad Montes Claros provinciae Goyaz, *Pohl 1204* [=1400 d.], ex parte (lectotype: W 0028043); synonymized by Barneby (1991).
≡ *Mimosa foliolosa* subsp. *pachycarpa* var. *multipinna* (Benth.) Barneby (1991: 378), ***syn. nov.***
= *Mimosa foliolosa* subsp. *pachycarpa* var. *gravida* Barneby (1991: 379–380), ***syn. nov.*** Type: Brazil. Mato Grosso: Barra do Garças, [Vale de Sonhos, approx. 15°40' S, 52°20' W (80 km N of Barra do Garças on road to Xavantina),] 28 August 1972, fr., *J.A. Ratter et al. 2294* (holotype: NY!, isotypes: K!, U photo!, UB!, UC photo!, UEC!).

Fig. 42.

Diagnostic characterization: *Mimosa multipinna* is compared here to the closely similar *M. foederalis* and *M. pubescens*. It is distinguished from *M. foederalis* by the presence of glandular setae on branches (vs. absence), caducous stipules (vs. persistent) and fruits with rounded to obtuse base (vs. cuneate). From *M. pubescens*, it differs by basal rachillas ca. half the size of medial rachillas (vs. isometric), glabrous surface of leaflets (vs. pubescent with simple trichomes), filiform setae absent from the apex of the calyx tube (vs. present) and infundibuliform corollas (vs. campanulate).

Notes: *Mimosa foliolosa* var. *gravida* was defined in comparison to *M. multipinna*, and considered different from the latter by the larger fruits and the fewer leaflets per pinna (Barneby 1991). However, specimens displaying intermedi-

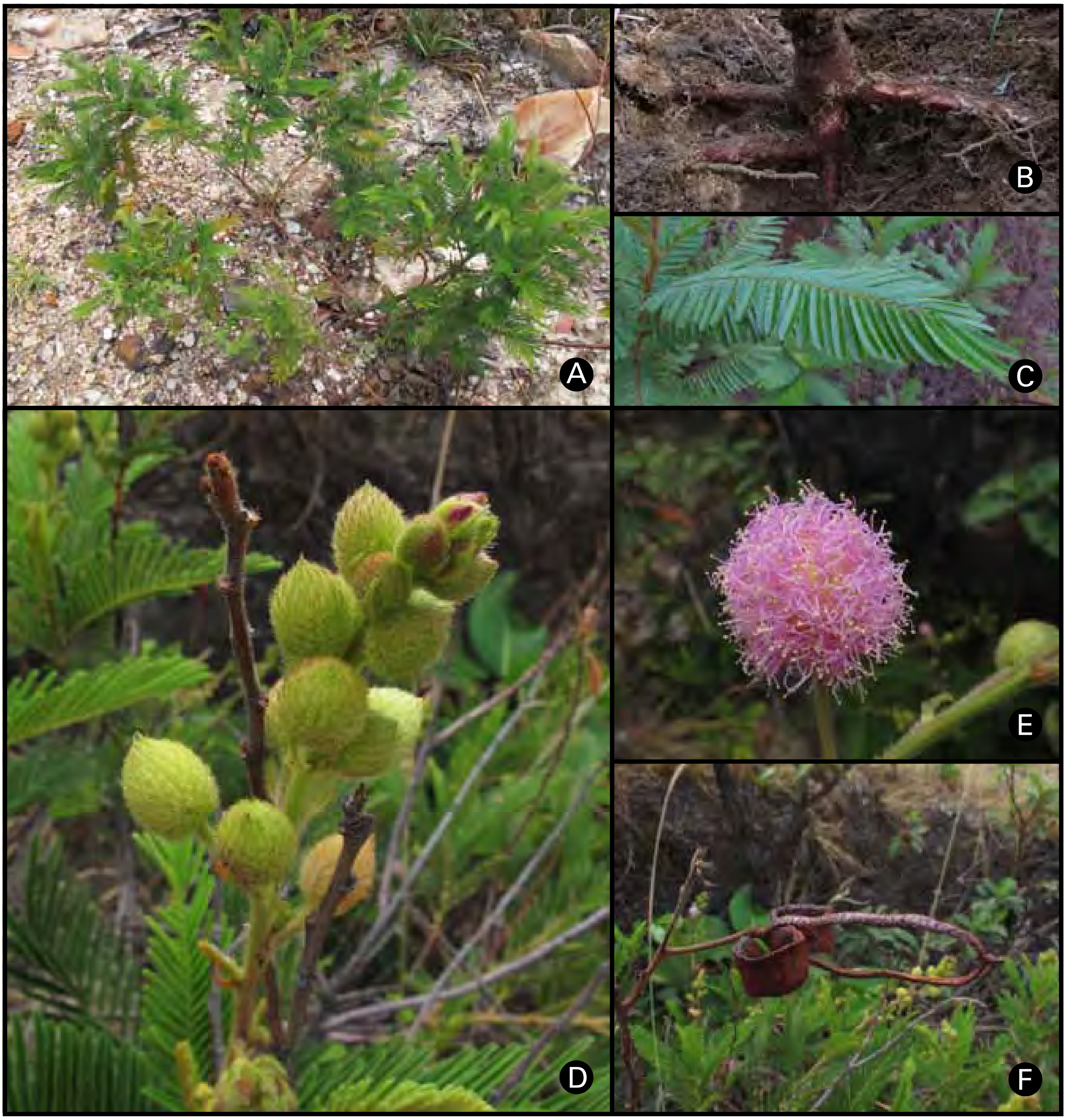

Figure 42. *Mimosa multipinna*. A. Habit. B. Xylopodium (Xp). C. Leaf. D. Synflorescence. E. Raceme. F. Fruit.

ate states do exist (*e.g. Anderson 10009*) and field examination of populations located in the border of Goiás and Mato Grosso states show that fruit size is variable (e.g. *Borges 961*, *972*; *985*). Moreover, both taxa are known to form a monophyletic group (Borges *et al.* Chapter 1). Thus, *Mimosa foliolosa* var. *gravida* is here synonymized under *M. multipinna*.

Mimosa foliolosa var. *macrocephala* appear within taxa whose affinities and status Barneby (1991) was not able to exactly point (*incertae sedis*). Examination of the lectotype at M indicates that it matches perfectly the concept of *M. multipinna* and hence it is here also treated under the latter.

Barneby (1991) expressed concern about the collection locality of *Mimosa multipinna* var. *microphylla,* which he thought would be far away from the distribution range of *M. multipinna*. Nevertheless, Montes Claros de Goiás lays within the known occurrences of *M. multipinna* and *M. foliolosa* var. *gravida*.

DISTRIBUTION AND HABITAT: *Mimosa multipinna* occurs in *campos rupestres* and cerrados of the Goiás and Mato Grosso states, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Goiás, Estrada Goiás–Barra do Garças, a 1,2 km do primeiro trevo de Goiás, ramal à esqueda para Fazenda Vereda; 2,5 km da rodovia, 4 November 2012, fr., *L.M. Borges et al. 961* (SPF!, NY!); Mossâmedes, Fazenda do Jander (fazenda Estância Quinta da Serra), Serra Dourada, 16°02' S, 50°03' W, *J.E.Q. Faria 403* (HUEG!, UB!); Serra Dourada, Reserva Biológica da UFG, 19 April 1988, *Ana 6541* (UFG!); Parque Nacional das Emas, 20 October 1989, *H.D. Ferreira 2424* (UFG!). Mato Grosso: Barra do Garças, Eastern base of mountain ca. 9 km NE of Barra do Garças, [15°49'33'' S, 52°11'26'' W,] 450 m elev., 5 May 1973, *W.R. Anderson 9732* (G!, K!, NY!, P!, R!, S!, UB!). Mato Grosso do Sul: Pedro gomes, Serra do Roncador, [18°06'03'' S, 54°33'06'' W,] 11 February 1974, G. *Hatschbach 34034* (HBG!, K!, MBM!, NY!);

37. Mimosa myrioglandulosa V.F. Dutra & F.C.P. Garcia (2012: 164, 166–168). Type: Trilha da Escada de Pedras, 14 September 2004, fl., *J. Nakajima et al. 3816* (holotype: HUFU!, isotypes K, VIC).
Fig. 43.

DIAGNOSTIC CHARACTERIZATION: Dutra & Garcia (2012) established *Mimosa myrioglandulosa* in comparison to *M. maguirei* using the presence of glandular setae on its branches (vs. absence) as a distinctive character. The species is also similar to *M. neonitens*, but stands out from this species by the presence of filiform setae on branches (vs. presence) and by the overall sessile glandular setae (vs. stipitate).

Figure 43. *Mimosa myrioglandulosa*. A. Habit. B. Synflorescence.

Distribution and habitat: *Mimosa myrioglandulosa* is endemic to *campos rupestres* of Serra da Canastra and Serra de Canabrava, both located in Minas Gerais state, Southeastern Brazil. Particularly at Serra da Canastra it was found only in areas belonging to the municipality of Divinópolis.

Selected specimens: Brazil. Minas Gerais: Delfinópolis, estrada para Casinha Branca, Sete Cidades, 8 October 2002, fl., *Volpi* 194 (HUFU!, VIC); Delfinópolis, trilha Escada de Pedras, Fazenda José Antunes, 11 October 2002, fl., fr., *R. Romero 6466* (HUFU!, VIC); Sacramento, Serra da Canabrava, 21 October 1988, fl., *M. Brandão 13649* (PAMG!).

38. Mimosa neonitens (Bentham 1876: 387) L.M. Borges in Borges et al. (Chapter 3). *M. setosa* var. *nitens* Bentham (1876: 387). Lectotype (designated by Barneby 1991): Brazil. [probably Minas Gerais]: Habitat ad Arrado Velho (prov.?), *J.B.E. Pohl 664*, (lectotype: W! [2 sheets]).

Fig. 44.

Diagnostic characterization: *Mimosa neonitens* differs from *M. paludosa* by differs by the absence of aculei and by the fruits partially articulated (vs. completely articulated). From *M. setosa*, it is distinguished by the presence of xylopodium (vs. absence); presence of shallowly triangular calyx lobes (vs. absence of lobes); and fruits partially articulated (vs. completely articulated).

Notes: One of the most distinguishing features of *Mimosa neonites* is its fruit somewhat transitional between typical and unjointed craspedia, is reddish, almost glabrate and shiny.

Distribution and habitat: *Mimosa neonites* occurs in *campos rupestres*, *campo* in red clay, *cerrado* and *cerrado rupestre* of western Minas Gerais State, Southeastern Brazil, at 850–1050 m elevation.

Selected specimens: Brazil. Minas Gerais: Araguari, 40 km NO da cidade de Araguari, 25 May 1963, fl., G.M. Magalhães 19266 (HB!, NY!); Araxá, 9 February 1956, fl., *A. Macedo 4285* (IAN!); [Coromandel ?], MG 188 (Patrocínio – Coromandel), beira de estrada, 18° 48' S, 46° 55' W, 28 February 1989, fl., *R.C. Mendonça 1230* (CEN, IBGE, NY!); Indianópolis, Fazenda Bela Tanda and neighbouring fazendas, 6 km NE of Indianópolis, Fazenda Seriema, 19°13'S, 47°57'W, 850 m elev., 2 March 1986, fl., *G.K. Gottsberger & Döring J. 118-2386* (NY!); [Patrocínio ?], ca. 25 km NE of Patrocínio, 1050 m elev., 20 January 1970, fl., *H.S. Irwin 25551* (NY!); Perdizes, Estação Ambiental Galheiro, Mata da Aparecida, 14 February 2003, *R. Arruda 206* (BHCB!, HUFU!); Perdizes, Estação Ambiental Galheiro, Macega, 7 March 2003, fl., fr., *E.H. Amorim 697* (HUFU!).

39. Mimosa nitens Bentham (1842: 404). Lectotype (designated by Barneby 1991): Brazil. Goiás: ad rio Trahiras, *J.B.E. Pohl d. 1464 [=1737]* (holotype: K! [annotated only "1464"], isotypes: F! [annotated "1737 (1464 D)", NY! [annotated only "1737", W! [annotated "1737" and "1464 d."].

Fig. 45.

Diagnostic characterization: *Mimosa nitens* is similar to *M. foederalis*, but is set apart from it by the caducous

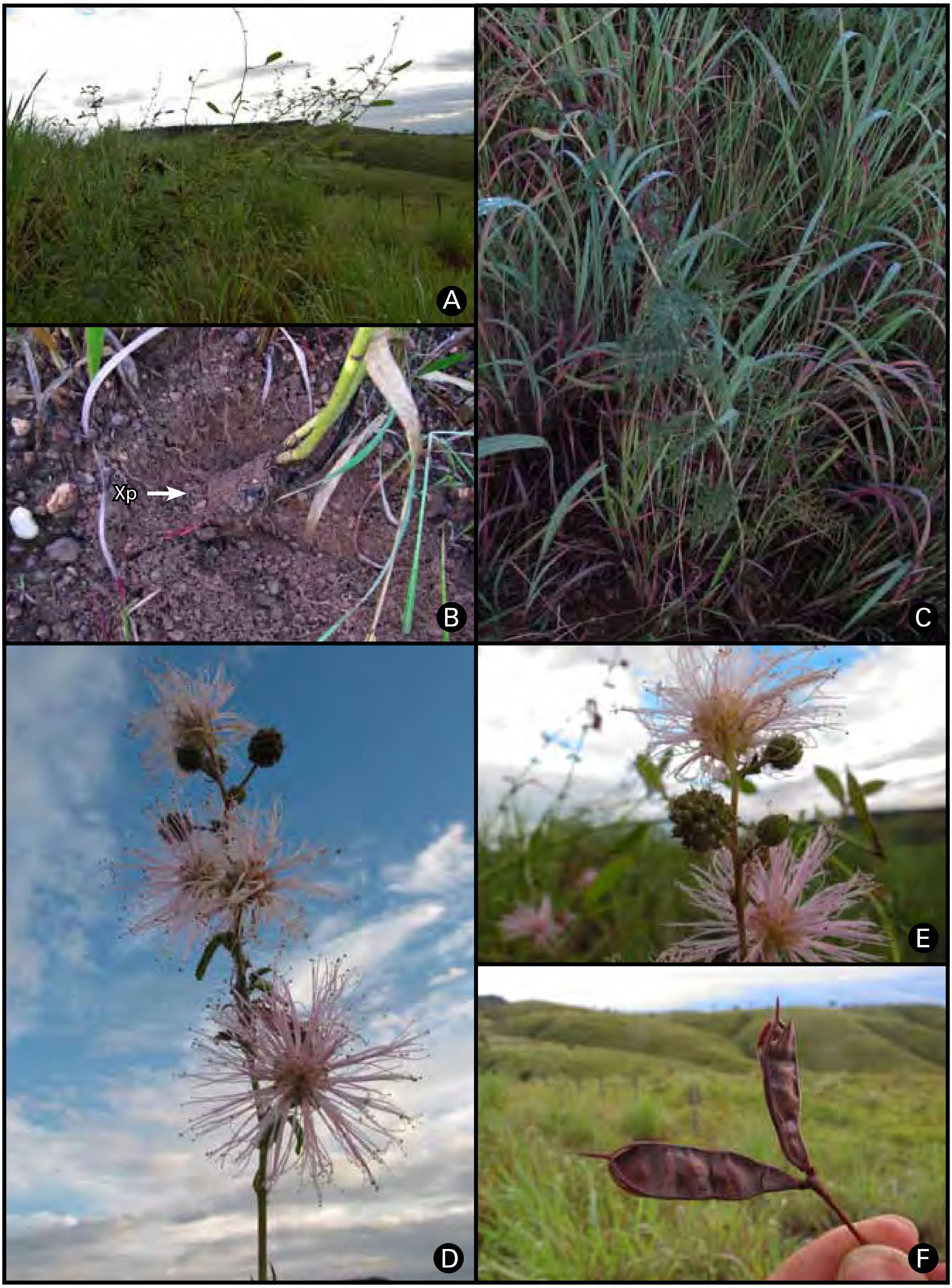

Figure 44. *Mimosa neonitens*. A. Habit. B. Xylopodium (Xp). C. Detail of a branch. D. Synflorescence. E. Racemes. F. Fruits.

stipules (vs. persistent), leaves not developing on the synflorescence axis during or after maturation of fruits (vs. leaves expanding) and fruits lacking glandular setae (vs. present). Also, it share affinities with *M. leiocephala* and is

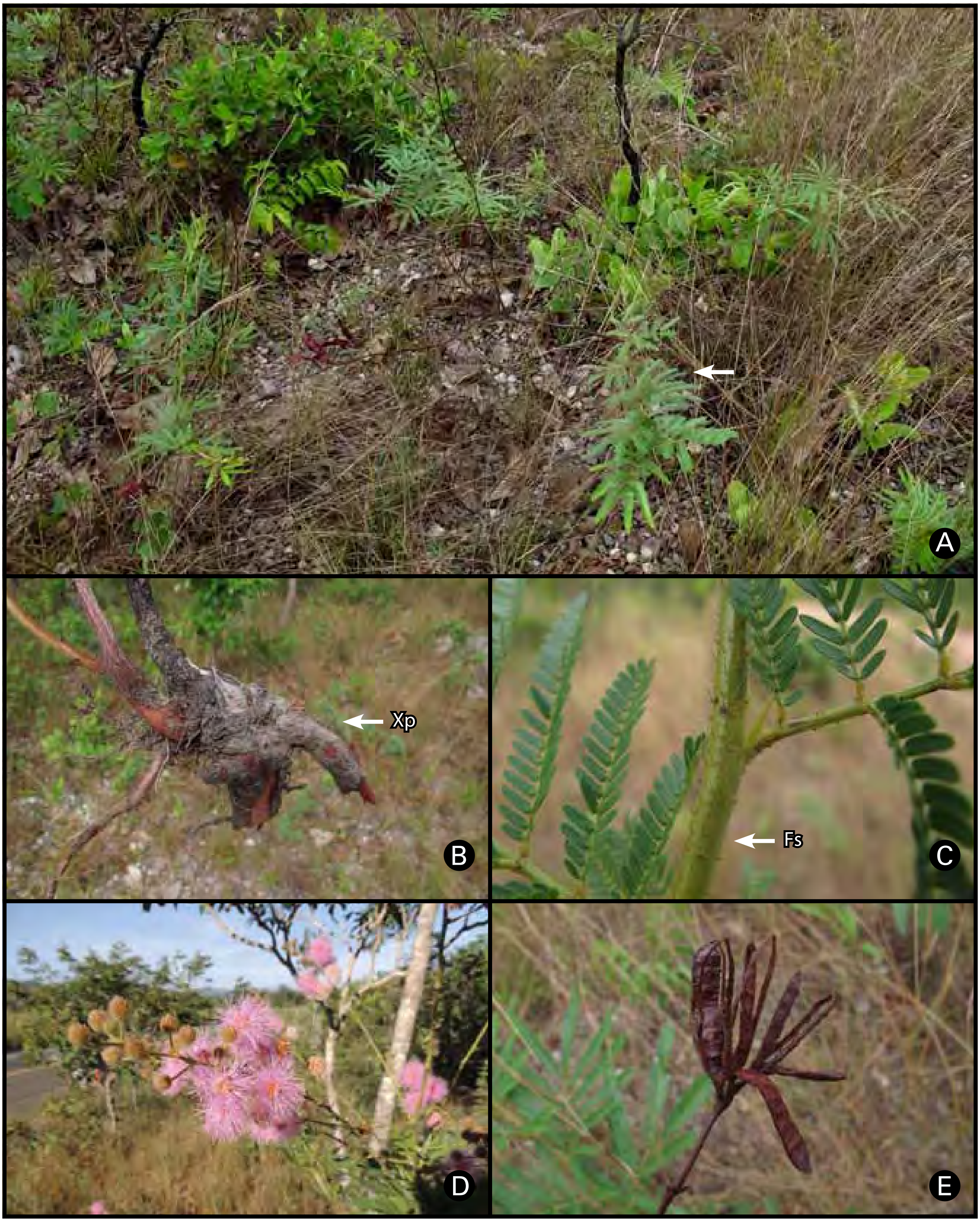

Figure 45. *Mimosa nitens*. A. Habit. B. Xylopodium (Xp). C. Branch with antrorse filiform setae (Fs). D. Synflorescence. E. Fruits. Photo D by Rubens Queiroz.

differentiated from it by the branches with patent or antrorse, but not appressed setae (vs. appressed), medial rachillas two times longer than the rachis (vs. as long as the rachis), leaves not developing on the synflorescence axis during or after maturation of fruits (vs. leaves expanding) and infundibuliform corollas (vs. campanulate).

Notes: *Mimosa nitens* and *M. vernicosa* var. *ciliata* share several morphological affinities, but are different in three main characters: orientation of filiform setae on branches (respectively patent or antrorse, but not appressed setae vs. appressed), presence of filiform setae on the corolla lobes (respectively present vs. absent) and fruit shape (respectively narrowly oblong vs. oblong). Also, they phylogenetic analysis indicate that they form a clade (Borges *et al.* Chapter 1). However, lack of concomitant presence of flower and fruits in analyzed specimens prevent a full evidence that those characters may occur in different combinations, a fact that would allow us to circumscribe a single species here. Collection and examination of additional specimens are necessary to solve this intriguing puzzle, whose resolution may either set those taxa as distinct unities of merge them and, in that case, extend the problem to the boundaries with *M. leiocephala* (See also notes under *M. vernicosa* var. *ciliata*).

Distribution and habitat: *Mimosa nitens* occurs in *cerrados* and *campo rupestres* with rocky and sandy soils of altitudinal areas in the border between Goiás and Tocantins states, Central Brazil. Particularly at Serra da Mesa, it is also present in nickel rich soils.

Selected specimens: Brazil. Goiás: Cavalcante, Serra Branca, APA Pouso da Serra, 13°36'00" S, 48°03'54" W, 425 m elev., 3 August 2005, *Fonseca, M.L. 5863* (K!, RB!); Niquelândia, Estrada de acesso a barra do Rio Bagagem com o Rio Tocantinzinho, 14°01' S, 48°17' W, 450 m elev., 20 July 1995, *T.B.Cavalcanti 1487* (CEN!, HUEFS!, K!); Uruaçu, margem da estrada de terra entre o Km 300 da BR-153 e Campinaçu, próximo ao córrego Palmeirão, *J.E.Q. Faria 1530* (CEN!, HUEG!, UB!). Tocantins: Almas, Estrada para Natividade, ca. 27km de Almas, 11°37'59" S, 47°23'26" W, 22 July 2000, *V.C. Souza 24510* (ESA!).

40. Mimosa oedoclada Barneby (1991: 419–420). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] Chapada dos Veadeiros, ±20 km n. of Alto Paraiso, ±12[5]0 m [elev.], 19 March 1971, fl., fr., *H.S. Irwin et al. 32230* (holotype: UB!, isotypes: G!, GH!, K!, LE!, NY!, P!, R!, US!, S!).

Fig. 46.

Diagnostic characterization: *Mimosa oedoclada* emerges as a distinct species amongst all treelet species with periderm shedding by the combination of the following characters: patent filiform setae on branches, indumentum concentrated on pulvini, and presence of an interpinnal projection. From other treelet species with interpinnal projection and glandular indumentum on branches it differs by the capitate setae (vs. clavate in *M. capito*), tubular calyx and glandulose corolla lobbes (vs. cupulate calyx and corolla lacking glandular setae in *M. dominarum*), triangular to ovate acuminate stipules and paraphylidia present (vs. narrowly triangular stipules and paraphylidia absent in *M. longepedunculata*), and ochraceous setae (vs. orange in *M. splendida*).

Notes: *Mimosa oedoclada* can also be readily recognized by its thick, viscous and black branches. Even though not diagnostic, the obpyramidal shape of its crown make *M. oedoclada* stand out among other treelets of *M.* ser. *Pachycarpae* having corymbose crowns.

Distribution and habitat: *Mimosa oedoclada* is endemic to *cerrado* and *campo rupestre* of Chapada dos Veadeiros, at the municipality of Alto Paraíso de Goiás, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Fazenda Água Fria, cerca de 10km em direção a Teresina de Goiás, 14°04'22" S, 47°30'34" W, 1448 m elev., 18 January 2001, *C. Munhoz 2428* (RB!); Alto Paraíso, Estrada para Teresina de GO, entre os Kms 174 e 176 da GO-118, 14°07' S, 47°31' W, *C.E.B. Proença 1182* (HUEG!, HUTO!, UB!, UFG!); Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 20 km W. of Alto Paraíso de Goiás (formerly Veadeiros), [14°07'00" S, 47°42'07" W,] 1000 m elev., 9 February 1966, *H.S. Irwin 12413* (G!, K!, LE!, NY!, R!, UB!, US!).

Figure 46. *Mimosa oedoclada*. A. Habit. B. Branch with peridermis exfoliation. C. Branch evidencing persistent stipules. D. Synflorescence. E. Fruits.

41. Mimosa oligosperma Barneby (1991: 413–414). Type: Brazil. Goiás: Cavalcante, 1828, fl., fr., *W. J. Burchell 7915* (holotype: K!, isotype: P!) [Paratype *W.J.Burchell 7886* mounted on same sheets both in K and P].

Fig. 47.

Diagnostic characterization: *Mimosa oligosperma* differs from related species (see notes under *M. densa* for a list) by the oblong (vs. narrowly oblong) fruits. Particularly from *M. densa*, it is different by the absence of filiform setae with a calcar (vs. presence) and by incurved orientation of setae on branches (vs. antrorse).

Notes: Barneby (1991) indicated that *M. oligosperma* seldom possess glandular setae on floral bracts, but the holotype has glandular setae on branches, and part of the *Burchell 7886* specimens mounted with the type, on leaflets margins. Also, both collections bear glandulose stipules. Hence, the part of the plant in which glandular setae appear is prone to variation. *Mimosa oligosperma* is frequently infected with *Pilostyles blanchetii* (Gardner) R.Br. (Apodanthaceae), which is known to alter regular development of *M. maguirei* and may well do so with this species.
Mimosa alligantina shows an overall resemblance to *M. oligosperma* and at first sight appears to be a phenotype restrict to the southernmost distribution of this species, but in fact they are two distinct taxonomic units (see detailed comments on their similarities under *M. alligantina*). Proper identification of the specimen *Macedo 3633* was not possible. That specimen was indicated by Barneby (1991: 414) as belonging to *M. oligosperma*, but it surely is not, and, therefore, the possibility that *M. alligantina* could also be a prostrate shrub is now rejected.

Distribution and habitat: *Mimosa oligosperma* is present in *cerrados* with sandy soils above 900 m elev. at the north of the municipality of Cavalcante, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Cavalcante, cerca de 30km ao norte de Cavalcante, caminho entre vila Engenho e cachoeira Santa Barbara, 13°32'42'' S, 47°29'03'' W, 1060 m elev., *M.F. Simon 865* (UB!); Cavalcante, Vila Engenho, caminho para Cachoeira Santa Barbara, 13°32' S, 47°29' W, 1070 m elev., 12 October 2002, *M.F. Simon 450* (ESA!, HUEFS!, UB!); Chapada dos Veadeiros. Estrada de terra Cavalcante-Colinas do Sul; saída ao sul da área urbana de Cavalcante em direção à Fazenda Forquilhinhas; ca. 11 km de Cavalcante, 13°51'01.5"S, 47°29'53.4"W, 903 m elev., 23 March 2012, *L.M. Borges 577* (SPF!).

42. Mimosa pachycarpa Bentham (1842: 406). Lectotype: Brazil. Minas Gerais: Vallo Fundo, fr., *F. Sello s.n.* (lectotype: †B photo!, isotype: F frag.!).

= *Mimosa foliolosa* subsp. *foliolosa* var. *corpulenta* Barneby (1991: 377–378), ***syn. nov.*** Type: Brazil. Minas Gerais: Lenhoso do rio Tejuco, fr., *W.J. Burchell 5736* (holotype: K!, isotype: NY [frag.]!).

Fig. 48.

Diagnostic characterization: *Mimosa pachycarpa* differs from *M. foliolosa* and *M. pubescens* by the glabrous surface of leaflets (vs. pubescent with simple trichomes), and infundibuliform corollas (vs. campanulate). Particularly from *M. pubescens*, it differs by the clavate glandular setae (vs. capitate) and basal rachillas ca. half the size of medial rachillas (vs. isometric). From *M. foliolosa* it is also set apart by filiform setae with bulbous base (vs. tapering), which

Figure 47. *Mimosa oligosperma*. A. Habit. B. Young individual with xylopodium (Xp). C. Branch with peridermis exfoliation. D. Branch infected with *Pilostyles*. D.

are forwardly appressed or antrorse filiform setae on branches (vs. patent). *M. multipinna* shares with *M. pachycarpa* similar features that distinguish both from the above mentioned species (see notes under *M. multipinna*), but its branches present glandular setae, and these are lacking in *M. pachycarpa*.

Figure 48. *Mimosa pachycarpa*. A. Habit. B. Fruits.

Notes: Specimens of *Mimosa pachycarpa* usually present incurved ascending branches forming a crown and bear fruits long after release of the seeds. The species is a common host to *Pilostyles blanchetii* (Gardner) R.Br. (Apodanthaceae) (Amaral *et al.* 2011, Gomes *et al.* 1994).

Although Barneby (1991), based on rachillas size, did not established a relationship between *Mimosa foliolosa* var. *corpulenta* and *M. pachycarpa*, those taxa have essentially the same characters and differ only on size of fruits and, supposedly, of rachillas. Size of fruits is known to vary and, similarly to what happens in *M. multipinna* it is not considered to be a distinguishing feature. Moreover, the only leaves present in the known specimen of *M. foliolosa* var. *corpulenta* are the ones subtending the inflorescences, which are know to be smaller than leaves produced during vegetative development. Hence, this variety is treated here as a synonym of *M. pachycarpa* and represents its easternmost area of occurrence.

Barneby (1991) suggested that the type could have been collected at Serra do Cipó based on the itinerary given by (Urban 1906, 107). We agree with him and stress that the collection site is located at the southernmost part of the range, where Sello has been on his way to Ouro Preto.

Distribution and habitat: *Mimosa pachycarpa* is known from the Minas Gerais state, where it occurs on sandy or rocky soils of *campos rupestres*, *cerrado* and riverine forest (probably transitional to *campos rupestres*) from Serra do Cipó, at the Southern Espinhaço Range and in iron rich soils of Serra do Curral, at Belo Horizonte municipality, Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Belo Horizonte, Barreiro, 6 June 1956, *Roth, L. s.n.* (CESJ!, SPF!); Santana do Riacho, Estrada Santana do Riacho–Cardeal Mota, via Melo, 23 April 2006, fl., *L.M. Borges 111* (SPF!); Santana do Riacho, Caminho da Base do IBAMA do Rio Cipó para o Capão dos Palmitos, 950 m, Parque Nacional da Serra do Cipó, 25 March 1991, fl., fr., J.R. Pirani CFSC 11986 (SPF!); Serra do Cipó, Véu da Noiva, , 6 April 1995, *A.A. Grillo CFSC 13911* (SPF!)

43. Mimosa pachycarpoides Malme (1931: 53). Type: Brazil. Mato Grosso: Santa Anna da Chapada [now Chapada dos

Guimarães], in campo arenoso, graminoso, arboribus raris obsito, 17 May 1903, fr., *Regnell Iter II: s.n.* (holotype: S!, isotype: SI frag. photo!)

Fig. 49.

Diagnostic characterization: *Mimosa pachycarpoides* is morphologically related to *M. multipinna*, but differs from it by the presence of calcarate filiform setae (calcarate), absence of glandular setae on branches (usually also absent in the leaves) (vs. presence), persistent stipules (vs. caducous), filiform setae of fruits forwardly appressed (vs. antrorse, but not appressed).

Notes: *Mimosa pachycarpoides* is known from a few specimens other than the type collection, all of them bearing only fruits. Further collections of the species may render only superficial the distinction of this species from *M. multipinna*, which has the same habit and fruits, but so far they should be kept as distinct entities.

Distribution and habitat: The species is known only from sandy soils on *campo cerrado* at Chapada dos Guimarães, located at the homonym municipality in Mato Grosso state, Western Central Brazil.

Selected specimens: Brazil. Mato Grosso: Chapada dos Guimaraes, Chapada dos Guimarães, Véu da Noiva e Cachoeirinha, 19 March 1983, P. *Lisboa 3150* (MG!); Chapada dos Guimaraes, Cuiabá-Chapada dos Guimaraes H'wy (MT251), 3 km W of Buriti, 15°27'39'' S, 55°44'58'' W, 600 m elev., 12 July 1984, *S.A. Mori 16720* (K!, MO!, NY!); Cuiabá, Parque Nacional da Chapada dos Guimarães, estrada de acesso do Parque ao longo da margem do platô onde se localizam a Cachoeira da Mata Fria e os Monumentos de Pedra, 15°24'04.9"S 55°50'43.9"W, 639 m elev., 22 June 2012, L.M. Borges 839 (SPF!).

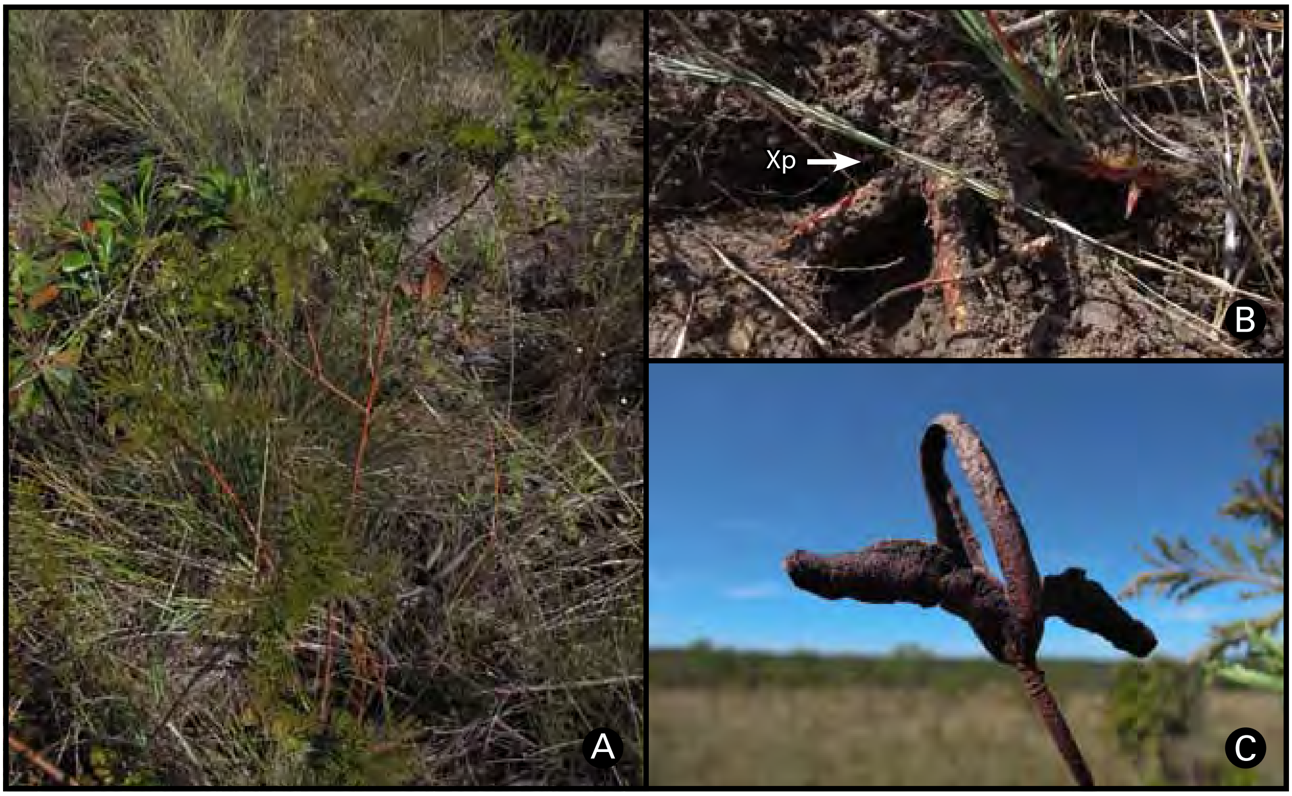

Figure 49. *Mimosa pachycarpoides*. A. Habit. B. Xylopodium (Xp). C. Fruit.

44. Mimosa paludosa Bentham (1842: 400). Lectotype (designated by Barneby 1991): Brazil. Marshy [ground] near Barra do Jardim [7°35'S, 39°15'W in South Ceará (Barneby 1991)], December 1838, *Gardner 1942* (lectotype: K!; isolectotypes: BM!, E, F!, G!, K!, NY!, P!, W!).

≡*Mimosa setosa* subsp. *paludosa* (Benth.) Barneby (1991: 354). *Mimosa setosa* var. *paludosa* [autonym generated by *M. setosa* var. *metadenotricha*]; synonymized by Borges *et al.* (Chapter 3).

=*Mimosa setosa* var. *metadenotricha* Barneby (1991: 354). Type: Brazil. Distrito Federal: 3 km s. of Sobradinho, 1 May 1966, fl., *Irwin et al. 15523* (holotype: UB!; isotypes: G!, GH!, K!, LE!, MBM, NY!, P!, R!, S!, US!); synonymized by Borges *et al.* (Chapter 3).

Fig. 50.

Diagnostic characterization: *Mimosa paludosa* presents straight to slightly inclined aculei, a feature that is shared with *M. granitica* and randomly with *M. setosa*, but those may be differentiated by the prominent secondary veins on the leaflets the first, and by the absence of prickles on leaf primary axes, and calyces with plane projection laterally fused of the latter. The absence of fusion between such structures on the calyx of *M. paludosa* is shared with *M. granitica* and *M. neonitens*, but the latter is distinguished by its partially jointed fruits and presence of a xylopodium (see also Chapter 3 for further notes).

Notes: *Mimosa paludosa* is one of the most variable species within *M.* ser. *Pachycarpae* and, by that, poses problems for the definition of related taxa (see chapter 3). Particular attention should be paid to the variation on indumentum composition and length of the flowers and their associate bracts, which, although visually striking is misleading and not taxonomically significant. Chromosome number show variations within the species (Dahmer *et al.* 2010).

Distribution and habitat: *Mimosa paludosa* commonly occurs near streams in *cerrados*, *campos rupestres* and rain forests on almost all Brazilian states to the north of Paraná state and also in adjacent Paraguay. It is the single species of *M.* ser. *Pachycarpae* occurring outside of the Brazilian Cerrado Domain.

Selected specimens: Brazil. Acre: Rio Branco, Rodovia BR 364, 30 April 1995, L.C.L. *Meneses Filho 11* (NY!). Amazonas: Coari, Base de Operações Geólogo Pedro de Moura, Estrada para o porto Evandro, 4°77'20" S, 65°43'10" W, 24 September 2008, J.S. *Sousa 100* (MG!); Presidente Figueiredo, na beira da BR 174, próxima ao município, 15 December 2011, fl., M.F. Santos & M.T.C. Watanabe 771 (NY!, SPF!). Bahia: Abaíra, Chapada Diamantina, Catolés, descida do Morro do Bicota, 13°19'46" S, 41°51'20" W, 1503 m elev., 30 May 2003, *M.J.G. Andrade 334* (HUEFS!); Rio de Contas, Pico das Almas, 13°34'45" S, 41°48'41" W, 10 April 1999, *R.C. Forzza 1162* (NY!, RB!). Ceará: São Benedito, Inhuçu, Serra da Ibiapaba, 4°02'55" S, 40°51'54" W, 24 July 1971, A.G. *Fernandes s.n.* (NY!). Distrito Federal: Brasília, Cachoeira do Colorado, próximo à fábrica de asfalto, 15°35' S, 47°53' W, M.F. *Simon 61* (UB!); Espírito Santo: Linhares, Reserva Natural da CVRD, estrada peroba amarela, estrada peroba amarela, km 1.2, 7 July 2006, L.M. Borges 119 (CVRD!, SPF!).Goiás: Morrinhos, 17°49'22" S, 49°03'39" W, *C.E.B. Proença, 2003* (HUFU!, UB!, UFG!). Maranhão: Entrada para Ouro Preto, 2 October 1997, *S.M. de Faria 1377* (RB!). Mato Grosso: Nossa Senhora do Livramento, about 5 km southeast of Pirizal village along the trail to Coqueiro Lake, 16°14' S, 56°15' W, 120 m elev., 15 July 1993, *M. Schessl 3384* (NY!). Mato Grosso do Sul: 20 km road Aparecida do Tabuado-Paranaíba, 27 April 1981, *J.A. Winder 153* (K); Rio Verde, Sete Quedas, [18°56'19" S, 54°54'07" W,] 8 August 1997, G. *Hatschbach 66574* (ESA!, HBG!, MBM!, NY!). Minas Gerais: Diamantina, Estrada Mendanha–Inhaí, margens do Rio Jequitinhonha, 18°02'40" S, 43°32'48" W, elev. ca. 700 m, 6 February 2009, fl., L.M. Borges 390 (NY!, SPF!); Grão Mogol, Córrego da Escurinha, 16°35' S, 42°57' W, 750 m elev., 29 May 1988, fl., R. Barreto et al. CFCR 12097 (HUEFS!, K!, SPF!). Pará: Belém, Ramal de entrada na area da APEG, próximo à estrada do

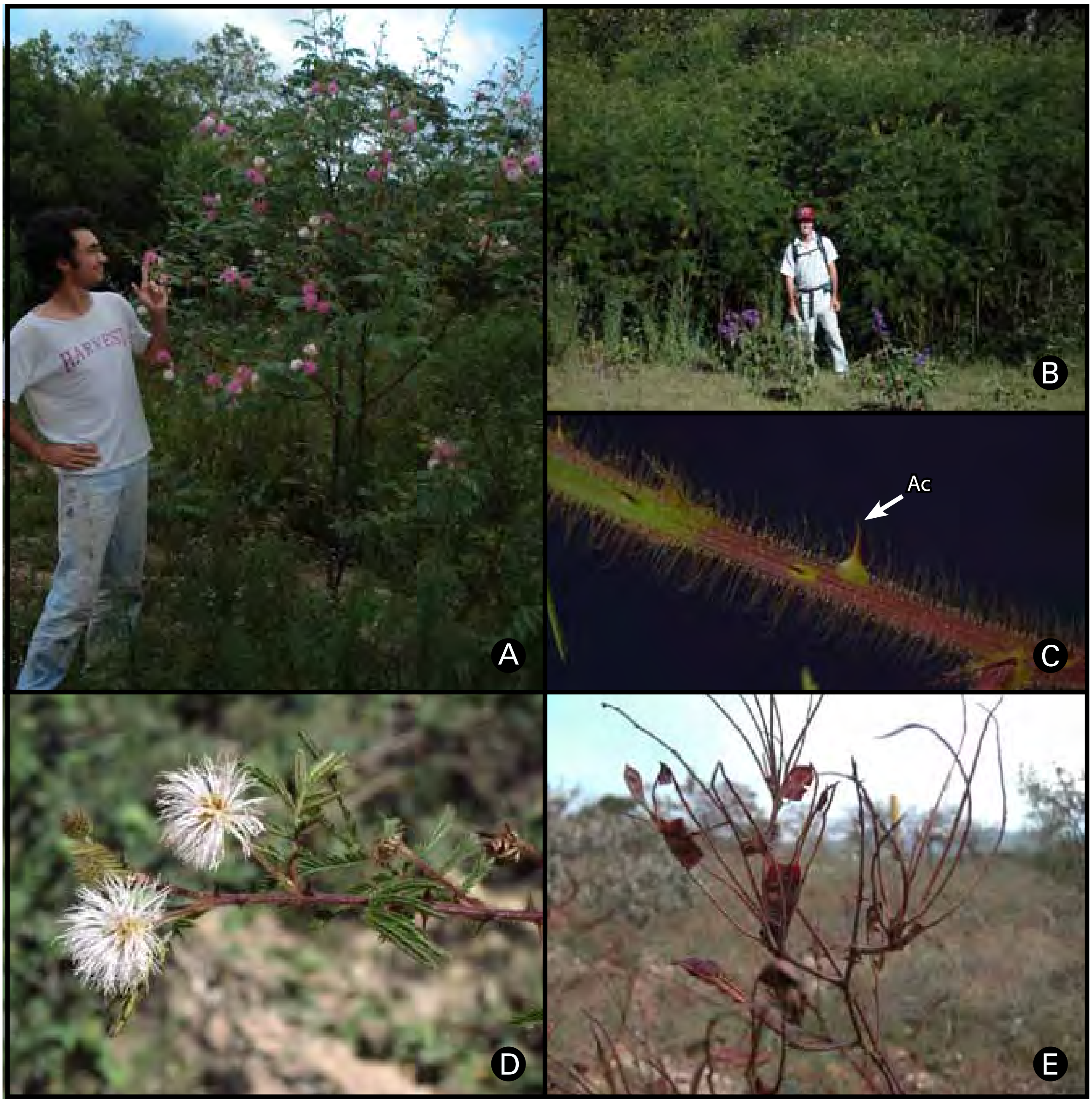

Figure 50. *Mimosa paludosa*. A. Habit. B. Densely clustered individuals. C. Detail of a branch evidencing the aculeus (Ac). D. Synflorescence. E. Fruits after breakage of the valves.

CEASA, 4 January 2000, *M.R. Cordeiro 4809* (IAN!, K!). Paraná: Cornélio Procópio, Arredores de Cornélio Procópio, 29 August 1996, F. Silva *Chagas 1952* (HUEFS!, K!). Pernambuco: Buíque, Vale do Catimbau, Trilha da Cachoeira, 24 January 2006, *A. Bocage 1079* (HUEFS!). Piauí: G. *Gardner 1942* (BM!, G!, NY!, W!). São Paulo: Barretos, Região do Ribeirão Anhumas, 20°26' S, 48°50' W, 18 March 1997, *E.D. Castellani, 185* (HRCB!). Rio de Janeiro: Cachoeiras de Macau, 6 distrito, Fazendas consorciadas - Fazenda Sertão, 22°27'25'' S, 42°49'64'' W, 120 m elev., 2 October 2000, *F.B. Pereira 0638* (RB!). Rondônia: Porto Velho, Vila de Nova Califórnia, BR-364, Ramal da Mendes Júnior, Rio Azul, Área indígena de Caxarari, 27 October 1997, *L.C.B. Lobato 2253* (MG!). PARAGUAY. Amambay: Bella Vista, Rio Aquidaban, camino de Ruta 5 a Bella Vista, 23 June 1977, A. *Krapovickas 32594* (CTES, K!, NY!).

