



## A new xerophytic species of *Mimosa* (Mimosoideae, Leguminosae) from Madagascar

MATÍAS MORALES<sup>1,2,3,4</sup> & RENÉE H. FORTUNATO<sup>1,2,3</sup>

<sup>1</sup> Facultad de Agronomía y Ciencias Agroalimentarias, Universidad de Morón, Cabildo 134, (B1708JPD), Morón, Argentina.

<sup>2</sup> Instituto de Recursos Biológicos, CIRN, CNIA, INTA, N. Repetto & Los Reseros s/n (1686), Hurlingham, Argentina.

<sup>3</sup> Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.

<sup>4</sup> Author for correspondence ([mmorales0007@gmail.com](mailto:mmorales0007@gmail.com), [morales.matias@inta.gob.ar](mailto:morales.matias@inta.gob.ar))

### Abstract

A new Malagasy species, *Mimosa dupuyana*, is described and illustrated. This species is closely related to *M. delicatula*, but they can be distinguished by the leaf formula, leaf morphology and pods. *M. dupuyana* has leaves with broad, flattened, and dorsiventrally compressed petioles and only 2–3 leaflet pairs, while *M. delicatula* has narrow, terete to subteretepetioles and 5–9 leaflet pairs. In addition, the pods of *Mimosa dupuyana* are constricted between seeds, coriaceous, reddish and elevated on each seeds. The latter species is quite different to the remainder known Malagasy species of *Mimosa*, by combination of some or all of these characters: leaf-formula, habit, form of petioles, and form and armament of pods. Together, *M. delicatula* and *M. dupuyana* resemble some lineages of South American section *Batocaulon* series *Farinosae*, which occur in seasonally dry subtropical formations, and this could be an interesting example of convergent evolution. Illustrations, keys for identification and taxonomical, distribution and ecological comments are included.

**Key words:** *Batocaulon*, *Farinosae*, Malagasy Flora, *Mimosa dupuyana*

### Resumen

Una nueva especie malgache, *Mimosa dupuyana*, es descrita e ilustrada. Esta especie está estrechamente relacionada a *M. delicatula*, pero pueden ser distinguidas por la fórmula y morfología foliar, y por sus frutos. *M. dupuyana* tiene hojas con pecíolos anchos, dilatados y comprimidos dorsiventralmente, y sólo 2–3 pares de foliólulos, mientras que *M. delicatula* tiene hojas con pecíolos angostos, teretes o subteretes, y 5–9 pares de foliólulos. Además, en *Mimosa dupuyana*, los frutos son comprimidos entre las semillas y elevados sobre las mismas, coriáceos y rojizos. Ésta última especie es enteramente diferente al resto de las especies malgaches conocidas de *Mimosa*, por combinación de algunos o de todos los siguientes caracteres: fórmula foliar, hábito, forma de los pecíolos y forma y armamento de los frutos. *M. delicatula* y *M. dupuyana* recuerdan algunos linajes de la sección *Batocaulon* serie *Farinosae* de Sudamérica, que crecen en formaciones subtropicales estacionalmente secas, lo que podría representar un interesante ejemplo de evolución convergente. Se incluyen ilustraciones, claves para identificación, y comentarios sobre la taxonomía, distribución y ecología de la especie.

**Palabras clave:** *Batocaulon*, *Farinosae*, Flora Malgache, *Mimosa dupuyana*

### Introduction

The megadiverse genus *Mimosa* Linné (1753: 533) comprises more than 530 species, with a pantropical and subtropical distribution, including tropical America, Asia, Africa, and some islands in the Pacific Ocean (Barneby 1991; Villiers 2002; Luckow 2005; Simon *et al.* 2011). There are two main centers of diversification for the genus: 1) central and southern Mexico, minor ones in Cuba-La Hispaniola and the Orinoco Basin; and 2) southern South America: southern Amazon Basin and adjacent areas of Brazilian Plateau, northeastern Argentina, Paraguay, and Uruguay (Barneby 1991). Madagascar should be considered an important center of endemism in this genus: it is interesting to point out that 31 of the 33 Malagasy *Mimosa* species are endemic of this island (Villiers 2002; Lefèvre

& Labat 2006). In contrast, in continental Africa, this genus is poorly represented by four or five species, and only two of them appear to be endemic (Brenan & Brummitt 1970; Simon *et al.* 2011).