45. Mimosa paranani (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa foliolosa* var. *paranani* Barneby (1991: 383). Type: Brazil. Goiás: [Formosa, Serra Geral de

Goiás,] Rio Paranã, ±35 km n. of Formosa toward São Gabriel, [950 m elev.,] 29 March 1966, fr., fr. imm., *H.S. Irwin et al. 14225* (holotype: UB!; isotypes: G!, K!, LE!, NY! [3 sheets], M!, P! [2 sheets], R!, S!, US!).

=*Mimosa claussenii* var. *vespertilionis* Barneby (1991: 401), ***syn. nov.*** Type: Brazil. Goiás: Serra do Morcego, 50 km n.-e. of Formosa [800 m elev.], 23 April 1966, fl., *H.S. Irwin et al. 15284* (holotype: UB!, isotypes: G!, GH!, K!, LE!, P!, NY!, R!, S!, US!).

Fig. 51.

DIAGNOSTIC CHARACTERIZATION: *Mimosa paranani* is in many aspects similar to *M. brevibractea*, but is distinguished

Figure 51. *Mimosa paranani*. A. Habit. B. Xylopodium (Xp). C. Branch with appressed indumentum. D. Fruits. E. Synflorescence.

from it by the fruits with apiculate apex (vs. rounded to obtuse) and with incurved indumentum on valves (vs. forwardly appressed).

NOTES: The distinction between *Mimosa paranani* and *M. brevibractea* may appear to be superficial, since it is based on only two characters of the fruit. However, up to now, there is no evidence from herbaria collection or field observations to support the idea that the indumentum orientation of fruits in both species is prone to variation. Hence, we use this character to set those two species apart, but we understand that if this is unreliable, and in the lack of new evidence supporting their segregation, those widely similar taxa shall be merged. On the other hand, evidence from phylogenetic studies indicate that *M. paranani* is more closely realated to other taxa than to *M. bravibractea* (Borges *et al*. Chapter 1).

Study of specimens recently collected and of natural populations indicate that individuals growing near streams and in apparently deeper soils tend to be taller and to be more branched (e.g. *Borges 1017*). Hence, the metric features used by Barneby (1991: 401) to make distinction between *Mimosa paranani* and *M. claussenii* var. *vespertilionis* cannot be taken as significant. Moreover, the methods adopted here also indicate that they should be treated as a single unit and, hence, *M. claussenii* var. *vespertilionis* is synonymized under *M. paranani*.

DISTRIBUTION AND HABITAT: *Mimosa paranani* occurs on sandy and rocky soils of *cerrado* at Serra Geral do Paranã and Serra do Morcego, in the municipalities of Água Fria de Goiás and Formosa in Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Água Fria de Goiás, 7 km by road S of São João da Aliança. Serra Geral do Paraná, 14°46'48" S, 47°30'00" W, 1100 m elev., 22 March 1973, W.R. *Anderson 7657* (NY!, UB!, US!); Formosa, 15°23'50" S, 47°28'21" W, *M.L. Fonseca 4388* (RB!, UB!); Formosa, Serra do Morcêgo. Ca. 50 km NE of Formosa. Alt. 800 m, 15°32'14" S, 47°20'03" W, 23 April 1966, *Irwin H. S. 15284* (G!, NY!, P!, UB!, US!).

46. Mimosa paucipinna (Bentham 1876: 388) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa gardneri* ? var. *paucipinna* Bentham (1876: 388). Lectotype (designated by Barneby 1991): Brazil. Habitat in campis Brasiliae centralis, [1844, fl.,] *M.A. Weddel 2510* (holotype: P! [also numbered "282"]).

≡ *Mimosa albolanata* var. paucipinna (Bentham 1876: 388) Barneby (1991: 395), ***syn. nov.***

Fig. 52.

DIAGNOSTIC CHARACTERIZATION: *Mimosa paucipinna* has the same habit of *M. albolanata*, but it differs from it by the antrose, but not appressed, setae of branches, (vs. incurved), stipules narrowly triangular (vs. triangular or broadly ovate-acuminate), fruits with surface not fully covered by the indumentum (vs. concealed by it).

NOTES: Specimens from Minas Gerais state, collected at the municipalities of Itacambira and Francisco de Sá are slightly distinct from typical collections of *Mimosa paucipinna* from the Goiás state, mainly due to differences in distance between leaflets, and shape of fruits and racemes. But they may be considered the expression of local variation. One specimen (*Hatschbach 66199*) was identified by Barneby as *M. albolanata* var. *paucipinna* and confirmed as

Figure 52. *Mimosa paucipinna*. A. Habit. B. Stem with developed suber. C. Raceme. D. Immature fruits in between the leaves.

thus by Dutra & Garcia (2014). It is, in fact, *M. brevibractea*, which shares similarities with *M. paucipinna*, but is clearly distinguesd by being an erect shrub.

We considered *Mimosa paucipinna* as a species distinct from *M. albolanata* based on the characters above mentioned, which are fairly constant on the known populations of the species. However, a few specimens of *M. albolanata* may show a lesser concentration of indumentum on fruits, what weakens the hypothesis that those are distinct taxa. Moreover, phylogenetic analysis indicates that two accessions of the species are paraphyletic in respect to a sample of *M. albolanata* var. *brasiliana*, here equated with *M. albolanata* (See under it). Further investigation may show that the differences observed here and by Barneby (1991) can be considered as intraspecific variation leading to the synonymization of them.

DISTRIBUTION AND HABITAT: *M. paucipinna* is endemic to *campos* and *campos rupestres* of Serra dos Cristais and Serra dos Pireneus at the Goiás State and to the southernmost areas of the northern portion of the Espinhaço Range, at the Minas Gerais State, Central and Southeastern Brazil.

SELECTED SPECIMENS: Brazil. Goiás: Cocalzinho de Goiás, Serra dos Pireneus, Fazenda Capitão do Mato, estrada da casinha da fazenda em direção do Morro do Cabeludo, 15°48'24" S, 48°48'07" W, 1100 m elev., *P.G. Delprete 10241* (RB!, UB!); Cristalina, Serra dos Cristais, estrada de terra para a Reserva Particular do Patrimônio Natural Linda Serra dos Topázios, a partir da rodovia BR-050, a ca. de 3 km S de Cristalina, ramal secundário da estrada, 16°46'38.3"S 47°39'03.9"W, 1210 m elev., 19 March 2012, L.M. Borges 521 (SPF!).

Minas Gerais: Serra do Espinhaço, ca. 30 km N.E. of Francisco Sá, on road to Salinas, [16°25'44" S, 43°16'04" W,] 1100 m elev., 10 February 1969, *H.S. Irwin 22985* (NY!, UB!, US!).

47. Mimosa peregrina (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa foliolosa* subsp. *pachycarpa* var. *peregrina* Barneby (1991: 381–382). Type: Brazil. Bahia: [Rio de Contas,] 9–11 [misprinted 10] km N of Rio de Contas, [na Estrada para o povoado Mato Grosso, 1000 m elev., 13°32' S, 41°46' W,] 20 July 1979, fr., *S.A. Mori et al. 12353* (holotype: CEPEC, isotypes: NY!, US!).

Fig. 53.

DIAGNOSTIC CHARACTERIZATION: Within the core group of species related to *Mimosa foliolosa* (see notes under it), *M. peregrina* shares only with *M. foliolosa* var. *franciscana* the presence of incurved filiform setae on fruits, a character that sets both apart from those taxa (see notes under *M. foliolosa*). It is further distinguished from *M. foliolosa* var.

Figure 53. *Mimosa peregrina*. A. Habit. B. Raceme. C. Fruits. Photos A–B by C.M. Siniscalchi; C by G.P. Lewis.

franciscana by the indumentum concealing the valves of fruits (vs. not concealing and randomly distributed). From *M. pachycarpa*, that also occurs at the Espinhaço Range, it differs by the incurved filiform setae of branches (vs. forwardly appressed or antrorse), corolla lobes with surface concealed by filiform setae (vs. not concealed) and fruits lacking glandular setae (vs. glandulose).

Notes: Barneby (1991) mentioned a supposed relationship of *Mimosa foliolosa* var. *peregrina* to elements belonging to *M. foliolosa* subsp. *brevibractea*. However, *M. peregrina*, however, does not present the same kind of habit and the thick branches which are common to *M. brevibractea* and *M. paranani*, two species here recognized but previously treated as *M. foliolosa* subsp. *brevibractea*.

Distribution and habitat: *Mimosa peregrina* occurs in *campo rupestre* and transitions to *carrasco* at Chapada Diamantina, in Bahia state, and also at northmost areas of the Espinhaço Range in the Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Bahia: Rio de Contas, Pico das Almas, ao longo da estrada, a ca. 2–3 km da Fazenda Morro Redondo, em direção à cidade, 3 April 1994, *S. Atkins CFCR 14760* (CEPEC, ESA!, HUEFS!, K!, SPF!); Rio de Contas, em direção ao Rio Brumado, 5 km de Rio de Contas, 950 m elev., 13 December 1984, G.P. *Lewis CFCR 6797* (K!, NY!, SPF!). Minas Gerais: Itacambira, Serra de Itacambira, Estrada Juramento–Itacambira, à direita, no alto da Serra, 1250 m elev., 30 September 1997, *R. Mello-Silva 1488* (HUEFS!, SPF!).

48. Mimosa perplicata L.M.Borges in in Borges *et al.* (2014: 37–41). 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, 17°41'24.1" S, 44°11'43.6" W, 1025 m, 26 April 2012, fl., *L.M. Borges et al. 647* (holotype SPF!, isotypes K!, NY!, P!, RB!)
Fig. 54.

Diagnostic characterization: *Mimosa perplicata* is set apart from *M. caliciadenia* by the clavate glandular setae (vs. capitate) and aculeate foliar rachides (vs. unarmed). From *M. paludosa*, it is distinguished by the secondary veins of leaflets as prominent as the primaries (vs. less prominent) and glabrous corolla lobes (vs. pubescent).

Notes: Borges *et al.* 2014 proposed that *Mimosa perplicata* could have been originated by divergence of subpopulations of *M. paludosa*, or by vicariant spceciation of an ancestral population that also gave origin for *M. caliciadenia*. Phylogenetic analysis (Borges *et al.* Chapter 1), however, indicate that the species is more closely related to *M. acroconica*.

Distribution and habitat: *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, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Joaquim Felício, Serra do Cabral, 28 July 1976, fl., fr., *P.E. Gibbs 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. Hatsch-*

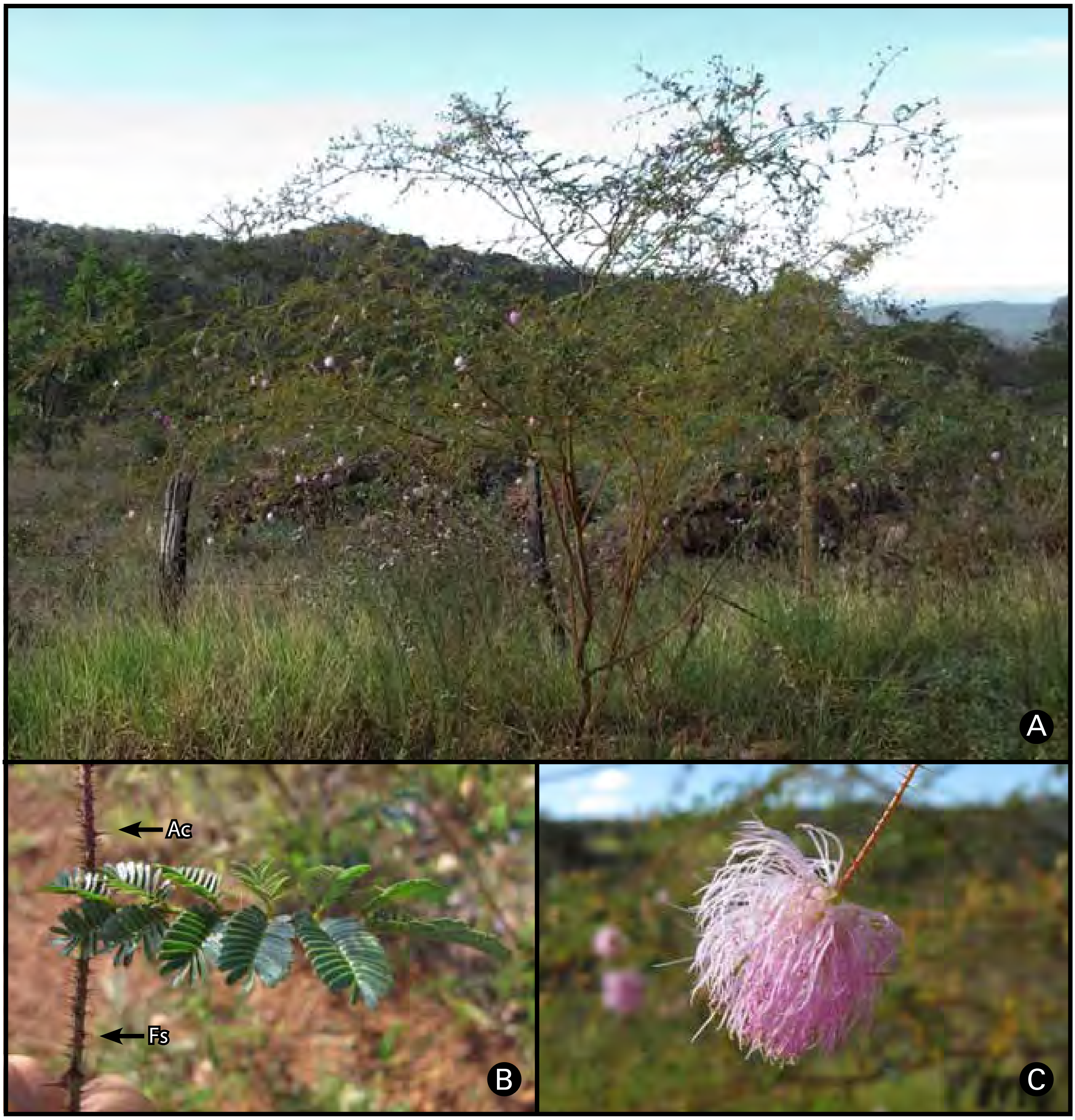

Figure 54. *Mimosa perplicata*. A. Habit. B. Branch with filiform setae (Fs), aculei (Ac) and a leaf. C. Raceme.

bach 69421 (MBM, NY!); 8 July 2001, fl., fr., *A.Q. Lobão 614* (SPF!, VIC); campo rupestre, solo arenoso, 15 April 1996, fl., *G. Hatschbach 64817* (HBG!, MBM, NY!, SPF!).

49. Mimosa prorepens Barneby (1991: 389–390). Type: Brazil. Goiás: in campo ±10 km s. of São João da Aliança, 17 March 1971, fl. bd., *H.S. Irwin et al. 32064* (holotype: UB!, isotypes: G!, K!, LE!, NY!, P!, R! S!, US!).

Fig. 55.

Diagnostic characterization: *Mimosa prorepens* features amongst other species with humifuse habit, particularly *M. humivagans*, *M. pseudofoliolosa* and *M. urbana*. From the later it is readily distinguished by the absence of an interpinnal projection (vs. presence). From *M. pseudofoliolosa* it differs by the petioles more than four times longer

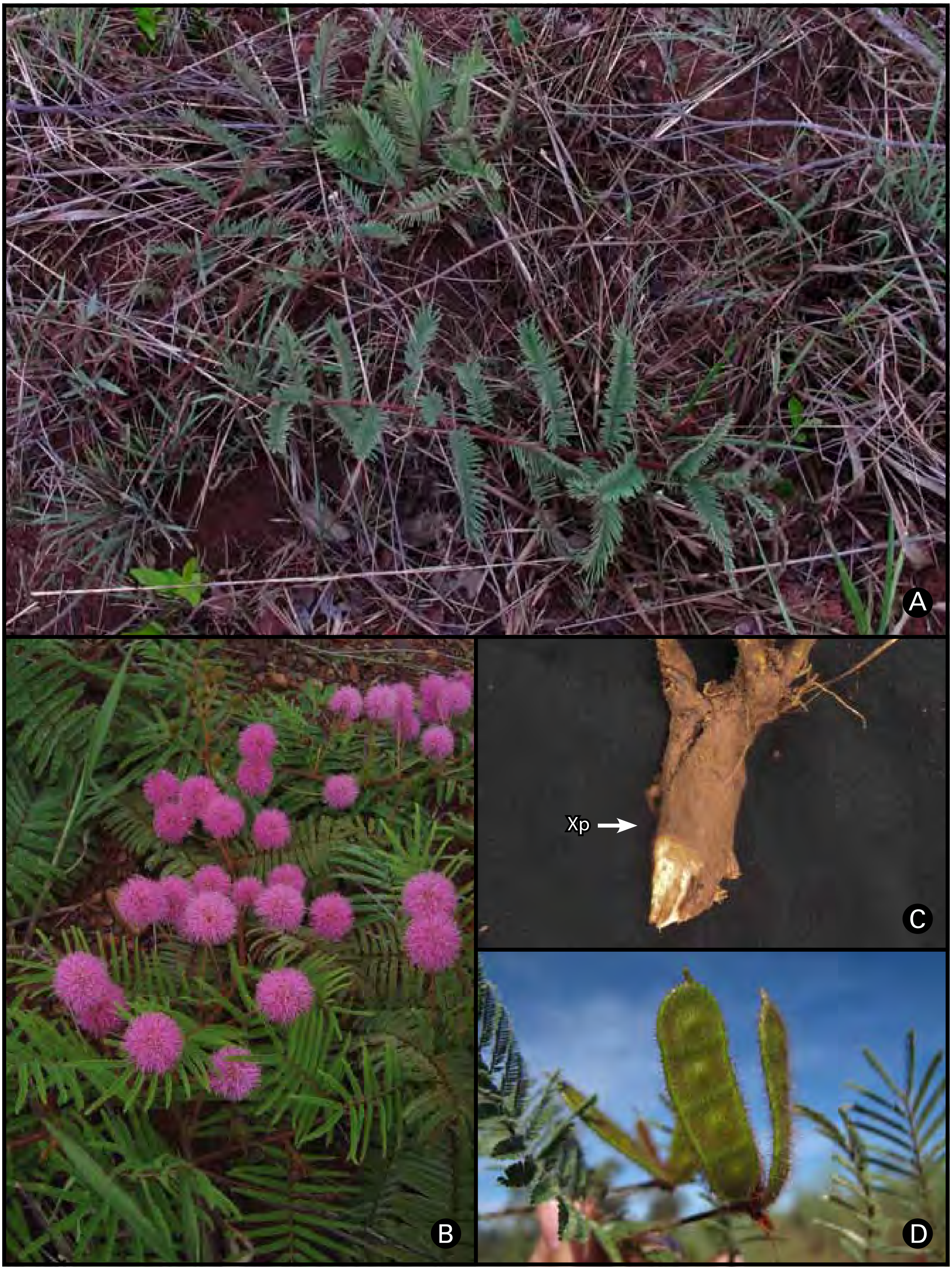

Figure 55. *Mimosa prorepens*. A. Habit. B. Synflorescence. C. Xylopodium (Xp). D. Immature fruits.

than the pulvini (vs. one to two times longer), and by infundibuliform flowers (vs. campanulate). Notes on differences to *M. humivagans* are presented under that species..

Notes: Precise fruit morphology of *Mimosa prorepens* is still unknow despite increased sampling of specimens since its description (Barneby 1991). Immature fruits show breakage lines that indicate them as being typical craspedia, but it is possible that the unjointed condition to be achieved only on final stages of the development.

Distribution and habitat: *Mimosa prorepens* occurs in *campo* and *campo cerrado* at Serra Geral do Paranã and Chapada dos Veadeiros, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Água Fria de Goiás, Serra Geral do Paranã, ca. 10 km S.of São João de Aliança, 14°47'25'' S, 47°32'00'' W, 950 m elev., 17 March 1971, *H.S. Irwin 32041* (G!, K!, NY!, UB!, US!); Alto Paraíso de Goiás: Chapada dos Veadeiros, estrada GO 239, Alto Paraíso de Goiás-São Jorge, 9 km de Alto Paraíso; margem esquerda da estrada, área rica em Mimosa manidea, 14°09'26.2"S, 47°35'57.6"W, 1176 m elev., 24 March 2012, L.M. Borges 600 (SPF). São João d'Aliança, Córrego das Brancas, próximo a barra do Jacaré, 14°42'21'' S, 47°31'28'' W, 9 February 1994, *G. Hatschbach 60171* (HBG!, MBM, NY!, S!).

50. Mimosa prorsiseta (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa claussenii* var. prorsiseta Barneby (1991: 399–400). Type: Brazil. Goiás: [Cristalina, Serra dos Cristais,] ±20 km n. of Cristalina, 1100 m [elev.], 7 March 1966, fl., *H.S. Irwin et al. 13682* (holotype: UB!; isotypes: C, G!, K!, LE!, MBM, NY!, P!, R!, US!).

= *Mimosa claussenii* var. *corneiseta* Barneby (1991: 401), ***syn. nov.*** Brazil. Goiás: [Alto Paraíso de Goiás,] 8 km w. of Veadeiros[, road to Cavalcante, 1200 m elev.], 22 October 1965, fr., *H.S. Irwin et al. 9476* (holotype: UB!, isotypes: G!, K!, LE!, MBM, NY!, P!, R!, S!, US!).

Fig. 56.

Diagnostic characterization: *Mimosa prorsiseta* is similar to *M. claussenii*, but differs by the incurved filiform setae (vs. retrorse) and plane setae on the calyx rim laterally fused (vs. not free from each other). From *M. capito*, which has similar habit and leaves, it is set apart for having incurved filiform setae (vs. patent), lacking interpinnal projections (vs. present) and corolla lobes completely concealed by the indumentum (vs. visible in between the indumentum).

Notes: For detailed notes on the morphological affinities between *Mimosa prorsiseta* and *M. claussenii*, see coments under the latter. *Mimosa clausenii* var. *corneiseta* was established apart from *M. claussenii* var. *prorsiseta* by its larger number of leaflets (15–36, not 9–22) and for being a pachycaul treelet (vs. shrub to treelet) with thicker branches, as well as by the overall larger filiform setae. The overall aspect of those structures indeed are notable in herbarium specimens, but they can be understood as the upper most limit of alometric variation within a single species that varies according to edaphic conditions and probably also frequence of fire occurrence. Hence, *M. claussenii* var. *corneiseta* is here treated as a synonym of *M. prorsiseta*.

Distribution and habitat: *Mimosa prorsiseta* occurs in *cerrados* and in transitions to *campo rupestre* above 900 m elev., in Minas Gerais and Goiás state, Central Brazil.

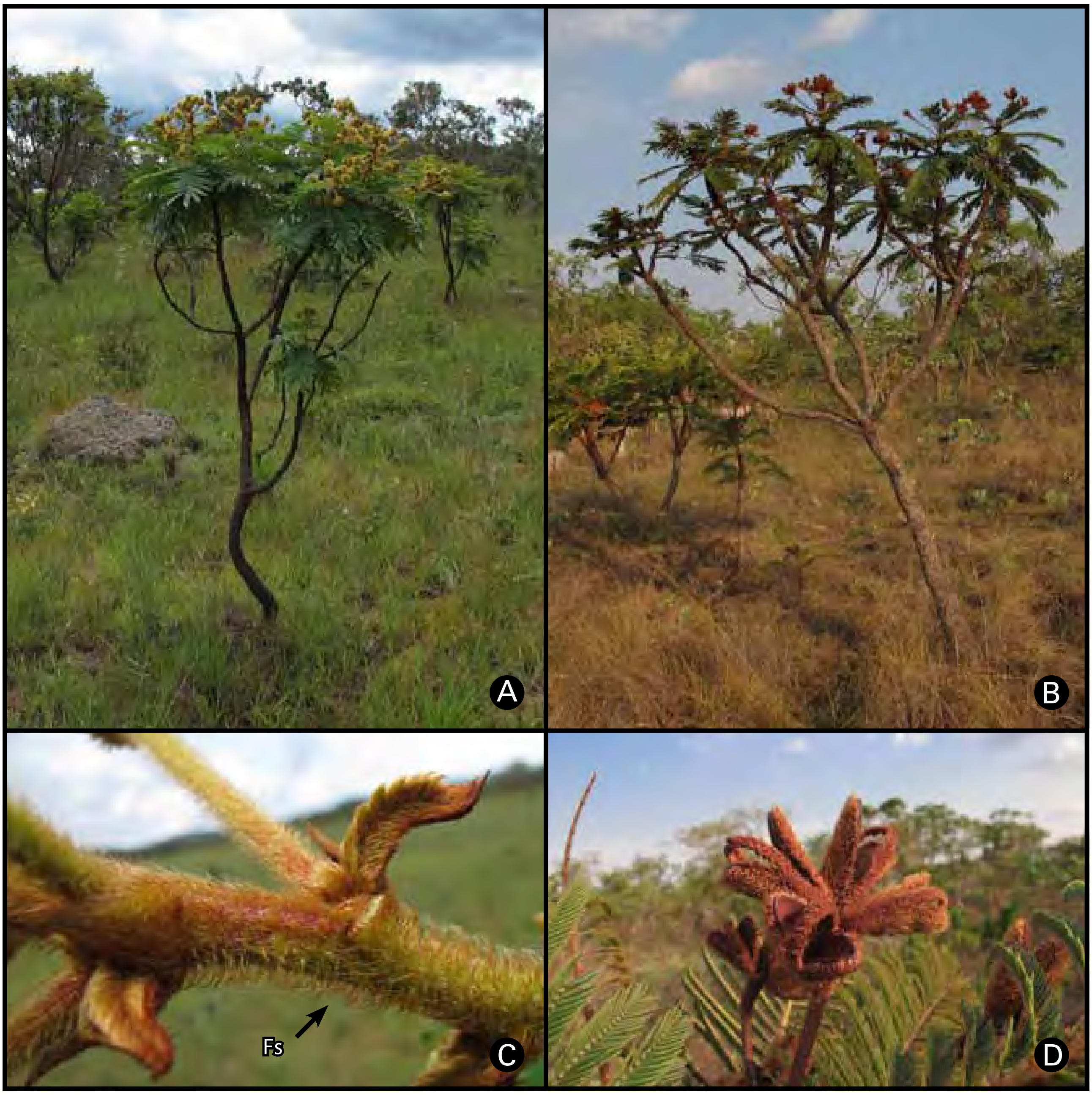

Figure 56. *Mimosa prorsiseta*. A–B. Habit. C. Branch with incurved filiform setae (Fs). D. Fruits.

SELECTED SPECIMENS: Brazil. Distrito Federal: Brasília, Sobradinho, *R.P. Belém 484* (UB!). Goiás: Alto da Serra de Pirineus, na base dos três picos, 7 April 1971, *Rizzo, J.A. 6159* (UFG!); Alto Paraíso de Goiás, Fazenda São Bento, 14°09'29" S, 47°36'45" W, 1200 m elev., *J.R.R Pinto 353* (UB!); Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, Arredores da sede em São Jorge, 14°17'48" S, 47°82'38" W, 3 October 2007, J. *Paula-Souza 8821* (SPF!); Alto Paraíso de Goiás, Estradinha de terra a 3 km N de Alto Paraíso de Goiás, com entrada privativa, 14°08' S, 47°27' W, 1380 m elev., 14 March 1995, *T.B. Cavalcanti 1323* (CEN!, HUEFS!, K!, SPF!, UB!); Minaçu, Estrada Minaçu/Serra da Mesa, cerca de 25 km de Minaçu, relevo plano em região acidentada, 13°49' S, 48°26' W, 930 m elev., March 1996, *B.M.T. Walter 3286* (CEN!, UB!). Minas Gerais: Umuarama, 16°05' S, 46°26' W, 955 m elev., *C.E.B. Proença 2300* (BHCB!, HUFU!, UB!); Unaí, Fazenda São Miguel (Grupo Votorantim), 16°21'28" S, 46°54'21" W, 950 m elev., 23 April 1992, B.A.S. *Pereira 2075* (IBGE!, NY!)

51. Mimosa pseudofoliolosa Barneby (1991: 390–391). Type: Brazil. Goiás [Distrito Federal]: [Brasília,] Samambaia, rio Corumbá, 15 January 1967, fl., *E. P. Heringer 11314* (holotype: UB!, isotypes: MG! NY! [2 sheets]).

Diagnostic characterization: *M. pseudofoliolosa* is mainly related to *M. prorepens* and *M. humivagans:* both are also prostrate humifuse (sub-)shrubs. It differs from both of them by the campanulate flowers (vs. infundibuliform) and particularly from *M. prorepens* by petioles one to two times longer than the pulvini (vs. more than four times longer). Particular distinction to *M. humivagans* relies on presence of glandular setae on branches (vs. absence), and absence of plane setae on calyx rim (vs. presence). It differs from *M. pubescens* mainly the prostrate habit (vs. erect).

Notes: On the protologue, Barneby (1991: 391) indicates lack of paraphyllidia, but those were observed in the specimen *Hatschbach 56299*. Their absence on other specimens may be related to their small size and consequently ease to detach from the rachillas. *Burchell 7587*, previously identified as *M. foliolosa* var. *pubescens* (Barneby 1991) is actually the first collection of *M. pseudofoliolosa*. All collections of the species done after its publication are all of flowering specimens and the fruits of *M. pseudofoliolosa* are still unknown.

Distribution and habitat: *Mimosa pseudofoliolosa* occurs in *cerrados* from the Distrito Federal and eastern areas of the Goiás state, Central Brazil.

Selected specimens: Brazil. Distrito Federal: Brasília, Samambaia, Rio Corumbá, 15°46'47'' S, 47°55'46'' W, 15 January 1967, *E.P. Heringer 11314* (IAN!, MG!, NY!). Goiás: Cavalcante, Guardamôr to ribeirão de S. João, *W.J. Burchell 7587* (GH!, K!, P!); Niquelândia, Rod. GO-327, 25 km a leste de Niquelândia, 21 January 1992, fl., Hatschbach et al. 56299 (B!, MBM, NY!).

52. Mimosa pubescens (Benth.) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa foliolosa* var. *pubescens* Bentham (1842: 406). Lectotype (designated by Barneby 1991): Brazil. Goiás, ad Montes Claros, s.d., fl., *J.B.E. Pohl 1400* (type: K! [2 sheets], isolectotypes: NY! [2 sheets, NY 00002816 numbered “1400 d” and “1204”, NY 00002817 numbered only “1204”], W!)

≡*Mimosa foliolosa* var. *strigosa* Bentham (1876: 388); synonymized by Barneby (1991).

Fig. 57.

Diagnostic characterization: *Mimosa pubescens* is mostly similar to *M. foliolosa*, due to the presence on both of campanulate corollas and leaflets with trichomes on both surfaces, while other taxa related to them usually have ciliate leaflets (see notes under *M. foliolosa*). They are established as distinct species by the presence on the first of bulbous filiform setae (vs. tapering) which are forwardly appressed or antrose on branches (vs. patent), capitate glandular setae (vs. clavate) and caducous stipules (vs. persistent).

Notes: Individuals of *M. pubescens* usually show abundant indumentum on branches, calyces with filiform setae both at the rim and at the tube apex, as well as pubescent corollas with simple trichomes and filiform setae, and occasionally also glandular setae. Nevertheless, specimens from Minaçu, Niquelândia and part of Cavalcante municipalities may present glabrescent to glabrous corollas and branches, as well as calices with setae restricted to the rim (e.g. *Bringel 945*, *Walter 3284*).

Figure 57. *Mimosa pubescens*. A. Habit. B. Branches fasciculate at base. C. Leaf. D. Synflorescence. E. Fruit.

Distribution and habitat: *Mimosa pubescens* occurs in *cerrados* of the Federal District, and adjacent Goiás and Minas Gerais states, Central Brazil.

Selected specimens: Brazil. Distrito Federal: Fazenda Água Limpa, 15°57'45" S, 47°56'03" W, 1096 m elev., 17 March 2006, *M.F. Simon 733* (HUEFS!, UB!). Goiás: BR 040, ca. 32 km de Cristalina em direção a Luziânia, 16°33'19" S, 47°47'16" W, 21 January 2005, *J. Paula-Souza 4270* (ESA!, HUEFS!, K!). Minas Gerais: Parque Nacional Grande Sertão Veredas; área proximo a cachoeira do Ribeirao Mato Grande, 15°21'54" S, 45°57'30" W, 710 m elev., 16 February 1999, *A.C. Sevilha 1812* (IBGE!, NY!, RB!).

53. Mimosa pycnocoma Bentham (1842: 405). Lectotype (designated by Barneby 1991): Brazil. Goiás: [maybe Cavalcante] ad Serra do S. Felix prope Rio Trahiras, July 1819, fl., *J.B.E. Pohl d. 1408* (lectotype: K!, isolectotypes: F!, GH! M!, NY!, US!, W! [isolectotypes annotated also as “1927”, except the GH and M specimens, which is not numbered, but are certainly duplicates of *Pohl d. 1408*]).

Diagnostic characterization: *Mimosa pycnocoma* is distinguished from *M. oligosperma* for having clavate (vs. capitate) glandular setae. From *M. densa* it differs for the branches incurved indumentum (vs. antrorse). Also *M. pycnocoma* is distinct from those two species by the broadly ovate-acuminate stipules (vs. triangular), cupulate (vs. shallowly cupulate) calices with plane setae of the rim laterally fused (vs. free) and craspedia (vs. unjointed craspedia).

Notes: Simon *et al.* (2010), based on the first collections of the species after the type, confirmed it as being a treelet around 2–3 m height. Field observations (Simon *et al.* 2010) indicate that this habit is constant, but similarities with *M. kalunga* (see notes under it) suggest the need for further examination of natural populations to confirm whether or not the species can also occur as dwarf shrubs.
See notes under *Mimosa densa* and *M. kalunga* for more information on the taxonomic affinities of *M. pycnocoma*.

Distribution and habitat: *Mimosa pycnocoma* is known only from the northern Chapada dos Veadeiros, near the municipality of Cavalcante, Goiás state, Central Brazil, where it occurs in *cerrado* slopes with rock outcrops.

Selected specimens: Brazil: Goiás: Cavalcante, cerca de 30km ao norte de Cavalcante, caminho entre Vila Engenho e cachoeira Santa Bárbara, 13°32'42'' S, 47°29'03'' W, 1060 m elev., 5 January 2007, *M.F. Simon 868* (HUEFS!, UB!)

Figure 58. *Mimosa pycnocoma*. A. Habit. B. Branch with densely congested leaves and lanate indumentum. C. Inforescences nested within the foliage.

54. Mimosa rava Barneby (1991: 385–386). Type: Brazil. Distrito Federal: dry hills ± 55 km e. of Brasília near road to Planaltina, 13 September 1964, fl., fr., *H.S. Irwin & T.R. Soderstrom 6172* (holotype: UB!, isotypes: C [photo!], G!, K!, LE!, NY!, P!, R!, RB!, S!, US!

Diagnostic characterization: *Mimosa rava* shares the same habit and foliage of *M. accedens*, but differs from it by the indumentum of leaves concentrated on pulvini (vs. homogenously distributed), secondary veins of leaflets not prominent (vs. as prominent as primaries), triangular calyx lobes (vs. lobes absent), infundibuliform corollas (vs. campanulate) with indumentum present on lobes (vs. absent).

Notes: Despite being established in comparison to *Mimosa auriberbis*, *M. rava* shares no close affinities with it and is in fact morphologically more related to the above mentioned species. The base of the branches in the isotype at NY indicates that the species may present peridermal exfoliation, but this is not clear and other duplicates do not confirm that suspicion. Efforts should be made in order to recollect this species only known from a region under high anthropic pressure. Based on the solely known specimen of *Mimosa rava*, it is not possible to assert with certainty whether its inflorescences are all axillar to fully expanded leaves, or if they could have been organized along an exsert synflorescence with development of leaves suppressed during anthesis. Also it is not possible to be sure if the fruits are regular or unjointed craspedia, since only immature ones are present on the type specimens. Apparently stipules can vary from linear to narrowly ovate, since each one of the two isotypes at R present only one of those shapes.

Distribution and habitat: *Mimosa rava* is only known by the type specimen, collected in dry hills of *cerrado* in the eastern Federal District, Central Brazil

55. Mimosa regina Barneby (1991: 416–417). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] Chapada dos Veadeiros, ±20 km n. of Alto Paraiso, [1250 m elev.,] 25 March 1971, fl., *H.S. Irwin et al. 33145* (holotype: UB!, isotypes: C photo!, G!, GH!, K!, LE!, MBM, NY!, P!, R!, S!, TEX photo!, US!).

Fig. 59.

Diagnostic characterization: *Mimosa regina* belongs to the group of treelet species with large ovate-acuminate stipules such as *M. acroconica*, *M. bispiculata* and *M. rhodostegia*. It is readily distinguished from *M. acroconica* and *M. bispiculata* by absence of interpinnal projections (vs. presence), absence of aculei (vs. presence), leaves that do not develop on synflorescence axes (vs. developing after anthesis of associate raceme) and calyces with plane setae present on the rim (vs. absent). From *M. rhodostegia* it is differentiated by the incurved (rarely retrorse) filiform setae on branches (vs. patent), caducous stipules that shift from triangular on branches to broadly ovate-acuminate on synflorescenes (vs. persistent and constantly broadly ovate-acuminate), and corolla lobes surface completely concealed by the indumentum (vs. not concealed).

Notes: Stipules present in the synflorescences of *M regina* are similar to the ones found in *M. acroconica*, *M. bispicu-*

Figure 59. *Mimosa regina*. A. Habit. B. Branch with shedding peridermis and triangular stipules (St). C. Synflorescence with ovate stipules connate at the base. D. Raceme. E. Fruits.

lata and *M. rhodostegia:* all are broadly ovate-acuminate and at least partially reddish. However, only in *M. rhodostegia* and *M. regina* the stipules are connate at the base. Moreover, this particular shape is restrict to inflorescences axes, and stipules formed during vegetative growth are triangular and smaller. Amongst those species, shift in stipules shape is known to occur only in *M. regina*, since it is not present in *M. rhodostegia* and not yet known in *M. acroconica* and *M. bispiculata*, due to the precocious fall of stipules, which happens way before abscission of their associate leaf. Field observations are needed to elucidate whether this particular character may be also present in those two remaining species. See also notes under *M. rhodostegia* for comments on those two sibling species.

Distribution and habitat: *Mimosa regina* is endemic to *campos rupestres* and *cerrados* of Chapada dos Veadeiros, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros. Ca 20 km N of Alto do Paraíso,, 14°07'57'' S, 47°30'35'' W, 1250 m elev., 25 March 1971, *H.S. Irwin 33145* (G!, NY!, P!, UB!, US!); Alto Paraíso de Goiás, Chapada dos Veadeiros, 10km oeste de Alto Paraiso, 14°10' S, 47°35' W, 1200 m elev., 28 October 2000, *M.F. Simon 317* (ESA!, UB!, UFG!); Alto Paraíso de Goiás, Chapada dos Veadeiros, entroncamento entre a estrada GO 239 e a estrada para as Sete Lagoas, passando a leste do Morro da Baleia e pelo Peito de Moça, 14°09'44.2"S, 47°37'47.5"W, 1146 m elev., 20 March 2012, *L.M. Borges 551* (SPF!)

56. Mimosa rheiptera Barneby (1991: 405–406). Type: Brazil. Goiás: [prob. Alto Paraíso de Goiás,] Chapada dos Veadeiros 38 km n. of S. Joao da Aliança, 25 April 1956, fl., *E.Y. Dawson 14552* (holotype: NY!, isotype: RSA photo!)
Fig. 60.

Diagnostic characterization: *Mimosa rheiptera* is similar to other treelets with glandular indumentum on branches and exerted synflorescences, particularly to *M. decorticans* (see under it for further notes), but stands apart from it by bearing tapering filiform setae (vs. with bulbous base) and infundibuliform corollas (vs. narrowly infundibuliform). From the closely related *M. struthionoptera* it differs by the clavate glandular setae (vs. capitate).

Notes: As several other treelet species occurring at Chapada dos Veadeiros, *Mimosa rheiptera* shows exfoliation of the periderm, which was not perceived by Barneby (1991), since he only knew it by the type specimen. Although present, the character is not as prominent as in *M. densa* or *M. oligosperma*, and may be absent from specimens presenting just the distal portion of branches.

Specimens of *Mimosa rheiptera* are commonly identified as *M. densa* in herbaria. Both species are treelets with orange–reddish underbark exposed by exfoliation of the periderm, but that confusion is more related to the thought that *M. rheiptera* was known only by the type specimen and a few additional collections from the southern portion of Chapada dos Veadeiros, Goiás. This species is, in fact, a common element in the landscape of that region, were *M. densa* also occurs. Both species may be readily distinguished by the presence of glandular setae, which are constant in vegetative organs of *M. rheiptera*, but never found in *M. densa*. Moreover, inflorescences of *M. rheiptera* are organized in an exsert synflorescence, and its fruits have incurved indumentum, while racemes of *M. densa* lay inserted amongst the leaves and its fruits have antrorse, but not appressed, indumentum. It is worth noting that specimens collected near the Chapada dos Veadeiros National Park, where the species is particularly common, appear to be more robust than the type specimen, but all the features of those are in accordance and match the concept of *M. rheiptera*.

Distribution and habitat: *Mimosa rheiptera* forms large patches of individuals and is a common treelet in areas of *cerrado* and *campo rupestre* at Chapada dos Veadeiros, at the Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Alto Paraíso de Goiás, 14°04'21'' S, 47°30'33'' W, *C.B.R. Munhoz 713* (RB!,

Figure 60. *Mimosa rheiptera*. A. Habit. B. Branch with shedding peridermis. C. Reproductive branch with exserted synflorescence. D. Fruit.

UB!); Alto Paraíso de Goiás, Chapada dos Veadeiros, estrada GO 239, Alto Paraíso de Goiás-São Jorge; próximo à São Jorge, 20 March 2012, L.M. Borges 555 (SPF!); Brazil. Goiás: Alto Paraíso de Goiás, PARNA Chapada dos Veadeiros, estrada para o Córrego dos Inglêses, 14°07'57'' S, 47°30'35'' W, 1080 m elev., 23 October 1996, *A.M.S. Vaz 1166* (IBGE!, K!, NY!, RB!); Alto Paraíso de Goiás, Fazenda Loquinhas, 10km a leste cidade, 14°08'39'' S, 47°29'22'' W, 1186 m elev., *M.F. Simon 884* (OXF, UB!).

57. Mimosa rhodostegia Barneby (1991:414–416). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] Arrededores da sede do Parque Nacional do Tocantins [now Parque Nacional da Chapada dos Veadeiros], 46 km w. de Veadeiros, 25 September 1967, fl., fr., *J.H. de Haas Sr. et al. 307* (holotype: NY!; isotypes: GH!, HB!, NY!)

Diagnostic characterization: *Mimosa rhodostegia* shares with *M. acroconica, M. bispiculata* and *M. regina* the presence of broadly-ovate stipules. From *M. acroconica* and *M. bispiculata* it is readily distinguished by the absence of interpinnal projections (vs. presence) and from *M. regina* by the filiform setae patent on branches (vs. incurved, rarely retrose), persistent broadly ovate-acuminate stipules (vs. caducous and triangular on vegetative branches passing to broadly ovate-acuminate on synfloresncence axes) and corolla lobes surface not concealed by the indumentum (vs. concealed).

Notes: *Mimosa rhodostegia* and *M. regina* are the only species of *M.* ser. *Pachycarpae* bearing stipules fused at the base. On *M. regina* this character state is present only along the synflorescence axes (see notes under that species), but all stipules of *M. rhodostegia*, which are persistent, have it. This makes specimens belonging to the species readily recognizable, especially when associated with the branches indumentum, rich in villi and in glandular setae, and only remotely composed by patent filiform setae.

The exclusive occurrence of connate stipules in two sympatric species made Barneby (1991) express doubts about the taxonomic distinction of *Mimosa rhodostegia* from *M. regina*. However, he knew those plants only by their types, which did not allow to evaluate that *M. regina* has shape-shifting stipules and that those structures are persistent in *M. rhodostegia*. Those two features are remarking additions to all other character states segregating the two species and vanish any doubts about their circumscription, even though the latter is know only from a few recent records.

Distribution and habitat: *Mimosa rhodostegia* is a rare endemic species occurring in rocky *cerrados* around 1400 m in elevation, at the surroundings of the Chapada dos Veadeiros National Park, particularly in sites located at the municipality of Alto Paraíso de Goiás, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, Parcelas 4 e 5, 14°46’11” S, 47°46’11” W, 26 September 1995, fl, *M.L. Fonseca 590* (IBGE!, SPF!); Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, 14°07’0” S, 47°47’0” W, 1400 m elev., 07 September 1996, fl, *M.F. Simon 3* (UB!).

58. Mimosa rupigena (Barneby 1991: 357–358) L.M. Borges in Borges *et al.* (Chapter 3) *M. setosa* var. *rupigena* Barneby. Type: Brazil. Minas Gerais: Gouveia, 6 September 1971, fl., fr., *Hatschbach 27302*, (holotype: NY!; isotypes: HBG!, MBM)

Diagnostic characterization: *Mimosa rupigena* differs from *M. paludosa* and *M. setosa* by the absence of glandular setae on branches and floral bracts (vs. presence) and by leaves not developing on synflorescences axes after maturation of the fruits (vs. developing). Additionally, it lacks aculei, which are always present in *M. paludosa*. From *M. neonitens*, it may be distinguished by its bracteose synflorescence (vs. frondose), by the presence of trichomes on leaflets surface (vs. absence) and of plane projections throughout the calyx rim.

Distribution and habitat: *Mimosa rupigena* occurs in *campos rupestres* and *cerrados* with rock outcrops and rocky soils of the Diamantina plateau, located at the Southern Espinhaço Range in the state of Minas Gerais, Southeastern Brazil.