The study of *Mimosa* from Madagascar was undertaken first by Benthham (1842, 1875). Later Villiers (2002) made a complete revision of Malagasy *Mimosa*. Recently, a new species, *M. manomboensis* Lefèvre & Labat (2006: 74) was described. According to the study of Villiers (2002), it is possible to infer that, in Madagascar, the subhumid areas include several species of the genus, which are generally vines and shrubs with ample plurijugate leaves and leaflets. Contrarily, in the driest areas of south and west of the island there are mainly shrubs and trees with xerophytic habit and reduced, congested leaves arising from brachyblasts with racemes, such as *M. delicatula* Baillon (1886: 24) and *M. grandidieri* Baillon (1883: 357). This group of species can be distinguished from other Malagasy species of *Mimosa* by habit, leaf formula, size of leaves, inflorescence type and the unarmed craspedia (Villiers 2002).

The most extensive phylogenetic study about *Mimosa* (Simon *et al.* 2011) suggests that Malagasy, together with endemic Asian and continental Africa species (clade E from Simon *et al.* 2011) have been derived from a clade of South American ancestors (clade D from Simon *et al.* 2011), but this conclusion is controversial, since many of the Old World *Mimosa* have been previously included in the series *Rubicaules* Benthham (1842: 394) (Benthham 1875; Barneby 1991), a group whose center of diversification is in North and Central America (Benthham 1875, 1876; Barneby 1991; Simon *et al.* 2011).

According to Simon *et al.* (2011), the clade of South American hypothetical ancestors of Malagasy species (clade D) comprises many species from different series of section *Batocaulon*: series *Farinosae* Barneby (1991: 190), *Ceratoniae* Barneby (1991: 258), *Bimucronatae* Barneby (1991: 160), *Leiocarpae* Benthham (1841: 341), and *Caesalpiniifoliae* Benthham (1842: 392).

In the context of a revision of Malagasy *Mimosa*, a new species, close to *M. delicatula*, *Mimosa dupuyana* M. Morales & Fortunato, is here described and illustrated. The taxonomic position, distribution and ecology of this species is discussed regarding the current evolutionary hypotheses and systematic infrageneric proposals in *Mimosa*. We also discuss the morphological similarities between American and Malagasy xerophytic species in the context of the latest evolutionary studies.

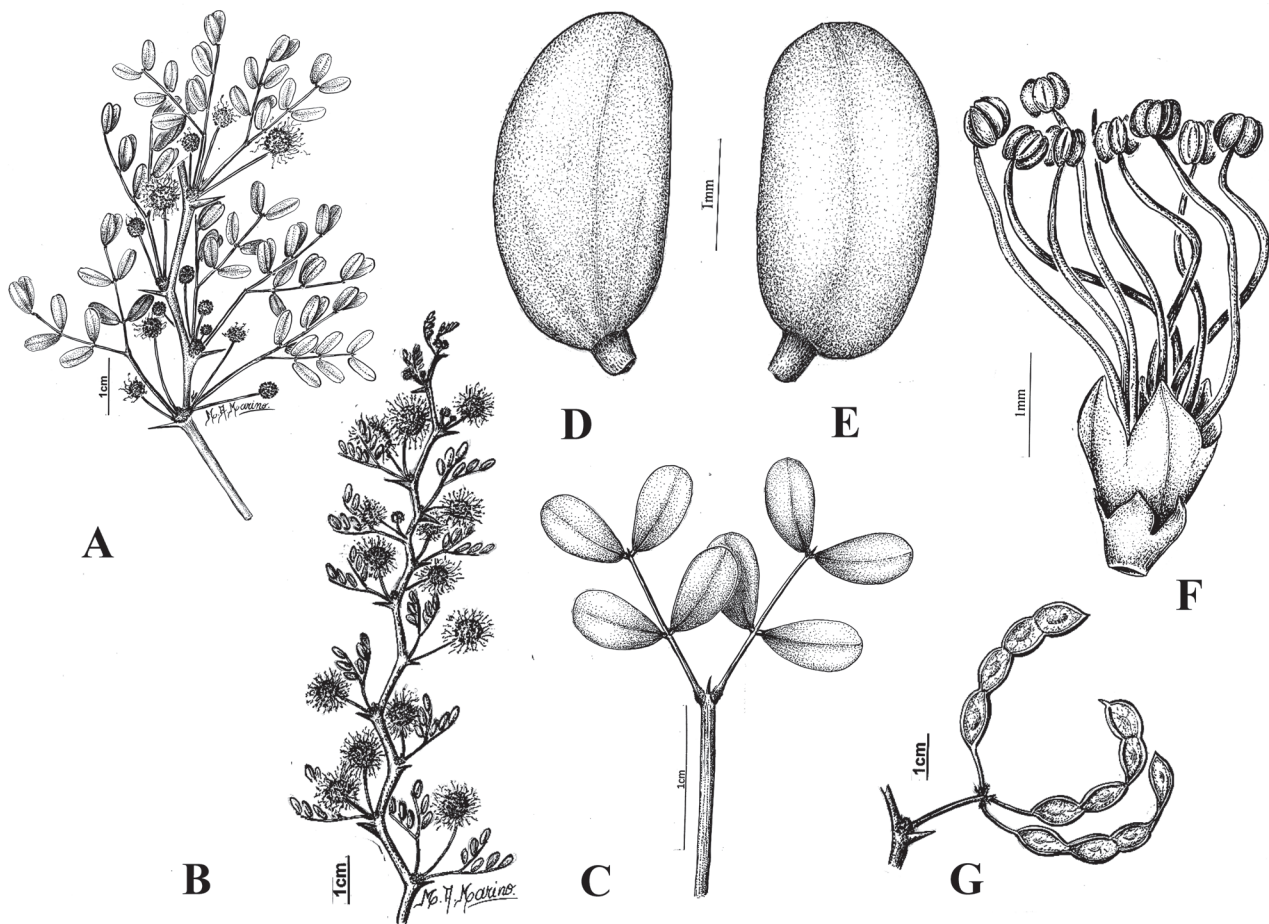
## Taxonomy

### *Mimosa dupuyana* M. Morales & Fortunato, *sp. nov.*

Type:—MADAGASCAR. Toliara: Ca. 1 km N of Itampolo, 08 February 1990, D.J. Du Puy, B.P. Du Puy, J.-N. Labat & P.B. Phillipson M452 (holotype MO 6250882!, isotypes: K, P [photo!]). (Fig. 1A–G).

Differs from *M. delicatula* by its broad, flattened and dorsiventrally compressed (not narrow, terete to subterete) petioles, 2–3 pairs of leaflets per pinna (not 5–9), and narrow, reddish, coriaceous, and constricted between seeds (not broad, brownish, papery and straight) craspedia.