Selected specimens: Datas, Rodovia Diamantina–Gouveia (BR 367), 18°20'54" S, 43°40'60" W, ca. 1350 m elev., 5 February 2009, fr., L.M. Borges et al. 370 (SPF!, NY!); Diamantina, Biribiri, Alto da Sentinela, 646170/7988977, 1100 m elev., 16 September 2004, fl., C.V. Mendonça et al. 1141 (DIAM!); Gouveia, Fazenda Prata (de Everaldo GonçalvesP, 19 July 1980, fl., J. Semir et al. CFCR 179 (F, NY!, SPF!); Gouveia, Córrego do Tigre, 14 September 1985, fl., fr., G. Hatschbach & R. Kummrow 49667 (K!, MBM, NY!, SPF!).

59. Mimosa serpensetosa L.M.Borges in Borges *et al.* (2014: 41–46). Type: Brazil. Minas Gerais: Santana do Riacho, Serra do Cipó, Estrada Santana do Riacho–Cardeal Mota, via Melo, cerrado de altitude, 19013'34.5" S, 43039'58" W, 814 m, 23 April 2006, fl., fr., *L.M. Borges et al. 104* (holotype SPF!, isotypes BHCB!, K!, NY!, P!, RB!, UB!, US!).

Fig. 61.

Diagnostic characterization: *Mimosa serpensetosa* differs from *M. paludosa* by 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).

Notes: *Mimosa pachycarpa*, which is sympatric with *M. serpensetosa*, may be mistaken with it, 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 the northernmost distribution of the *M. serpensetosa* (Santana de Pirapama) tend to present bigger leaves, leaflets and glomerules, coarser filiform setae, as well as not showing the markedly villous branches that are seen on other specimens. Those differences are, however, only infraspecific alometric variatation (Borges *et al.* 2014). For a detailed discussion on the morphological affinities of *M. serpensetosa* see Borges *et al.* (2014).

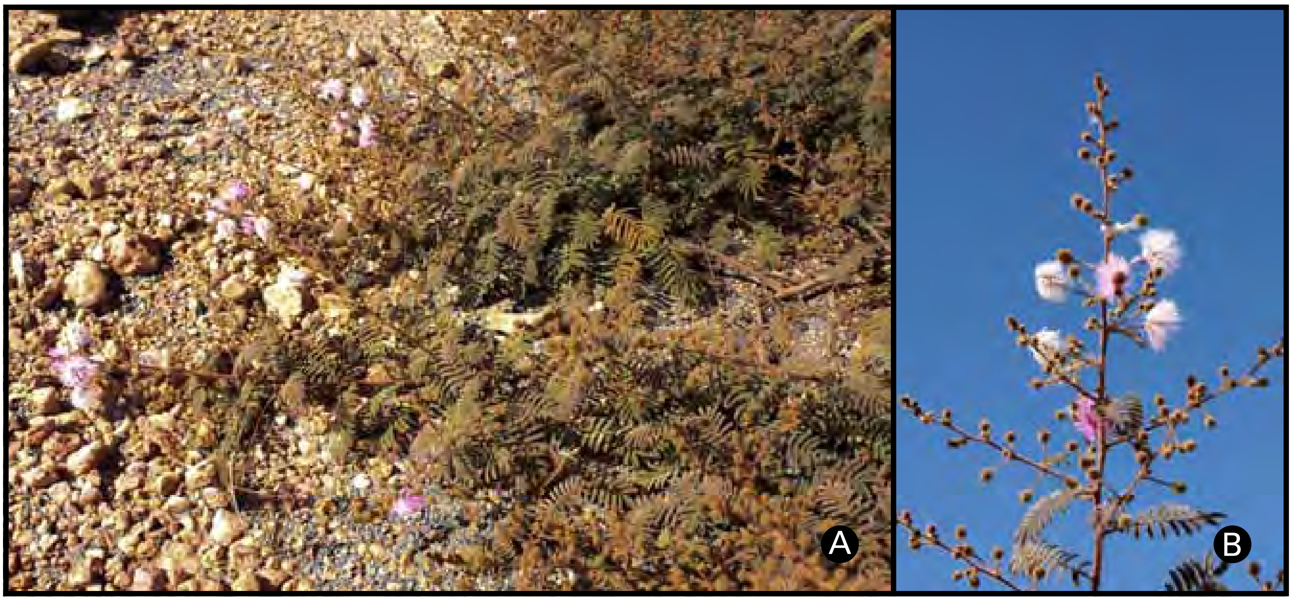

Figure 61. *Mimosa serpensetosa*. A. Habit. B. Synflorescence.

DISTRIBUTION AND HABITAT: *Mimosa serpensetosa* is endemic to altitudinal cerrados and campos rupestres with quartizitic substrate of Serra do Cipó, and with two records from iron rich soils of Serra de Capanema, both at Minas Gerais state, Southeastern Brazil.

SELECTED SPECIMENS: Brazil. Minas Gerais: [Itabirito] Capanema, s.d., fl., L. Riedel 8 (K!, LE!). Santana do Pirapama, Serra do Cipó, acesso pela Fazenda Inhame, Estrada velha para a mina de manganês, subida da Serra, campo sujo, 18°55'3.44" S, 43°47'20.46" W, 1236 m, fl., 13 November 2009, D.C. Zappi et al. 2349 (K!, SPF!). Santana do Riacho, Serra do Cipó, 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. 19°17'38" S, 43°33'50" W, fl., 14 June 2010, L.M. Borges et al. 432 (SPF);

60. Mimosa setosa Bentham (1842: 404–405). Lectotype (designated by Barneby 1991): Brazil. [Goiás: ad Rio S. Marcos,], fl., December 1818, *J.B.E. Pohl 1409 [=846]* (lectotype K 000504963!, isotypes: F!, K 000504962!, NY! (2 sheets), W!)

=*Mimosa formosana* Taubert (1896: 433). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: [Formosa], "prope Formosa", September 1894, fl., *E. Ule 2827* (lectotype HBG! [also annotated as "N° 4"; "Chapadões bei Formosa"]); synonymized by Barneby (1991).

= *Mimosa setosa* subsp. *setosa* var. *pseudomelas* Barneby (1991: 356–357), Lectotype (designated by Barneby 1991): Brazil. São Paulo: ad Vila de Batatais, fl., fr., *Regnell III/510* [*Ser. III n° 510*] (lectotype: K!; isotypes: S!) "]); synonymized by Borges *et al.* (Chapter 3).

Fig. 62.

DIAGNOSTIC CHARACTERIZATION: *Mimosa setosa* stands out as a distinct species from *M. paludosa* by the absence of aculei on leaves primary axes (vs. presence) and plane setae of calyx rim laterally fused, and from *M. urbica* mainly for being a shrub, not a trailing subshrub.

NOTES: Individuals of *Mimosa setosa* generally are not armate with aculei, but these can appear at the base of branches and sometimes even at their tips, intermingled with the leaves. Aculeate specimens may be confused with the constantly armate *M. paludosa*, but on it aculei are triangular and have a broad longitudinally fusiform base, while on *M. setosa*, those are conical. The relationship between *M. setosa*, *M. melanocarpa* and *M. setosa* var. *pseudomelas* is discussed in detail in Borges *et al.* (Chapter 3)

DISTRIBUTION AND HABITAT: *Mimosa setosa* occurs in lateritic soils of *cerrados* in the Federal District and the states of Goiás and São Paulo, Central and Southeastern Brazil.

SELECTED SPECIMENS: Brazil: Distrito Federal: Brasília, Folha SD-23-Y-C, Reserva Ecológica do IBGE, entre a guarita e a sede, aprox. 15°57'01" S, 47°52'14" W, aprox. 1100 m elev., 14 February 2009, fr., M.A. Silva & F.C. Pinheiro 6957 (IBGE!). Goiás: no locality and date given, fl., E.P. Heringer 12242 (UB); Cristalina, Fazenda Nossa Senhora de Fátima (fundo de alfaville), ca. 1000 m elev., 15 November 1986, fl., A.F.P de Araújo s.n. (UB!); Luziania, centro da cidade, 8 December 1982, fl., E.P Heringer 18497 (UB!); Morrinhos, 11 December 1951, fl., A. Macedo 3414 (SP!); Servo do Ribeirão da Paciencia, 29 August 1827, W.J. *Burchell 5452* (K!, P!). São Paulo: [Araraquara], Araracoara et Batatais, May 1834, fl., L. Riedel 2232 (LE!,NY!); [Franca,] inter Franca et Rio Grande, n.d., fl., P.W. Lund 5 (C, NY!) ; Mogi Guaçu,

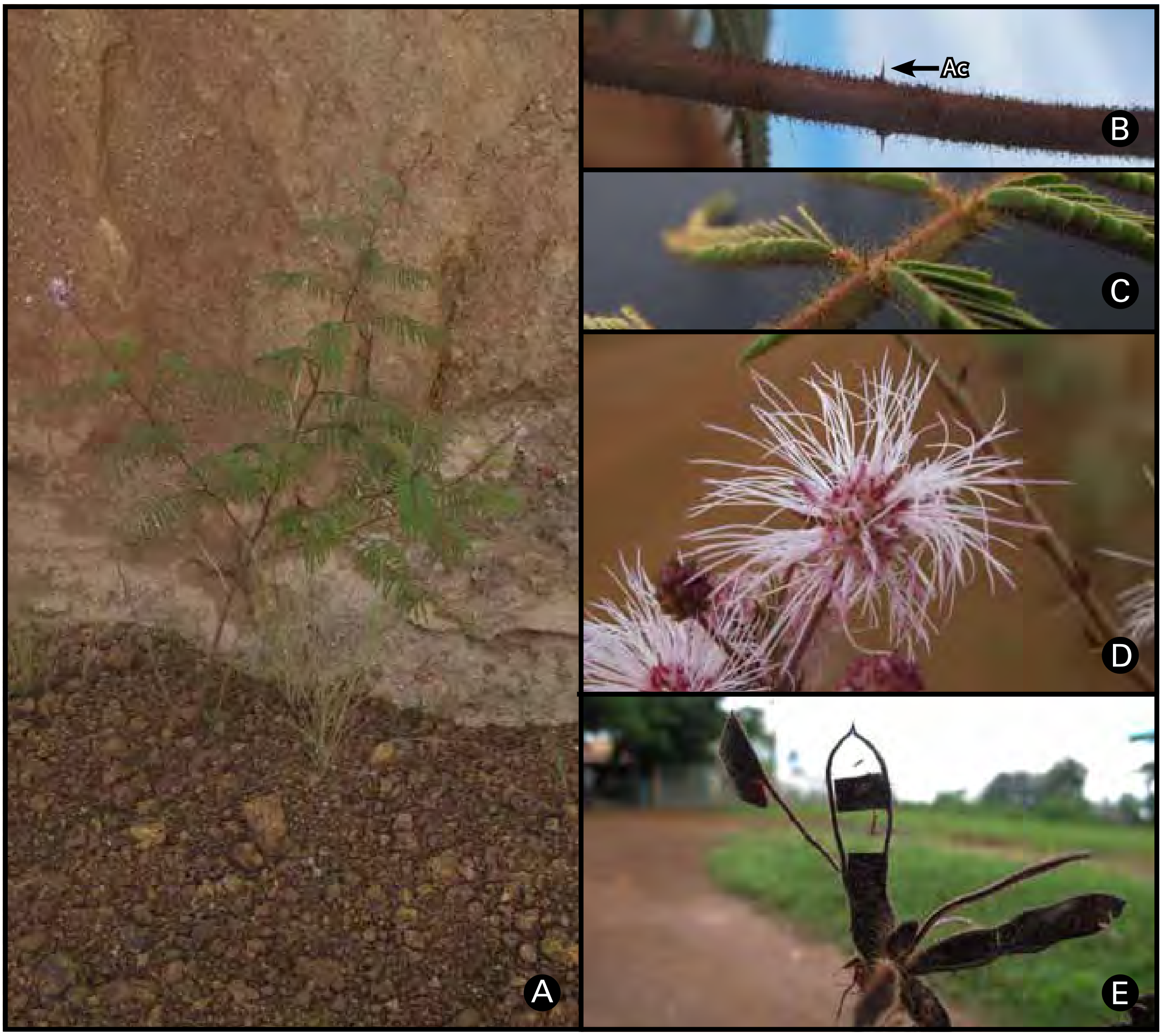

Figure 62. *Mimosa setosa*. A. Habit. B. Branch with aculei (Ac). (Ip). C. Detail of a leaf showing the interpinnal projection. D. Raceme. E. Fruits.

Reserva Florestasl Fazenda Campininha, perto de Pádua de sales, 30 October 1957, fl., fr., O. Handro 738 (SP!).

61. Mimosa setosissima Taubert (1896: 434). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: [Pirenópolis], Serra dos Pyreneos [Pirineus], August 1892, fl., *E. Ule 2853* (lectotype: HBG! [also annotated as "101"], isotypes: P! [only annotated as "101"], R! [two sheets only annotated as "101"; one (R 000003315a) named "*Mimosa nettoana* Taub. sp. n.", a nom. nud., on the other (R 000003315), this same name is crossed and replaced by "Mimosa setosissima Taub. n. sp."].

Fig. 63.

Diagnostic characterization: *Mimosa setosissima* shares affinities with *M. decorticans* (see under the later for notes on other species), but may be distinguished from it by the racemes nested in the foliage (vs. exserted in a compound synflorescence) and by the filiform setae of leaves becoming laterally fused (vs. free).

DISTRIBUTION AND HABITAT: *Mimosa setosissima* forms dense patches of individuals in sandy and rocky soils *cerrado* slopes with outcrops of Serra dos Pirineus, at the Goiás state municipalities of Pirenópolis, Cocalzinho de Goiás and Corumbá de Goiás Goiás, Goiás state, Central Brazil.

SELECTED SPECIMENS: Brazil. Distrtito Federal: Brasília, Folha SD-23-Y-C, Reserva Ecológica do IBGE, entre a guarita e a sede, aprox. 15°57'01" S, 47°52'14" W, aprox. 1100 m elev., 14 February 2009, fr., M.A. Silva & F.C. Pinheiro 6957 (IBGE!). Goiás: Cristalina, Fazenda Nossa Senhora de Fátima (fundo de alfaville), ca. 1000 m elev., 15 November 1986, fl., A.F.P de Araújo s.n. (UB!); Morrinhos, 11 December 1951, fl., A. Macedo 3414 (SP!); Servo do Ribeirão da Paciencia, 29 August 1827, W.J. *Burchell 5452* (K!, P!). São Paulo: Mogi

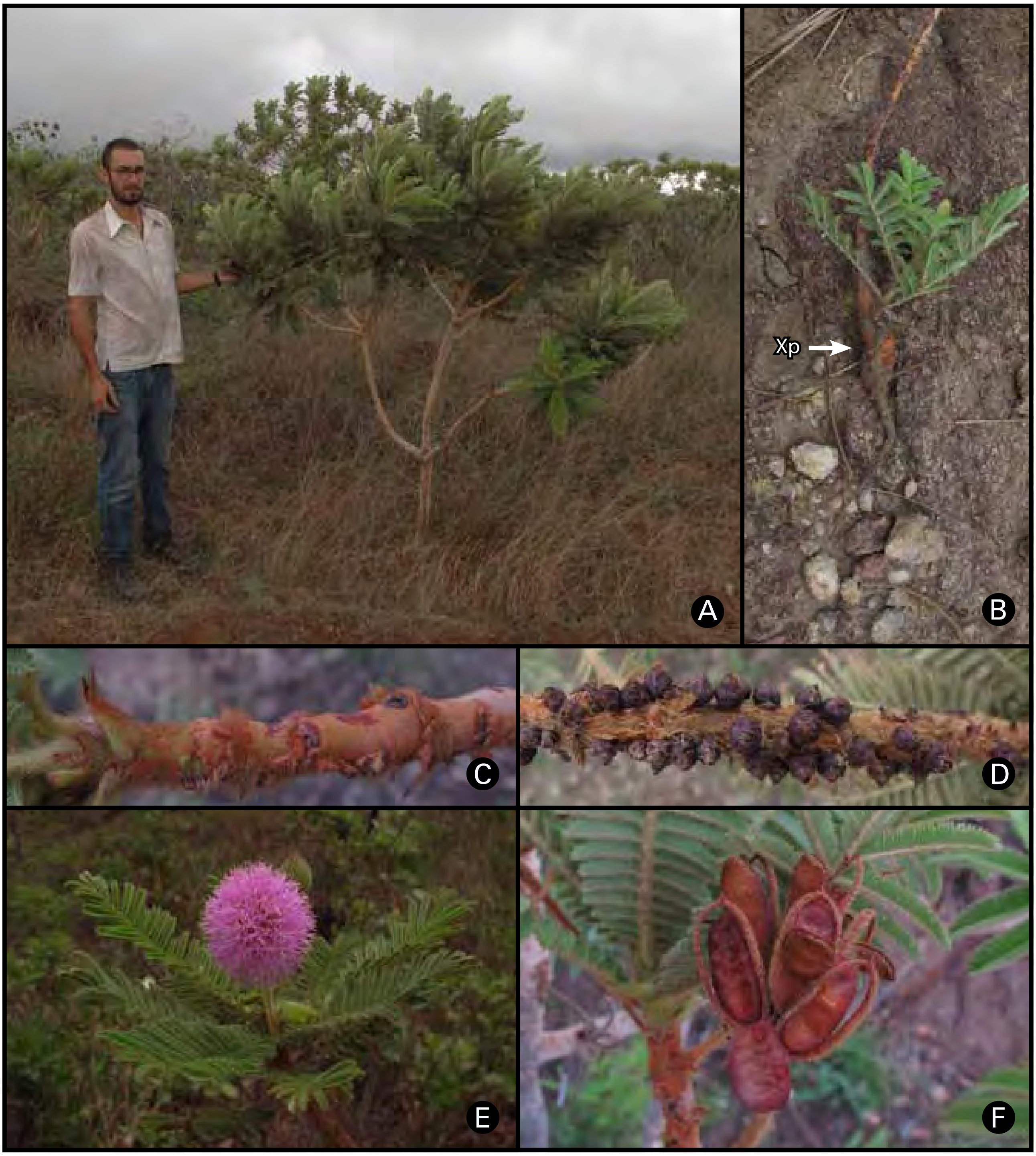

Figure 63. *Mimosa setosissima*. A. Habit. B. Young individual resptrouting from xylopodium (Xp). C. Exfoliation of the peridermis revealing the orange underbark. D. Branch infested with *Pilostyles*, E. Raceme subtended by a fully expanded leaf. F. Fruits.

Guaçu, Reserva Florestasl Fazenda Campininha, perto de Pádua de sales, 30 October 1957, fl., fr., O. Handro 738 (SP!).

62. Mimosa soderstromii (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basyonim: *Mimosa* claussenii var. *soderstromii* Barneby (1991: 401–402). Type: Brazil. Distrito Federal: [Brasília,] ±35 km e. of Brasília, dry slopes in *cerrado*, 700–1000 m [elev.], 21 August 1964, fl., fr., *H.S. Irwin & T.R. Soderstrom 5408* (holotype: UB!, isotypes: G!, K!, LE!, NY!, P!, R!, S!, US!).

Diagnostic characterization: *Mimosa soderstromii* differs from *M. claussenii* and *M. prorsiseta* by its a diffuse shrubby habit (vs. erect shrub or treelet), indumentum of petioles concentrated on the pulvini (vs. homogenously distributed) and by the presence of glandular indumentum on the inflorescence axes (vs. absent).

Notes: The abundant glandular indumentum of *Mimosa soderstromii* is one of its most remarkable characters. However, a more accurate examination of specimens is needed in order to evaluate whether it is really constant, since the isotype at NY has only a few glandular setae the peduncles, although the holotype and other isotypes do have them. The habit and inflorescence of *M. soderstromii* is reminiscent of *M. megistophylla*, a species endemic to the northern Chapada dos Veadeiros, but the later lacks glandular indumentum on rachides, leaflets and peduncles. Present knowledge allows us to define those taxa as two different entities, but further studies should be carried on in order to evaluate whether or not they could be regional variations of a single species.

Distribution and habitat: *Mimosa soderstromii* is known only from a few collections form *cerrado* areas at the eastern Federal District, Central Brazil. Despite being located in a well-surveyed region those areas deserve further exploration, as also indicated by the co-occurrence of other poorly known species of *M.* ser. *Pachycarpae* (*e.g. M. rava* and *M. auriberbis*).

Selected specimens: Brazil. Distrito Federal: Brasília, Bacia do Rio São Bartolomeu, 4 June 1980 (fl.), E.P. Heringer et al. 5007 (IBGE!, US!); Brasília, Bacia do Rio São Bartolomeu, 18 June 1980 (fl.), E.P. Heringer et al. 5013 (IBGE!, NY!, US!).

63. Mimosa speciosissima Taubert (1896: 431). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás, Habitat in montibus Serra da Baliza, September 1892, fl., *E. Ule 2828* (lectotype: HBG! [also annotated as "N° 5"], isotypes: P! [only annotated as "N° 5"]).

Fig. 64.

Diagnostic characterization: *Mimosa speciosissima* features as distinct among other species of *M.* ser. *Pachycarpae* for being a subshrub with orange-reddish filiform setae, a character it shares with *M. splendida*, but it is set apart from the latter by the absence of interpinnal projections (vs. presence) and absence of plane setae on clayx rim (vs. presence).

Figure 64. *Mimosa speciosissima*. A. Habit. B. Habit evidencing the massive xylopodium (Xp). C. Raceme. D. Fruits.

Notes: Barneby (1991) expressed concern about the distinction based on number of pinnae pairs and degree trunk development between populations located at Chapada dos Veadeiros (Goiás state) or Chapada da Contagem (Federal District) and the ones located in the surroundings of the Paranoá Lake, Federal District. Although more recent collections do not fill the gap in number of pinnae pairs, the size of plants fits the same scenario of small individuals of *M. splendida* and those populations must be indeed considered as belong to a sole species. This is reinforced by the grouping of samples from each area of occurrence in the phylogeny of *M.* ser. *Pachycarpae* (Borges *et al.* Chapter 1).

Distribution and habitat: *Mimosa speciosissima* occurs in open *cerrado*, *campo cerrado* and *campos rupestres* on altitudinal areas connecting the Distrito Federal to Chapada dos Veadeiros, in Goiás state, Central Brazil.

Selected specimens: Brazil. Distrito Federal: Brasília, Cristo Redentor, 15°46'47'' S, 47°55'46'' W, 25 July 1990, *A.L. Brochado 43* (NY!); Brasília, Reserva Biológica da Contagem, 15°38'55'' S, 47°52'26'' W, 1220 m elev., *M.R.V. Zanatta 881* (UB!). Goiás: Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, Cruzeiro; Rodovia BR 010, Alto Paraíso de Goiás-Teresina de Goiás, ca. de 20,5 km de Alto Paraíso; margem esquerda da estrada; estrada de acesso do Parque que leva a campos rupestres a partir da BR 010, 13°58'29.3"S, 47°29'55.4"W, 1553 m elev., 22 March 2012, L.M. Borges 575 (SPF!).

64. Mimosa splendida Barneby (1991: 421–422). Type: Brazil. Goiás: [Alto Paraíso de Goiás,] près du passage du rio Couros, dans le campo, 17 January 1895, fl. *A.F. M. Glaziou 21088* (holotype: K 000532564!, isotypes: †B photo!, BR photo!, C, F!, G!, K?, LE!, M!, P! [3 sheets], S!).

=*Mimosa irwinii* Barneby (1991: 422–423), ***syn. nov.*** Type: Brazil. Goiás: [Alto Paraíso de Goiás], Chapada dos Veadeiros, 10 km w. of Alto Paraiso, [1000 m elev.,] 24 March 1969, fl., *H.S. Irwin et al. 24987* (holotype: UB!, isotypes: G!, K!, LE!, NY! [3 sheets], R!, S!, US!).

Fig. 65.

Diagnostic characterization: *Mimosa splendida* differs from all other species of *Mimosa* ser. *Pachycarpae* by the indumentum composed by orange-reddish filiform setae, presence of persistent stipules and of interpinnal projections. See also notes under *M. speciosissima* for detailed distinctions.

Notes: Barneby (1991) treated *M. splendida* as comprising only treelets with 1–2 m tall, a feature that was subsequently confirmed by (Simon & Amaral 2003). Nonetheless, further field observations show that *M. splendida* can

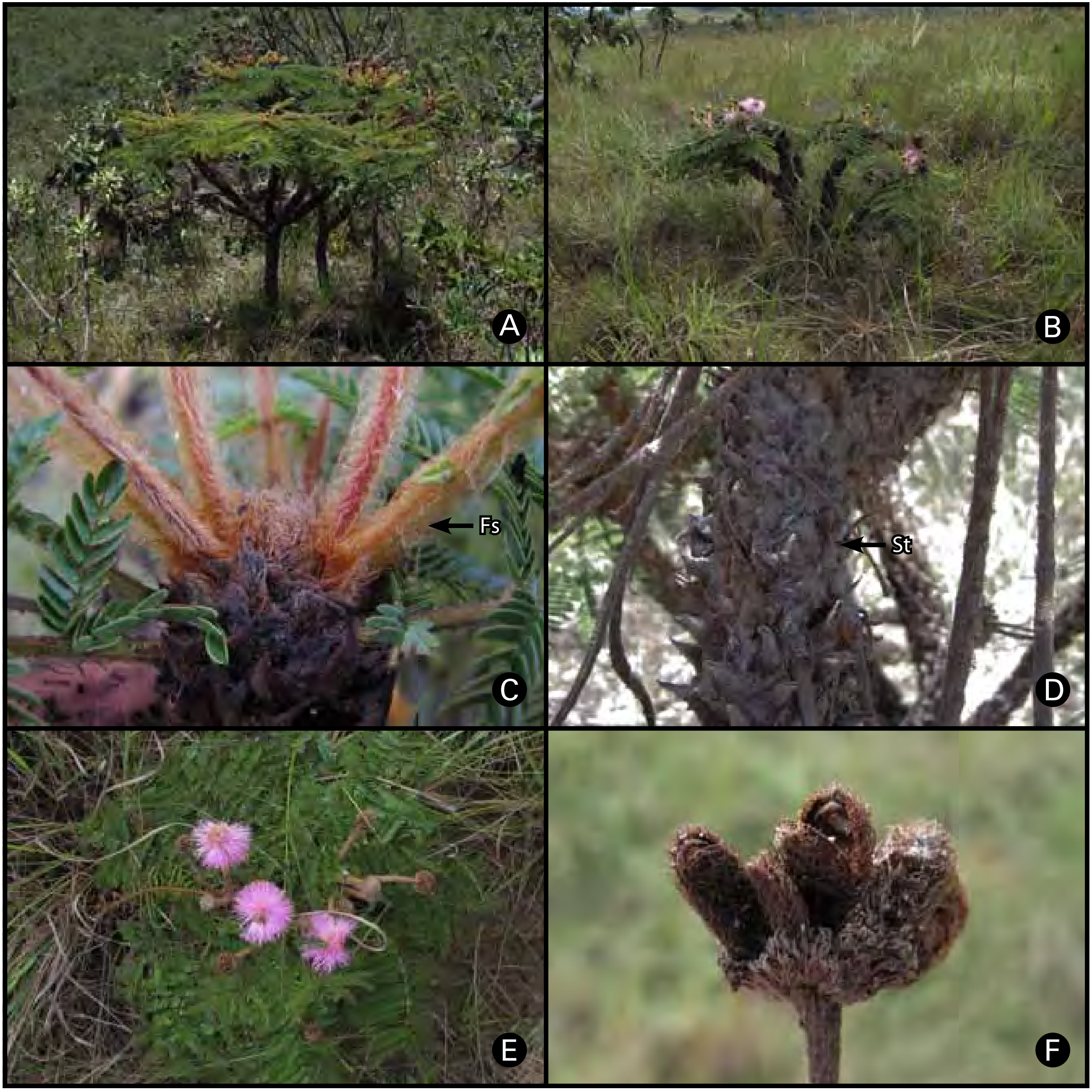

Figure 65. *Mimosa splendida*. A–B. Habit. A. Individual ca. 1.6 m tall. B. Individual ca. 50 cm tall. C. Petioles with orange filiform setae (Fs). D. Trunk with persistent stipules (St). E. Racemes subtended by fully expanded leaves. F. Fruits.

also grow as smaller shrubs, which are either young individuals or maybe forms with diminished growth due to environment restrictions, such as regular occurrence of fire.

Mimosa irwinii presents all the diagnostic features of *M. splendida* but was set apart from it for being a "humifuse rosette-shrub with prostrate woody branches" with ellipsoid inflorescences in a long peduncle. In fact, the habit of *M. irwinii* corresponds, in fact, to the one observed on small individuals of *M. splendida* (see above) and its ellipsoid inflorescences may be viewed as an abnormal development, which is also common in forms of *M. claussenii*. This allows our understanding of *M. irwinii* as a developmental variant of *M. splendida* and, hence, we synonymize the former names.

Distribution and habitat: *Mimosa splendida* is endemic to *campos* and rocky hills of *cerrado* with sandy soils from Chapada dos Veadeiros, at the municipality of Alto Paraíso de Goiás, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, 10 km oeste de Alto Paraíso, 14°10' S, 47°35' W, 1200 m elev., 6 June 2001, *M.F. Simon 431* (CEN!, HUEFS!, UB!, UFG!); Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, estrada para as Sete Lagoas, passando a leste do Morro da Baleia e pelo Peito de Moça; trecho da estrada logo após a guarita do Parque, próximo à base do Morro da Baleia, 14°06'43.4"S, 47°38'55.4"W, 1254 m elev., 20 March 2012, L.M. Borges 540 (SPF!); Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 10 km W of Alto do Paraíso (formerly Veadeiros), 1000 m elev., 24 March 1969, *H.S. Irwin 24987* (G!, NY!, UB!, US!); Près du Rio dos Couros, 17 January 1895, *A.F.M. Glaziou 21088* (G!, NY!, P!).

65. Mimosa struthionoptera Barneby (1991: 406–407). Type: Brazil. Goiás: [Alto Paraíso de Goiás] Morro das Antas entre a Sede do Parque Nacional do Tocantins [now Parque Nacional da Chapada dos Veadeiros] e Veadeiros, 26 September 1967, fl., *J.H. de Haas Sr. et al. 376* (holotype: HB!, isotype: NY!).

Diagnostic characterization: *Mimosa struthionoptera* shares affinities with *M. decorticans*, *M. setosissima* and *M. rheipthera*, but is clearly more similar to the latter, which occurs sympatrically (see also notes under *M. decorticans*). It differs from *M. rheiptera* mainly by the presence of capitate glandular setae (vs. clavate).

Notes: The indumentum of *M. struthionoptera* is visually remarkable due to the abundance of simple trichomes and capitate glandular setae and almost complete lack of filiform setae, a feature also shared with *M. rhodostegia* (see below).

The indumentum on branches of *M. struthionoptera* is similar to the one observed in *M. acroconica* and *M. rhodostegia*, but both may be distinguished by their broadly ovate-acuminate stipules (vs. lanceolate-acuminate [Barneby 1991]). Moreover, *M. acroconica* bears interpinnal projections (vs. absent) and long and patent filiform setae are abundant in *M. rhodostegia*. As already noted by Barneby (1991), *M. struthionoptera* and *M. rheiptera* are very similar and it is possible that both are conspecific, even though the indumentum on branches of both is quite dissimilar, the first being abundant in capitate glandular setae and the later in filiform incurved setae. The latter is a common species at Chapada dos Veadeiros and it is not unlike for *M. struthionoptera* to be an aberration or variation extreme of it, but since it is known only by the type specimen, which has remarkable morphological features, it is recognized here as a distinct taxonomic entity. Efforts should be made in order to find new records of this visually striking species, particularly of its fruits, which are unknown so far and may help to achieve an accurate definition of the taxon.

Distribution and habitat: The type of *Mimosa struthionoptera* was collected at the Chapada dos Veadeiros National Park in the municipality of Alto Paraíso de Goiás, Goiás state, Central Brazil, lacking a precise indication of habitat, but which is likely an area of *cerrado* or *campo rupestre* with rock outcrops.

66. Mimosa stylosa Barneby (1991: 405). Type: Brazil. Minas Gerais: [Diamantina,] Sa. do Espinhago 23 km e. of Diamantina, [900 m elev.,] 15 March 1970, fl., fr., *H.S. Irwin 27583* (holotype: UB!, isotypes: G!, K!, LE!, NY! [2 sheets], P!, R!, S!, US!

Fig. 66.

Diagnostic characterization: *Mimosa stylosa* differs from *M. brevibractea*, which is sympatric at Serra do Cabral, Minas Gerais, by the incurved filiform setae of branches and fruits (vs. forwardly apressed), the absence of paraphyllidia on leaves (vs. presence) and corolla lobes not concealed by the indumentum (vs. concealed). From *M. prorsiseta* it is distinct by calyx lacking fused plane projections (vs. present), but with glandular setae (vs. absent), corolla lobes not concealed by the indumentum (vs. concealed).

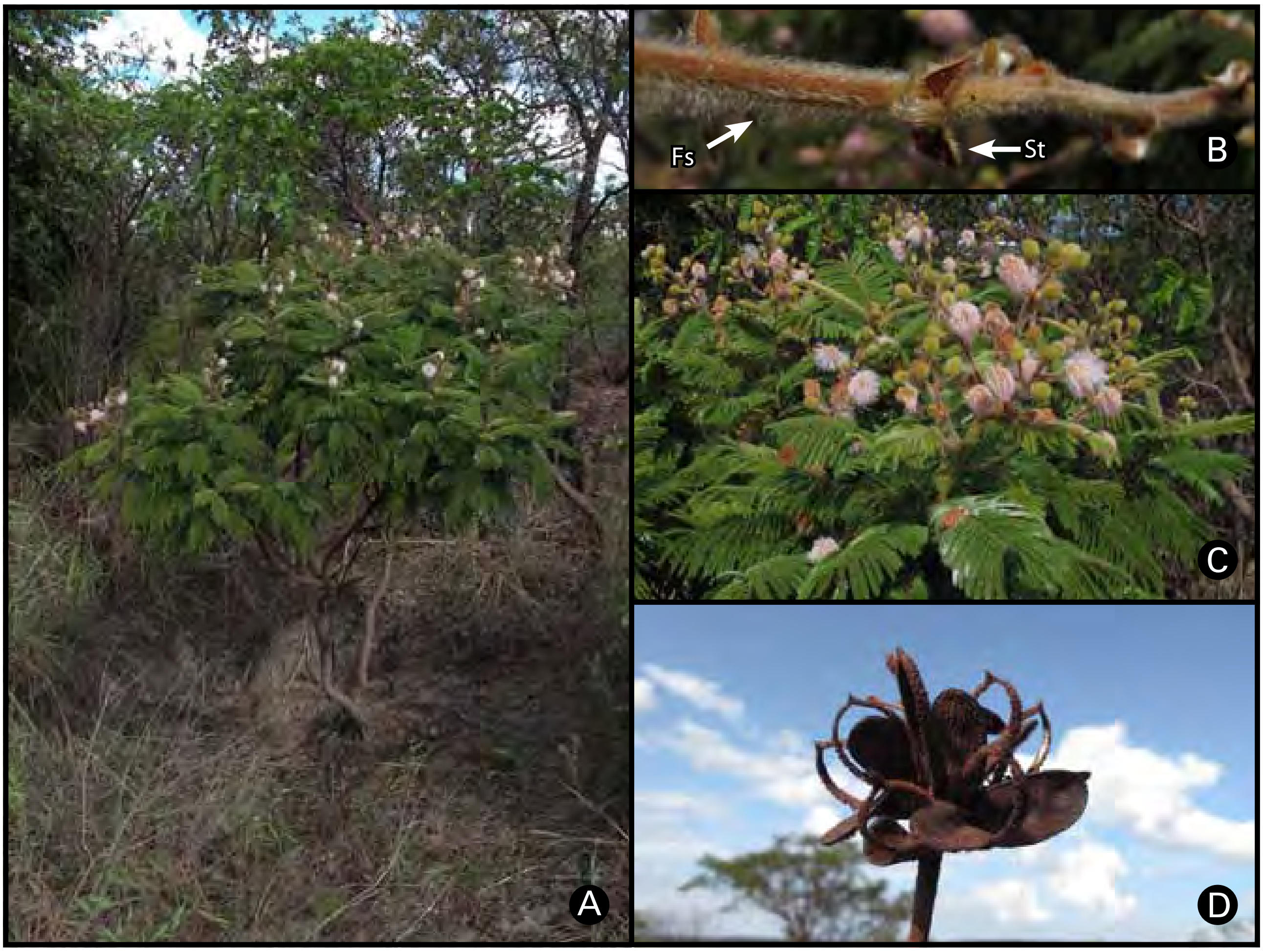

Figure 66. *Mimosa stylosa*. A. Habit. B. Synflorescence axis with incurved filiform setae (Fs) and narrowly triangular stipules (St). C. Crown with exserted synflorescences. D. Fruits.

Notes: A remarkable feature of *Mimosa stylosa*, particularly amongst other species from *M.* ser. *Pachycarpae* occurring at the Espinhaço Range, is its densely foliate and sometimes globos crown with several exserted synflorescences.

Distribution and habitat: *Mimosa stylosa* occurs in *campos rupestres* and *cerrados* of Serra do Cabral, Serra do Cipó and the Diamantina Plateau, all belonging to the Southern Espinhaço Range, located in the Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Francisco Dumont, Serra do Cabral, estrada Joaquim Felício–Várzea da Palma, 21,3 km de Joaquim Felício, estrada Joaquim Felício–Francisco Dumont, a 8 km de Francisco Dumont, 17°21'19.1"S, 44°13'50.6"W, 946 m elev., 28 April 2012, *L.M. Borges 672* (SPF!); Serra do Cipó, ao longo da Estrada da Usina, 16.IV.1972, A.B. Joly CFSC 1748 (UEC!); Serra do Espinhaço, ca. 23 km E. of Diamantina, 900 m elev., 15 March 1970, *H.S. Irwin 27583* (G!, NY!, P!, UB!, US!).

67. Mimosa tocantina Taubert (1896: 431–432). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: habitat in ditione Tocantini superioris in montosis ad Vargem grande, September 1892, fl., *E. Ule 2826* (lectotype: HBG! [also annotated as "N° 3"], isotype: P! [only annotated as "N° 3"; "nos morros da regiao do Tocantins superior, Pizarao {= Ribeirão Pizarão, 14°10'S, 47°35'W (Barneby 1991)}]").

> =*Mimosa pseudosetosa* Marc.F. Simon & C.E. Hughes in Simon et al. (2010: 279, 281). Type: Brazil. Goiás: Cavalcante, Vila Engenho, caminho para cachoeira Santa Bárbara, campo sujo, solo arenoso, 13°32' S 47°29' W, 1070 m, 12 Oct 2002 (fl, fr imm), *M. F. Simon 453* (holotype: UB; isotypes: CEN, FHO n.v., K) "]); synonymized by Borges & Pirani (2014a).
>
> Fig. 67.

Diagnostic characterization: By its habit, *Mimosa tocantina* resembles *M. albolanata*, since botha are procumbent shrubs. These species, however, are different by the presence on the first of branches with patent filiform setae (vs. incurved), presence of interpinnal projections (vs. absence), shallowly cupulate calices without plane setae at the rim (vs. cupulate with plane setae).

Notes: The filiform setae of *Mimosa tocantina* are ochraceous, but at the tip of young and still expanding leaves they may be orange-reddish, similar to the ones found in *M. splendida* and *M. speciosissima*. Further notes are presented by Borges & Pirani (2014b).

Distribution and habitat: *Mimosa tocantina* occurs in the *campos rupestres* between 1000 and 1700 m elev. and with sandy or sandy and rocky soils, prone to become waterlogged, of Chapada dos Veadeiros, at Brazil's Goiás state, Central Brazil.

Selected 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 33032* (K!, NY!, 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

Figure 67. *Mimosa tocantina*. A. Habit. B. Racemes subtended by heterochronic leaves. C. Fruits.

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, 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 594* (SPF!).

68. Mimosa ulei Taubert (1896: 432–433). Lectotype (designated by Borges & Pirani 2014a): Brazil. Goiás: habitat in campis ad fluvium Rio Preto in ditione Maranhão [Tocantins, not Maranhão] superioris, September 1892, fl., fr. [present only at the R duplicate and not seen by Taubert 1896], *E. Ule 2829* (lectotype: HBG! [also annotated as "N° 6"; "Rio Preto"], isotypes: CORD (image!) [also annotated as "N° 6"; "im oberen Tocantins gebiet"], P! [two sheets only annotated as "N° 6", "região do Tocantins superior"], R! [three sheets annotated only as "N° 6", "região do Tocantins superior"].

Fig. 68.

DIAGNOSTIC CHARACTERIZATION: *Mimosa ulei* stands out amongst other species of *M.* ser. *Pachycarpae* by the following combination of characters: presence of congested leaves devoid of simple trichomes and with interpinnal projections, exsert paniculate synflorescence, and fruits with pericarp and endocarp detaching from each other. It is closely related to *M. grallator*, and notes distinguishing both species are presented under the latter.

NOTES: *Mimosa ulei* is usually a 10–15 cm tall virgate shrub with a single short and corky stem bearing the congest leaves at its tips from where the tall synflorescence raises up to 2 m long. It is not uncommon, however, to observe individuals with stems reaching up to 1.5 m tall, but sometimes even further, and branching at the apex. Close observation shows that there is no difference in habitat, the tall condition being achieved probably due to lack of interference to the regular development of the plant. A similar condition is also observed in *M. splendida*.
Tall individuals of *Mimosa ulei* (e.g. Irwin 24935) were previously referred by Barneby (1991) as *M. gymnothyrsa*, a *nomen in schedulae*.

Apparently Taubert's (1896) indication of the collection site as being at the upper Maranhão River was a mis-

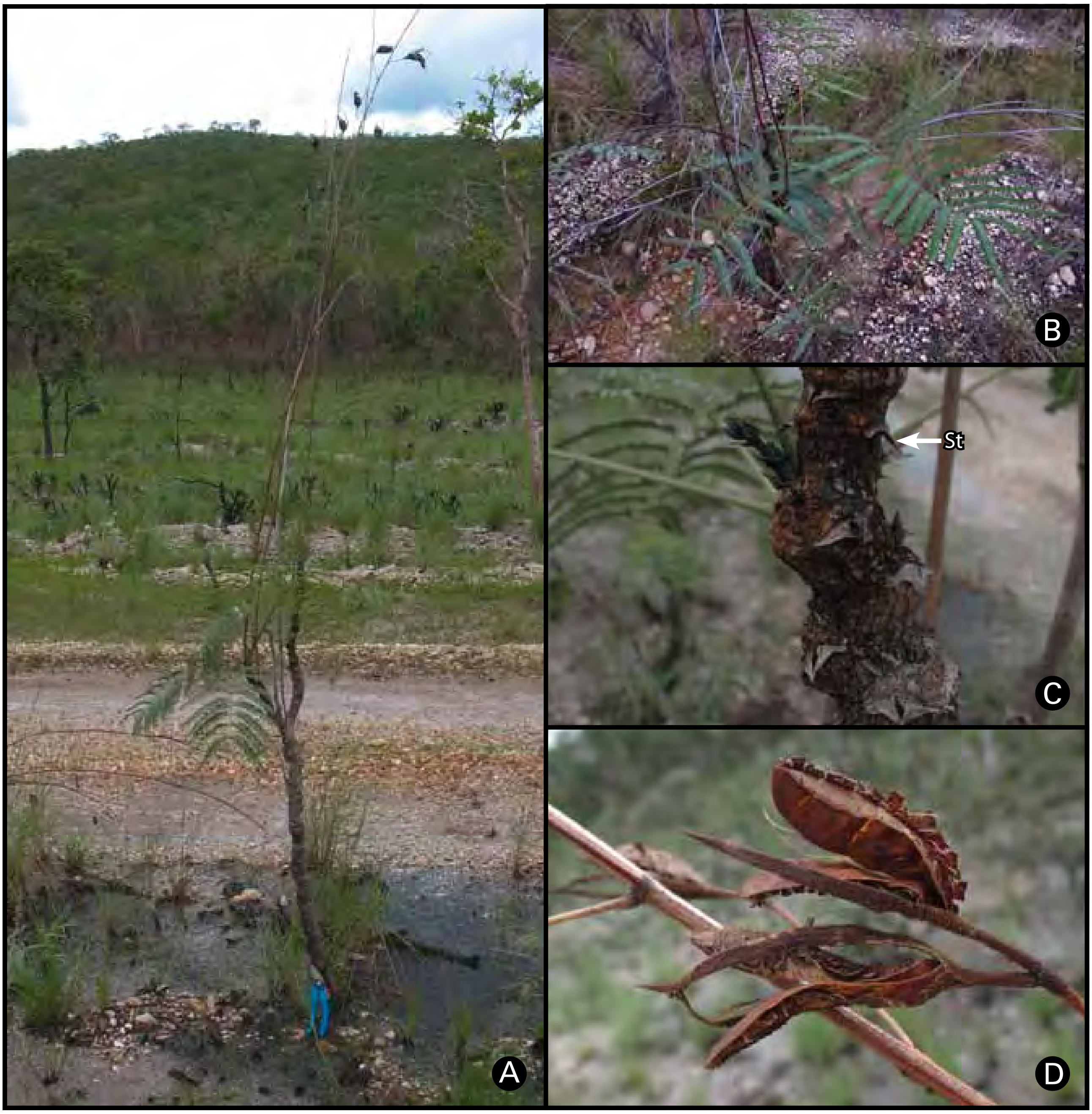

Figure 68. *Mimosa ulei*. A–B. Habit. A. Individual with stem reaching ca. 1.5 m tall. B. Individual with stem up to 50 cm tall. C. Stem with developed suber and persistent stipules (St). D. Fruits.

quote, since the specimens labels indicate it as being at the upper Tocantins river

Distribution and habitat: *Mimosa ulei* is endemic of *campos* and *campos rupestres* with sandy and rocky soils of Chapada dos Veadeiros, at the municipalily of Alto Paraíso de Goiás, Goiás state, Central Brazil.

Selected specimens: Brazil. Goiás: Alto Paraíso de Goiás, Estrada para o Vale da Lua, ca. 3 km da estrada para o Parque, 14°10'25'' S, 47°47'04'' W, 1010 m elev., 23 January 2005, *J. Paula-Souza 4491* (ESA!, HUEFS!, K!); Alto Paraíso de Goiás, Parque Nacional Chapada dos Veadeiros, 14°07' S, 47°47' W, 1400 m elev., *M.F. Simon 2* (UB!); Alto Paraíso de Goiás, Parque Nacional da Chapada dos Veadeiros, Área entre o Morro da Baleia e o Peito de Moça, entre o Rio Preto e o córrego do Fel, 14°04'14'' S, 47°39'36'' W, 15 November 1996, *M.A. Silva, 3315* (RB!).