Shrubs or treelets up to 3 m tall, with sinuous branches (especially the primary branches), armed with a solitary aculeus at or immediately below the node (rarely paired in some nodes), glabrous, and frequently with reddish, sessile to subsessile glandular trichomes loosely distributed, but more densely in the apex of the stems, petioles, peduncles, and corolla lobes. Stipules 0.6–1.1 × 0.2–0.3 mm, subulate or triangular, tenuously 1–nerved. Leaves with 1 pair of pinnae; petioles 2.5–16 × 0.5–0.8 mm, dorsiventrally compressed, flattened, succulent; rachis 2.5–20 mm; leaflets 2–3–pairs, 2.5–7 × 1.5–4.2 mm, the basal ones lanceolate to oblanceolate, the distal ones oblanceolate to obovate, apex generally obtuse (sometimes acute in the first pairs of each pinna), base asymmetric, leaflet surface glabrous or sometimes with loosely red sessile to subsessile glandular trichomes, margin glabrous, ratio length:width (1.1)1.2:1–3.3:1, 1–3–nerved, the secondary venation not visible, succulent. Inflorescences axillary, composed by racemes globose, solitary to arranged in fascicles, arising simultaneously with the leaves from brachyblasts 1–2 mm long or at basis of them; peduncles 3–27 mm; racemes 3–5.5 mm in diameter, spheroid, moriform; floral bracts 0.6–1 × 0.2 mm, spatulate, ciliolate in the margin of the apex, mucronate, 1–nerved, caducous. Flowers 4-merous; calyx 0.5–1 mm long, campanulate; corolla 2–2.5 mm long, obconical-campanulate, glabrous or with glandular trichomes at lobes, whitish; androecium with stamens 8, filaments 3.5–5 mm long, free to base, anthers 0.4–0.5 × 0.3–0.4 mm; gynoecium with ovary 1.3–2 mm long, glabrous, style and stigma ca. 5 mm long, style attenuate, stigma poriform, undifferentiated. Craspedia 37–64 × 5.5–7 mm, narrow, constricted between seeds, falcate, stipitate, the stipe 5–11(13) mm long, reddish, coriaceous, unarmed, glabrous, unarmed, glabrous, elevated over each seed, 2–8–seeded, replum 0.6–1 mm wide. Mature seeds not seen.



**FIGURE 1.** *Mimosa dupuyana*. A) and B) Branches with flowers and fruits. C) Leaf. D) Leaflet, adaxial surface. E) Leaflet, abaxial surface. F) Flower. G) Fruit. Fig. 1A, drawn from *Ranaivojaona* 497 (MO); Fig. 1B–G, drawn from the holotype. All illustrations by Angélica Marino.

**Notes:**—Among the set of Malagasy *Mimosa* species, *M. dupuyana* is easily distinguishable by its combination of sinuous stems, solitary (rarely two) infrastipular aculei, flattened, dorsiventrally compressed, and succulent petioles, reduced leaflets arising from brachyblasts or at their basis, together with the axillary heads, leaf formula, and constricted between seeds craspedia (Fig. 1A–G).

*M. dupuyana* bears the resemblance to *M. delicatula*, because both are xerophytic shrubs to treelets with reduced leaves, sinuous stems, brachyblasts, indumentum composed by reddish, sessile to subsessile, glandular trichomes, and armed stems with mainly solitary aculeous per node. However, there are several characters which allows to distinguish both species. *M. dupuyana* has constantly 2–3 pairs of leaflets per pinna, while *M. delicatula* has 5–9 pairs. In *M. dupuyana* the petioles are broader (0.5–0.8 mm wide, while those of *M. delicatula* are up to 0.4 mm, rarely 0.5 mm wide), flattened, dorsiventrally compressed, and succulent; this type of petiole was not already described in the Malagasy species of *Mimosa* (Table 1). Finally, fruits of *Mimosa dupuyana* are different in form and texture from those of *M. delicatula*: they are constricted between seeds, reddish, with a broad replum, and coriaceous valves (Fig. 1G), while the mature pods of *M. delicatula* are straight or almost, not or only tenuously constricted between seeds, brownish or withish, with narrow replum, and coriaceous or chartaceous valves.

*Mimosa dupuyana* shows also morphological similarity with *M. grandidieri*, and both are sympatric with *M. delicatula*. *M. grandidieri* shares with both species the type of indumentum and presence of brachyblasts. However, *M. grandidieri* has three aculei per node, large, exserted pseudoracemes, and chartaceous, straight, compressed craspedia with narrow replum (up to 0.5 mm wide). In addition, its leaf formula is something different from the new species, having from 1 to 4 pairs of pinnae and from 3 to 13 leaflets in the largest leaves, and their petioles are not flattened and dorsiventrally compressed, but terete or subterete (Table 1).