69. Mimosa urbica (Barneby 1991: 358) L.M. Borges in Borges *et al.* (Chapter 3). *Mimosa setosa* subsp. *urbica* Barneby. *M. setosa* subsp. *urbica* Barneby var. *urbica* [Autonym generated by *M. setosa* subsp. *urbica* var. *urbana* Barneby (1991: 358)]. Type: Brazil. Brasília: near Setor Industrial, 1050 m, 30 December 1965, fl., *Irwin 9713* (holotype: UB!; isotypes: G!, K!, LE!, NY!, P!, R!, S!, US!)

> =*Mimosa setosa* subsp. *urbica* var. *urbana* Barneby (1991: 358). Type: Brazil. Distrito Federal: Estação de Biologia da Universidade de Brasília, 20 Fev 1969, fl., *Heringer 11770* (holotype UB!, isotype: NY!) ”]); synonymized by Borges et al. (Chapter 3).

Fig. 69.

Diagnostic characterization: *Mimosa urbica* differs from *M. setosa* and *M. paludosa* by the presence of a xylopodium (vs. absence); the prostrate habit (vs. erect); lack of prickles (vs. present in *M. paludosa* and very rarely occurring in *M. setosa*).

Notes: *Mimosa urbica* is generally a trailing subshrub with ascending terminal synflorescences. It also occurs as subshrubs with 50 cm tall at most, a condition attained probably when regenerating from fire. For detailed notes on the species see Borges *et al*. (Chapter 3).

Distribution and habitat: *Mimosa urbica* is endemic to the Distrito Federal, Brazil, where it occurs in natural open formations of *cerrado*, and its remnants in urbanized areas.

Selected specimens: Brazil. Distrito Federal: Brasília, Parque Olhos D´Água - lado oposto à Lagoa dos Sapos, 15°44'40'' S, 47°53'16'' W, 1050 m elev., *S.M. Fank-de-Carvalho 30* (UB!); Brasília, Planaltina, Estação Ecológica das Águas Emendadas, 15°35'21'' S, 47°35'20'' W, 1155 m elev., 15 April 2005, L.P. *Queiroz 10302* (HUEFS); Parque Nacional de Brasília, Próximo à área do Exército, 15°53' S, 47°56' W, 21 January 1991, *P.C.M. Ramos 561* (ESA!, UB!).

70. Mimosa vernicosa Bongard ex Bentham (1842: 404). Lectotype (designated by Barneby 1991): Brazil. Minas Gerais: Serra da Lapa, October 1824, fl., *L. Riedel 12* [miscited as “Langsdorff” in Bentham 1842 (Barneby 1991)] (lectotype: K!, isolectotypes: A! [2 sheets], LE! [3 sheets], NY! US! [All numbered *1093*, except for K (labeled “12”) and LE specimens: LE

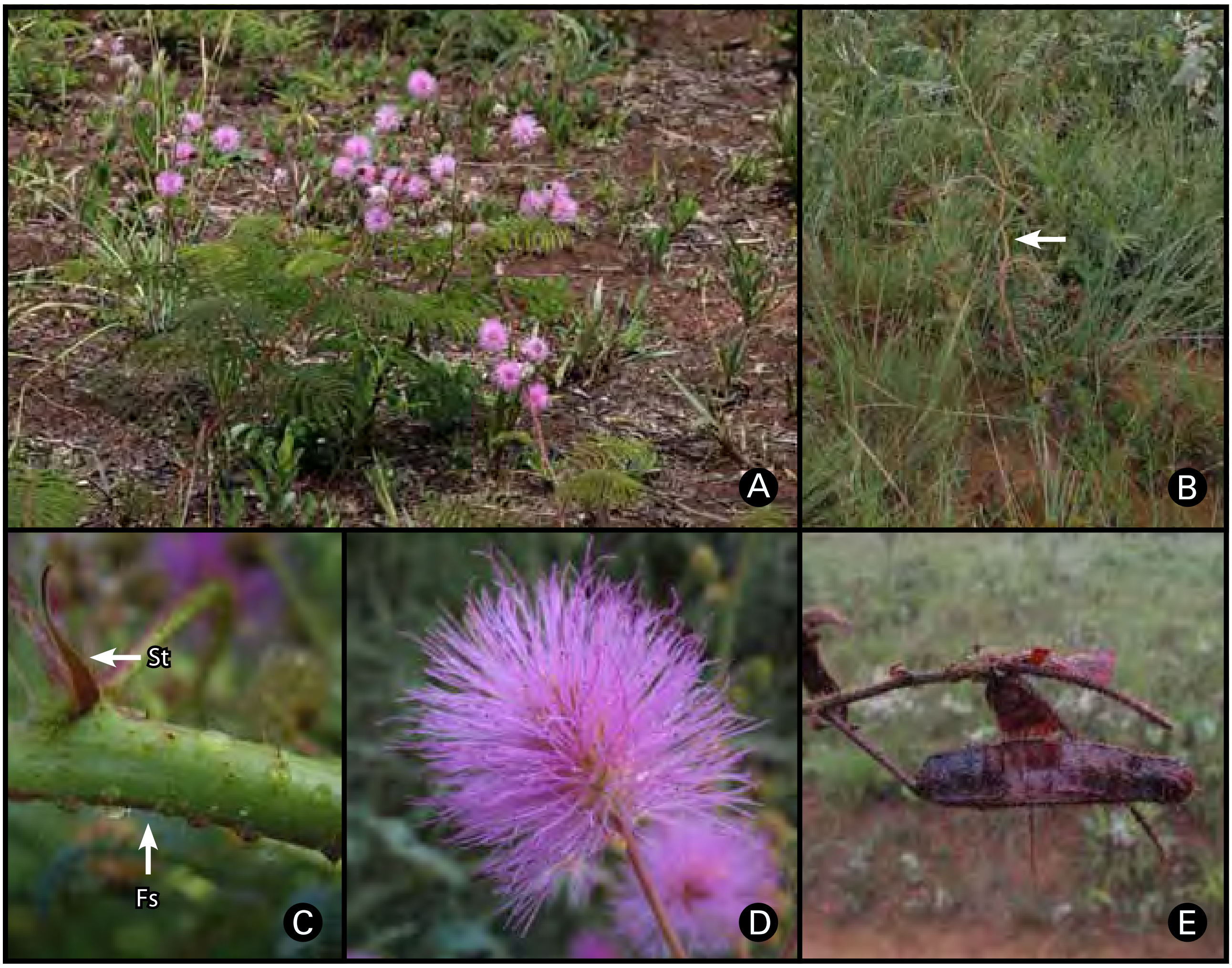

Figure 69. *Mimosa urbica*. A–B. Habit. A. Individual with assurgent stems. B. Individual with prostrate stems. C. Branch with narrowly triangular stipule (St) and filiform setae (Fs), but lacking glandular setae. D. Raceme. E. Fruits.

00002223 with two labels, one numbered “12” and the other “629”; LE 00002225 numbered 1093; LE 00002224 not numbered]).

≡*Mimosa foliolosa* var. *vernicosa* (Benth.) Barneby, ***syn. nov.***

Fig. 70.

Diagnostic characterization: Within taxa treated by Barenby (1991) as varieties of *M. foliolosa*, *Mimosa vernicosa* surely has remarkable characters to deserve species status. From the sympatric *M. viscidula*, it differs by the forwardly apressed or antrorse filiform setae of branches (vs. patent to incurved), for bearing an interpinnal projection (vs. absence), campanulate corolla (vs. infundibuliform) with lobes not concealed by the indumentum (vs. concealed). Moreover, it stands apart from *M. pachycarpa* by the presence of capitate glandular setae (vs. clavate), presence of an interpinnal projecton (vs. absence) and the campanulate corolla (vs. infundibuliform).

Notes: Glandular setae occurring in *M. vernicosa* are mostly sessile and just a few are stipitate. Although this is not a distinguishing character, it is useful for recognition of the species from others belonging to *M.* ser. *Pachycarpae* also occurring at the Espinhaço Range. Two specimens (*Chukr CFSC 9550* and *Hatschbach 53043*), although assigned to *M. vernicosa*, deserve further analysis for presenting rachillas lacking glandular setae, floral bracts with glabrous abaxial

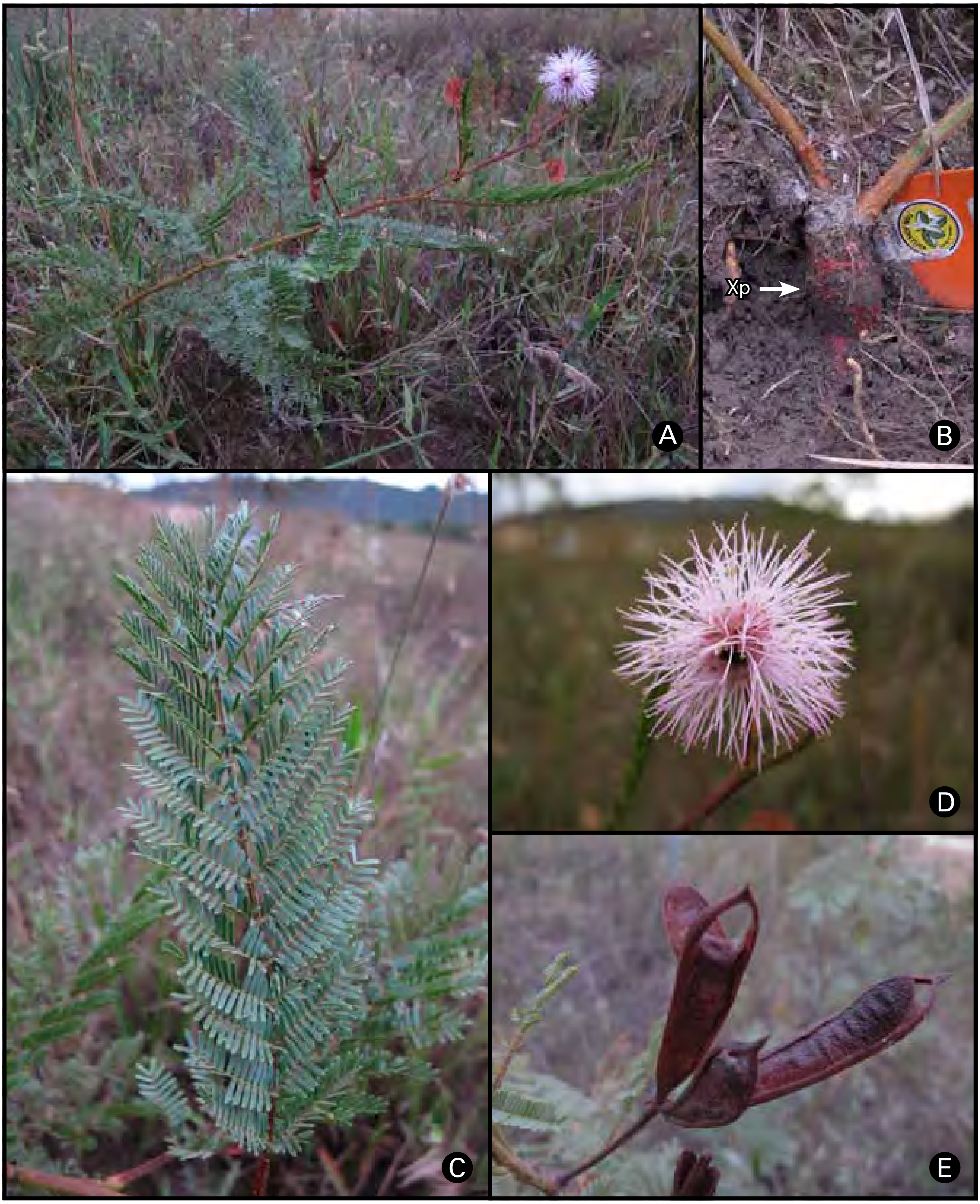

Figure 70. *Mimosa vernicosa*. A. Habit. B. Xylopodium (Xp). C. Leaf. D. Raceme. E. Fruits.

surface, calyces without plane setae on the rim, but with glandular setae, and sub-glabrous corollas.

Mimosa vernicosa may also share a relationship with *M. neonitens*, known from altitudinal areas to the north to its distribution. Both species have glandular setae as an important component of the indumentum, but those have a capitate head on the first and a clavate one on the later. Moreover, they also share the presence of an interpinnal laminar projection, but can be further distinguished by the corolla shape, campanulate in *M. vernicosa* and infundibuliform in *M. neonitens*.

Distribution and habitat: *Mimosa vernicosa* is endemic to *campos rupestres* of the Diamantina plateau, Minas Gerais state, Southeastern Brazil.

Selected specimens: Brazil. Minas Gerais: Diamantina, km 167-168 da MG 220 na direção de Conselheiro Mata, 18°18' S, 43°53' W, 1200 m elev., 7 February 2009, *L.M. Borges 403* (SPF!); Diamantina, Estrada Conselheiro Mata–Diamantina, Km 166, 23 February 1986, *N.S. Chukr CFCR 9550* (F!, MBM!, NY!, SPF!, UEC!, VIC); Gouveia, Serra Barro Preto, Km 66 da Estraa Curvelo–Diamantina, estrada para a antena de televisão, 18°36' S, 43°54' W, 9 April 1982, *A. Furlan CFCR 3208* (F!, NY!, SPF!, VIC).

71. Mimosa viperina M. F. Simon & C. E. Hughes in Simon et al. (2010: 281, 283). Type: Brazil. Goiás: Cavalcante, estrada 60 km ao norte de Cavalcante em direção à cachoeira do Prata, Campo sujo sob[re] solo encharcado, 13°25' S, 47°39' W, 1077 m elev., 3 March 2003, fl., fr., *M.F. Simon 461* (holotype: UB!, isotypes: CEN!, FHO, HUEFS, NY, K).
Fig. 71.

Diagnostic characterization: Amongst species with prostrate humifuse branches, *Mimosa viperina* is most similar to *M. prorepens* and *M. humivagans*. From *M. prorepens* it is readily distinguished by absence of glandular setae (vs. presence). From both *M. prorepens* and *M. humivagans* it differs by the pubescent corolla tube (vs. glabrous)

Notes: The lower number of pinnae pairs (3–4; vs. 7 or more) is remarking feature of *M. viperina*.

Distribution and habitat: *Mimosa viperina* is endemic to the north end of Chapada dos Veadeiros, Goiás state, Central Brazil, where it occurs on sandy soils of *campo sujo* and *campo* with rock outcrops between 1000–1200 m elev.

Selected specimens: Brasil. Goiás, Cavalcante, estrada Cavalcante–Prata, a 20.6 km de Cavalcante, em frente à estrada de acesso à Fazenda São Vicente, 2 November 2012, *L.M. Borges 929* (SPF!).

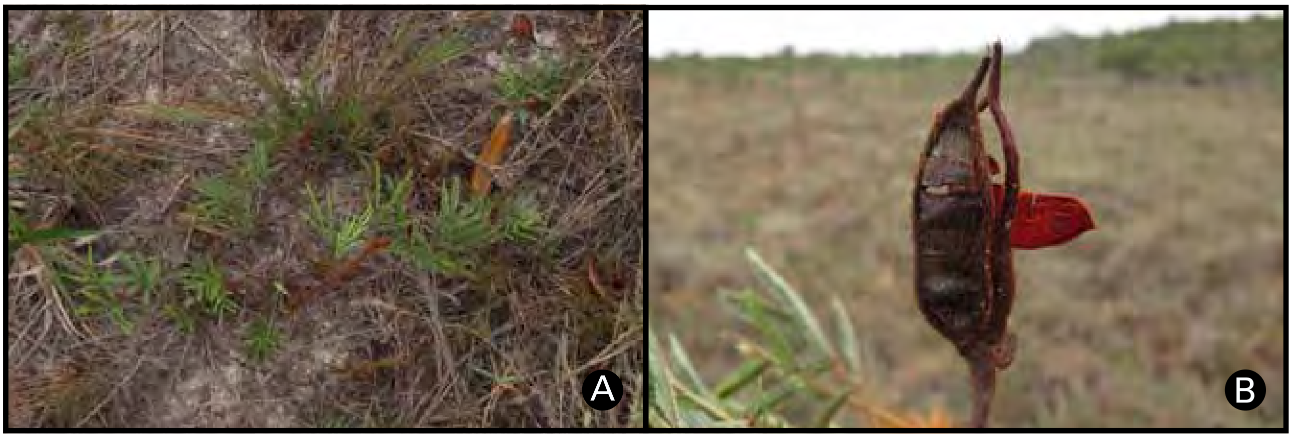

Figure 71. *Mimosa viperina*. A. Habit. B. Fruit.

72. ***Mimosa viscidula*** (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa foliolosa* subsp. *pachycarpa* var. *viscidula* Barneby (1991: 380). Type: Brazil. Minas Gerais: Mun. Inimutaba, above BR-259 near Córrego Garrote, 650 m [elev.], 23 February 1975, fl., fr. annot., *W. R. Anderson 11528* [misprinted "1528" on the protologue] (holotype: UB!, isotypes: G!, K!, NY!, US!).

Fig. 72.

Diagnostic characterization: *Mimosa viscidula* is closely related to *M. pachycarpa*, particularly based on habit and fruit morphology evidences. Both differ by the occurrence on the first of capitate glandular setae (vs. clavate), patent to incurved filiform setae of branches (vs. forwardly apressed or antrorse) and corolla lobes with indumentum concealing their surface (vs. not concealing). Dissimilarities with the sympatric *M. vernicosa* are discussed under that species.

Notes: Within taxa previously treated by Barneby (1991) under *Mimosa foliolosa* var. *pachycarpa* (*M. foederalis*, *M. multipinna*, *M. pachycarpa*, *M. peregrina* and *M. vernicosa* of this account), *M. viscidula* bear patent filiform setae constantly lacking a calcar or a small spur at the base, a feature that, although not present in all filiform setae of the other taxa, is regularly present.

Distribution and habitat: *Mimosa viscidula* is endemic to *campos rupestres* of the Diamantina plateau, Minas Gerais state, Southeastern Brazil.

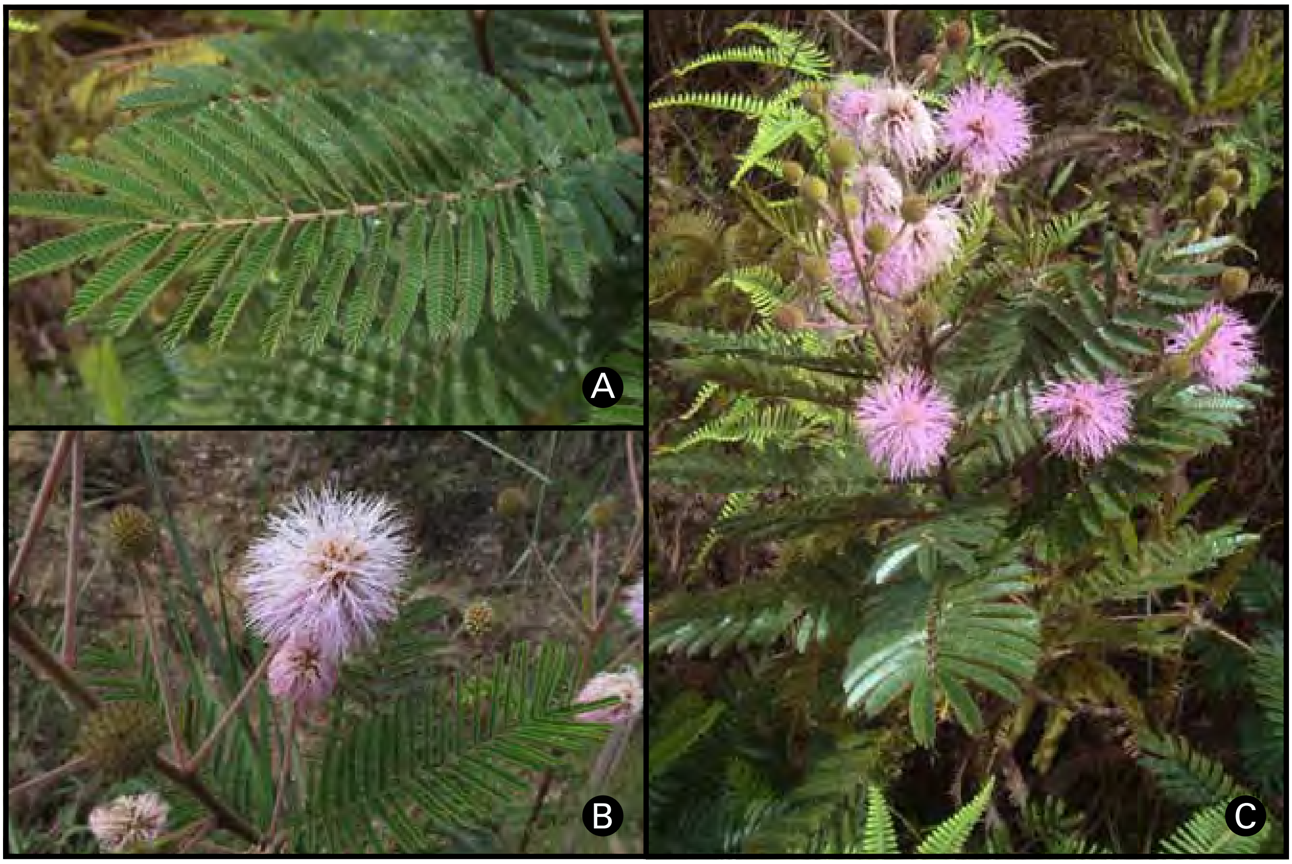

Figure 72. *Mimosa viscidula*. A. Leaf. B. Glomerules subtended by leaves not completely expanded. C. Distal portion of branch with exserted synflorescences. All photos by C. Andrino.

Selected specimens: Brazil. Minas Gerais: Gouveia, Estrada Curvelo-Diamantina, 18°36'41'' S, 43°59'06'' W, 882 m elev., 20 March 2008, *V. Dutra 573* (RB!); Diamantina, Estrada entre Diamantina e Conselheiro Mata, km 185-186. Próximo à entrada do Sítio Pica-Pau, 18°17'00'' S, 43°43'43'' W, 1340 m elev., 8 July 2001, *V.C. Souza 25404* (ESA!); Inimutaba, Above BR-259, near Corrego Garrote, 18°43'46'' S, 44°21'38'' W, 650 m elev., 23 February 1975, W.R. *Anderson 11528* (G!, NY!, RB!, US!).

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CHAPTER THREE

TAXONOMIC UPDATES IN *MIMOSA* (LEGUMINOSAE, MIMOSOIDEAE): REVISITING THE INFRASPECIFIC CLASSIFICATION OF *M. SETOSA*

Leonardo Maurici Borges, Marcelo Fragomeni Simon & José Rubens Pirani

Abstract

Mimosa setosa Benth., as currently circumscribed by Barneby, is a polytypic species comprising four subspecies and eight varieties. Phylogenetic analysis shows that those infraspecific taxa do not form a monophyletic group. Morphological analysis of a complete set of specimens from several herbaria, including types, and recent collections made by the first author and application of the Phylogenetic Species Concept allows to treat the assembly of taxa under *M. setosa* as six different species. Congruence with recent phylogenetic data and recognition of specific rank as the least inclusive unity for description and, thus, comparison of biological diversity are the main advantages of the proposed treatment.

Key words

Brazil, *campo rupestre*, *cerrado*, Fabaceae,

Introduction

Mimosa is one of the largest genera in Leguminosae Mimosoideae, with ca. 550 species (Barneby, 1991; Luckow, 2005; Simon *et al.*, 2011. Most species occur in Tropical America, but a few are found in Africa and Asia (Barneby, 1991; Villiers, 2002). In the Americas, Central Brazil is a key area for studies in the genus, since 279 species are found in the Cerrado and Caatinga Domains (Dutra & Morim, 2014). Although morphologically variable, the genus can be broadly defined by the presence of craspedium-like fruit and its derivate forms (Barneby 1991) and, within the diplostemonous Mimosoideae, the lack of extrafloral nectaries, which are present only in a small group of 15 species (Barneby, 1991; Simon *et al.*, 2011).

The taxonomy of *Mimosa* is based on the monumental work of Barneby (1991), the first and single comprehensive revision produced after (Bentham, 1841, 1842, 1845, 1846, 1875, 1876) treatments. Barneby's (1991) classification is strikingly marked by the recognition of many infraspecific taxa, usually hierarchically arranged with subspecies subtending varieties, although in a few species only varieties are recognized (e.g. *M. claussenii* Benth.; *M. aurivillus* Mart.), or only subspecies (e.g. *M. dolens* Vell.).

Amongst the many polytypic species recognized by Barneby, is *Mimosa setosa* Bentham (1842). On the lack of specimens with fruits, the species was initially ascribed by Bentham (1845) to *M.* ser. *Pachycapae* Benth., which is characterized by the presence of non-articulated craspedia. However, the species currently belongs to *M.* ser. *Setosae* Barneby, created mainly to accommodate species from *M.* ser. *Pachycarpae* that in fact have typical craspedial fruits (Barneby, 1991).

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Mimosa setosa comprises three subspecies, two of them with varieties, which are largely differentiated by the presence or absence of aculei, as well as characteristics of the indumentum (Barneby, 1991). Barneby (1991) achieved this infraspecific classification by means of aggregation (and subsuming when needed) of three taxa previously described by Bentham (1842, 1876) (*M. paludosa* Benth., *M. setosa*, and *M. setosa* var. *nitens* Benth.), and description of new infraspecific taxa (e.g. *M. setosa* var. *rupigena* Barneby). Table 1 summarizes the ranks of those taxa in both Bentham's (1842, 1876) and Barneby's (1991) views.

Mimosa setosa is distributed along altitudinal areas in the Brazilian Cerrado Domain, with many of its infraspecif taxa being allopatric micro-endemics. A few exceptions are, however, observed, such as the co-occurrence of *M. setosa* var. *setosa* and *M. setosa* subsp. *urbica* Barneby (1991) and its varieties and of *M. setosa* var. *paludosa*, that tends to be sympatric with all the other varieties due to its wide distribution range.

Barneby (1991:352–353) considered his circumscription of *Mimosa setosa* as more comprehensive, since it was based on the examination of a large number of specimens, mostly not available for Bentham during his work with *Mimosa*. To him, the morphological variability of the specimens could be understood as an expression of variation along the geographical distribution of the plants. Hence, those morphotypes could be recognized at infraspecific level (Barneby, 1991: 353).

Besides showing that *Mimosa* ser. *Setosae* and *M.* ser. *Pachycarpae* form a monophyletic group, but cannot be individualized from each other, Simon et al. (2011) also indicate, by sampling of two varieties of *M. setosa* (*M. setosa* var. *paludosa* and *M. setosa* var. *urbica*), that the species is not monophyletic. Although it has been used as a criterion for delimitation of species, monophyly does not necessarily should be applied at this level of biological hierarchy (Hennig, 1968). However, reciprocal illumination is still a valid procedure for evaluation of results and, in this sense, to find out that two marked varieties of the same species do not cluster together in a phylogenetic analysis may be an indication of inaccurate rank selection.

The analysis of specimens accumulated in herbaria after more than 20 years following Barneby's monograph, associated with study of natural populations and recent phylogenetic analysis (Borges *et al.* Chapter 1), reinforces the notion that the morphological features used to circumscribe infraspecific taxa in *Mimosa setosa* may be

Table 1. Bentham (1842, 1876) and Barneby's (1991) acknowledgment of taxa related to the latter's concept of *Mimosa setosa*. S. subsuming by Barneby (1991) of a taxon described by Bentham at species level; N. taxon described as new by Barneby (1991); =. taxon recognized at the same level by both authors.

Bentham	Barneby	Status
	M. setosa subsp. *setosa*	
M. setosa	var. *setosa*	S
	var. *pseudomelas*	N
M. setosa var. *nitens*	var. *nitens*	=
	var. *rupigena*	N
	M. setosa subsp. *paludosa*	
M. paludosa	var. *paludosa*	S
	var. *metadenotricha*	N
	M. setosa subsp. *urbica*	
	var. *urbica*	N
	var. *urbana*	N
	M. setosa subsp. *granitica*	N

used to define species. Hence, here we propose a new classification for those taxa.

Materials & Methods

Species concept

We review the taxonomy of *Mimosa setosa*, adopting the Phylogenetic Species Concept, which defines 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). Contrary to suggestions by McDade (1995) and adopted by Henderson (2004, 2005a, 2005b, 2011), species are treated as the least inclusive taxonomic level and thus, no infraspecific taxa are here recognized.

Species delimitation

Species were delimited based on external morphology and following an adaptation of the "population aggregation analysis" method of Davis & Nixon (1992: 430–432). Instead of using populations, however, the initial clusters of individuals were the infraspecific taxa recognized by Barneby (1991) within *Mimosa setosa* and closely related taxa, namely *M. melanocarpa* Benth., *M. occidentalis* var. *novo-galiciana* Barneby and *M. serpensetosa* L.M.Borges,.

The morphological qualitative and quantitative (coded by relational proportions) features analyzed (Appendix 1) were scored in a matrix produced with Mesquite 2.75 (Maddison & Maddison, 2011) and the varying ones retained for comparison (to be made available at MorphoBank). The differentiation between traits and characters was made based on the known variation for other taxa within *M.* ser. *Setosae* and species were delimited by the presence of at least one distinctive character.

Source of data

Herbarium specimens, including types, held in A, ALCB, B, BHCB, BM, CEN, CESJ, DIAM, ESA, F, G, HB, HBG, HRCB, HTO, HUEFS, HUFU, IAN, IBGE, K, LE, M, MG, MO, NY, OUPR, P, PAMG, R, RB, RFA, S, SP, SPF, UB, UEC, US, VIC, W (acronyms according to Thiers, 2014), and/or living plants observed in the field, were used as sources of morphological features, those utilized to evaluate taxa delimitation. The taxonomic treatment presents a list of selected specimens of each taxon, but a full list of analyzed and identified specimens is also given. When necessary, a microscope with 10–63 # magnification was used to analyze the specimens.

Most morphological features studied are qualitative, but some of them may be quantitative features coded by relational proportions (e.g. "Leaves, medial rachilla, length relative to the rachis"). Terminology follows Radford *et al.* (1976) and of Harris & Harris (2001), as well as Barneby & Grimes (1996) for venation patterns, Weberling (1989) for inflorescence typology, and Barroso *et al.* (1999) for fruit morphologies. Features peculiar to *Mimosa* follow Barneby (1991).

Results

As an upturn of the methods applied here we propose to break up *Mimosa setosa* into six species, four of which are new combinations of infraspecific taxa previously described (Barneby, 1991; Bentham, 1876). Also, two varieties described by Barneby (1991) are viewed as expressions of intraspecific morphological variation and, thus, synonymized.

TAXONOMIC TREATMENT

KEY TO SPECIES

1\. Leaflets secondary veins as prominent as primary ones; corolla lobes tomentose with filiform setae completely covering the surface (Chapada dos Veadeiros, Goiás) .... 1. *M. granitica*

– Leaflets secondary veins less prominent than the primary ones; corolla lobes pubescent with a combination of trichomes, and/or filiform setae, and/or glandular setae that do not conceal the lobes surface 2

2\. Branches, petioles, and rachides charged with triangular aculei, the latter with a broad longitudinally fusiform base .... 3. *M. paludosa*

– Branches, petioles and rachides lacking aculei, or rarely with conical aculei 3

3\. Filiform setae of branches antrorse, but not appressed; plane setae of calyx rim not laterally fused; corolla lobes lacking filiform setae; fruits partially articulate .... 2. *M. neonitens*

– Filiform setae of branches patent or forwardly appressed; plane setae of calyx rim laterally fused; corolla lobes mostly bearing filiform setae (rarely wanting in *M. setosa*); fruits completely articulate 4

4\. Subshrubs with humifuse or shortly ascending stems; indumentum of branches and leaves lacking glandular setae or almost so; glandular setae absent from leaflet margins; glomerules 19–24 # 11–13 mm .... 6. *M. urbica*

– Shrubs 1–3 m tall; indumentum of branches partially composed by glandular setae; glandular setae present on leaflet margins; glomerules 9–13 # 9–12 mm 5

5\. Indumentum of branches composed by forwardly appressed filiform setae with a bulbous base; leaves 5–8-jugate; floral bracts and fruits lacking filiform setae .... 4. *M. rupigena*

– Indumentum of branches composed by simple trichomes and patent filiform setae, which gradually taper from base to apex; leaves 13–16-jugate; floral bracts and fruits bearing filiform setae .... 5. *M. setosa*

1. Mimosa granitica (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa setosa* subsp. *granitica* Barneby (1991: 358–359). Type: Brazil. Goiás: Chapada dos Veadeiros, 20 km W of Veadeiros, granitic mountain at 1000 m [elev.], 16 February 1966, fl., *Irwin 12944* (holotype: UB!; isotypes: G!, GH!, K!, LE!, NY!, P!, R!, US!).

Figs. 1–2.

Virgate shrubs 1–2.5 m tall; branches thin, tortuous, unarmed or armed with slightly incurved to antrorse aculei ca. 1–4.2 mm long. *Indumentum* composed of simple trichomes, filiform setae with or without a bulbous base, and stipitate glandular setae with clavate head; branches, petiole, rachis, rachillas and peduncles varying from almost glabrous to pubescent or rarely tomentose with simple trichomes 0.2–0.4 mm long, patent or antrorse, but not appressed filiform setae 0.7–1.5 mm long, and patent glandular setae 0.2–0.5 mm long; when the indumentum is abundant, branches appear whitish, when it is sparse, shiny red-brown; stipules fully pubescent or only ciliate with the triple indumentum; leaflets ciliate with the triple indumentum, apex of abaxial surface of the latter sometimes pubescent with trichomes. *Leaves* 10–15-jugate, except for the usually 4–6-jugate ones near or at the reproductive axis; *stipules* 5–7 mm # 1–1.4 mm, narrowly triangular, plane to cymbiform (on reproductive axis), early caducous; *petioles* 2–6.5 mm long (attaining up to 25 mm long on leaves near the reproductive axis), 1.4–2.1 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; *rachis* 132–155 mm long, 0.8–1.5 mm diam., armed when branches aculeate, grooved on adaxial surface and with a laminar projection 1.1–1.7 mm long between each pinnae pair, terminal projection 2–5 mm long, linear or narrowly triangular; basal *rachillas* 12–27 mm long, medial rachillas 28–45 mm long, distal rachillas 32–53(67) mm long, all 0.5–0.7 mm diam., in 10–2 mm apart; *leaflets* 3.2–6.6 # 1.3–2.4 mm, in 10–17 pairs on basal rachillas, in 23–28 pairs on medial rachillas, 14–29 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.1–1.8 mm apart, apex rounded, rarely mucronulate, base oblique, subcordate, rounded-truncate, venation 5–6-palmate, primary and secondary veins equally prominent on abaxial surface; paraphyllidia 0.3–0.5 # ca. 0.1 mm, subulate. *Inflorescences* in pairs, distributed along terminal or axillar double-racemes, forming a bracteose paniculate synflorescence exserted from foliage. *Glomerules* 12–14 # 10–13 mm, almost spherical, axillar leaves not expanding after anthesis or fruit maturation; *peduncles* 14–34 mm long; *floral bracts* 4.9–5.2 # 1.2–1.4 mm, narrowly or regularly spatulate-acuminate, cymbiform, 1-nerved, tomentose with filiform setae 0.8–1.2 mm long and glandular setae 0.1–0.2 mm long, sometimes also with trichomes; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* 0.2–0.3 mm long; *calyx* 0.4–0.5 mm long, cupulate, lobes ca. 0.1 # 0.3–0.5 mm, very shallowly triangular or absent, rim ciliate with filiform and plane setae 0.5–0.7 mm long, sometimes fused at base, and rarely also glandular setae ca. 0.3 mm long, tube glabrous; *corolla* 4.8–5.3 mm long, infundibuliform, tube glabrous, lobes 1.1–1.5 # 1–1.5 mm, ovate, 1-nerved, vein apex not prominent, tomentose with filiform setae 0.3–0.5 mm long, sometimes trichomes also present, indumentum concealing lobes surface; *filaments* 15–19 mm long, glabrous, fused 0.5–0.8 mm at base, pink; *anthers* 0.6–0.7 # 0.7–0.8 mm, glabrous; *ovary* 1.1–1.3 # 0.5–0.8 mm, compressed, elliptic, margins tomentose with filiform setae 0.5–0.6 mm long, *stipe* 0.2–0.3 mm long, glabrous; *style* 12–14 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 40–70 # 9–12 mm, narrowly oblong, papery, reddish-brown, apex obtuse to rounded, aristate, base cuneate, completely pubescent with trichomes, antrorse filiform setae 1–1.3 mm long and patent glandular setae 0.2–0.4 mm long; *pedicel* 6–13 # 0.9–1.1 mm; *replum* 0.8–1.3 mm wide; *valves* completely breaking only after seed liberation into 9–13 *articles*, central ones 2.5–4.3 # 6.2–8.5 mm, narrowly transversely oblong, veins prominent; 9–13 *seeds* 4.8–5 # 3.8–4 mm, ovate, lentiform, shiny brown, pleurogram present.

Characterization: *Mimosa granitica* is distinguished from *M. paludosa*, its closest species by villi and filiform setae not occurring constantly (vs. constant); basal pinnae less than half the size of medial rachillas (vs. equally long); leaflet's secondary veins equally prominent to the primary ones (vs. less than the primaries); calyx rim with plane projections fused laterally (vs. free from each other); corolla lobes with filiform setae concealing its whole surface (vs. a combination of triple indumentum); fruits with a stipe at least 5 # longer than wide (Fig 1) (vs. less then 4 # longer than wide or just a small projection of the base).

Morphological notes: The variation in indumentum is striking in *Mimosa granitica*, as already noted by Barneby (1991: 358–359), who even segregated a few specimens as a different species early in his studies of the genus. Specimens may be aculeate or not, densely villous to almost glabrous, and with filiform setae varying from thin to more robust and almost spiniform. This latter characteristic highlights the relationship that may exist between filiform setae and aculei, since they could be understood as modified expressions of the same character. This supposed relationship, however, needs to be properly evaluated under anatomic and developmental analysis. The specimen *Irwin*

Figure 1. *Mimosa granitica*. A. Habit. B. Habit showing a branch that died by fire (DB) and a resprouted branch (SB). C. Detail of the root system (R) evidencing lack of xylopodium. D. Leaf. E. Detail of a leaf base showing one stipule and the sulcate petiole. F. Fruits.

33045, considered by (Barneby, 1991; 357–358) as an aberration, is a remarkable example of the morphological variation on indumentum that can be found in *M. granitica*.

Distribution and habitat: *Mimosa granitica* is endemic to *campos rupestres* of Chapada dos Veadeiros in northern Goiás at 1000–1400 m elevation.

Representative specimens examined: Brazil. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, Rodovia GO-118, Brasília - Monte Alegre de Goiás, ca. 7 km após Alto Paraíso, saída para o Hotel Fazenda Água Fria, 14°04'23.3" S, 47° 30'36.6" W, 1348 m elev., 15 December 2010, fr., *L.M. Borges et al. 511* (NY!, SPF!); Entroncamento entre a estrada GO 239 e a estrada para as Sete Lagoas, passando a leste do Morro da Baleia e pelo Peito de Moça, 14°09'44.2" S, 47°37'47.5" W, 1146 m elev., 20 March 2012, fl., fr., *L.M. Borges et al. 553* (NY!, SPF!); Ca. 12 km NW of Veadeiros, 1200 m elev., 19 October 1965, fr., *H.S. Irwin et al. 9276* (NY!, SPF, UB!); Ca. 20 km N of

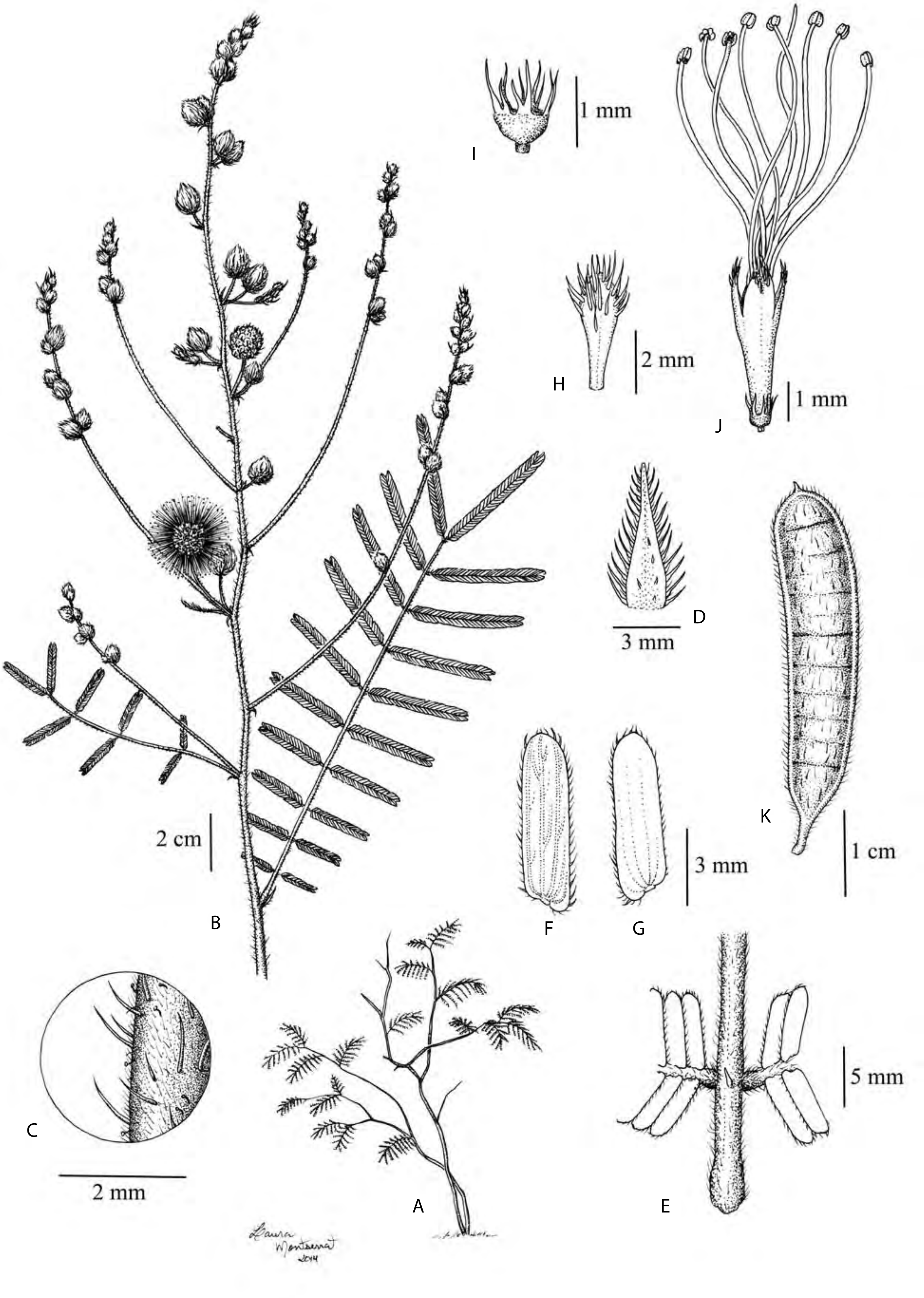

Figure 2. *Mimosa granitica*. A. Habit. B. Branch. C. Detail of the branch showing the indumentum. D. Stipule. E. Detail of the rachis with an interpinnal projection. F. Leaflet (abaxial face). G. Leaflet (abaxial face). H. Floral bract. I. Calyx. J. Flower. K. Fruit.

Alto Paraíso, ca. 1250 m elev., 19 March 1971, fl., *H.S. Irwin et al. 32231* (NY!, SPF!, UB!).

2. Mimosa neonitens (Benth.) L.M. Borges, ***nom.*** & ***stat. nov.***

Basionym: *M. setosa* var. *nitens* Bentham (1876: 387). Lectotype (designated by Barneby 1991): Brazil. [probably Minas Gerais:] Habitat ad Arrado Veljo (prov.?), fl., *Pohl 664*, (lectotype: W! [2 sheets]).

Figs. 3–4.

Shrubs 1–2 m tall, sometimes prematurely flowering with only 50 cm; branches thin, arising in fascicles from a xylopodium, unarmed. *Indumentum* composed of simple trichomes, filiform setae with or without a bulbous base, and stipitate glandular setae with clavate head; branches, petiole, rachis, rachillas and peduncles pubescent with simple trichomes ca. 0.2 mm long, antrorse, but not appressed filiform setae 1.1–3 mm long and patent glandular setae 0.2–0.6 mm long; sometimes trichomes restricted to adaxial surface of leaf-axes and only filiform setae present on branches; stipules and leaflets ciliate with the triple indumentum; indumentum rarely present on stipules abaxial face; leaflets sometimes lacking setae. *Leaves* 9–15-jugate, except for the usually 3–4-jugate ones at the reproductive axis; *stipules* 5.6–7 mm # 0.9–1.7 mm, lanceolate-acuminate, cymbiform, caducous; *petioles* 9–15 mm long, 1.1–1.3 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; *rachis* 75–150 mm long, 0.7–1(1.4) mm diam., grooved on adaxial surface and with a laminar projection 0.7–1.8 mm long between each pinnae pair, terminal projection 2.7–3.2 mm long, linear; basal *rachillas* 20–29 mm long, medial rachillas 38–66 mm long, distal rachillas 42–64 mm long, all 0.4–0.5 mm diam., 8.5–17 mm apart; *leaflets* 3.5–6.5 # 1.5–2.4 mm, in 13–20 pairs on basal rachillas, in 20–37 pairs on medial rachillas, in 22–37 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.2–2 mm apart, apex rounded, mucronulate, base oblique, subcordate, rounded-truncate, venation 4–5 palmate, primary veins slightly prominent only on abaxial surface; paraphyllidia 0.5–0.7 # 0.2–0.3 mm, subulate. *Inflorescence* a terminal or axillary exserted double-raceme of glomerules, usually forming a frondose paniculate synflorescence exserted from foliage. *Glomerules* 9–13 # 9–11 mm, spherical to slightly ellipsoid, 2–3-axillary to a suppressed leaf that expands after anthesis of its associate glomerule and is fully expanded during fruit maturation; on prematurely flowering specimens glomerules may be axillar to a fully developed leaf; *peduncles* 15–42 mm long; *floral bracts* 3–5 # 0.9–1.2 mm, narrowly acuminate-spatulate, cymbiform, 1-nerved, pubescent with trichomes, filiform setae 0.5–0.9 mm long and glandular setae 0.2–0.4 mm long; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* ca. 0.1 mm long; *calyx* 0.4–0.5 mm long, cupulate, lobes ca. 0.1 # 0.6 mm, very shallowly triangular, rim ciliate with trichomes, plane but not fused filiform setae 0.5–0.9 mm long (sometimes restricted only to less than half of the rim), and rarely also glandular setae ca. 0.3 mm long, tube glabrous; *corolla* 4–4.5 mm long, infundibuliform, tube glabrous, lobes 0.8–1.2 # 1.2–1.3 mm, ovate, 1-nerved, vein apex not prominent, pubescent with glandular setae ca. 0.1–0.3 mm long (rarely absent), sometimes trichomes also present, indumentum not concealing lobes surface; *filaments* 19–22 mm long, glabrous, fused ca. 0.5 mm at base, pink; *anthers* 0.7–0.8 # 0.7–0.8 mm, glabrous; *ovary* 1.2–1.4 # 0.5–0.7 mm, compressed, elliptic, margins tomentose with filiform setae 1–1.4 mm long and glandular setae 0.2–0.4 mm long, *stipe* 0.3–0.4 mm long, glabrous; *style* 20–20.5 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 26–47 # 9–11 mm, narrowly oblong, papery, greyish-brown, apex obtuse to rounded, aristate, base cuneate, completely pubescent with trichomes, and margins sometimes ciliate with filiform setae 1.2–1.8 mm long, as well as glandular setae 0.4–1.2 mm long; *pedicel* ca. 2–4

#1–1.5 mm; *replum* 1.3–1.5 mm wide; *valves* completely or partially breaking together with seed liberation into 4–9 *articles*, central articles 4–4.7 # 6.5–8 mm, transversely oblong; 4–9 *seeds* 4.7–5.5 # 3.1–3.5 mm, ovate, lentiform, shiny dark brown, pleurogram present.

Characterization: *Mimosa neonitens* stands as one of the most distinct taxa in the *M. setosa* complex, having particular dissimilarities to each other species, but differing from all by the branches with antrorse, but not appressed setae (vs. patent, or forwardly appressed). From *M. paludosa*, it differs by the absence of aculei and by the fruits partially articulated (vs. completely articulated). From *M. setosa*, it may be readily distinguished by the presence of xylopodium (vs. absence); presence of shallowly triangular calyx lobes (vs. absence); and fruits partially articulated (vs. completely articulated). In fact, *M. neonitens* strongly resembles *M. maguirei* Barneby (1991: 425–426), which is endemic to the Southern Espinhaço Range and readily distinguished by the glaucous glabrous stems and branches.

Morphological notes: Barneby (1991: 353) considered the calyx of *Mimosa neonitens* as "essentially" the same of *M. paludosa*, probably making a reference to the absence of fusion between the plane projections on the calyx rim in both taxa. In *M. neonitens*, however, the projections may be restricted to less than half of the rim. Fruits of *M. neonitens* are nitid, somewhat papery, lack both filiform and glandular setae on valves, and only partially break into articles; therefore those fruit features stand out as peculiar within the taxa related to *M. setosa*, all showing at least one type of setae on valves and usually completely articulated.

Distribution and habitat: *Mimosa neonites* is found in *campo rupestre*, *campo* in red clay, *cerrado* and *cerrado rupestre* of western Minas Gerais State, at 850–1050 m elevation. One record for woods (*Arruda 206*) is certainly erroneous. It is worth noting that one of the sites of occurrence of *Mimosa neonitens* and where it has been repeatedly collected, the campos rupestres of Morro das Pedras, in Coromandel, Minas Gerais (*Borges 1027*; *Irwin 25551*) is also where *M. lithoreas* Barneby (1991: 388–389) is known from only three collections. This highlights the importance of these areas for exploratory botanical surveys, before their particular flora becomes extremely endangered by the ongoing development of crop cultures already surrounding them.

Nomenclatural notes: Since the epithet "nitens" is previously occupied at species level by *Mimosa nitens* Benth., the use of a new name became necessary when treating this taxon at spcecific rank. Barneby (1991) indicates that the type was probably collected in Goiás, interpreting the unknown locality "Arrado Velho" as a corrupted form of "Corgo Vermelho". This is very unlike, since both names do not share any similarities in their Portuguese meaning, Old Plow and Red Stream, respectively. All modern collections of *Mimosa neonites*, however, have been made in *campos rupestres* in Minas Gerais State, some of them near the state northern border with Goiás State, where Pohl probably collected the type specimen when passing by Paracatu's environs in 1818 or 1820 (R. Mello-Silva pers. comm.)

Etimology: The name "*neonitens*" makes reference to the new (*neo*) rank here adopted for the taxon, named by Bentham (1876) in allusion to the plant's bright (*nitens*) leaflets.

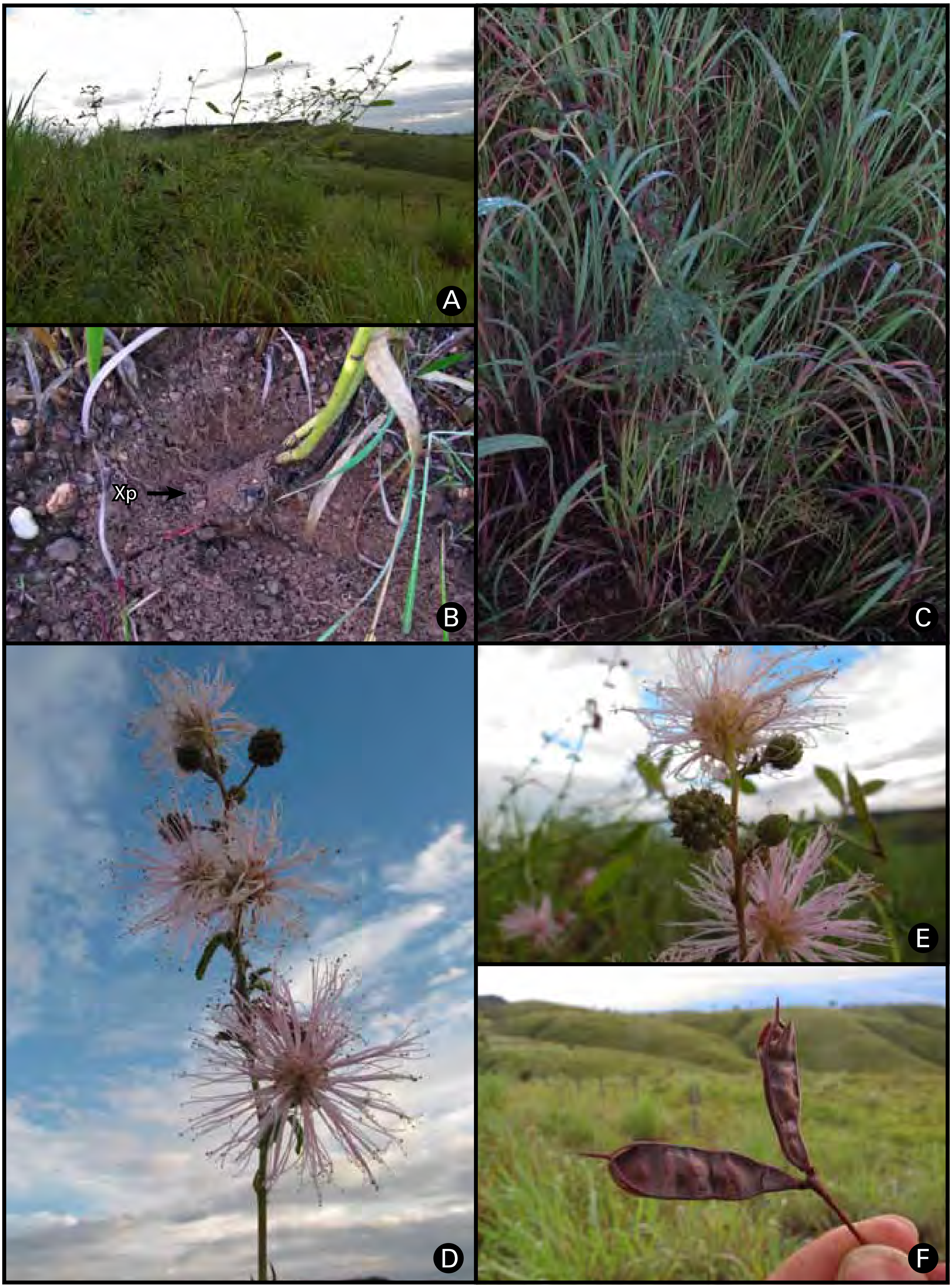

Figure 3. *Mimosa neonitens*. A. Habit. B. Detail of the root system evidencing the developed xylopodium (Xp). C. Virgate stem with leaves. D. Synflorescence axis with glomerules subtended by heterochronic leaves. E. Detail of the globose racemes. F. Fruits.

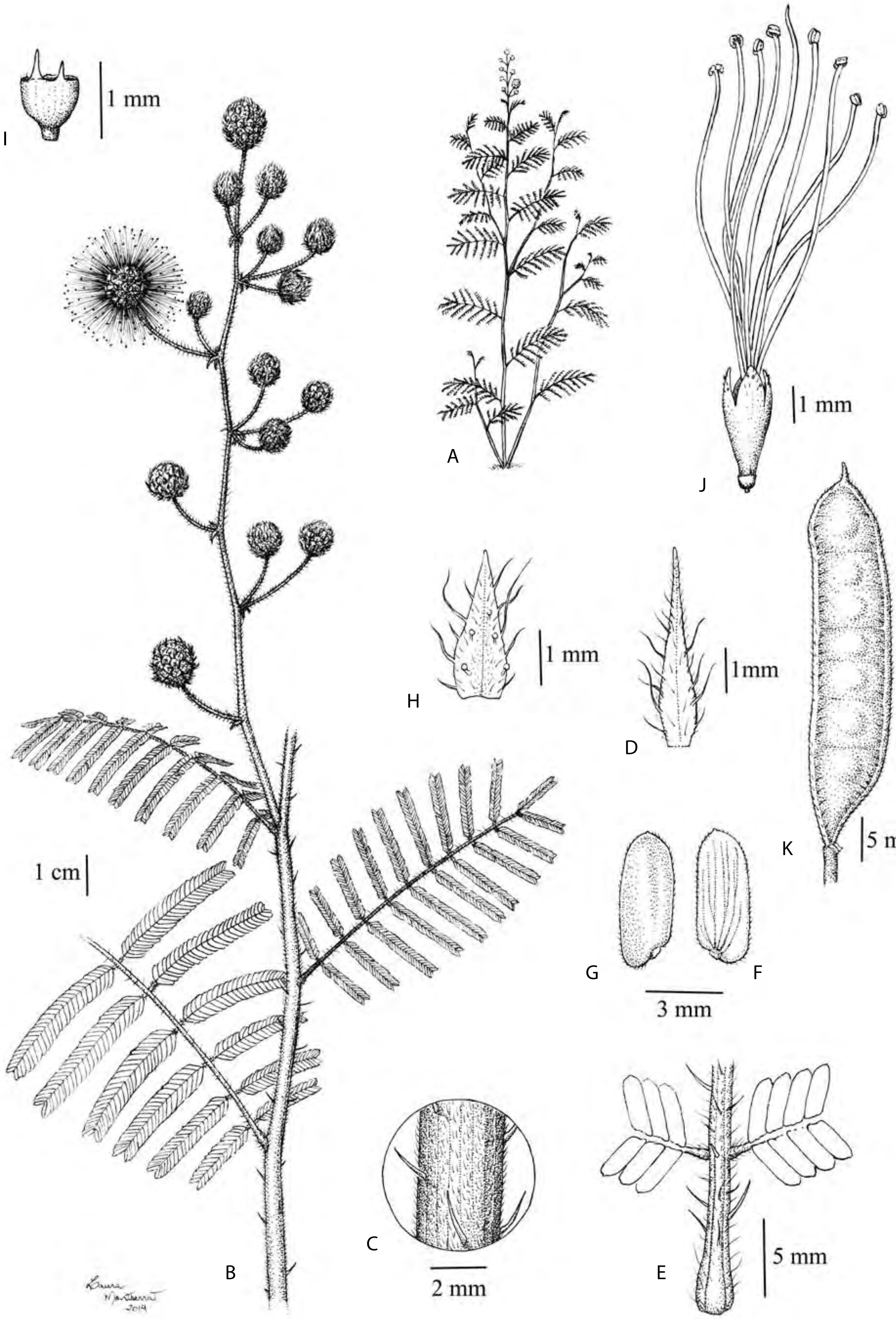

Figure 4. *Mimosa neonitens*. A. Habit. B. Branch. C. Detail of the branch showing the indumentum. D. Stipule. E. Detail of the rachis with an interpinnal projection. F. Leaflet (abaxial face). G. Leaflet (abaxial face). H. Floral bract. I. Calyx. J. Flower. K. Fruit.

SELECTED SPECIMENS EXAMINED: Brazil. Minas Gerais: Araguari, 40 km NO da cidade de Araguari, 25 May 1963, fl., *G.M. Magalhães 19266* (HB!, NY!); Araxá, 9 February 1956, fl., *A. Macedo 4285* (IAN!); [Coromandel ?], MG 188 (Patrocínio – Coromandel), beira de estrada, 18° 48' S, 46° 55' W, 28 February 1989, fl., *R.C. Mendonça et al. 1230* (CEN!, IBGE!, NY!); Coromandel, Rodovia MG 188, Coromandel–Patrocínio, 11 km do trevo de saída em Coromandel, 18°31'44.2" S, 47° 08'42.7", 28 March 2013, fl., fr., *L.M. Borges et al. 1027* (SPF!, NY!, RB!); Indianópolis, Fazenda Bela Tanda and neighbouring fazendas, 6 km NE of Indianópolis, Fazenda Seriema, 19°13'☝S, 47°57'☝W, 850 m elev., 02 March 1986, fl., *G.K. Gottsberger & J. Döring 118-2386* (NY!); [Patrocínio ?], ca. 25 km NE of Patrocínio, 1050 m elev., 20 January 1970, fl., *H.S. Irwin et al. 25551* (NY!); Perdizes, Estação Ambiental Galheiro, Mata da Aparecida, 14 February 2003, *R. Arruda et al. 206* (BHCB!, HUFU!); Perdizes, Estação Ambiental Galheiro, Macega, 7 March 2003, fl., fr., *E.H. Amorim et al. 697* (HUFU!).

3. Mimosa paludosa Bentham (1842: 400). Lectotype (designated by Barneby 1991): Brazil. Marshy [ground] near Barra do Jardim [7°35'S, 39°15'W in South Ceará (Barneby, 1991)], December 1838, *Gardner 1942* (lectotype: K!; isolectotypes: BM!, E, F!, G!, K!, NY!, P!, W!).

≡*Mimosa setosa* subsp. *paludosa* (Benth.) Barneby (1991: 354). *Mimosa setosa* var. *paludosa* [autonym generated by *M. setosa* var. *metadenotricha*].

=*Mimosa setosa* var. *metadenotricha* Barneby (1991: 354), ***syn. nov***. Type: Brazil. Distrito Federal: 3 km s. of Sobradinho, 1 May 1966, fl., *Irwin et al. 15523* (holotype: UB!; isotypes: G!, GH!, K!, LE!, MBM, NY!, P!, R!, S!, US!).

Figs. 5–6.

Shrubs to treelets 1–3 m; branches, petioles, rachides, and sometimes fruits margins armed with straight to inclined aculei 2–9 # 1–10 mm and with a broad and longitudinally fusiform base; those may also be antrorse and smaller, attaining only XX mm long. *Indumentum* composed of simple trichomes, filiform setae with or without a bulbous base, and stipitate glandular setae with clavate head; branches, stipules, petiole, rachis, rachillas and peduncles hirsute with simple trichomes 0.2–0.4 mm long, patent filiform setae 1–8.5 mm long, and patent glandular setae 0.4–2.5 mm long (the smaller setae present at leaflets and the larger ones at branches); leaflets ciliate with the triple indumentum. *Leaves* 4–11-jugate; *stipules* 10–12.5 mm # 0.6–1 mm, narrowly linear triangular to lanceolate-acuminate, plane, early caducous; *petioles* 15–30 mm long, 1.3–1.8 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; *rachis* 70–92 mm long, 0.8–1 mm diam., grooved on adaxial surface and with a spiculate or glandular projection 0.6–1.3 mm long randomly present between each pinnae pair, usually concealed by the indumentum, terminal projection 7–7.5 mm long; basal *rachillas* 30–35 mm long, medial rachillas 38–52 mm long, distal rachillas 48–64 mm long, all 0.3–0.5 mm diam., 9–17 mm apart, distance decreasing acroscopically; *leaflets* 4.5–7 # 1–1.5 mm, 24–25 pairs on basal rachillas, 25–30 pairs on medial rachillas, 26–37 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.3–1.6 mm apart, apex acute, mucronulate, base oblique, subcordate, rounded-truncate, venation 5-palmate, primary veins slightly prominent on abaxial surface; paraphyllidia 0.4–0.5 # 0.1–0.2 mm, subulate. *Inflorescences* in fascicles of 2–3 glomerules, distributed along terminal bracteose double-racemes exserted from foliage, axillar leaves partially developed during anthesis, fully expanding during fruit maturation. *Glomerules* 9–11 # 9–10 mm, spherical; *peduncles* 22–30 mm long; *floral bracts* 4.2–5.5 # 0.8–1.2 mm, narrowly spatulate-acuminate to spatulate-acuminate, cymbiform, tomentose with trichomes (sometimes absent), filiform setae 1–2 mm long, and glandular setae 0.3–0.5 mm long; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* ca. 0.2 mm long, glabrous; *calyx* 0.4–

0.7 mm long, cupulate, lobes lacking or ca. 0.1 # 0.5 mm, very shallowly triangular, rim ciliate with a random combination of trichomes, filiform setae 0.5–0.6 mm long, plane setae not fused at base ca. 0.5 mm long, and glandular setae 0.1–0.3 mm long, but never glabrous, tube usually glabrous, sometimes with filiform and glandular setae at the apex; *corolla* 4.5–4.8 mm long, infundibuliform, tube glabrous, lobes 0.9–1.6 # 1–1.4 mm, ovate, 1-nerved, vein apex prominent, pubescent with a random combination of trichomes, filiform setae 0.3–0.5 mm long, and glandular setae ca. 0.1 mm long, rarely completely glabrous, indumentum not concealing lobes surface; *filaments* 10–14 mm long, glabrous, fused 0.3–0.5 mm at base, pink; *anthers* 0.5–0.6 # 0.6–0.7 mm, glabrous; *ovary* 1.1–2.9 # 0.4–1.3 mm, compressed, elliptic, tomentose with filiform setae 0.8–1.3 mm long, and glandular setae 0.1–0.4 mm long, *stipe* 0.2–0.3 mm long, glabrous; *style* 7–13 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 53–82 # 9–10 mm, narrowly oblong, papery to chartaceous, brown, apex acute, aristate, base cuneate, completely pubescent with trichomes, antrorse filiform setae 1.3–1.7 mm long and patent glandular setae 0.5–1.5 mm long; *pedicel* 1.5–3 # 1–1.3 mm; *replum* 1.1–1.4 mm wide; *valves* completely breaking together with seed liberation into 7–10 *articles*, central ones 6–6.5 # 7.5–8 mm, transversely widely oblong, veins not prominent; 7–10 *seeds* 4.5–5 # 4.1–4.5 mm, widely ovate, lentiform, shiny brown, pleurogram present.

Characterization: Most morphological features that may be used do distinguish the other species in the *Mimosa setosa* complex are variable within *Mimosa paludosa*, posing a problem for its circumscription. However, the presence of straight to slightly inclined aculei is constant on individuals of the species, a feature that is shared with *M. granitica* and rarely with *M. setosa*, but these may be differentiated by the prominence of leaflets secondary veins of the first, and the absence of prickles on petioles and rachis, and by the calyces with plane projection laterally fused of the latter. The absence of fusion between such structures on the calyx of *M. paludosa* is shared with *M. granitica* and *M. neonitens*, but the latter is distinguished by its partially articulated fruits and presence of a xylopodium (see also characterization section of each mentioned species for particular further details).

Morphological notes: Although the presence of a few features are constant in *Mimosa paludosa*, most of its other characters are prone to variation. As Barneby (1991: 354) noted, particularly the indumentum is variable in density, length and composition. Even though the triple indumentum tends to be constantly present in branches, corollas may have almost all possible combinations of trichomes with filiform setae and glandular setae. Length of filiform setae on floral bracts is a varying feature that is particularly notable, but, at the same time, misleading, since it does not occurs in a pattern that would allow segregation of potential taxa. At the mountains of Chapada Diamantina, in the Bahia state, and Grão Mogol, in Minas Gerais state, those are randomly present in specimens that also have thicker and broader fruits, and that appear to differ from typical *M. paludosa* specimens (e.g. *Harley et al. 25771*, *Ganev 1940*, *Mello-Silva 1445*, *Barreto CFCR 12097*). However, up to now, no character state clearly supports their recognition as a different species, and they may fit the same scenario as *M. setosa* var. *metadenotricha* (discussed below). We stress those populations should be further investigated. Metric variation of parts is also observed in specimens of *M. paludosa* and are prominent on overall size of leaves and their number of parts, as well as size of glomerules.

Distribution and habitat: In natural environments *Mimosa paludosa* occurs on riverine forest or areas with sandy

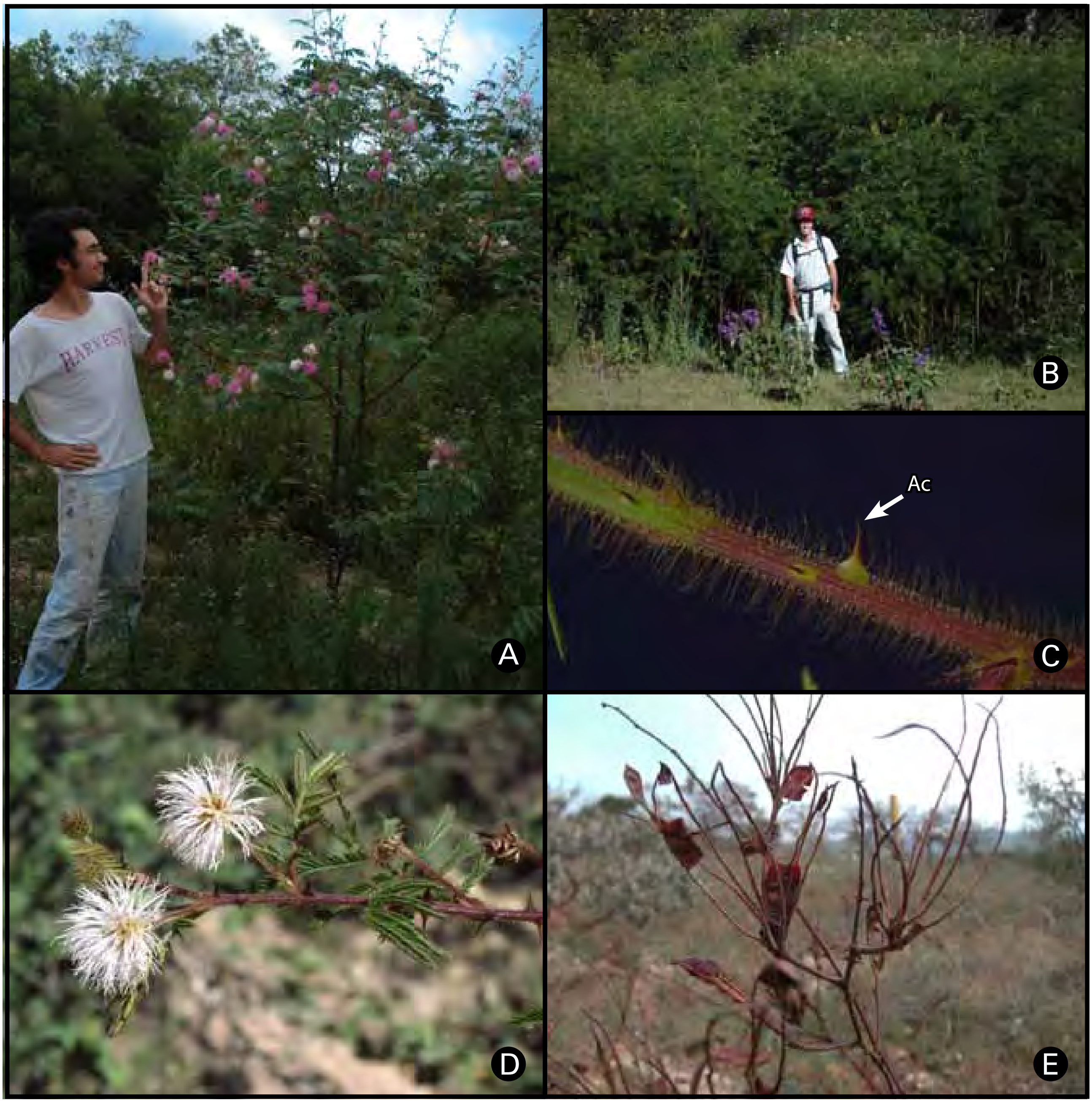

Figure 5. *Mimosa paludosa*. A. Habit. B. Densely clustered individuals. C. Detail of a branch evidencing the aculeus (Ac). D. Synflorescence. E. Fruits after breakage of the valves.

or sandy to clayey, marshy grounds of *cerrado*, *campos rupestres*, and *rain forest*. The species is also an opportunistic weedy, able to grow in different types of disturbed areas, such as pastures and roadsides, but apparently limited by some level of permanent humidity. It presents the widest distribution area of all species within *M.* ser. *Pachycarpae*.

Taxonomic notes: The inclusion of *Mimosa setosa* var. *metadenotricha* under synonymy of *M. paludosa* reflects the recognition of the latter as a morphologically plastic species. Segregation of these taxa as different entities would serve as a basis to name many geographical variants of the species and promote description of taxa that are only visually dissimilar. To that may be added that Barneby (1991) was wrong in considering the variety as ecologically distinct by occurrence in dry environments. The type of *M. setosa* var. *metadenotricha*, in fact, was not collected in such places, but in a "creek margin", the typical environment of occurrence of *M. paludosa*. There is evidence that older specimens that can be identified as *M. setosa* var. *metadenotricha* (e.g. *Glaziou 21052*) were probably also collected

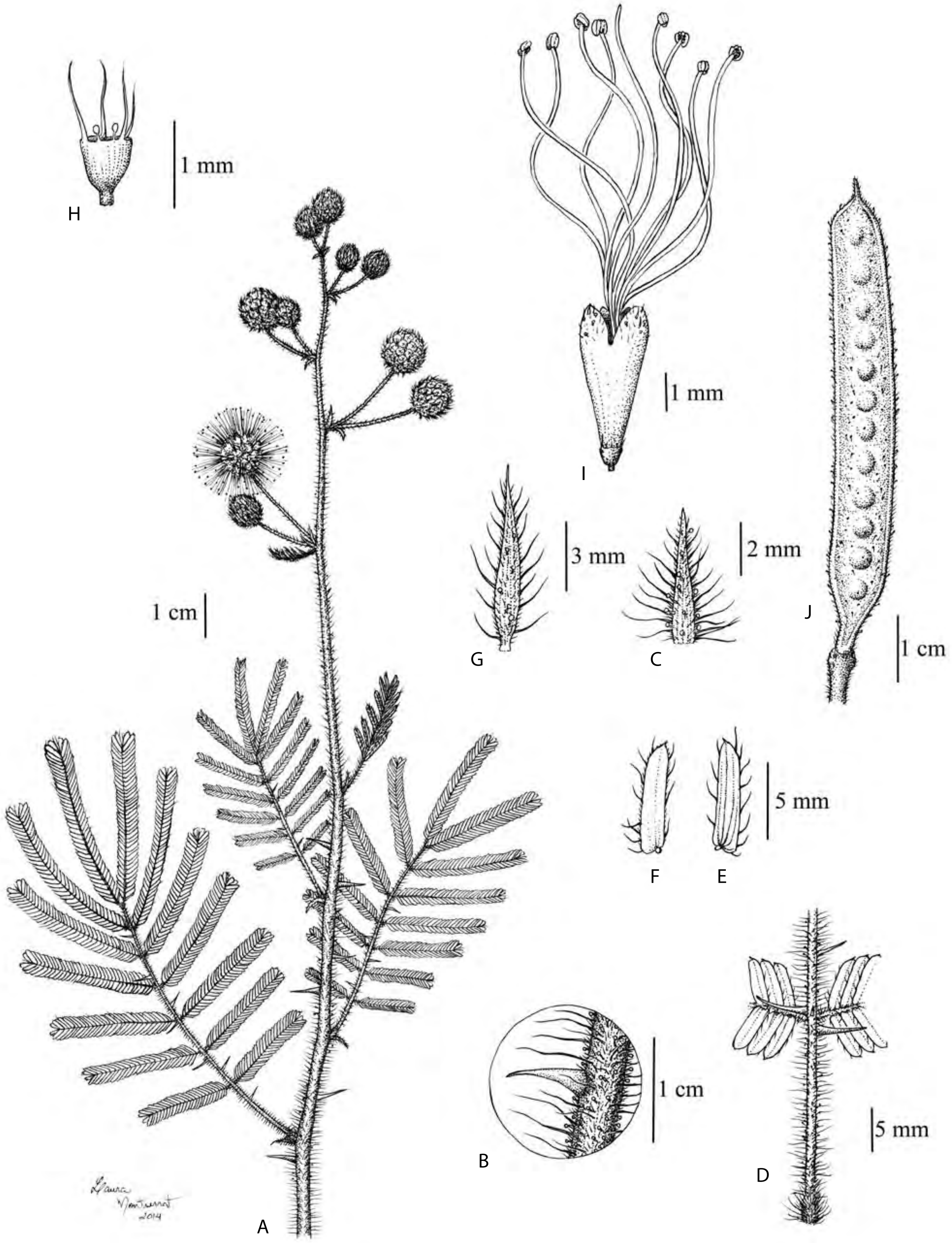

Figure 6. *Mimosa paludosa*. A. Branch. B. Detail of the armate branch showing the indumentum. C. Stipule. D. Detail of the aculeate rachis with an interpinnal projection. E. Leaflet (abaxial face). F. Leaflet (abaxial face). G. Floral bract. H. Calyx. I. Flower. J. Fruit.

near streams or marshes.

On the other hand, *Mimosa occidentalis* var. *novo-galiciana* Barneby is excluded from the synonyms' list, based on the presence of filiform setae on stipules, and leaflets margin (vs. present); secondary veins of leaflets as prominent as the primary ones (vs. not less prominent); elliptic-rhombic floral bracts (vs. spatulate-acuminate); and ovate calyx lobes (vs. absent or very shallowly triangular). In fact, *M. occidentalis* var. *novo-galiciana* appears to be indeed a taxon of *Mimosa* ser. *Neptunioideae*, where it was included by Barneby (1991). Although we do agree that this taxon should not be treated as a variety of *M. occidentalis*, it was mistakenly equated with *M. paludosa* by Grether (2000).

Recently described species share morphological characters with *Mimosa paludosa*, particularly indumentum and armature of branches, but differ from it either by habit, or floral features, as well as particular leaf morphology (Borges *et al.*, 2014).

Selected specimens examined: Brazil. Acre: Rio Branco, Rodovia BR 364, 30 April 1995, L.C.L. Meneses Filho 11 (NY!). Amazonas: Coari, Base de Operações Geólogo Pedro de Moura, Estrada para o porto Evandro, 4°77'20" S, 65°43'10" W, 24 September 2008, J.S. Sousa 100 (MG!); Presidente Figueiredo, na beira da BR 174, próxima ao município, 15 December 2011, fl., M.F. Santos & M.T.C. Watanabe 771 (NY!, SPF!). Bahia: Abaíra, Chapada Diamantina, Catolés, descida do Morro do Bicota, 13°19'46" S, 41°51'20" W, 1503 m elev., 30 May 2003, M.J.G. Andrade 334 (HUEFS!); Barra da Estiva, Chapada Diamantina, Morro de Ouro, 13°35' S, 41°18' W, 25 September 2010, M.L. Guedes 17677 (ALCB!); Catolés, caminho para o Guarda-Mor, 13°18'18" S, 41°51'55" W, 1230 m elev., 13 May 2000, Miranda Silva, E.B. 418 (HUEFS!); Lençóis, Vale do Rio São José, Área das antigas lavras de diamantes, 22 May 1998, R. Funch 47 (HUEFS!); Maracás, Fazenda Pantanal, 13°27'17" S, 40°24'00" W, 845 m elev., 3 October 2009, L. Pando 1 (HUEFS!); Rio de Contas, Pico das Almas, 13°34'45" S, 41°48'41" W, 10 April 1999, R.C. Forzza 1162 (NY!, RB!); Rio do Pires, beira do riacho da Forquilha, 13°54’ S, 42°29’ W, 1500 m elev, 24 July 1993, fr., W. Ganev 1940 (HUEFS!, SPF!). Ceará: São Benedito, Inhuçu, Serra da Ibiapaba, 4°02'55" S, 40°51'54" W, 24 July 1971, A.G. Fernandes s.n. (NY!). Distrito Federal: Brasília, Cachoeira do Colorado, próximo à fábrica de asfalto, 15°35' S, 47°53' W, M.F. Simon 61 (UB!); Espírito Santo: Linhares, Reserva Natural da CVRD, estrada peroba amarela, km 1.2, 7 July 2006, *L.M. Borges 119* (CVRD!, SPF!).Goiás: Caiapônia, Córrego d'Anta, ca. 40 km S. of Caiapônia, road to Jataí, Serra do Caiapó, [17°15'00" S, 51°48'00" W,] 900 m elev., 26 June 1966, H. S. Irwin 17728 (LE!, NY!, UB!); Caldas Novas, Near Caldas Novas, [17°44'31" S, 48°37'29" W,] 730 m elev., 11 July 1987, S.Tsugaru B-142 (NY!); Morrinhos, 17°49'22" S, 49°03'39" W, C.E.B. Proença, 2003 (HUFU!, UB!, UFG!); Maranhão: Entrada para Ouro Preto, 2 October 1997, S.M. de Faria 1377 (RB!); Mato Grosso: Nossa Senhora do Livramento, about 5 km southeast of Pirizal village along the trail to Coqueiro Lake, 16°14' S, 56°15' W, 120 m elev., 15 July 1993, M. Schessl 3384 (NY!); São José do Rio Claro, Estrada de terra em direção ao Rio Arinos, 13°18'43" S, 56°43'40" W, 26 April 1997, A. Rozza 332 (ESA!). Mato Grosso do Sul: 20 km road Aparecida do Tabuado-Paranaíba, 27 April 1981, J.A. Winder 153 (K); Rio Verde, Sete Quedas, [18°56'19" S, 54°54'07" W,] 8 August 1997, G. Hatschbach 66574 (ESA!, HBG!, MBM!, NY!). Minas Gerais: Diamantina, Estrada Mendanha–Inhaí, margens do Rio Jequitinhonha, 18°02’40” S, 43°32’48” W, elev. ca. 700 m, 6 February 2009, fl., L.M. Borges 390 (NY!, SPF!); Grão Mogol, Córrego da Escurinha, 16°35’ S, 42°57’ W, 750 m elev., 29 May 1988, fl., R. Barreto et al. CFCR 12097 (HUEFS!, K!, SPF!); Grão Mogol, Ribeirão dos Bois, próximo à estrada para o Rio Ventania, 780 m elev., 28 September 1997, fr., R. Mello-Silva 1445 (HUEFS!, SPF!); Itabirito, Pico do Itabirito, 26 May 1994, Teixeira, W.A. 25034 (UEC!); Paracatu, 20 June 1964, fl., fr., J.M. Pires 58053 (NY!, SPF!); Santana do Riacho, Serra do Cipó, Ao longo da Rodovia MG-010, km 128, área de grande voçorosa em solo de quartzo-arenito próximo à estrada, do lado direito da rodovia sentido Santana do Riacho–Conceição do Mato Dentro, 19°14'10" S, 43°31'06" W, 1285 m elev., 15 June 2007, M. Groppo 1411 (RB!, SPF!); São Roque de Minas., Parque Nacional da Serra da Canastra, na beira da estrada antes da cabeceira do Rio Sao Francisco, 20°10'17" S, 46°39'52" W, 1396 m elev., 14 July 1997, J. A. Lombardi 1902 (NY!). Pará: Belém, Ramal de entrada na area da APEG, próximo à estrada do CEASA, 4 January 2000, M.R. Cordeiro 4809 (IAN!, K!); Itaituba, Parque Nacional da Amazônia, Base URUA - BR-166, 11 August

2010, T.B. Flores 759 (ESA!). Paraná: Cornélio Procópio, Arredores de Cornélio Procópio, 29 August 1996, F. Silva Chagas 1952 (HUEFS!, K!). Pernambuco: Buíque, Vale do Catimbau, Trilha da Cachoeira, 24 January 2006, A. Bocage 1079 (HUEFS!). Piauí: G. Gardner 1942 (BM!, G!, NY!, W!). São Paulo: Altinópolis, 6 km Altinópolis-Batatais, 9 May 1981, J.A. Winder 193/A (K!); Barretos, Região do Ribeirão Anhumas, 20°26' S, 48°50' W, 18 March 1997, E.D. Castellani, 185 (HRCB!); São Carlos, Fazenda São José do Lobo, 22°15'45'' S, 47°53'53'' W, 4 May 1994, K.D. Barreto 2414 (ESA!). Rio de Janeiro: Cachoeiras de Macau, 6 distrito, Fazendas consorciadas - Fazenda Sertão, 22°27'25'' S, 42°49'64'' W, 120 m elev., 2 October 2000, F.B. Pereira 0638 (RB!); Itaboraí, Entre os rios Ceceribu e Macacu, Ponto 3, Amostra Aires 1768, 22°39’26” S, 42°53’37.4” W, 10 August 2008, fr., A. Rodarte 3A (RB!). Rondônia: Porto Velho, Vila de Nova Califórnia, BR-364, Ramal da Mendes Júnior, Rio Azul, Área indígena de Caxarari, 27 October 1997, L.C.B. Lobato 2253 (MG!). Vilhena, Arredores do aeroporto, 24 May 1979, M.G. Silva 4632 (MG!). Paraguay. Amambay: Bella Vista, Rio Aquidaban, camino de Ruta 5 a Bella Vista, 23 June 1977, A. Krapovickas 32594 (CTES, K!, NY!).

4. Mimosa rupigena (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *M. setosa* var. *rupigena* Barneby (1991: 357–358). Type: Brazil. Minas Gerais: Gouveia, 6 September 1971, fl., fr., *Hatschbach 27302* (holotype: NY!; isotypes: HBG!, MBM).

Fig. 7.

Shrubs 0.50–2 m tall; unarmed. *Indumentum* composed of simple trichomes, filiform setae with bulbous base, and stipitate glandular setae with clavate head; branches, petiole, rachis, rachillas and peduncles pubescent with filiform setae 1.2–2 mm long, petiole, rachis, rachillas also with a few sparse glandular setae ca. 0.2 mm long, rachillas and peduncles also with trichomes ca. 0.1 mm long, the filiform setae, which are forwardly appressed on branches, become antrorse, but not appressed on peduncles and synflorescence axes; leaflets completely pubescent with trichomes and ciliate with filiform setae and less frequently a few glandular setae. *Leaves* 5–8-jugate; *stipules* 3.5–7 mm # 0.3–0.5 mm, linear, plane, ciliate with trichomes and filiform setae, early caducous; *petioles* 31–42 mm long, 0.9–1.2 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; *rachis* (50)70–90 mm long, 0.8–1 mm diam., grooved on adaxial surface and with a spiculate projection 0.8–1.7 mm long between each pinnae pair, terminal projection 2–3.5 mm long, linear; basal *rachillas* 30–45 mm long, medial rachillas 50–60 mm long, distal rachillas 60–74 mm long, all 0.4–0.5 mm diam., 10–17 mm apart; *leaflets* 3–6.3 # 1.3–1.7 mm, (15–)29–30 pairs on basal rachillas, 20–41 pairs on medial rachillas, 33–40 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.5–2 mm apart, apex rounded, mucronulate, base oblique, subcordate, rounded-truncate, venation 4–5-palmate, sometimes veins slightly prominent only on abaxial surface; paraphyllidia 0.5–0.7 # 0.2–0.3 mm, subulate. *Inflorescences* arranged in fascicles of 1–2 distributed along double-racemes, organized in a terminal, exserted from foliage, bracteose, and paniculate synflorescence. *Glomerules* 9–13 # 9–12 mm, spherical, development of axillar leaves not observed during or after fruit maturation; *peduncles* 12–24 mm long; *floral bracts* 5.9–6.8 # 0.8–1 mm, narrowly acuminate-spatulate, cymbiform, 1-nerved, hirsute with filiform setae 1.8–2.5 mm long; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* 0.1–0.2 mm long; *calyx* 0.2–0.5 mm long, cupulate, lobes absent, rim ciliate with plane setae 1.6–2.7 mm long, irregularly fused at base, tube glabrous; *corolla* 3.5–5 mm long, infundibuliform, tube glabrous, lobes 1–1.6 # 0.9–1.2 mm, ovate, 1-nerved, vein apex not prominent, pubescent with trichomes ca. 0.1 mm long, filiform setae 0.9–1.4 mm long, and glandular setae ca. 0.2 mm long, indumentum not concealing lobes surface; *filaments* 11–14 mm long, glabrous, fused ca. 0.2 mm at base, pink; *anthers* ca. 0.5 # 0.5–0.6 mm, glabrous; *ovary* 1–1.3 # 0.5–0.7

mm, compressed, elliptic, margins tomentose with filiform setae 1– mm long and glandular setae 0.1–0.2 mm long, *stipe* 0.2–0.3 mm long, glabrous; *style* 13–14 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 28–43 # 9–12 mm, narrowly oblong, papery, dark-brown, apex obtuse to rounded, obliquely aristate, base cuneate, completely pubescent with trichomes (this sometimes lacking on old fruits) and hirsute with filiform setae 2–2.5 mm long and glandular setae 0.4–1.8 mm long, the latter more abundant; *pedicel* 0.8–2.3 #1.3–1.4 mm; *replum* 0.8–1.3 mm wide; *valves* partialy and irregularly breaking long after seed liberation; *seeds* not seen.

Characterization: *Mimosa rupigena* is the only species within the complex to present forwardly appressed caulinae setae. Particularly, it differs from *M. paludosa* and *M. setosa* by the absence of glandular setae on branches and floral bracts (vs. presence) and by leaves not developing on synflorescences axes after maturation of the fruits (vs. developing). Additionally, it lacks the prickles which are always present in *M. paludosa*. From *M. neonitens*, it may be distinguished also by its bracteose synflorescence (vs. frondose), by the presence of trichomes on leaflets surface (vs. absence) and of plane projections throughout the calyx rim.

Morphological notes: The fruit indumentum is mainly composed by thick glandular setae, which may lose their heads with time, seeming to be filiform setae. The latter are less frequent, but easily observed on young fruits, whose very slim tips allow clear distinction from the capitate glandular ones.

Distribution and habitat: *Mimosa rupigena* is restricted to *campos rupestres* and *cerrados* with rock outcrops and rocky soils from the Diamantina plateau, located at the Espinhaço Range in the state of Minas Gerais.

Representative specimens examined: Brazil. Minas Gerais: Datas, Rodovia Diamantina–Gouveia (BR 367), 18°20'54" S, 43°40'60" W, ca. 1350 m elev., 5 February 2009, fr., *L.M. Borges et al. 370* (SPF!, NY!); Diamantina, Biribiri, Alto da Sentinela, 646170/7988977, 1100 m elev., 16 September 2004, fl., *C.V. Mendonça et al. 1141* (DIAM!); Gouveia, Fazenda Prata (de Everaldo GonçalvesP, 19 July 1980, fl., *J. Semir et al. CFCR 179* (F, NY!, SPF!); Gouveia, Córrego do Tigre, 14 September 1985, fl., fr., *G. Hatschbach & R. Kummrow 49667* (K!, MBM, NY!, SPF!).

5. Mimosa setosa Bentham (1842: 404). Type: Brazil. Goiás: ad Rio São Marcos [locality in Bentham (1876) (Barneby, 1991)], December 1818, *Pohl 846* (=*d. 1409*) (holotype: K (herb. Benth.)!; isotypes: F!, K (herb. Hooker)!, NY!, W!).

=*Mimosa formosana* Taubert (1896: 433). Lectotype (designated by Borges & Pirani 2014): Brazil. Goiás: [Formosa], "prope Formosa", September 1894, fl., *E. Ule 2827* (lectotype HBG! [also annotated as "N° 4"; "Chapadões bei Formosa"]); synonymized by Barneby (1991).

=*Mimosa setosa* subsp. *setosa* var. *pseudomelas* Barneby (1991: 356–357), ***syn. nov***. Lectotype (designated by Barneby 1991): Brazil. São Paulo: ad Vila de Batatais, fl., fr., *Regnell III/510* [*Ser. III n° 510*] (lectotype: K!; isotypes: S!).

Figs. 8–9.

Shrubs 0,5–3 m tall; generally unarmed, but seldom with patent aculei ca. 1.5 mm long and 0.3–0.4 mm wide at the circular base, usually at the older portions of branches and, (hence rarely represented on exsiccatae), sometimes occurring on apical portions and leaf rachis. *Indumentum* composed of simple trichomes, filiform setae with bulbous base,

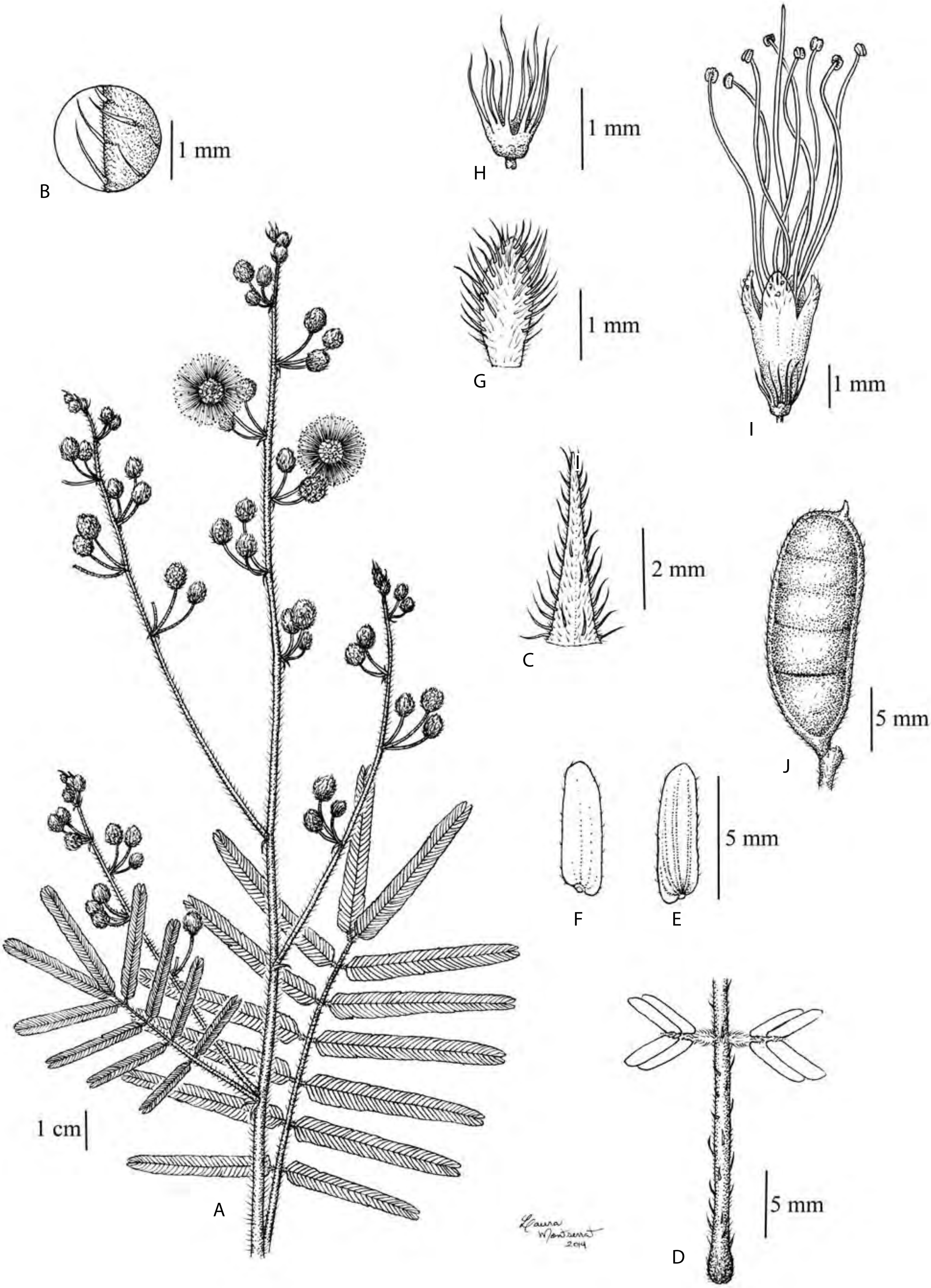

Figure 7. *Mimosa rupigena*. A. Branch. B. Detail of the branch showing the indumentum. C. Stipule. D. Detail of the rachis with an interpinnal projection. E. Leaflet (abaxial face). F. Leaflet (abaxial face). G. Floral bract. H. Calyx. I. Flower. J. Fruit.

and stipitate glandular setae with clavate head; branches, petioles, rachides, rachillas and peduncles pubescent with simple trichomes 0.3–0.4 mm long, filiform setae 1.4–3.3 mm long, and glandular setae 0.5–1 mm long; leaflets ciliate with the triple indumentum and sometimes pubescent with trichomes on both surfaces. *Leaves* 13–16-jugate; *stipules* 3.5–7 mm # 0.3–0.5 mm, linear, plane, ciliate with trichomes and filiform setae, early caducous; *petioles* 24–27 mm long, 2–2.7 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; *rachis* 170–258 mm long, 1.2–1.6 mm diam., grooved on adaxial surface and with a laminar projection 1.1–2 mm long between each pinnae pair, terminal projection 5.5–6 mm long, linear; basal *rachillas* 36–41 mm long, medial rachillas 43–58 mm long, distal rachillas 40–50 mm long, all 0.4–0.5 mm diam., 7–15 mm apart; *leaflets* 2.8–4.8 # 0.8–1.2 mm, in 31–41 pairs on basal rachillas, in 31–50 pairs on medial rachillas, in 35–40 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.2–1.4 mm apart, apex rounded, base oblique, subcordate, rounded-truncate, venation 3[?]-palmate, veins not prominent; paraphyllidia 0.4–0.7 # ca. 0.2 mm, subulate. *Inflorescences* arranged in fascicles of 1–2 distributed along double-racemes, organized in a terminal, usually exserted from foliage, bracteose, and paniculate synflorescence; sometimes inflorescences may be nested in the foliage, instead of exserted in a secondary synflorescence. *Glomerules* 9–13 # 9–12 mm, spherical, development of axillar leaves not observed during or after fruit maturation; *peduncles* 12–24 mm long; *floral bracts* 5.9–6.8 # 0.8–1 mm, narrowly acuminate-spatulate, cymbiform, 1-nerved, hirsute with filiform setae 1.8–2.5 mm long; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* 0.1–0.2 mm long; *calyx* 0.2–0.5 mm long, cupulate, lobes absent, rim ciliate with plane setae 1.6–2.7 mm long, fused irregularly at base, tube glabrous; *corolla* 3.5–5 mm long, infundibuliform, tube glabrous, lobes 1–1.6 # 0.9–1.2 mm, ovate, 1-nerved, vein apex not prominent, pubescent with trichomes ca. 0.1 mm long, filiform setae 0.9–1.4 mm long, and glandular setae ca. 0.2 mm long, indumentum not concealing lobes surface; *filaments* 11–14 mm long, glabrous, fused ca. 0.2 mm at base, pink; *anthers* ca. 0.5 # 0.5–0.6 mm, glabrous; *ovary* 1–1.3 # 0.5–0.7 mm, compressed, elliptic, margins tomentose with filiform setae 1– mm long and glandular setae 0.1–0.2 mm long, *stipe* 0.2–0.3 mm long, glabrous; *style* 13–14 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 28–43 # 9–12 mm, narrowly oblong, papery, dark-brown, apex obtuse to rounded, obliquely aristate, base cuneate, completely pubescent with trichomes (this sometimes lacking on old fruits) and hirsute with filiform setae 2–2.5 mm long and glandular setae 0.4–1.8 mm long, the latter more abundant; *pedicel* 0.8–2.3 # 1.3–1.4 mm; *replum* 0.8–1.3 mm wide; *valves* partially and irregularly breaking long after seed liberation; *seeds* not seen.

Characterization: *Mimosa setosa* stands out as a distinct species from *M. paludosa* by the absence of aculei on the petiole and rachis (vs. presence), and plane setae of calyx rim laterally fused, and from *M. urbica* mainly for being a shrub (vs. a trailing subshrub).

Morphological notes: Very rarely, *Mimosa setosa* may present a few aculei scattered on branches (*e.g. Borges 1008*; *Heringer 12242* Irwin). Those, however, are somewhat conical and smaller than the ones occurring in *M. paludosa*, which are usually triangular, with a broad longitudinally fusiform base.

Distribution and habitat: Mimosa setosa occurs in soils with red clay of *cerrados* in the states of Goiás, São Paulo and at the Federal District.

Taxonomic notes: Barneby (1991) noted the striking affinity between *Mimosa setosa*, *M. melanocarpa* and *M. setosa* var. *pseudomelas*, and also pointed how Bentham changed his mind about naming specimens of the latter, naming it initially as *M. setosa* and later as *M. melanocarpa* (Barneby 1991: 357). *M. setosa* var. *setosa* and *M. melanocarpa* differ by several characters, notably the stipitate fruit and the abundant presence of filiform setae on pedicels of the latter (referred by Barneby [1991] as being located on the calyx tube). *M. setosa* var. *pseudomelas* also posses many differences from *M. melanocarpa*, but all of them are shared with *M. setosa* var. *setosa*, from which it differs only by the absence of filiform setae on fruits. In this way, *M. setosa* var. *pseudomelas* is only transitional between *M. setosa* var. *setosa* and *M. melanocarpa* when the presence of stipitate fruits is taken into account. This character, however, is variable and fruits of *M. setosa* var. *pseudomelas* may be stipitate or sessile even in the same specimen (e.g. *Handro 738*). Barneby (1991) also used lack of interpinnal projections to distinguish *M. setosa* var. *pseudomelas*. However, study of specimens that could be ascribed to this variety, prominently the isotype at US, reveal the presence of interpinnal projections, which are fragile and prone to detach from the rachis upon manipulation, leaving an almost imperceptible scar. This would explain their overall absence in specimens analyzed by Barneby and his inaccurate use of that

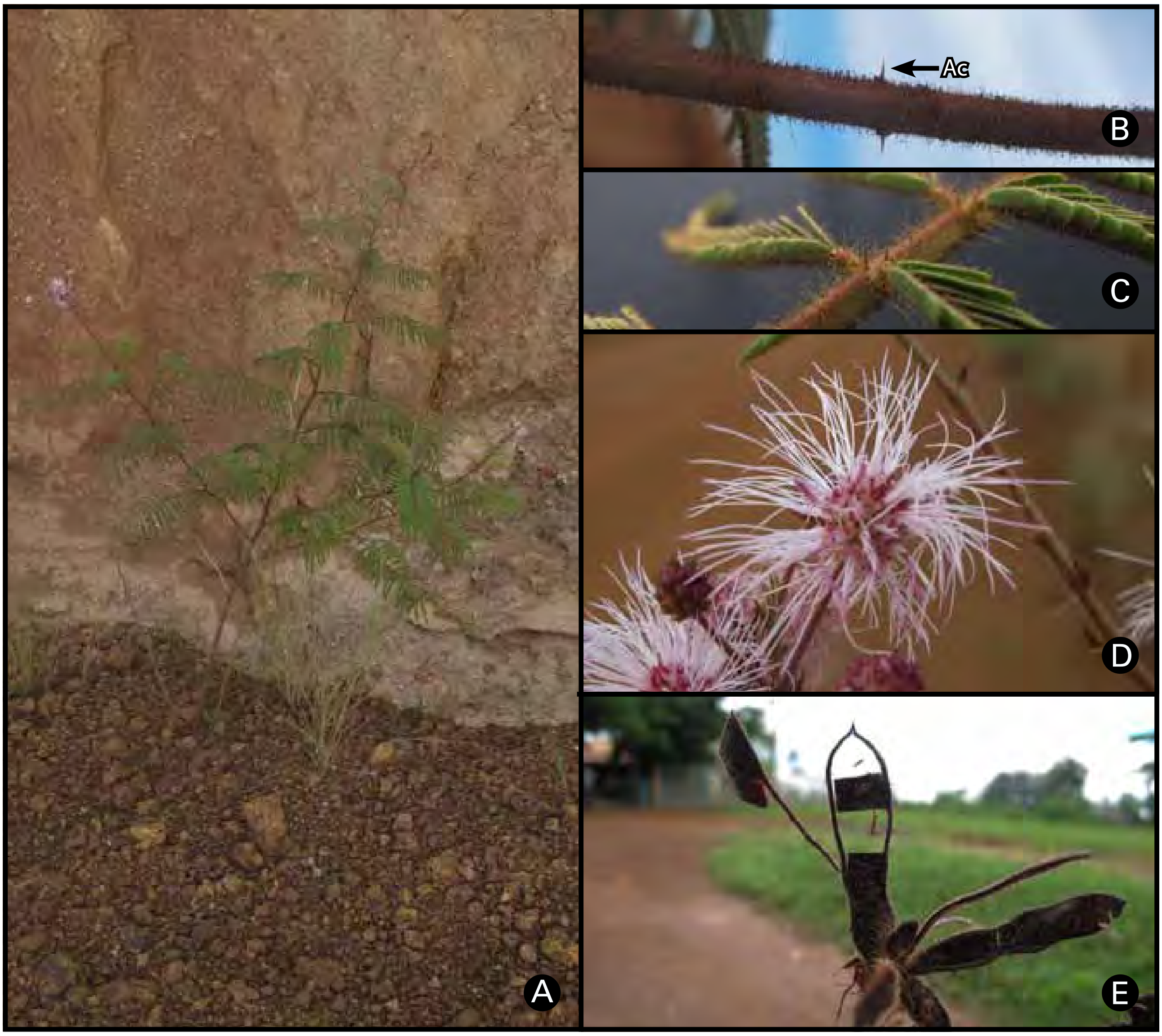

Figure 8. *Mimosa setosa*. A. Habit. B. Branch with aculei (Ac). (Ip). C. Detail of a leaf showing the interpinnal projection. D. Raceme. E. Fruits.

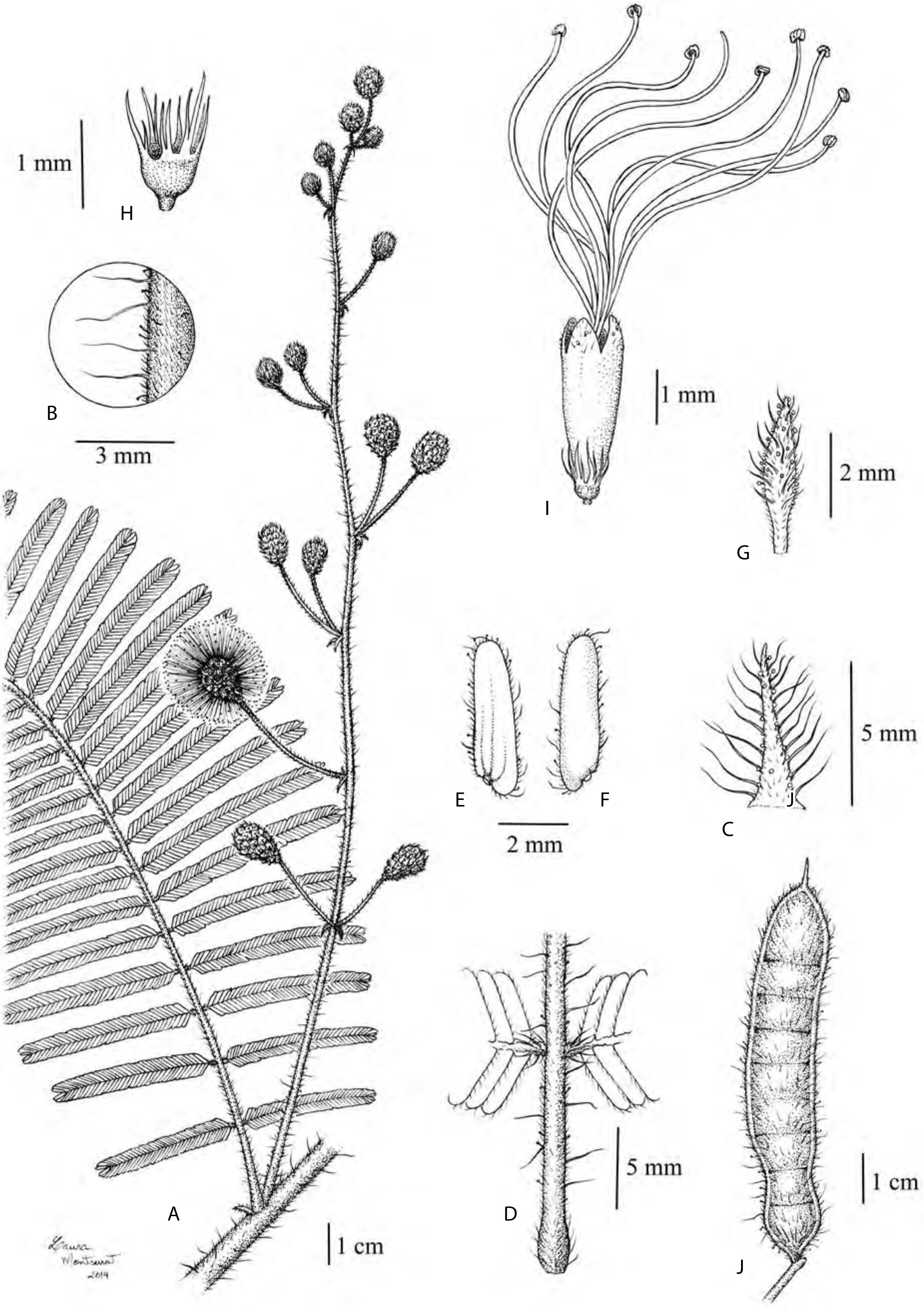

Figure 9. *Mimosa setosa*. A. Branch. B. Detail of the branch showing the indumentum. C. Stipule. D. Detail of the rachis with an interpinnal projection. E. Leaflet (abaxial face). F. Leaflet (abaxial face). G. Floral bract. H. Calyx. I. Flower. J. Fruit.

feature as informative. Based on that, *M. setosa* var. *pseudomelas* is here synonymized under *M. setosa*, in agreement with Bentham's first impression.

Representative specimens examined: Brazil. Distrito Federal: Brasília, Folha SD-23-Y-C, Reserva Ecológica do IBGE, entre a guarita e a sede, aprox. 15°57'01" S, 47°52'14" W, aprox. 1100 m elev., 14 February 2009, fr., *M.A. Silva & F.C. Pinheiro 6957* (IBGE!). Goiás: no locality and date given, fl., *E.P. Heringer 12242* (UB); Cristalina, Fazenda Nossa Senhora de Fátima (fundo de alfaville), ca. 1000 m elev., 15 November 1986, fl., *A.F.P de Araújo s.n.* (UB!); Luziania, centro da cidade, 8 December 1982, fl., *E.P Heringer 18497* (UB!); Morrinhos, 11 December 1951, fl., *A. Macedo 3414* (SP!); Servo do Ribeirão da Paciencia, 29 August 1827, *W.J. Burchell 5452* (K!, P!). São Paulo: [Araraquara], Araracoara et Batatais, May 1834, fl., *L. Riedel 2232* (LE!,NY!); [Franca,] inter Franca et Rio Grande, n.d., fl., *P.W. Lund 5* (C, NY!) ; Mogi Guaçu, Reserva Florestasl Fazenda Campininha, perto de Pádua de sales, 30 October 1957, fl., fr., *O. Handro 738* (SP!).

6. Mimosa urbica (Barneby) L.M. Borges, ***comb.*** & ***stat. nov.***

Basionym: *Mimosa setosa* subsp. *urbica* Barneby (1991: 358). *M. setosa* subsp. *urbica* Barneby var. *urbica* [autonym generated by *M. setosa* subsp. *urbica* var. *urbana* Barneby (1991: 358)]. Type: Brazil. Brasília: near Setor Industrial, 1050 m, 30 December 1965, fl., *Irwin et al. 9713* (holotype: UB!; isotypes: G!, K!, LE!, NY!, P!, R!, S!, US!).

> =*Mimosa setosa* subsp. *urbica* var. *urbana* Barneby (1991: 358). ***syn. nov.*** Type: Brazil. Distrito Federal: Estação de Biologia da Universidade de Brasília, 20 Fev 1969, fl., *Heringer 11770* (holotype UB!, isotype: NY!).
>
> Figs. 10–11.

Shrubs or subshrubs 0.1–1(–2[?]) m, prostrate or ascending, probably also forming patches of tangled stems; unarmed. *Indumentum* composed of simple trichomes, filiform setae, and stipitate glandular setae with clavate head, the latter generally absent from vegetative parts and fruits and, when present, not abundantly; branches, stipules, petiole, rachis, rachillas and peduncles pubescent with simple trichomes ca. 0.2 mm long, patent filiform setae (0.7)1.5–5 mm long, and very rarely also patent glandular setae ca. 0.3 mm long; leaflets ciliate with trichomes, filiform setae (sometimes absent) and very rarely also glandular setae. *Leaves* 10–22-jugate; *stipules* 12 mm #1.2–2 mm, lanceolate-acuminate to narrowly triangular, plane, caducous; *petioles* 24–28 mm long, 2.2–2.5 mm diam., grooved on adaxial surface, the pulvinus 5–5.5 mm long; *rachis* 200–220 mm long, 1.5–1.6 mm diam., grooved on adaxial surface and with a laminar projection 1.8–2.1 mm long between each pinnae pair, terminal projection 4.5–5 mm long, linear; basal *rachillas* 31–43 mm long, medial rachillas 48–66 mm long, distal rachillas 42–52 mm long, all 0.4–0.5 mm diam., 9.5–10 mm apart; *leaflets* 4.8–6 #1.9–2.1 mm, in 23–26 pairs on basal rachillas, in 23–30 pairs on medial rachillas, in 22–28 pairs on distal rachillas, narrowly-oblong, inequilateral, 1.2–1.4 mm apart, apex rounded, mucronulate, base oblique, subcordate, rounded-truncate, venation 4-palmate, primary veins prominent on abaxial surface; paraphyllidia 0.6–1.2 #0.1–0.2 mm, subulate. *Inflorescences* arranged in fascicles of 2 glomerules distributed along frondose, terminal double-racemes, exserpted from foliage, sometimes organized in a frondose, paniculate synflorescence. *Glomerules* 19–24 #11–13 mm, elliptic, associate leaf developing after anthesis, fully expanded when fruits mature; *peduncles* 2.2–3 mm long; *floral bracts* 6.5–7.5 #1–1.5 mm, narrowly acuminate-spatulate, cymbiform, pubescent with trichomes and filiform setae 1.3–1.7 mm long, prominently present on margins; *flowers* 4-merous, diplostemonous, basal ones only staminate; *pedicel* 0.1–0.2 mm long; *calyx* 0.4–0.6 mm long, cupulate, lobes absent, rim ciliate with plane setae 1.3–2 mm long, laterally fused at base, tube glabrous; *corolla* 5.3–6 mm long, infundibuliform, tube glabrous, lobes 1.7–2.1 # 1.3–1.5 mm, ovate, 1-nerved, vein apex prominent, pubescent with filiform setae 0.5–0.8 mm long, and glandular setae ca. 0.1 mm long, indumentum not concealing lobes surface; *filaments* 18–22 mm long, glabrous, fused 0.5–0.6 mm at base, pink; *anthers* 0.7–0.8 # 0.7–0.8 mm, glabrous; *ovary* 1.5–1.7 # 0.7–0.8 mm, compressed, elliptic, tomentose with filiform setae ca. 1 mm long and glandular setae ca. 0.4 mm long, *stipe* 0.2–0.3 mm long, glabrous; *style* 17–20 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a craspedium 28–43 # 9–12 mm, narrowly oblong, papery, dark-brown, apex obtuse to rounded, obliquely aristate, base cuneate, completely pubescent with trichomes (this sometimes lacking on old fruits) and hirsute with filiform setae 2–2.5 mm long and glandular setae 0.4–1.8 mm long, the latter more abundant; *pedicel* 0.8–2.3 # 1.3–1.4 mm; *replum* 0.8–1.3 mm wide; *valves* partialy and irregularly breaking long after seed liberation; *seeds* not seen.

Characterization: *Mimosa urbica* differs from *M. setosa* and *M. paludosa* by the presence of a xylopodium (vs. absence); the prostrate habit (vs. erect); lack of prickles (vs. present in *M. paludosa* and very rarely occurring in *M. setosa*).

Morphological notes: Barneby (1991) indicates that *Mimosa setosa* var. *urbica* and *M. setosa* var. *urbana* differ in habit, the first being an "ascending shrub" and the latter a "trailing subherbaceous plant". Field observations indicate that the distal portion of those trailing subshrubs is usually erect, attaining around 50 cm long and exposing the synflorescence axis above ground level. Hence, the erect disposition of *M. setosa* var. *urbica*, may be the expression of a mature plant regenerating from damages to its aerial part (probably by fire, a common ecological factor in the Brazilian Cerrado). Glandular setae on vegetative organs are lacking in most *M. urbica* collections, and may be useful as an identification tool. However, some specimens do present this indumentum type, so it cannot be used as a delimiting character state.

Distribution and habitat: *Mimosa urbica* is endemic to the Distrito Federal, Brazil, where it occurs in natural open formations of *cerrado*, and its remnants in urbanized areas.

Taxonomic notes: Besides the habit differences mentioned above, Barneby (1991) also distinguished the varieties of *Mimosa setosa* subsp. *urbica* by the number of pinnae and leaflets pairs (the latter related to pinnae length). *M. setosa* var. *urbica* would present 15–23 pairs of pinnae with 28–42 pairs of leaflets, while *M. setosa* var. *urbana*, 4–12 and 16–22 pairs respectively. Leaves with more pairs of pinnae usually also have more pairs of leaflets, but many specimens present intermediate numbers, preventing the distinction between the varieties (e.g. *Kirkbride 3101* [pinnae: 18; leaflets 28]; *Jouvim 472* [pinnae: 18; leaflets 27]; *Duarte 9958* [pinnae: 14; leaflets 28]; *Pereira 4630* [pinnae: 15; leaflets 25]). Hence, those varieties are here treated as a single taxonomic entity at species level. On the other hand, the distinction between *M. setosa* and the here proposed *M. urbica*, as here circumscribed, was highlighted above and is also related to habit. So far we have not found any examples of transitions between different habit types such as this occurring in *Mimosa*, therefore we considered it as a distinctive character between these species. If experimental work or more accurate field observations demonstrate that this is the case, and no other distinctive characters is discovered, the habits of *M. setosa* var. *setosa*, *M. setosa* var. *urbica*, and *M. setosa* var. *urbana* could be understood as a clinal variation of that feature within a single species.

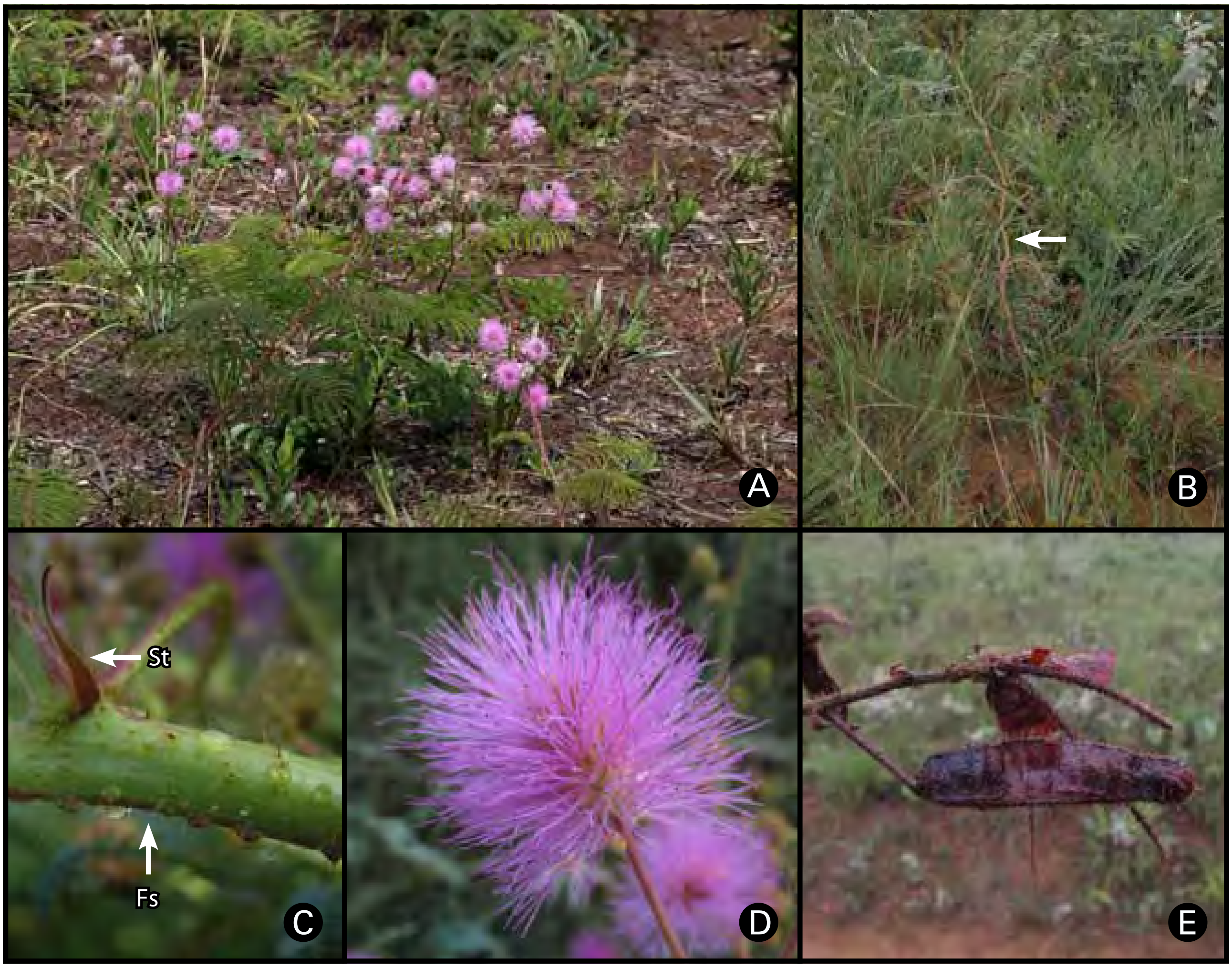

Figure 10. *Mimosa urbica*. A–B. Habit. A. Individual with assurgent stems. B. Individual with prostrate stems. C. Branch with narrowly triangular stipule (St) and filiform setae (Fs), but lacking glandular setae. D. Raceme. E. Fruits.

Representative specimens examined: Brazil. Distrito Federal: Brasília, Parque Olhos D´Água - lado oposto à Lagoa dos Sapos, 15°44'40'' S, 47°53'16'' W, 1050 m elev., *S.M. Fank-de-Carvalho 30* (UB!); Brasília, Planaltina, Estação Ecológica das Águas Emendadas, 15°35'21'' S, 47°35'20'' W, 1155 m elev., 15 April 2005, *L.P. Queiroz 10302* (HUEFS); Parque Nacional de Brasília, Próximo à área do Exército, 15°53' S, 47°56' W, 21 January 1991, *P.C.M. Ramos 561* (ESA!, UB!).

Concluding remarks

Even though the changes here proposed in the *Mimosa setosa* complex drastically changes the rank of taxa recognized by Barneby (1991), they barelly differ from his view on the limits of each one of them. The exceptions are the synonymization of *M. setosa* var. *pseudomelas* under *M. setosa*, of *M. setosa* var. *metadenotricha* under *M. paludosa* and of *M. setosa* var. *urbana* under *M. urbica*, which reduces the total number of least inclusive taxa from nine to six. We believe that the association of field observations and a more complete set of collections to the recognition of taxa only at species level, with a resulting reduction in number of taxa, is an improvement to the classification of *Mimosa*. Moreover, it is in accordance with the hierarchical pattern found in phylogenetic analysis. The taxa circumscriptions here proposed highlight the diversity of the genus with more accuracy and in a more appropriate rank.

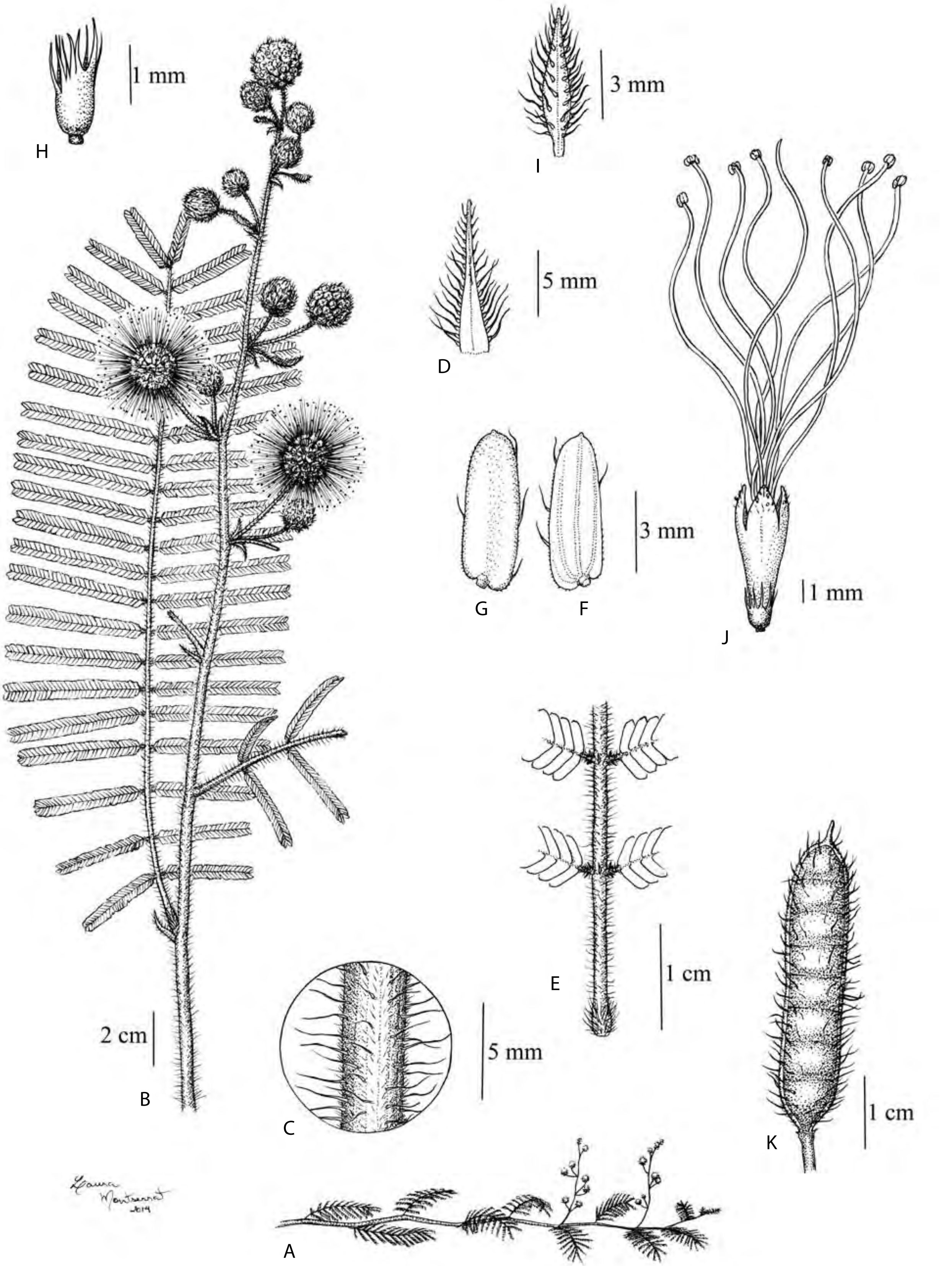

Figure 11. *Mimosa urbica*. A. Habit. B. Branch. C. Detail of the branch showing the indumentum. D. Stipule. E. Detail of the rachis with an interpinnal projection. F. Leaflet (abaxial face). G. Leaflet (abaxial face). H. Floral bract. I. Calyx. J. Flower. K. Fruit.

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Appendix 1. List of morphological features used to evaluate the status of taxa belonging to *Mimosa setosa* and closely related taxa.

1. xylopodium
0 absent
1 present
2. habit
0 shrub
1 subshrub
2 treelet
3. stem, disposition
0 erect
1 prostrate
2 deflexed
3 humifuse
4. Branching system
0 regular
1 pivotant
2 dicotomic
3 wandlike
5. filiform setae
0 absent
1 present
6. filiform setae, base, shape
0 tapering
1 bulbous
7. glandular setae
0 absent
1 present
8. prickles
0 absent
1 present
9. branch, prickles
0 absent
1 patent (or slightly inclined)
2 antrorse
3 retrorse
10. branch, trichomes
0 absent
1 present
11. branch, filiform setae
0 absent
1 present
12. branch, filiform setae orientation
0 patent
1 incurved
2 forwardly appressed
3 retrorse
4 antrorse (but not appressed)
5 inclined
13. branch, glandular setae
0 absent
1 present
2 clavate
3 capitate
14. leaves, stipules, shape
0 lanceo-acuminate
1 linear
2 ovate-lanceolate
3 ovate
4 broadly-ovate-acuminate
5 narrowly triangular
6 triangular
7 broadly triangular
8 linear triangular
9 lanceolate
10 ovate acuminate
15. leaves, stipules, persitency
0 caducous
1 persistent
16. leaves, stipules, abaxial face, trichomes
0 absent
1 present
17. leaves, stipules, abaxial face, filiform setae
0 absent
1 present
18. leaves, stipules, abaxial face, glandular setae
0 absent
1 present
19. leaves, stipules, margin, trichomes
0 absent
1 present
20. leaves, stipules, margin, filiform setae
0 absent
1 present
21. leaves, stipules, margin, glandular setae
0 absent
1 present
22. leaves, petiole, lenght relative to the pulvinus
0 4:1 or more
1 1:1-2:1
23. leaves, rachis, interpinnal projection
0 absent
1 present
2 spiculate
3 laminar
4 glandular
24. leaves, rachis, lenght relative to the petiole
0 1:2 or less
1 ca. 1:1
2 2:1 or more
25. leaves, rachis, prickles
0 absent
1 present
26. leaves, rachis, trichomes
0 absent
1 present
27. leaves, rachis, glandular setae
0 absent
1 present
28. leaves, medial rachilla, lenght relative to the rachis
0 1:2 or less
1 ca. 1:1
2 2:1 or more
29. leaves, basal rachilla, lenght relative to the medial rachilla
0 1:2 or less
1 ca. 1:1
2 2:1 or more
30. leaves, rachilla, paraphyllidia
0 absent
1 present
31. leaves, rachilla, glandular setae
0 absent
1 present
32. leaves, leaflets, secondadry veins promination in relation to primary veins
0 not or less prominent
1 equally prominent
33. leaves, leaflets, margin, filiform setae
0 absent
1 present
34. leaves, leaflets, margin, glandular setae
0 absent
1 present
35. leaves, leaflets, adaxial surface, trichomes
0 absent
1 present
36. leaves, leaflets, abaxial surface, trichomes
0 absent
1 present
37. inflorescence, exhibition
0 excerpt from foliage
1 nested in the foliage
38. inflorescence, associated leaf, development
0 do not develop
1 partially at anthesis, fully when in fruit
2 fully or almost so at anthesis
3 partially at anthesis, with a diminute leaf when in fruit
39. inflorescence, secondary arrangement
0 absent
1 frondose paniculate
2 bracteose paniculate
40. inflorescence, peduncle lenght in relation to leaf stalk lenght of fully expanded leaf
0 1:5 or less
1 1:2-1:3
2 ca. 1:1
3 ca. 2:1
41. inflorescence, glomerule proportion of lenght to width
0 ca. 1:1
1 ca. 2:1

  - 2 ca. 3:2
- 42. inflorescence, masculine flowers at base
  - 0 present
  - 1 absent
- 43. floral bracts, shape
  - 0 spatulate-acuminate
  - 1 eliptic-rhombic
  - 2 spatulate-elliptic
  - 3 narrowly spatulate-acuminate
  - 4 lanceolate
  - 5 broadly spatulate-acuminate
  - 6 linear
  - 7 spatulate-rhombic
  - 8 spatulate
  - 9 oblong-acuminate
- 44. floral bract, abaxial surface, veins promination
  - 0 not prominent
  - 1 prominent
- 45. floral bract, trichomes
  - 0 absent
  - 1 present
- 46. floral bract, glandular setae
  - 0 absent
  - 1 present
- 47. flower, calyx, lobes
  - 0 absent
  - 1 fringed
  - 2 very shallowly triangular
  - 3 ovate
  - 4 triangular
  - 5 present
- 48. flower, calyx, lobes, plane projections
  - 0 absent
  - 1 present
  - 3 ovate
- 49. flower, calyx, plane projections, location
  - 0 troughout rim
  - 1 present just in half or less of rim
- 50. fusion
  - 0 absent
  - 1 present
- 51. flower, calyx, pedicel, filiform setae
  - 0 absent
  - 1 present
- 52. flower, calyx, rim, trichomes
  - 0 absent
  - 1 present
- 53. flower, calyx, rim, filiform setae
  - 0 absent
  - 1 present
- 54. flower, calyx, rim, glandular setae
  - 0 absent
  - 1 present
- 55. flower, calyx, tube apex, trichomes
  - 0 absent
  - 1 present
- 56. flower, calyx, tube apex, filiform setae
  - 0 absent
  - 1 present
- 57. flower, calyx, tube apex, glandular setae
  - 0 absent
  - 1 present
- 58. flower, corolla, shape
  - 0 infundibuliform
  - 1 campanulate
  - 2 narrowly infundibuliform
- 59. flower, corolla, lobes, trichomes
  - 0 absent
  - 1 present
- 60. flower, corolla, lobes, filiform setae
  - 0 absent
  - 1 present
- 61. flower, corolla, lobes, glandular setae
  - 0 absent
  - 1 present
- 62. flower, corolla, lobes, indument coverage
  - 0 do not conceals surface
  - 1 conceals suface
- 63. flower, corolla, lobes, veins, apex promination
  - 0 not prominent
  - 1 prominent
- 64. flower, ovary, thrichomes
  - 0 absent
  - 1 present
- 65. flower, ovary, filiform setae
  - 0 absent
  - 1 present
- 66. flower, ovary, glandular setae
  - 0 absent
  - 1 present
- 67. fruit, valves, segmentation
  - 0 integer
  - 1 partially articulated
  - 2 completely articulated
- 68. fruit, articles, time of separation relative to dehiscence of valves and liberation of seeds
  - 0 together
  - 1 after
- 69. fruit, valves, veins promination
  - 0 not prominent
  - 1 prominent
- 70. fruit, stipe, relative lenght to width
  - 0 less then 4x
  - 1 5x or more
- 71. fruit, shape
  - 0 oblong
  - 1 rounded
  - 2 narrowly oblong
  - 3 elliptic
- 72. fruit, base shape
  - 0 cuneate
  - 1 rounded
  - 2 obtuse
  - 3 attenuate
- 73. fruit, apex shape
  - 0 acute
  - 1 rounded
  - 2 obtuse
  - 3 apiculate
- 74. fruit, margin, ondulation
  - 0 no
  - 1 present
- 75. fruit, valves, trichomes
  - 0 absent
  - 1 present
- 76. fruit, valves, filiform setae
  - 0 absent
  - 1 present
- 77. fruit, valves, glandular setae
  - 0 absent
  - 1 present
- 78. fruit, valves, prickles
  - 0 absent
  - 1 present
- 79. fruit, margin, trichomes
  - 0 absent
  - 1 present
- 80. fruit, margin, filiform setae
  - 0 absent
  - 1 present
- 81. fruit, margin, glandular setae
  - 0 absent
  - 1 present
- 82. fruit, margins, prickles
  - 0 absent
  - 1 present
- 83. fruit, indumentum, setae orientation
  - 0 patent
  - 1 incurved
  - 2 forwardly appressed
  - 3 retrose
  - 4 antrorse (not appressed)
- 84. fruit, indumentum, concenctric pattern of organization
  - 0 absent
  - 1 present
- 85. seed, position related do margins
  - 0 paralel
  - 1 perpendicular
  - 2 inclined

CHAPTER FOUR DOT ONE

THE CENSUS CONTINUES: TWO NEW MONTANE SPECIES OF *MIMOSA* (LEGUMINOSAE MIMOSOIDEAE) FROM SOUTHERNEAST BRAZIL

Leonardo Maurici Borges, Marcelo Fragomeni Simon & José Rubens Pirani

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

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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 (M F Simon *et al.* 2011).

The distinction between *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* is given mainly by fruit type, which is a 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)reconstruct the evolution of a set of morphological characters, and establish the relationships of Old World species to the rest of the genus. \u2022 Methods: We used trnD-trnT plastid sequences for 259 species of Mimosa (ca. 50% of the total 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 (1991:), *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 containing all variable features 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)browser based tool that performs rapid geospatial analysis to ease the process of Red Listing taxa. Developed to utilise spatially referenced primary occurrence data, the analysis focuses on two aspects of the geographic range of a taxon: the extent of occurrence (EOO. 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., 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 afloramento rochosos, 17°41'24.1" S, 44°11'43.6" W, 1025 m, 26 April 2012, *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!, NY!, MBM, 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

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.

Taxon	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

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.

Notes: Oldest collections of *Mimosa perplicata* were identified as *M. setosa* var. *paludosa* (e.g. *Hatschbach et al. 64817;* as *M. setosa* var. *paludosa* (Benth.) Barneby), 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.

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

> *Mimosa serpensetosa* is very similar to *M. setosa* var. *paludosa* Benth, 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);

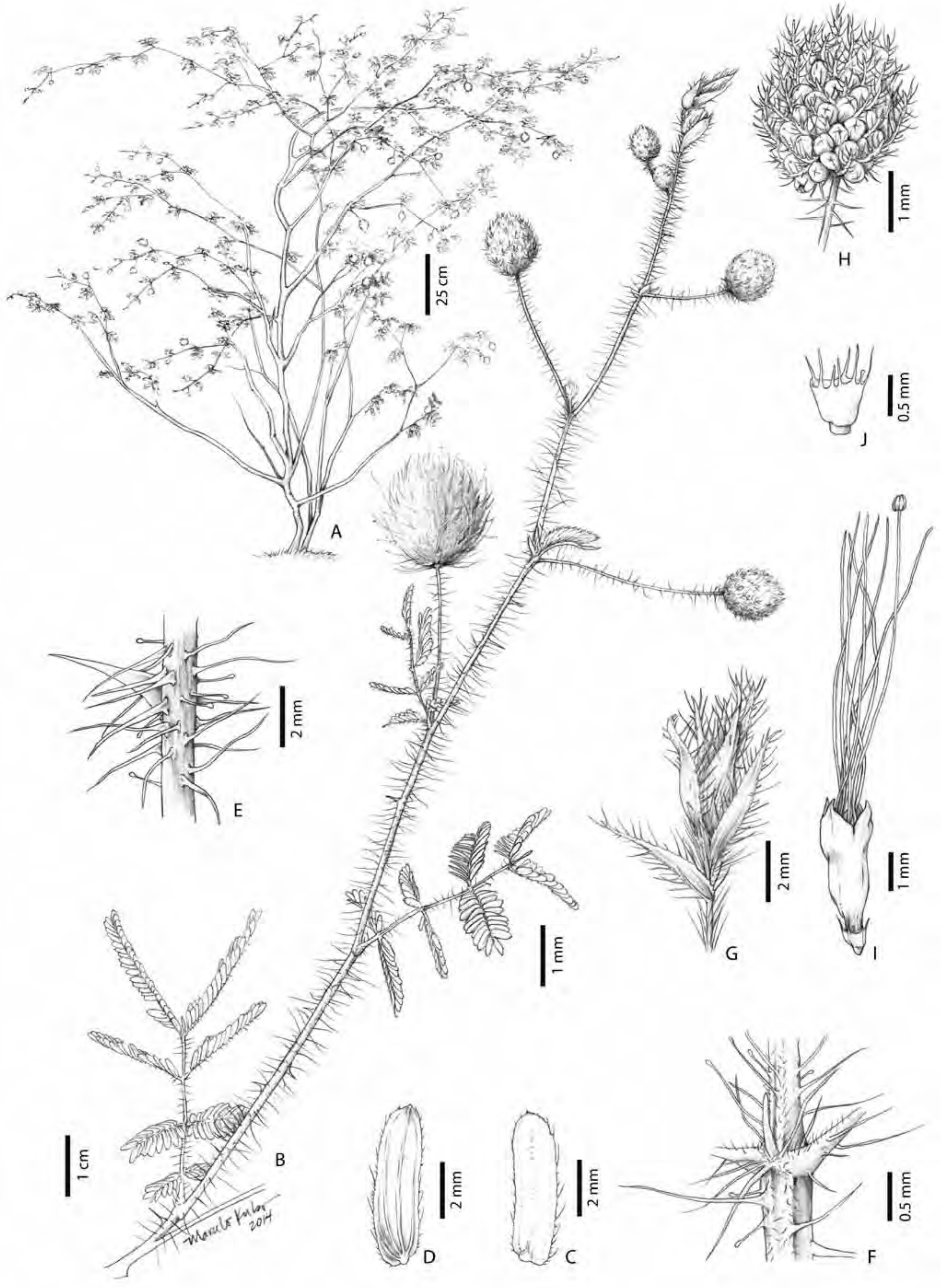

FIGURE 1. *Mimosa perplicata*. A. Habit. B. Branch. C. Adaxial surface of leaflet. D. Abaxial surface of leaflet. E. Branch detail showing the aculei and the indumentum composed by filiform and glandular setae. F. Detail of the rachis showing the interpinnal projection and triple indumentum of trichomes, filiform setae, 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.

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, 19°13'34.5" S, 43°39'58" W, 814 m, 23 April 2006, *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

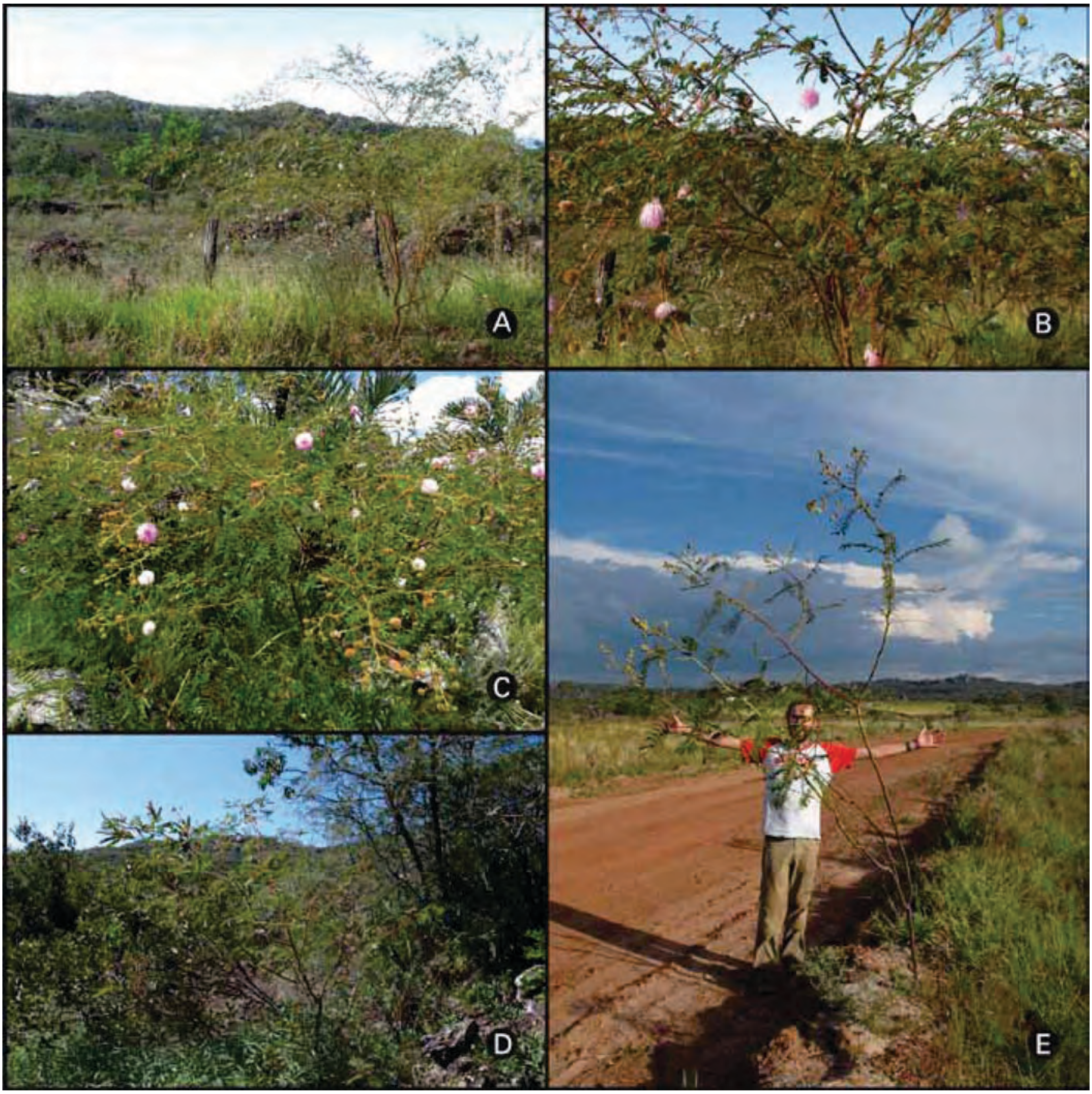

FIGURE 2. HABITS OF *Mimosa perplicata* AND RELATED SPECIES. A–B *M. perplicata*. C. *M. caliciadenia*. D. *M. setosa* VAR. *paludosa*. E. *M. acroconica* AND DR. B. LOEUILLE. ALL PHOTOS BY L.M. BORGES.

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.

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 excerpt double-raceme, which may form a frondose and excerpted 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.

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, 18°55'3.44" S, 43°47'20.46" 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, 18°55'31.1" S, 43°47'37.3" W, 950 m, fl., 27 November 2009, *A.P. Savassi-Coutinho et al. 1313* (ESA, K!); Trilha subindo o morro, 18°55'31.1" S, 43°47'37.3" 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. 19°17'38" S, 43°33'50" 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, 19°25'08.9" S, 43° 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 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, were 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. *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

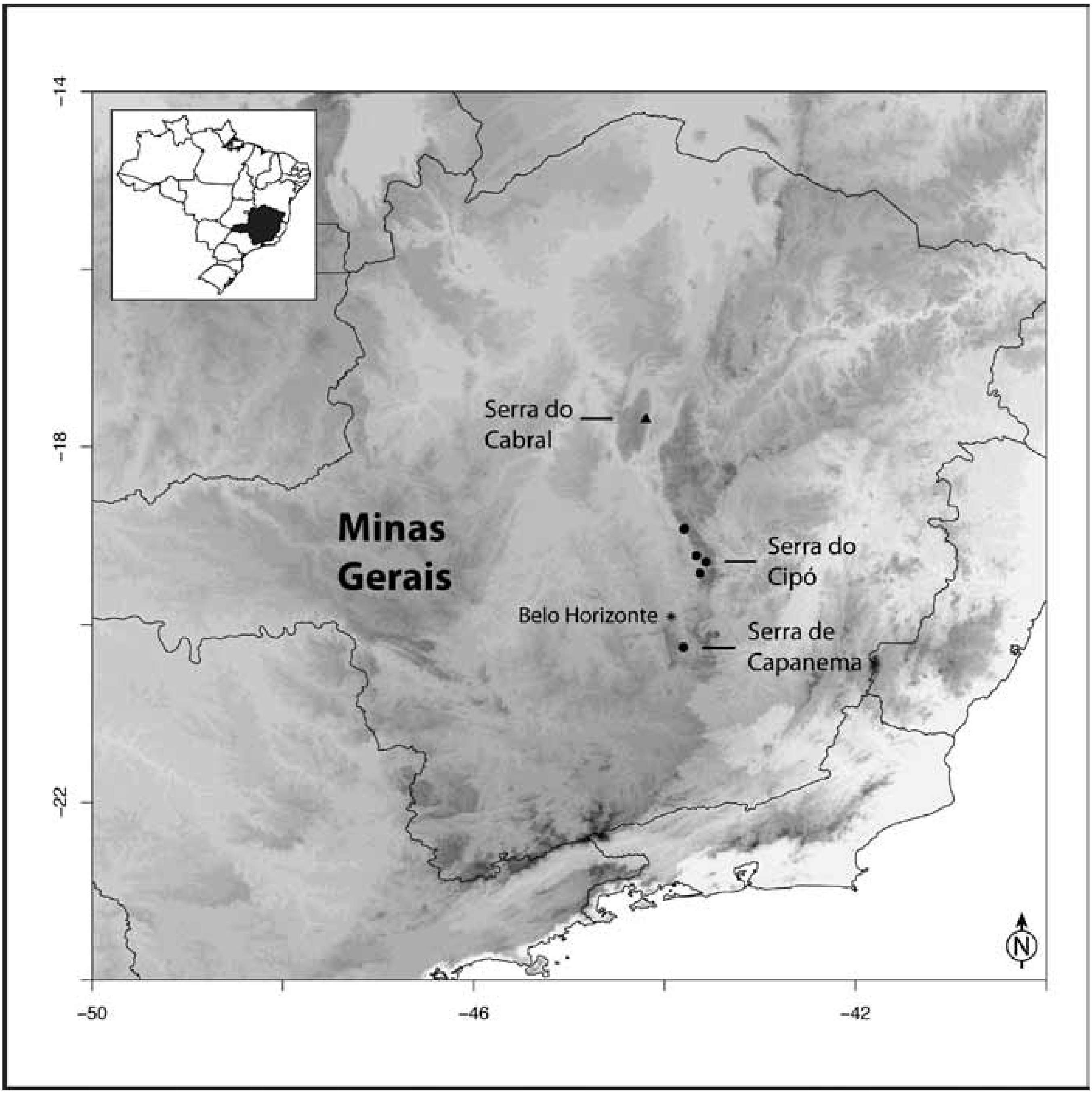

FIGURE 4. Distribution map of *Mimosa perplicata* (▲) and *M. serpensetosa* (●).

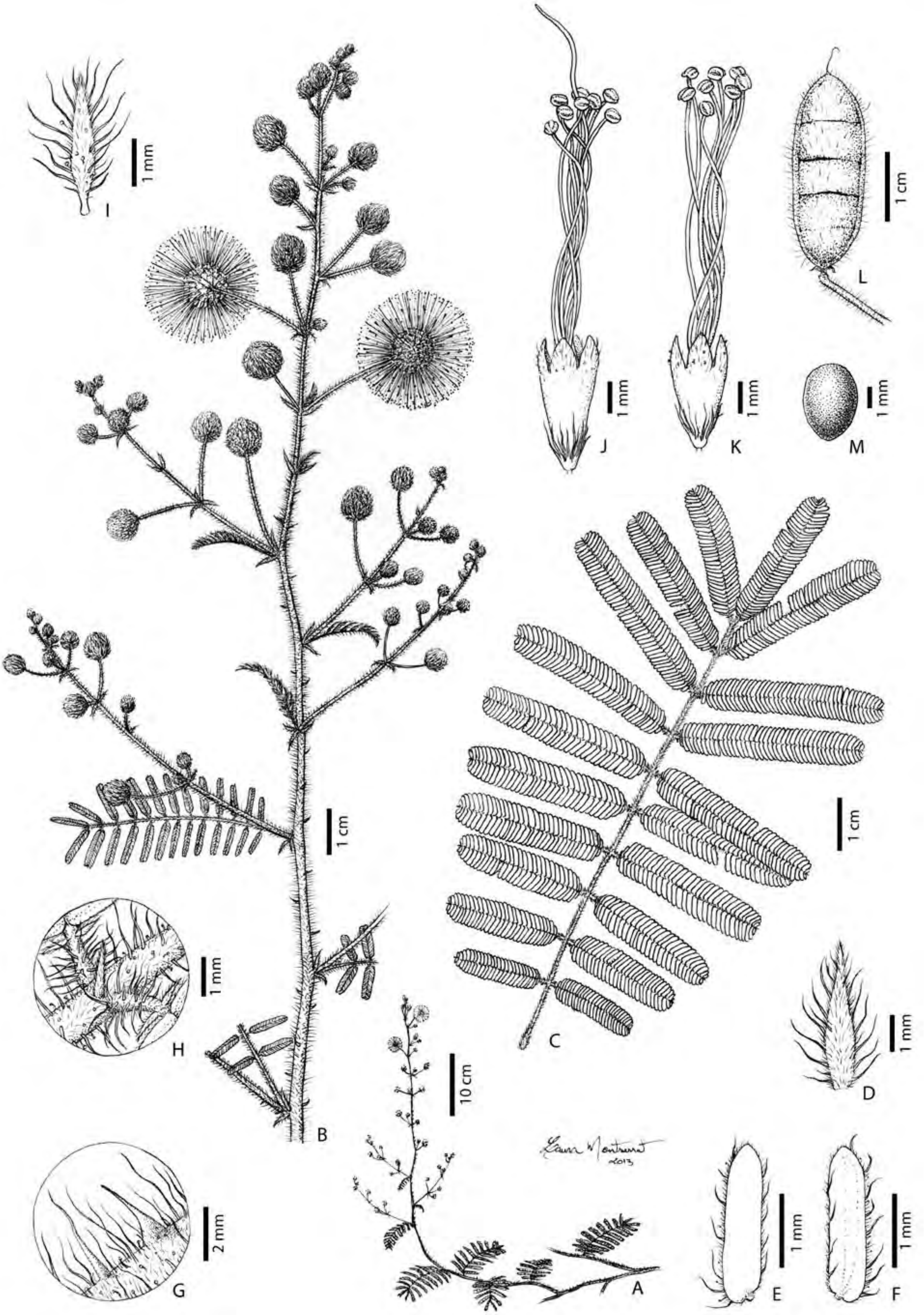

FIGURE 5. *Mimosa serpensetosa*. A. Habit. B. Branch. C. Leaf. D. Stipule (abaxial surface). E. Adaxial surface of leaflet. F. Abaxial surface of leaflet. G. Branch detail showing the triple indumentum of trichomes, filiform setae, glandular setae, aculei with loose apex (la) and after fall of apex (af). 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. Excerpted 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. Supplementary material captions

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).

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 fili-

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.

Taxon	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 var. *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	?

form setae, as well as not showing the markedly villous branches that are seen on other specimens. Since those are mainly allometric variations, they are interpreted here as intraspecific geographical variability. 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 excerpted 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 species, 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 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* (M.F. 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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CHAPTER FOUR DOT TWO

BUSTED GHOSTS: REDISCOVERY OF SUPPOSEDLY DESTROYED TYPES OF BRAZILIAN *MIMOSA* (LEGUMINOSAE, MIMOSOIDEAE)

Leonardo Maurici Borges & José Rubens Pirani

Abstract

In his monograph for neotropical *Mimosa*, Rupert Barneby made seemingly effective lectotypifications for a few binomials originally published by Taubert. He chose specimens in the Berlin herbarium (B), which he supposed had been destroyed. We hereby bring new evidence for the absence of these specimens in Berlin, their being in Hamburg (HBG) instead, and we designate them as lectotypes for the names in question.

Key words

Berlin, Brazil, Fabaceae, Hamburg, lectotype, nomenclature, typification

Introduction

Mimosa Linnaeus (1753: 516) is a large genus with more than 500 species distributed mainly in the neotropical Region (Barneby 1991, Luckow 2005). Although broadly characterized by the constant presence of a craspedium-like fruit (and its derivatives) (Barneby 1991), *Mimosa* shows a wide range of morphological diversity, mainly in habit, encompassing life forms from trees to tiny subshrubs. Pachycaul treelets and shrubs with developed underground systems, apparently associated with fire regimes (Barneby 1991, Simon *et al.* 2009, occur in several *Mimosa* species from the Cerrado Domain in Central Brazil, the South American center of endemism of the genus (Luckow 2005, Simon & Proença 2000).

For a long time the Central Brazilian Plateau has been a target of botanical interest, having been explored by naturalists such as W.J. Burchell, A.F.M. Glaziou and E. Ule (Glaziou 1906, Smith & Smith 1967, Taubert 1896, Urban 1906). Particularly Ule visited some of the altitudinal areas highlighted by Simon & Proença (2000) as major centers of diversity for *Mimosa*, namely Chapada dos Veadeiros, Serra dos Cristais and Serra dos Pirineus in Goiás State, as well as Chapada da Contagem in the Federal District. In his expeditions to those areas, between 1892 and 1894, he collected a few *Mimosa* species that were later described by Taubert (1896), who worked at the Royal Botanical Museum (now the Botanic Garden and Botanical Museum Berlin-Dahlen), in Berlin, from 1889 to 1895 (Stafleu & Cowan 1986).

Taubert's descriptions of *Mimosa* species, each based on a single collection, meet all the criteria for valid publication of names of new taxa (Articles 32–45 of the Code; McNeill *et al.* 2012), but they lack information about collections (or herbaria) holding the studied specimens, preventing a proper indication of holotypes.

Barneby (1991), in his comprehensive monograph of the genus and after studying European collections, apparentrly clarified the situation by making implicit lectotypifications, by citing a particular specimen as "holotypus". As the protologues lack mention of herbaria, Barneby assumed that the holotypes would have been in the Berlin herbarium (B), where Taubert worked (see above), but he indicated them as having been destroyed (by fire, in World War II) by

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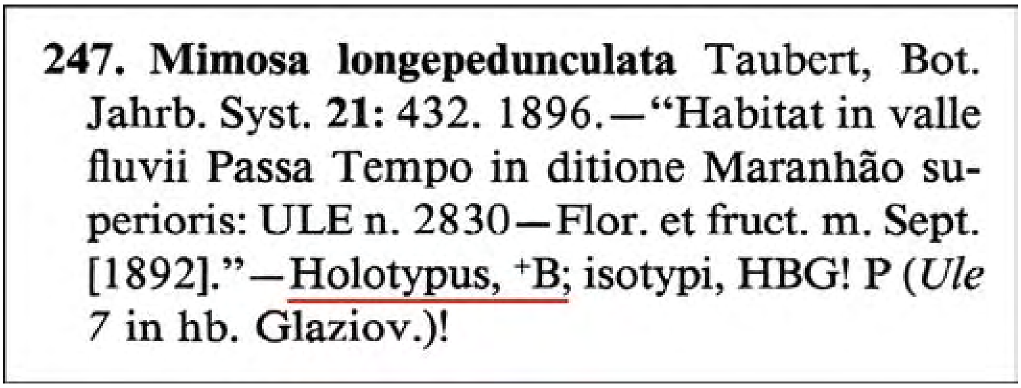

247. Mimosa longepedunculata Taubert, Bot. Jahrb. Syst. **21:** 432. 1896.—"Habitat in valle fluvii Passa Tempo in ditione Maranhão superioris: ULE n. 2830—Flor. et fruct. m. Sept. [1892]."—Holotypus, $^{+}$B; isotypi, HBG! P (*Ule* 7 in hb. Glaziov.)!

FIGURE 1. Example of an entry in Barneby (1991), for *Mimosa longepedunculata* Taub., which indicates the holotype as a destroyed specimen in the Berlin herbarium ("$^{+}$B").

placing a cross "†"before the herbarium code "B"(Fig. 1). However, there may never have been duplicates of the types in Berlin, since there are no images of them among the Field Museum Berlin Negatives Collection (http://fieldmuseum.org/explore/our-collections/berlin-negatives), and most of Ule's collections below number 5000 were actually sent to Hamburg (HBG) (Matthias Schultz [http://migre.me/hgGRS], pers. comm., based on letters archived at HBG). Hence, Barneby's indications of these "holotypes" do not point to actual specimens and, thus, are not in accordance with Article 9.2 and 9.12 of the Code (McNeill *et al.* 2012); they are mere speculation, not to be accepted.

Whereas it is highly probable that those particular specimens collected by Ule were never at Berlin, and consequently were not destroyed, the species names are still lacking types and therefore demand proper lectotypification, which is provided below.

NOMENCLATURAL ARRANGEMENTS AND NOTES

In order to properly designate lectotypes, we studied specimens held at the herbaria B, HBG, P and R (acronyms according to Thiers 2014+), as well as images personally provided by their staff, or stored at the Global Plants portal (http://plants.jstor.org/), the virtual collection of the Muséum National d'Histore Naturelle (http://science.mnhn.fr/institution/mnhn/item/search/form), and the Herbarium Hamburgense Virtual Herbarium (http://www.herbariumhamburgense.de).

Ule specimen labels usually bear a provisional number (in black ink) at the upper left corne, and his official sequential number added later in blue at the upper right corner (Matthias Schultz, pers. comm.). However, duplicates of several Ule specimens were distributed annotated only with the provisional number. Hence, in the following lectotype designations for *Mimosa* species names published by Taubert (1896), we selected the specimens held at HBG, because they are chiefly the ones bearing Ule's official numbering sequence cited in the protologues.

Notes on information not present in the protologues, but available on the specimen label, appear inside brackets, and we follow the taxon sequence used by Taubert (1896).

Mimosa cyclophylla Taub.(Taubert 1896: 429–430). Lectotype (designated here): Brazil. Goiás: habitat in ditione Tocantini superioris in campis ad Paraizo, September 1892, fl., fr., *E. Ule 2825* (HBG [also annotated as “2”; “in der Chapadões inter thalle des Paraizo] photo!, isolectotype: R [only annotated as “2”; “nos campos da região do Tocantins superior, Paraizo”]).

Mimosa paraizensis Taub. (Taubert 1896: 430). Lectotype (designated here): —Brazil. Goiás: habitat in ditione Tocantini superioris in campis ad Paraizo, September 1892, fl. [, fr. imm.], *E. Ule 2824* (HBG photo! [also annotated as “1”; “in den Chapadões am Paraizo”], isolectotypes: CORD photo! [also annotated as “1”; “in den Chapadões am Paraizo Maranhãogebiet”], P [indicated by Barneby 1991 as being annotated as “1”, but not found at the online database], R! [only annotated as “1”; “Nos campos da região do Tocantins superior, Paraizo”]).

Mimosa paraizensis was considered by Barneby (1991: 674) as a synonym of *M. radula* var. *imbricata* (Bentham 1841: 378) Barneby.

Only two collections identified as *Mimosa paraizensis* were found in P’s online database (P 03151832, P 03151833). However, both were collected by Glaziou in January 1895. A personal examination of this collection is necessary in order to confirm the existence of an isotype at P.

Mimosa pyrenea Taub. (Taubert 1896: 430–431). Lectotype (designated here): Brazil. Goiás: habitat in montibus Serra dos Pyreneos, August 1892, fl, *E. Ule 2854* (HBG photo! [also annotated as “102”, “in der Serra dos Pyreneos”], isolectotypes: P photo! [only annotated as “102”], R [only annotated as “102”; “in der Serra dos Pyreneos”]).

Barneby (1991: 666) indicated that, in 1984, no duplicate of *Ule 2854* was found at HBG and that the specimen *Ule 2852* could be a misnumbered isotype. We were not able to verify whether this particular collection is a specimen of *Mimosa pyrenea*, but it is clearly not an isotype since *Ule 2854* is indeed at HBG. Probably Barneby was not able to find this material due to organizational problems related to the evacuation of the Hamburg herbarium (Poppendieck 2001).

Mimosa speciosissima Taub. (Taubert 1896: 431). Lectotype (designated here): Brazil. Goiás: Habitat in montibus Serra da Baliza, September 1892, fl., *E. Ule 2828* (HBG! [also annotated as “N° 5”], isolectotype: P! [only annotated as “N° 5”; “Serra da Baliza”]).

Mimosa tocantina Taub. (Taubert 1896: 431–432). Lectotype (designated here): —Brazil. Goiás: Habitat in ditione Tocantini superioris in montosis ad Vargem grande, September 1892, fl., *E. Ule 2826* (HBG! [also annotated as “N° 3”], isolectotype: P! [only annotated as “N° 3”; “nos morros da regiao do Tocantins superior, Pizarao = Ribeirão Pizarão, 14°10’S, 47°’35’W (Barneby 1991)]”).

The duplicate held at HBG is composed by a synflorescence axis with a few young leaves, not fully developed. On the other hand, the one at P bears leaves completely expanded and is, in that sense, more complete. Still, since both specimens can be identified as *Mimosa tocantina*, we decided to follow our selection criteria and chose the HBG specimen as the lectotype.

FIGURE 2. Lectotype of *Mimosa cyclophylla* Taub. (HBG 506638). Image used with permission and provided by the Herbarium Hamburgense.

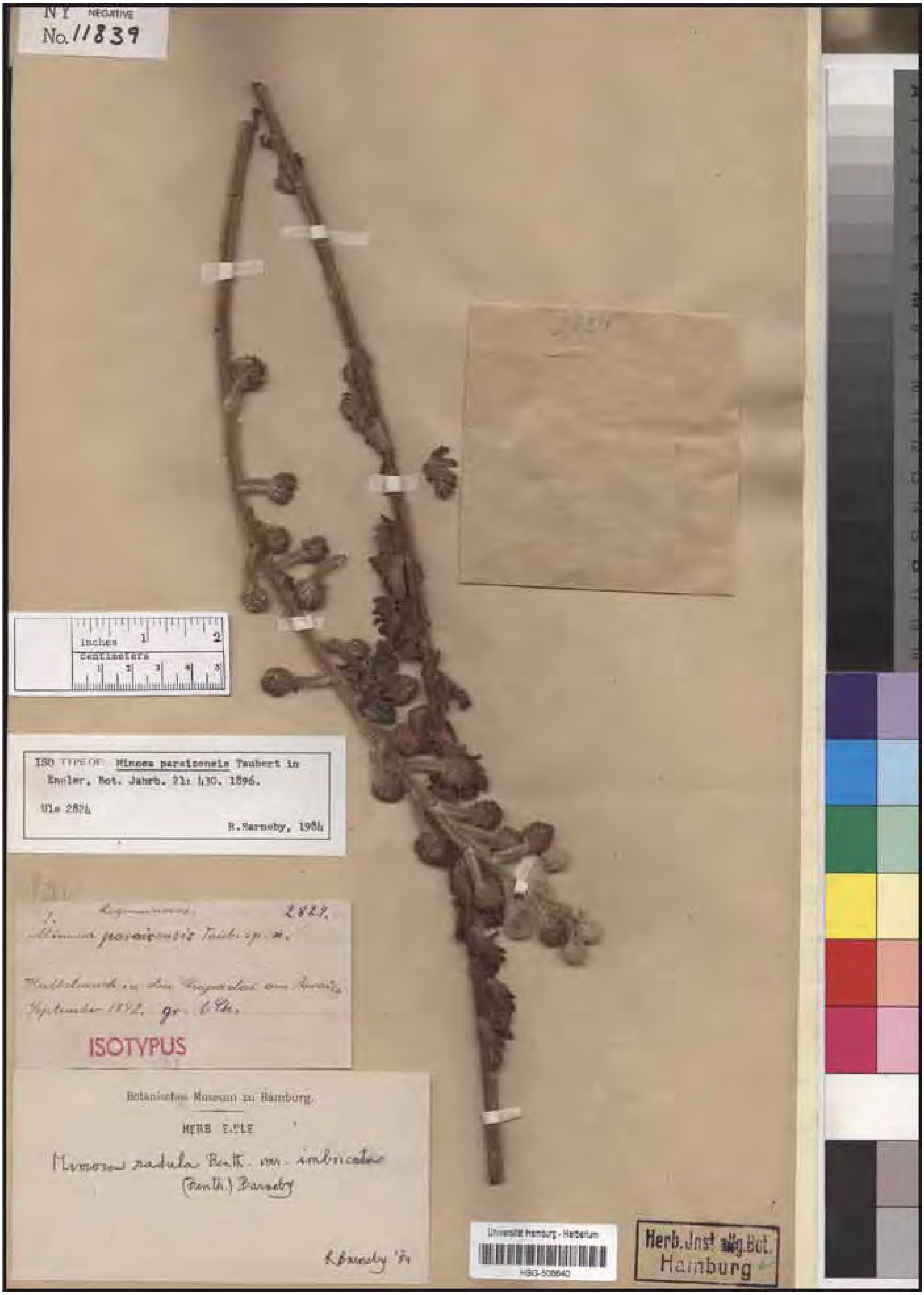

FIGURE 3. Lectotype of *Mimosa paraizensis* Taub. (HBG 506640). Image used with permission and provided by the Herbarium Hamburgense.

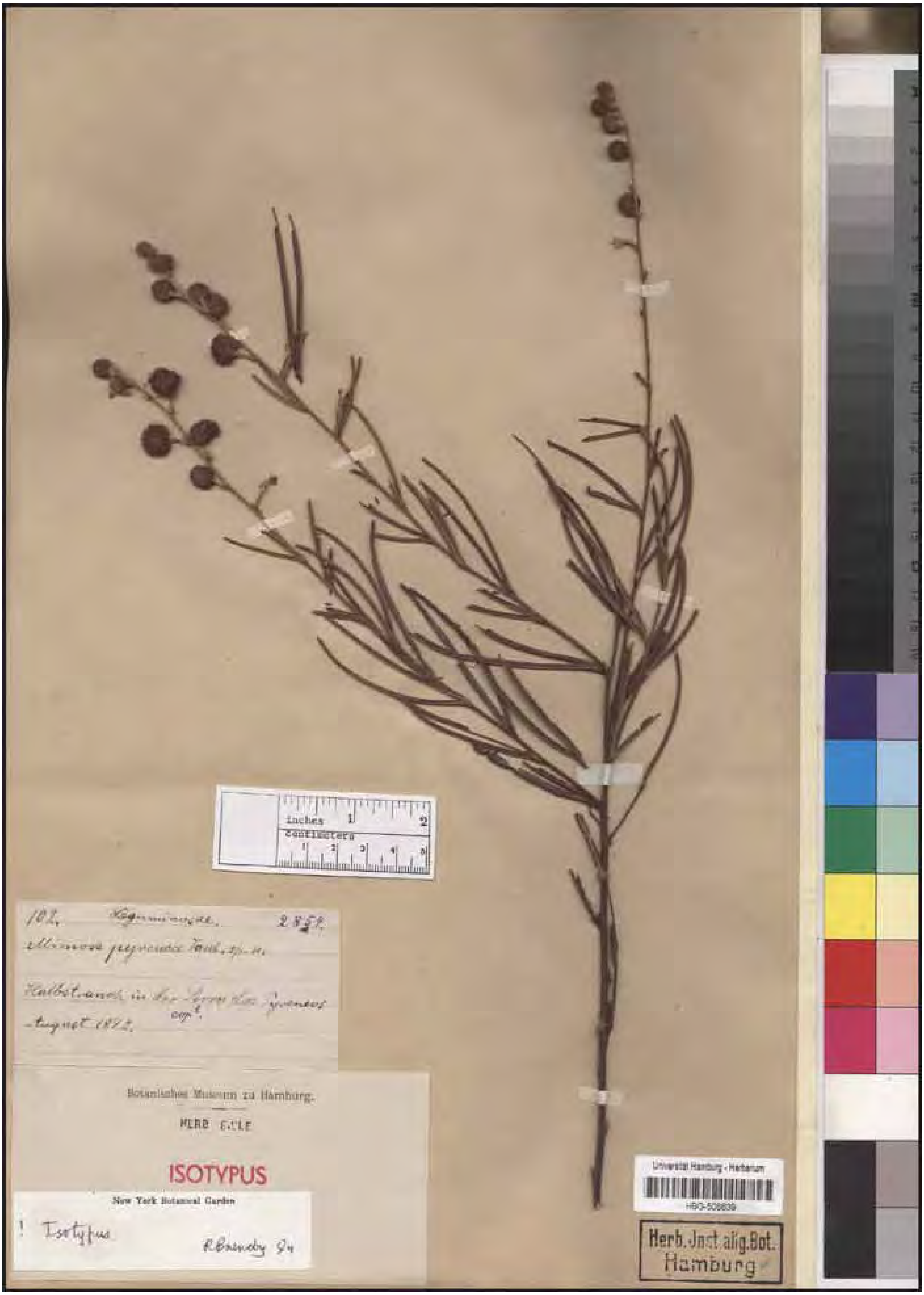

FIGURE 4. Lectotype of *Mimosa pyrenea* Taub. (HBG 506639). Image used with permission and provided by the Herbarium Hamburgense.

FIGURE 5. Lectotype of *Mimosa speciosissima* Taub. (HBG 506641). Image used with permission and provided by the Herbarium Hamburgense.

Mimosa longepedunculata Taub. (Taubert 1896: 432). Lectotype (designated here): Brazil. Goiás: Habitat in valle fluvii Passa Tempo in ditione Maranhao superioris, September 1892, fl., fr., *E. Ule 2830* (HBG! [also annotated as "7"; "im Thale des Passa Tempo"]; isolectotypes: P! [only annotated as "N° 7"; "Serra dos Viadeiros; no Valle do Passa Tempo"], R! [two sheets annotated only as "N° 7"; one indicated as "im Thale des Passa Tempo obere Paranangebiet", the other: "Serra dos Viadeiros; no Valle do Passa Tempo"]).

Mimosa ulei Taub. (Taubert 1896: 432–433). Lectotype (designated here): Brazil. Goiás: Habitat in campis ad fluvium Rio Preto in ditione Maranhão [Tocantins, not Maranhão] superioris, September 1892, fl., fr. [present only at the R duplicate and not seen by Taubert 1896], *E. Ule 2829* (HBG! [also annotated as "N° 6"; "Rio Preto"], isolectotypes: CORD photo! [also annotated as "N° 6"; "im oberen Tocantins gebiet"], P! [two sheets only annotated as "N° 6", "região do Tocantins superior"], R! [three sheets annotated only as "N° 6", "região do Tocantins superior"].

Mimosa formosana Taub. (Taubert 1896: 433). Lectotype (designated here): Brazil. Goiás: [Formosa], "prope Formosa", September 1894, fl., *E. Ule 2827* (HBG! [also annotated as "N° 4"; "Chapadões bei Formosa"]).

Mimosa albolanata Taub. (Taubert 1896: 433–434). Lectotype (designated here): Brazil. Goiás: Serra Dourada, January 1893, fl., *E. Ule 2872* (HBG! [also annotated as "415"], isolectotype: R! [two sheets only annotated as "415"]).

Mimosa setosissima Taub. (Taubert 1896: 434). Lectotype (designated here): Brazil. Goiás: habitat in montibus Serra dos Pyreneos, August 1892, fl, *E. Ule 2853* (HBG! [also annotated as "101", "in den Chapadões der Serra dos Pyreneos"], isolectotypes: P! [only annotated as "101", "Serra dos Pyreneos"], R! [two sheets, both numbered "101"; R 000003315 also annotated "Serra dos Pyreneos" and R 000003315a "in den Chapadões der Serra dos Pyreneos"])

Duplicates of Ule 2853 at R are also labelled "*Mimosa nettoana* sp. n.", a name never published, which is crossed out and replaced by "*Mimosa setosissima* n. sp." on the specimen R 000003315.

Mimosa laniceps Barneby (1991: 412) ≡ ***Mimosa tomentosa*** Taub. (Taubert 1896: 434), nom. illeg. [non *M. tomentosa* Humb. & Bonpl. ex Willd. (Willdenow 1806: 1033), nec *M. tomentosa* Rottler (Rottler 1803: 208). Lectotype (designated here): Brazil. Goiás: Valle rivi Vargem Grande, September 1892, fl., *E. Ule 2832* (HBG! [also annotated as "9"], isolectotype: P! [2 sheets; only annotated as "9"])

In order to correct the illegitimate publication of *Mimosa tomentosa* Taub., which is a later homonym, Barneby (1991: 412) chose *M. laniceps* as a replacement name for the taxon.

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We are grateful to Matthias Schultz for enlightenment on Ule's biography; to the curators and staff of the studied herbaria for facilitating access to the specimens, particularly Matthias Schultz and Norbert Jürgens from HBG for kindly providing and allowing use of type images, as well as Vera Lúcia C. Martins from R; Nick Turland and Werner Greuter for reviewing the original manuscript; FAPESP (2010/11093-1) and FAPESP (2013/ 13709-8) for support to LMB; as well as CNPq for support to JRP.

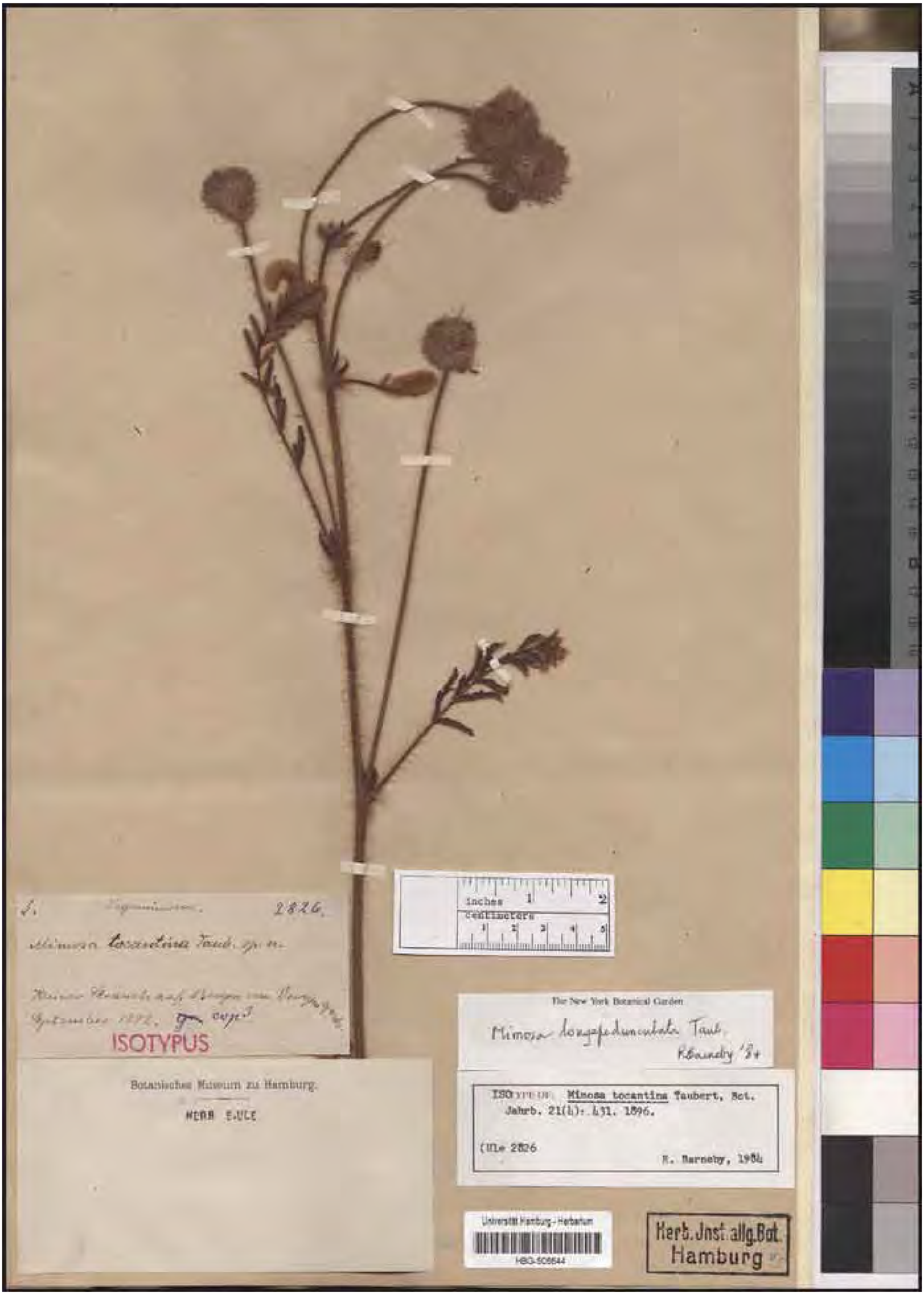

FIGURE 6. Lectotype of *Mimosa tocantina* Taub. (HBG 506644). Image used with permission and provided by the Herbarium Hamburgense.

FIGURE 7. Lectotype of *Mimosa longepedunculata* Taub. (HBG 506643). Image used with permission and provided by the Herbarium Hamburgense.

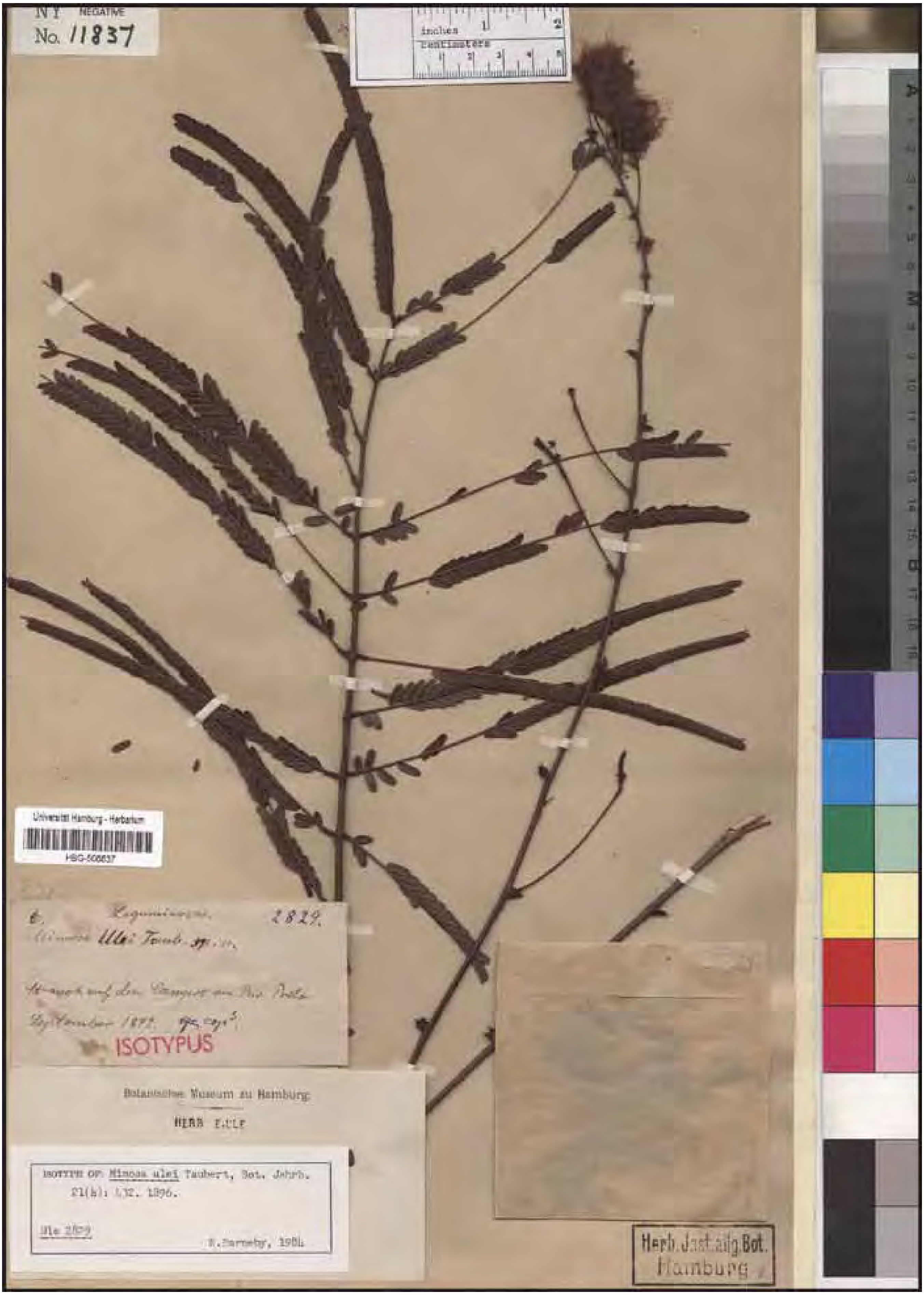

FIGURE 8. Lectotype of *Mimosa ulei* Taub. (HBG 506637). Image used with permission and provided by the Herbarium Hamburgense.

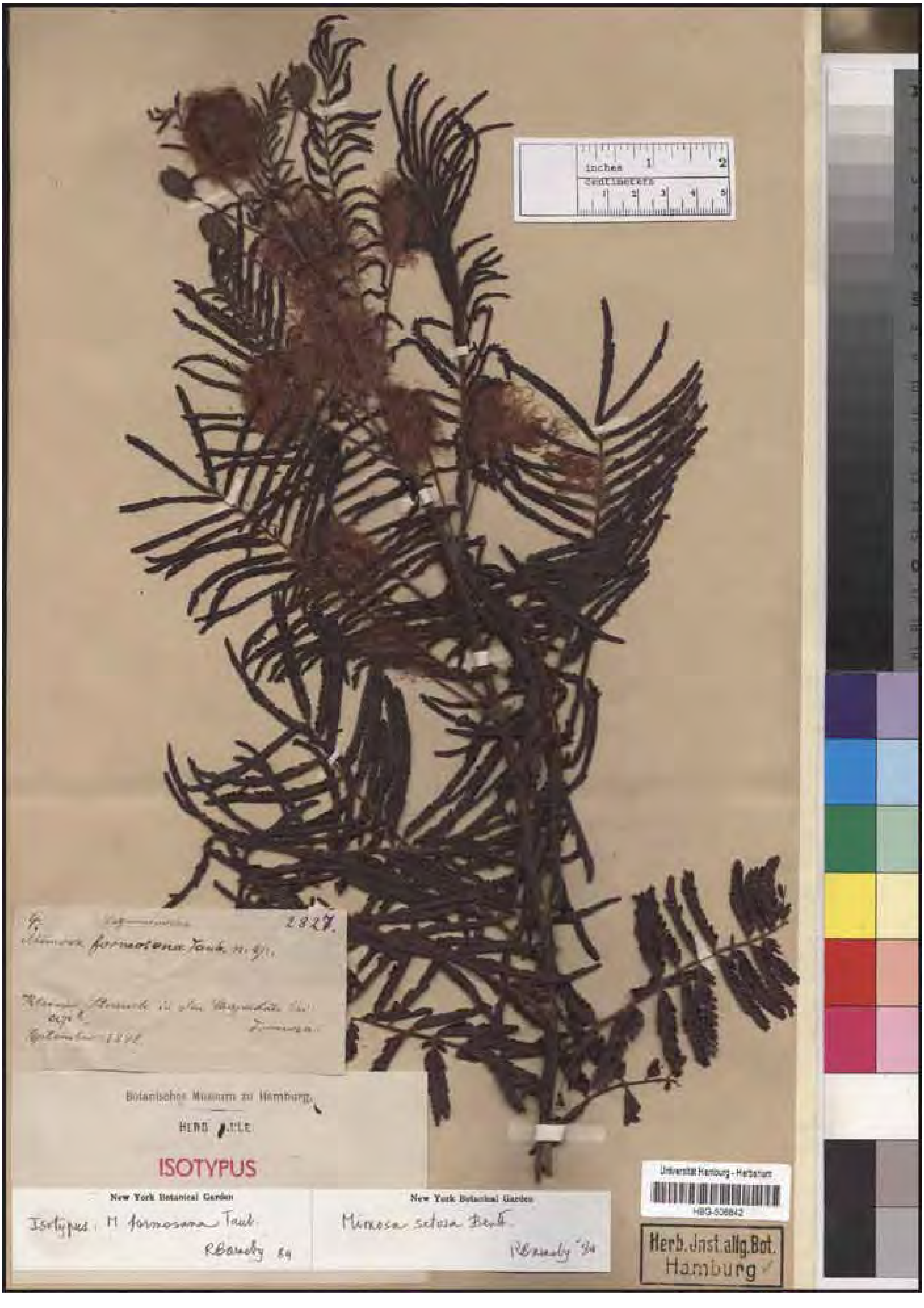

FIGURE 9. Lectotype of *Mimosa formosana* Taub. (HBG 506642). Image used with permission and provided by the Herbarium Hamburgense.

FIGURE 10. Lectotype of *Mimosa albolanata* Taub. (HBG 506647). Image used with permission and provided by the Herbarium Hamburgense.

FIGURE 11. Lectotype of *Mimosa setosissima* Taub. (HBG 506645). Image used with permission and provided by the Herbarium Hamburgense.

FIGURE 12. Lectotype of *Mimosa laniceps* Barneby. (HBG 506646). Image used with permission and provided by the Herbarium Hamburgense.

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CHAPTER FOUR DOT THREE

WHEN THE OLD GUYS KNEW BETTER: THE TRUE IDENTITY OF *MIMOSA LONGEPEDUNCULATA* AND REESTABLISHMENT OF *M. TOCANTINA* (LEGUMINOSAE, MIMOSOIDEAE)

Leonardo Maurici Borges & José Rubens Pirani

Abstract

Megadiverse genera generally 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 label 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 typification corrections, description of distribution and ecology, phenophase, 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 mega diverse 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, *Mimosa* was 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

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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 inarticulate craspedium (Fig. 1–2). These characters made it possible to assign it to *Mimosa* ser. *Pachycarpae* Bentham (1875: 439), a group highly diversified in the Brazilian Cerrado, particularly at Chapada dos Veadeiros, but not to any species present in Barneby's monograph (1991), nor 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 (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 Agronômico 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) of which a significant part belonged to *Mimosa*, of which many were 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],

TABLE 1. Morphological comparison of specimens of the unidentified Mimosa (Borges 915; 989) and species it could be assigned to. 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
Mimosa sp.	Treelet	+/-	+	+/-	20–23
Mimosa capito	PcTreelet	+	-	-	1–3
Mimosa manidea	PcTreelet	+	+	-	3–9
Mimosa oedoclada	PcTreelet	+	+	-	3–9
Mimosa dominarum	PcTreelet	+	+	+	3–6
Mimosa rheiptera	Treelet	+/-	+	-	5–8
Mimosa struthionoptera	Treelet	+/-	+	-	4–5
Mimosa longepedunculata	PrShrub	-	-	+/-	5–19

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).

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 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 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 *M. tocantina* (*Ule 2826*) and *Mimosa longepedunculata* (*Ule 2830*) (Taubert 1896). *Mimosa 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* Bentham (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).

Despite sharing the presence of long peduncles, the descriptions of the species show that they differ in other features. Specifically, *Mimosa tocantina* 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. longepeduculata* 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 *Mimosa tocantina* 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 tocantina* 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. tocantina* can be found at NY (NY Neg. 11812) (Barneby 1991). Moreover, besides citing the collection site of *M. tocantina* 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 regiao 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

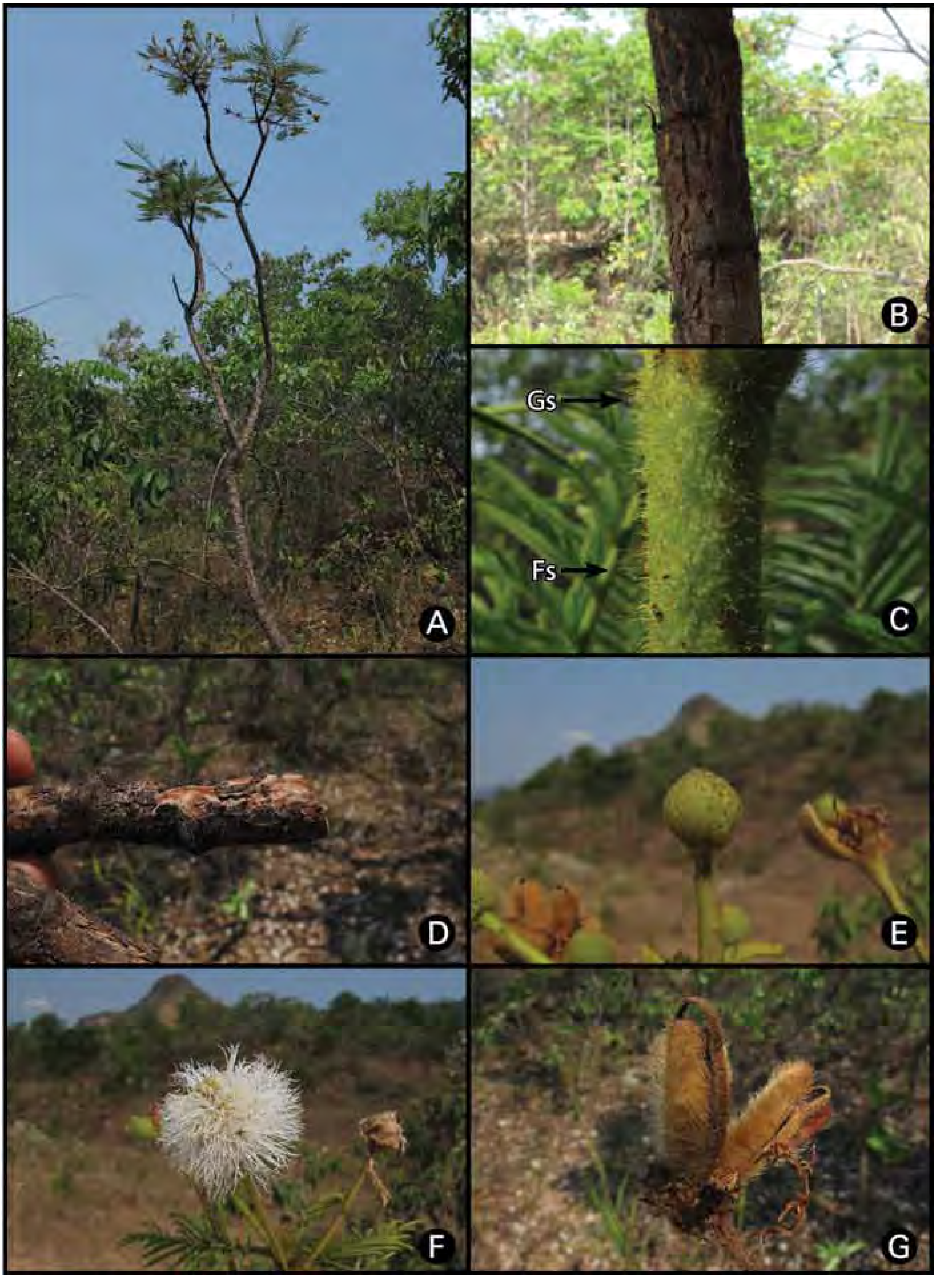

FIGURE 1. *Mimosa longepedunculata*. A. Habit. B. Trunk with persistent stipules. C. Branch with filiform (Fs) glandular (Gs) setae. D. Branch with dehiscent peridermis. E. Globose immature glomerule. F. Glomerule with expanded white filaments. G. Fruit. (*Borges 915*, SPF).

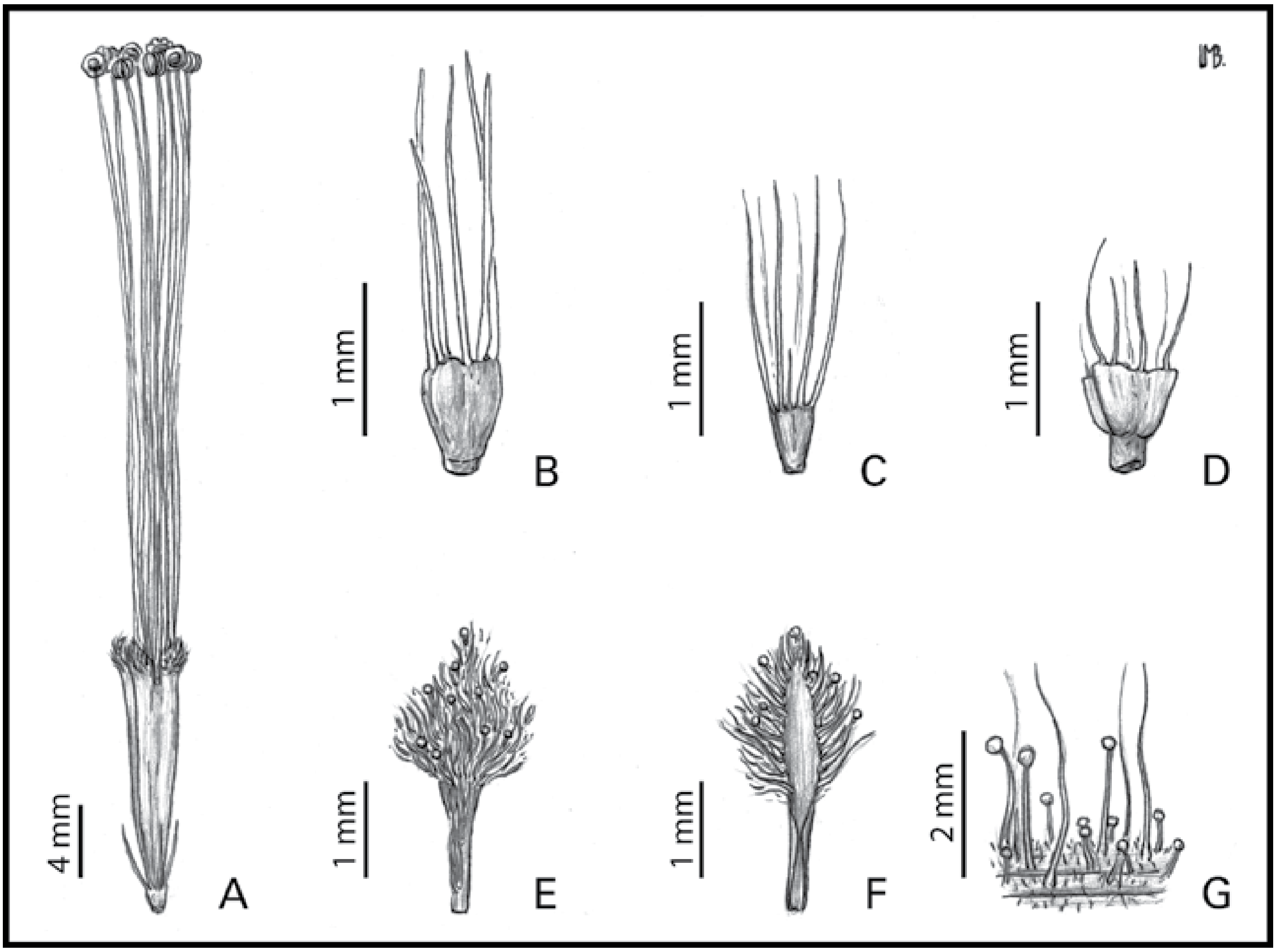

FIGURE 2. A–C; E–G. *Mimosa longepedunculata*. D. *M. tocantina*. A. Flower. B. Calyx with truncate rim (same scale as D). C. Lobate calyx. D. Calyx (same scale as C). E. Floral bract (abaxial surface). F. Floral bract (adaxial surface). G. Detail of the rachis surface showing the triple indumentum of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

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 it 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. tocantina*. 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. tocantina* held at UB (*Anderson 7190*). Also, the fact that the description for *M. longepedunculata* in Barneby (1991: 497–408) fits *M. tocantina* perfectly, but does not includes the features of *M. longepedunculata* sensu Taubert (see above). This 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. tocantina*'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 distinc-

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

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

FIGURE 5. Isotype of *Mimosa longepedunculata*. Field information in German. (*Ule 7* [=*Ule 2830*], sheet 1, R 00000324). Image used with permission and provided by the Museu Nacional Herbarium (R).

FIGURE 6. Isotype of *Mimosa longepedunculata* Field information in Portuguese. (*Ule 7* [=*Ule 2830*], sheet 2, R 00000324a). Image used with permission and provided by the Museu Nacional Herbarium (R).

tion between *Mimosa tocantina* and *M. longepeduculata*. 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 of *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. tocantina*, both of which are provided below.

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 MAPPING

Conservation status was assessed using the GeoCAT Tool (Bachman *et al.* 2011)browser based tool that performs rapid geospatial analysis to ease the process of Red Listing taxa. Developed to utilise spatially referenced primary occurrence data, the analysis focuses on two aspects of the geographic range of a taxon: the extent of occurrence (EOO. 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. 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 *Mimosa* 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 stems 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)

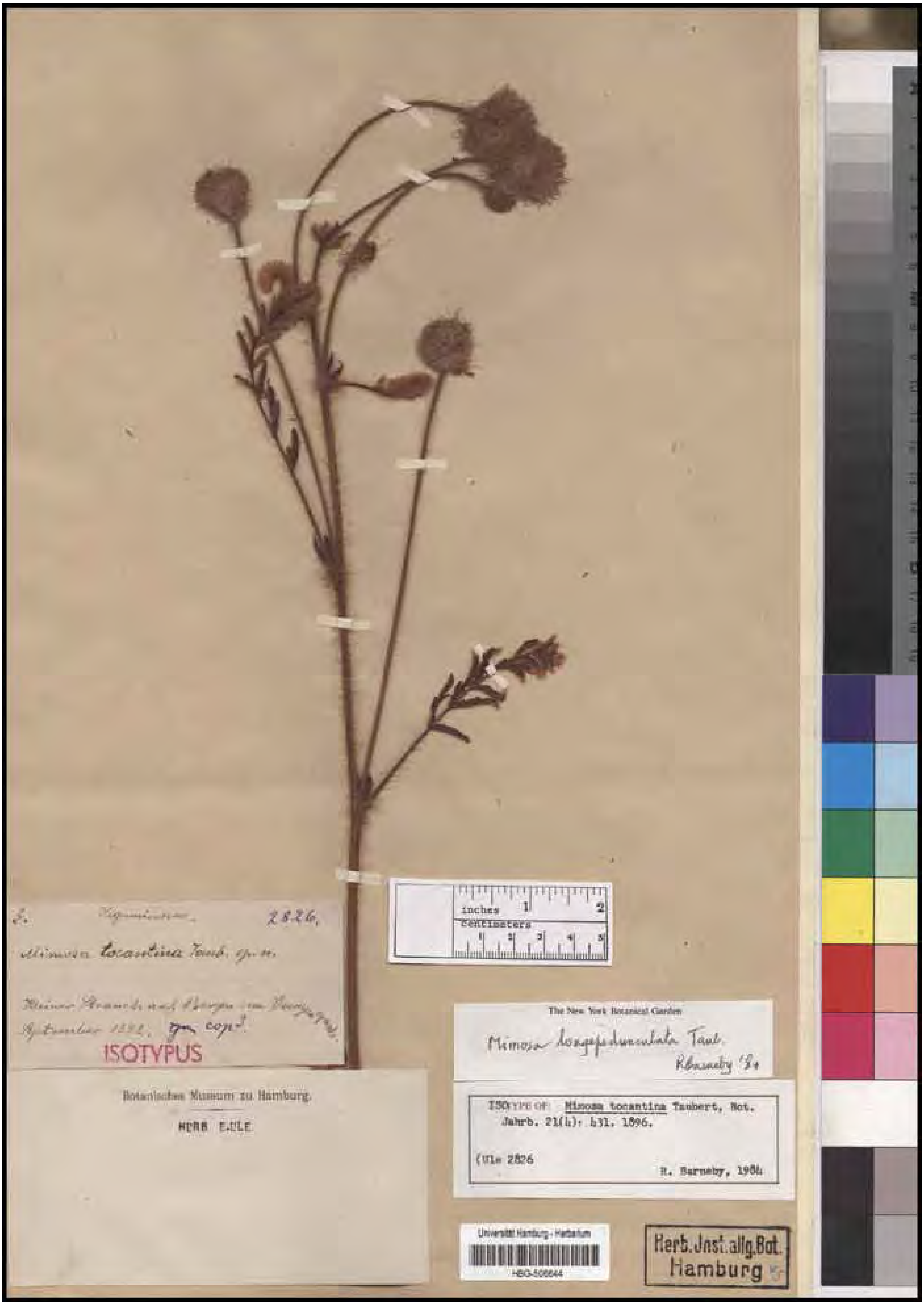

FIGURE 7. Lectotype of *Mimosa tocantina*. (*Ule 2826* [=*Ule 3*], HBG 506644). Image used with permission and provided by the Herbarium Hamburgense (HBG).

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

- 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 bellow 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. Lectoype (designated by Borges & Pirani 2014): Brazil. Goiás: Habitat in valle fluvii Passa Tempo in ditione 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 trough 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 inarticulated 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 conceals 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 & 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 km^2; AOO = 4 km^2 [consequence of the cell size of 2 km^2 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

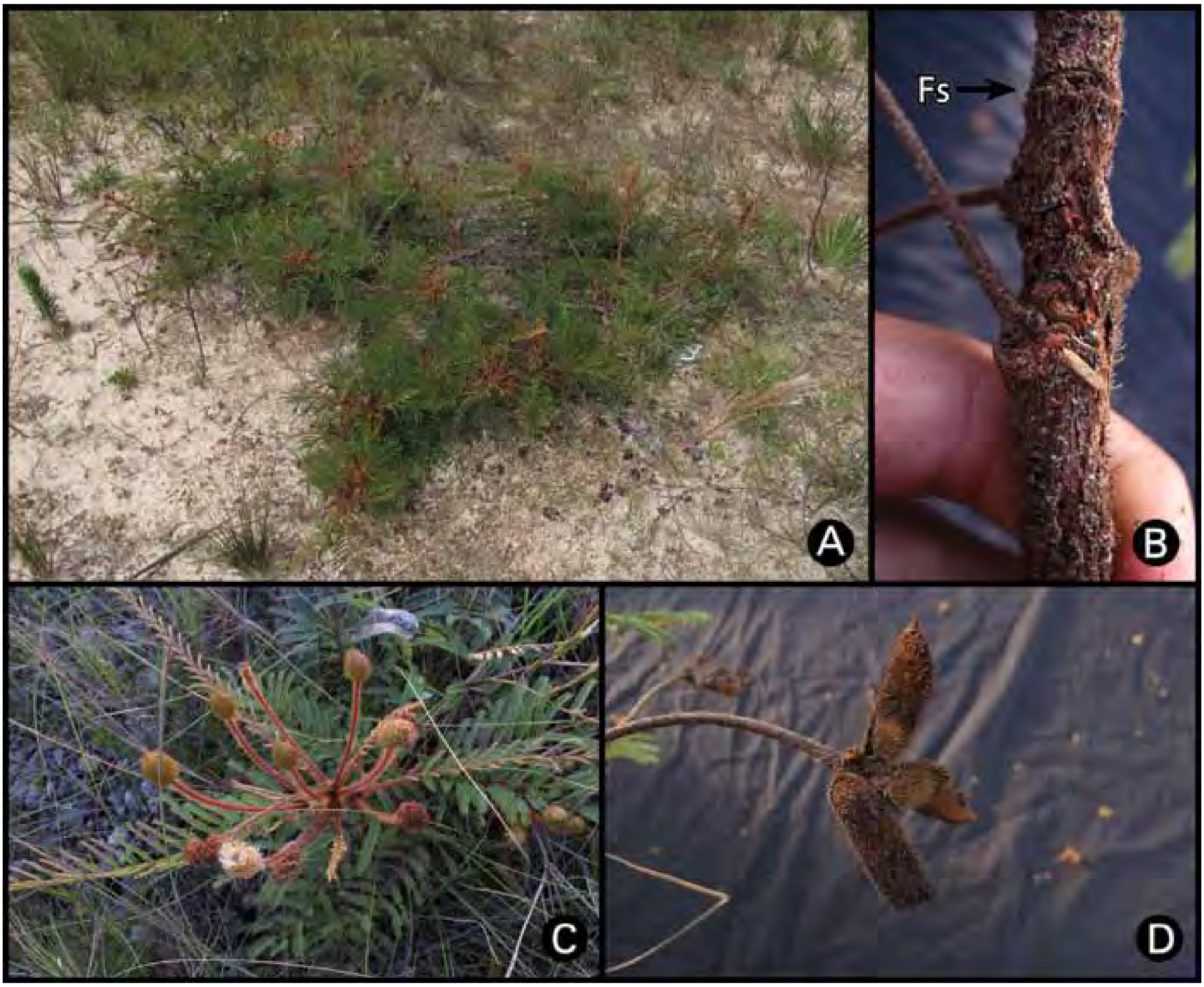

FIGURE 9. *Mimosa tocantina*. A. Habit. B. Branch with filiform setae (Fs). C. Apiculate immature glomerules. D. Fruit.

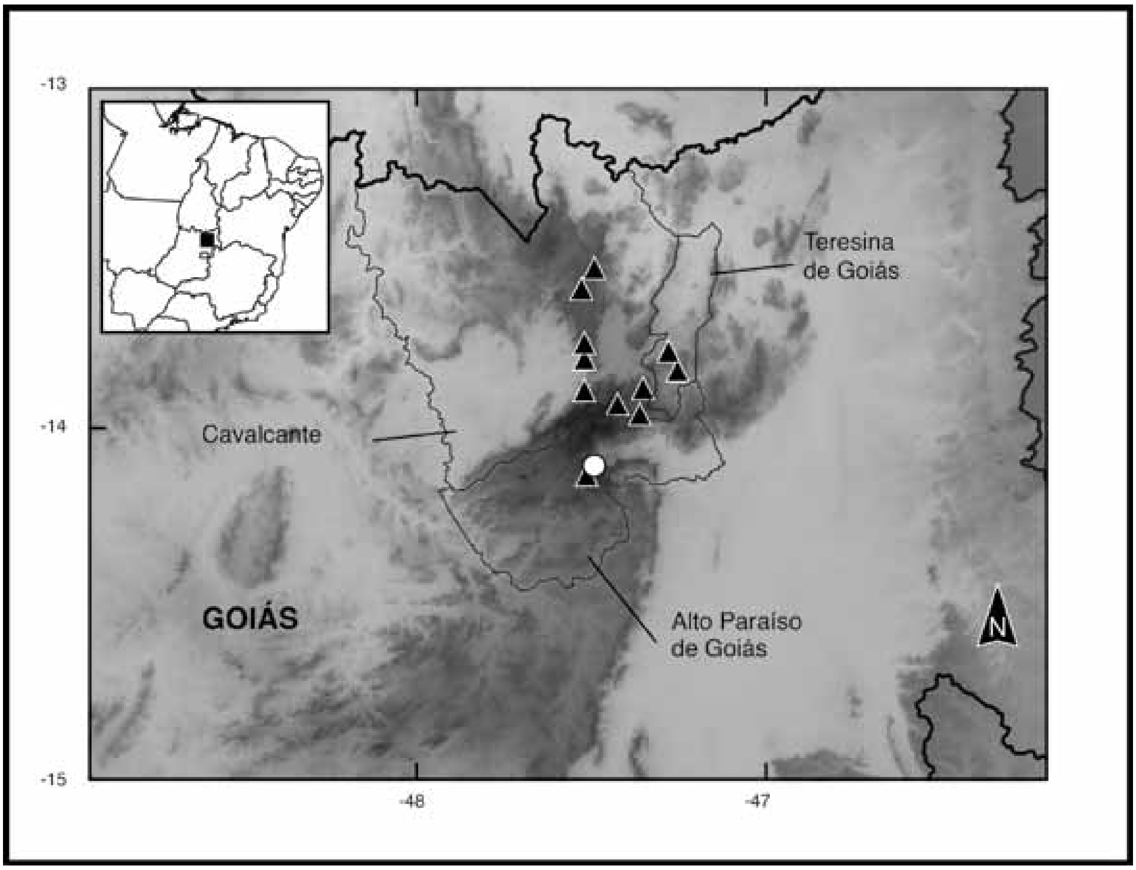

FIGURE 10. Northeastern Goiás area. Range of *Mimosa longepedunculata* (❍) and *M. tocantina* (▲). The boundaries of the Goiás State (thick line) and the municipalities (thin line) of occurrence are indicated.

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 ditione 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 regiao do Tocantins superior, Pizarao" = Ribeirão Pizarão, 14°10'S, 47°35'W (Barneby 1991)]). Figs. 2.G; 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 as *Mimosa longepedunculata* in Barneby (1991: 407–408) or by Simon *et al.* (2010: 279, 281–282), as *Mimosa 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, 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, 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, which 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 km^2; AOO = 44 km^2) the species may be classified as Endangered.

Flowering & 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.

Concluding 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 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 collecte. 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 planaltine 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 exists, 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 understantd *M. longepedunculata* as an extreme of variation of the former and to synonymize them.

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 being 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-planed expeditions focused on general collections covering areas poorly or unevenly explored, which will allow us to frame a more comprehensive picture of the flora.

ACKNOWLEDGMENTS

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CHAPTER FIVE

POINTING OUT DIVERSITY! THE IMPORTANCE OF SPECIES CIRCUMSCRIPTION AND RELYING CONCEPTS FOR LEGUME CLASSIFICATION

Leonardo Maurici Borges & José Rubens Pirani

Abstract

Classification systems in the first instance rely on species. Those, in turn, rely on empirical knowledge about organisms and species concepts. Application of different species concepts in recent approaches to the taxonomy of *Chamaecrista* and *Mimosa* indicate that there is hidden species diversity within the complex infraspecific system formulated by Irwin & Barneby, for the former, and Barneby, for the latter. In this paper we stress that efforts are needed to promote species studies based on explicit concepts in order to achieve not only testable species circumscriptions, but also robust, informative and predictive classification systems.

Keywords

Species concepts; taxonomy; classification system; Barneby; *Chamaecrista; Mimosa*

Introduction

Leguminosae is one of the largest families of flowering plants in the world. Hence, the family portrays a large array of species and features diversity, which may and are of interest to a number of botanical studies, from floras to DNA-based phylogenies, going through morphological studies and chemical analysis. Moreover, it can also be used as a model to understand biome diversification since the family is usually dominant in many formations around the globe (e.g Simon *et al.* 2009). Despite this diversity of subjects, all of them share one important feature: the reliance on species.

On the publication of Legumes of the World, Leguminosae comprised around 19325 species (Lewis *et al.* 2005). Since that time and up to 2013, 971 new species, from a total of 1257 taxa at the species and infraspecific levels (subspecies, variety and forma), were published as new (IPNI 2013). This represents an increase of 5% in the total number of species for the family, more or less, depending on the rate of elevating infraspecific taxa, lowering of species, and synonymization, respectively.

From this, we shall recall that the knowledge about species may change according to two main factors: increased scientific knowledge, which sheds light on unknown species or adjusts the hypothesis about species circumscription; and shifts on philosophical approaches, which influence decisions concerning lumping, splitting and rank choice (it is important to note that this factor may have influence over the first one). Increasing of knowledge comes particularly by study of museum collections, possibly the main source of new taxa (Fontaine *et al.* 2012) and field work, while the philosophical approach influences choice and application of a particular species concept.

Species are the objects of classification systems, which are dynamic, as can be seen through the history of plant classification, from Linnaeus' (1753) artificial system to the modern proposal by the APG III (2009) for high level

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classification. In this case, philosophical and methodological updates related to the production of a system were the main agents for the changes. The same is seen within Leguminosae with the advent of cladistics and the use of molecular datasets, which indicated the need for major rearrangements in legume systematics (Chappill 1995, LPWG 2013, Luckow *et al.* 2003, Simon *et al.* 2009, Wojciechowski *et al.* 2004). It is expected, however, that species also play an important role in this dynamism, since "the whole system of classification depends, in the first instance, on a right understanding of what is meant by species" (Bentham 1861).

The goal of this paper is to discuss the impact of contrasting species concepts on the recognition of taxa and their consequences for the assessment and classification of biodiversity, using an example from legumes.

R.C. Barneby's approach

Rupert C. Barneby (1911–2000), one of the most prominent botanists in the 20th Century and a leading researcher in Leguminosae taxonomy, worked with *Oxytropis, Astragalus, Dalea, Psorothamnus, Mimosa, Cassia, Senna, Chamaecrista*, among other legume genera, particularly from the New World (Welsh 2012).

Amongst Barneby's monumental work of more than 7000 published pages and hundreds of new names (Buck 2001) are his monographs for Neotropical *Mimosa* (Barneby 1991) and Cassiinae, the latter in colaboration with Howard S. Irwin (Irwin & Barneby 1982, Irwin 1964). Barneby's approach to the taxonomy of these two groups, particularly *Chamaecrista* and *Mimosa*, largely makes use of an infraspecific classification: 239 species of the former have 120 varieties under 3 subspecies (Irwin *et al.* 1982), and 479 species of the latter have 225 subspecies or varieties (Barneby 1991). It is interesting to note that Irwin's previous work with *Cassia* subsect. *Xerocalyx* Benth. was based on the recognition of taxa at species level (Irwin 1964), so the shift to a system with a large infraspecific structure was probably due to Barneby's influence. It is also noteworthy to stress out that Barneby himself stated in the monograph of *Mimosa*: "Where appropriate I have drawn attention to some of the unsolved taxonomic problems which can best be addressed by Latin American botanists living within easy access to the living plants" (Barneby 1991: 4). He clearly indicates that different approaches or taxon circumscriptions should be expected in those cases, as further fieldwork and larger samples from natural populations were carried out.

Recent approaches

The classifications proposed by Irwin and Barneby (1978, 1982a, 1982b) for *Chamaecrista* and Barneby (1991) for *Mimosa*, even if complex, are the main, if not in many cases the only sources of taxonomic knowledge for these genera and, thus, widely adopted (e.g. for Brazil, Cardoso & Queiroz 2007; Dutra & Morim 2013; Dutra *et al*. 2008a, 2008b; Simon & Proença 2000; Souza & Bortoluzzi 2013). However, recent taxonomic studies are providing new insights to a better circumscription and classification of these taxa.

Conceição *et al*. (2008), based both on morphological and molecular data, proposed to raise six of the seven varieties of *Chamaecrista cytisoides* (DC. ex Collad.) H.S. Irwin & Barneby to specific rank and to synonymize the remaining one. Similarly, Rando *et al*. (2013), based on extensive field work and analysis of additional herbarium specimens, treat varieties of *C. choriophylla* (Vogel) H.S. Irwin & Barneby as species, and consider *C. potentilla* (Mart. ex Benth.) H.S. Irwin & Barneby as a homogeneous species, with no subtended varieties.

For *Mimosa*, this tendency to abolish the recognition of infraspecific taxa is not necessarily followed. Dutra (2009) strictly adheres to Barneby's (1991) classification and later also describes a new variety for *M. foliolosa* Benth. (Dutra & Garcia 2012), which may indicate a preference for this kind of system. Särkinen *et al*. (2010), using evidence from molecular phylogenies and morphology, do not raise *M. montana* var. *sandemanii* Barneby to species status, but indicate it as a "candidate species sensu Vieites *et al*. (2009), and would do so on the availability of additional specimens for morphological study and more robust evidence for the polyphyly of *M. montana* Kunth varieties (For sake of discussion, we will consider this decision as a taxonomic update). Savassi-Coutinho (2009) takes a heterogeneous approach by raising four varieties, lowering two species and synonymizing varieties, in the end reducing the number of varieties within *M.* sect. *Calothamnos* Barneby from 13 to six. In this particular case, if we consider that the raising of taxa followed the synonymization procedure, two of eight varieties were treated as species. Another example comes from Borges *et al.* (Chapter 4), who update the taxonomy of *M. setosa* Benth., a species comprising nine infraspecific taxa (eight varieties and one subspecies) (Barneby 1991). Those authors treated this polytypic taxon as six distinct species (Borges *et al.* Chapter 3).

SPECIES CONCEPTS' RELEVANCE

Species are hypothesis propositions (Wheeler 2004) about the individualization of biological entities in nature (Cracraft 2000). As such, they must be as clear as possible, and the choice and explicitness of a species concept may be the first step in order to achieve that goal. Unfortunately, as McDade (1995) highlighted, botanists have not tended do discuss, or even indicate, the concepts adopted in their taxonomic works, and generally still do not do so today. Hence, for further considerations, it will be necessary to infer the species concepts adopted by Barneby (1991), Conceição *et al*. (2008), Dutra (2009), Dutra & Garcia (2012), Irwin & Barneby (1982b), Rando *et al.* (2013) Särkinen *et al*. (2010), and Savassi-Coutinho (2009). Only Borges *et al.* (Chapter 4) clearly stated that they followed the Phylogenetic Species concept (PSC) (Nixon & Wheeler 1990, Wheeler & Platnick 2000).

Apparently, the works of Irwin & Barneby (1982b) and Barneby (1991) make use of the Biological Species Concept (BSC) (Mayr 2000), which may have strongly influenced Barneby's taxonomic scheme, as can be inferred from his comment on some related species of *Mimosa*:

> "The taxonomic status of these obviously close kindred is debatable, but I have concluded that, on account of their spatial isolation and the *impossibility of interbreeding*, they may conveniently be classed as species" (Barneby 1991: 409; our emphasis).

Barneby would make use of morphological evidence to delimit distinct forms from herbarium specimens and, after that, infer the possibility of interbreeding through geographical distribution of the specimens to arrive at decisions regarding their recognition as species, or infraspecific taxa. This is reinforced by his view that infraspecific taxa were links in a geographical succession within the distribution area of a species:

> "[W]e are now in position to know with close approach to exactness the geographical ranges of the various elements of the *M. setosa-paludosa* complex. These ... form a concentric series, focused on the highlands of the Tocantins–São Francisco–Paranã watershed. The outermost ring corresponds with the limit of the species and of its subsp. *paludosa* ..." (Barneby 1991: 353).

An adherence to this particular species concept, linked with a small number of available herbarium specimens and lack of field knowledge on South American plants (Barneby 1991:4), may have played a major role on this classification based on infraspecific ranks, since the BSC is known to proliferate the description of taxa below species level.
Since Dutra (2009) and Dutra & Garcia (2012) show a tendency to follow Barneby's classification and to promote the complex infraspecific structure of *Mimosa foliolosa* Benth., it is reasonable to suggest that they are also adopting the BSC.

The use of both molecular and morphological data in a phenetic background by Conceição *et al*. (2008) to update the taxonomy of *Chamaecrista cytisoides* may reflect an approximation to the Unified Species Concept advocated (USC) by Queiroz (1999, 2005, 2007)leading to a half century of controversy concerning both the definition of the species category and methods for inferring the boundaries and numbers of species. Alternative species concepts agree in treating existence as a separately evolving metapopulation lineage as the primary defining property of the species category, but they disagree in adopting different properties acquired by lineages during the course of divergence (e.g., intrinsic reproductive isolation, diagnosability, monophyly. This concept is pluralist and permeable to the use of multiple sources of data to delimit lineages. The same may be inferred for Särkinen *et al*. (2010), although within a molecular phylogenetic framework associated with classical morphologic analysis. Rando *et al*. (2013) and Savassi-Coutinho (2009) mainly rely on analysis of morphological features observed either in herbarium specimens and living plants, so they may be adopting the Morphological (or Taxonomic) Species Concept (MSC).

Table 1 depicts the four different species concepts here identified and shows that there were almost no authors adopting the same concept within each genus. Despite this relatively large diversity in concepts, almost all recent approaches proposed updates to Irwin & Barneby (1982b) and Barneby's (1991) classifications.

The immediate consequence of the taxonomic changes here highlighted is related to the number of species belonging to *Chamaecrista* and *Mimosa*. It is shown above that in the former, approximately 80% of the varieties (including the type varieties) were treated as species, while in *Mimosa* around 41% gained species rank, when Savassi-Coutinho's (2009) interpretations and ours are taken into account, which do not strongly follow Barneby's (1991) view.

This may have come from the increase in knowledge about the plants over time and the application of different methods (A. S. Conceição *et al.* 2008), but apparently the choice and application of different species concepts

Table 1. Summary of species concepts adopted in *Chamaecrista* **and** *Mimosa*. *** Updates to the infraspecific classification of Irwin & Barneby (1982b) or Barneby (1991); Cham -** *Chamecrista*; **Mim -** *Mimosa*; **BSC - Biological Species Concept; MSC - Morphological Species Concept; PSC - Phylogenetic Species Concept; USC - Unified Species Concept.**

Taxon	Author	Species concept	Updates*
Cham	Irwin & Barneby (1982b)	BSC	-
Cham	Conceição *et al.* (2008)	USC	yes
Cham	Rando *et al.* (2013)	MSC	yes
Mim	Barneby (1991)	BSC	-
Mim	Borges *et al.* (Chapter 4)	PSC	yes
Mim	Dutra (2009); (Dutra et al. 2012)	BSC	no
Mim	Särkinen et al. (2010)	USC	yes
Mim	Savassi-Coutinho (2009)	MSC	yes

played an important role in the observed taxonomic changes. However, it is important to highlight that, although we are inferring that Dutra (2009) and Dutra & Garcia (2012) also followed the BSC, it is possible that the absence of modifications in the first case, comes from a particular choice to develop a local flora reflecting an existing classification, instead of presenting a revisionary view.

The observed tendency to reduce or eliminate the use of infraspecific taxa by recent authors may be a clue for the influence of the concept chosen in each case. The BSC is well known to promote the proliferation of taxa below species level, so the application of a distinct concept to the same set of organisms, as can be seen, is very likely to revert this.

Differences in species concept choices will, at least, individuate distinct numbers of species. If the patterns highlighted here become trends in the taxonomic practice within these genera, it is possible to suppose that the current knowledge about their diversity would radically change. By projecting the observed rates of rank update for all the infraspecific taxa recognized by Irwin and Barneby (1978, 1982a, 1982b) and Barneby (1991), there would be 96 and 92 additional species to *Chamaecrista* and *Mimosa*, respectively. The current number of species recognized in the former would jump from ca. of 330 to 426 and for the latter, from ca. 500 (Luckow 2005) to 592.

Classifications should and nowadays commonly do reflect phylogenies (Hennig 1968). Those are, in fact, "testable hypotheses that make explicit predictions about the *distributions of characters among species*" (Wheeler 2008: 7; our emphasis). Different interpretations on the limits of species—which may be directly influenced by the chosen concept, as shown—would then directly affect phylogenetic studies and, thus, classifications. The underestimation of species numbers, as presented here, may generate problems related to taxa sampling, which may largely influence tree topology (Hedtke *et al.* 2006, Rydin & Källersjo 2002), particularly for the ones agreeing that a distinction between tokogeny (to which infraspecific taxa would belong) and phylogeny should be made (Doyle 1995, Hennig 1968, Nixon *et al.* 1990, Wheeler *et al.* 2000, Wheeler 2008). Fortunately, in *Chamaecrista* and *Mimosa*, Irwin and Barneby did recognize distinct patterns of character distribution, although not as species. This implies the present need for botanists to review this system, ideally dealing with infraspecif taxa as the least inclusive units in phylogenetic analysis, and to seek for evidence from reciprocal illumination before making taxonomic changes. However, this is not always the case.

Conclusions

Species are the fundamental units of biodiversity and, as such, must be well defined. Although many different species concepts exist and it is probably not possible to find a consensus about one to be widely used (Balakrishnan 2005; but see also Wheeler 2010), explicitness about choice and application is extremely desirable (McDade 1995). More than that, concepts based on discovery of patterns, instead of, as the BSC, on processes, are welcome, since they do not make considerations about the process of speciation before the definition of the species (Luckow 1995, Wheeler 2010). Species concepts have an important role, as we see, but as important as them are the discovery and description of species. In the midst of a biodiversity crisis (Wheeler 2004), plants are between the organisms with largest shelf life to description of new species, behind only after invertebrates (Fontaine *et al.* 2012). Particular efforts should be made to promote the study and proposition of species hypotheses, since they are the cornerstones for robust, well-built phylogenies. It is the study of species that will provide new data on morphology, DNA, physiology, chemistry, etc., and, thus, help us to propose stronger phylogenetic hypothesis, particularly for groups with poor resolution on lower levels, as observed in the DNA-based phylogenies of *Chamaecrista* and *Mimosa* (Borges *et al*. Chapter 1; Conceição *et al*. 2009; Simon *et al*. 2011; Rando *et al*. unpublished data).

These phylogenies, will, in turn, be used to establish classifications, which will not solely be mirrors to the species trees. They are going to be repositories of biological information and predictability and, to fulfill this purpose, must be insufflated with knowledge about species coming from multidisciplinary approaches, as currently seen within the Leguminosae scientific community. The high number of researchers and research lines within the family may be of value to the production of proper monographs following the propositions by Marhold *et al*. (2013), which share a heart with Wheeler's (2008) ideas for revitalization of taxonomy.

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GENERAL CONCLUSION

The phylogenetic analysis of *Mimosa* ser. *Pachycarpae* Benth. and *M.* ser. *Setosae* Barneby (Borges *et al*. Chapter 1) here performed reinforces earlier suggestions that both series should be merged in a single group (Bessega *et al.* 2008). Also, we have shown that part of the species belonging to *M.* ser. *Setosae* is actually more related to *M.* ser. *Piresianae* Barneby, a group which was now sampled for the first time. In order to achieve a clade-based taxonomy for the taxa included in those three series, Bentham's (1875) early circumscription must be adopted together with transference of some species to *M.* ser. *Piresianae*. Moreover, Barneby's (1991) infraspecific classification is not corroborated by our tree topology and must be updated as much as possible either by synonymization or raising of infraspecific taxa to higher taxonomic ranks.

The clade formed by *Mimosa* ser. *Pachycarpae* and part of *M.* ser. *Setosae* (MPS clade) is supported both by molecular and morphological synapomorphies, these being the presence of xylopodium and filiform setae. However, the latter are homoplastic and reversals seem to have occurred in the history of the group. Hence, morphological definition of a broad *M.* ser. *Pachycarpae* is difficult due to the large morphological diversity observed in the group. Nonetheless, the unjointed craspedial is still the most common condition occurring in species of the group, even if not synapomorphic and homoplastic.

Combined application of different methods allowed us to frame a better picture of *Mimosa* ser. *Pachycarpae* diversity. The conclusion that the group comprises 77 taxa of which only five are infraspecific was achieved by means of different processes. Phylogenetic analysis (Borges *et al.* Chapter 1) indicated the need to transfer three species to *M* ser. *Piresianae* and also the need to review the infraspecific classification of taxa belonging to the MPS. The latter was done by evaluation of taxa limits based on analysis of herbarium specimens and living plants on the field (Borges *et al.* Chapter 1), which also culminated on the description of two new species ((Borges *et al.* Chapter 4.1) and reinstatement of one species (Borges *et al.* Chapter 4.3). The nomenclatural knowledge about the series was also refined by solving problems associated with the typification of species names based on Ernst Ule collections (Borges *et al.* Chapter 4.2).

Although the many modifications to Barneby's (1991) classification of *Mimosa* ser. *Pachycarpae* presented, we have shown that most taxa recognized by him have distinct character states and can actually be treated as species (Borges *et al.* Chapter 3). Apparently Barneby's adherence to a complex infraspecific classification is associated with his choice for a particular species concept (Borges *et al.* Chapter 5). If that is the case, similar changes may be applied for *Mimosa* as a whole, what would increase the number of species of the genus, but at same time decrease the total number of taxa. This would surely provide a better understanding of the diversity of the genus, and allow more precise comparisons to other taxa.

We believe that our results bring consistent contributions to Barneby's desire to see his work being improved by botanists with easy access to the plants (Barneby 1991: 4). Nonetheless, conclusions based on the phylogenetic analysis indicate that complex biological processes such as key innovations, niche evolution and phenotypic recombination may be involved in *Mimosa* ser. *Pachycarpae* evolution. Hence, development of multidisciplinary and integrative approaches to the study of this peculiar plant group are yet needed to fulfill Barneby's legacy.

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