**TABLE 1.** The main morphological differences between *Mimosa dapuyana* and other xerophytic Malagasy and Neotropical ser. *Farinosae*.

Series	Species	Indumentum	Aculei	Brachyblast	Form and primary nerves	Leaflets	Leaf formula (pinna and form pairs/leaflet)	Petiole Length (mm)	Rachis Length (mm)	Inflorescence	Calyx Length (mm)	Corolla Length (mm)	Stamens	Androecium	Form and pubescence	Pods	Dehiscence	Size (mm)	Articles per pod
Malagasy species	<i>M. dapuyana</i>	Reddish, sessile subsessile, glandular, trichomes	Infrastipular, solitary, rect.	Present	Oblong to oblanceolate.	2.5–7 × 1.5–4.2	i/2–3	2.5–20, flattened	2.5–20	Axillary	0.5–1	2–2.25	8		Oblong, constricted between seeds, elevated on each seed, glabrous.	Craspedium	37–64 × 5.5–7	2–8	
	<i>M. delicatula</i>	Reddish, sessile subsessile, glandular, trichomes	Infrastipular, solitary, rect.	Absent	Oblong to oblanceolate.	1–6.5 × 0.3–3	i–ii/2–10	0.5–10, subterete	1–6.5	Axillary	0.1–0.8	1.25–2.25	8		Oblong, straight, compressed, glabrous.	Craspedium with typical or only valvate dehiscence.	21–69 × 4–9	3–11	
	<i>M. grandidieri</i>	Reddish, sessile/ subsessile, glandular, trichomes, or eglandular	2–3 per node, rect.	Present/ absent	Oblong to oblanceolate.	3.5–18 × 0.5–8	i–iv/3–11	4–30, subterete	5–44	Pseudoracemose/ axillary	0.3–0.6	1.5–2	8		Oblong, straight, compressed, glabrous	Craspedium with typical dehiscence.	21–140 × 5–19	3–9	
	<i>M. onilahensis</i>	Pubescent to glabrous	Infrastipular, 1–3, rect	Absent	Obovate to suborbicular, 3–5–nerved.	Up to 32 × 30 mm.	i/1	5–13, subterete	4–15	Pseudoracemose/ axillary	0.75–1	2.5–3.5	8		Narrowly oblong, falcate, glabrous	Craspedium with typical dehiscence.	3.5–9 × 0.4–0.9	5–10	
	<i>M. ikondensis</i>	Reddish, sessile/ subsessile, glandular, trichomes	Infrastipular, solitary, rect	Absent	Suborbicular to orbicular	3–14 × 2–14	i/2–3	4–13, subterete	7–16	Pseudoracemose/ axillary	0.3–0.5	2.5–3	8		Narrowly oblong, falcate, compressed, glabrous.	Possibly craspedium.	±40 × 10, few seen.	±7, few seen.	
	<i>M. waterlotii</i>	Eglandular, villosous	Unarmed	Absent	Oblong to spatulate	Up to 5 × 3 mm	ii–vi/10–15	Up to 50, subterete	Up to 50	Pseudoracemose/ axillary	Up to 1	2	8		Narrowly oblong, ±straight, compressed, glabrous	Craspedium with typical dehiscence.	Up to 55 × 12	6–7	
<i>Farinosae</i>	<i>M. farinosa</i>	Reddish, sessile/ subsessile, glandular, trichomes	Infrastipular, geminate, rect or slightly recurved.	Present	Oblong to oblanceolate.	1.1–6 × 0.2–1.5	i/4–12	0.5–7, subterete	1.5–14(22)	Axillary	0.1–0.6	2–2.8	8		Oblong, straight, compressed, glabrous/ glandular trichomes.	Craspedium with typical dehiscence.	31–60 × 3–7	1–8	
	<i>M. detinens</i>	No glandular trichomes.	Infrastipular, geminate, recurved.	Present	Oblong to oblanceolate.	1.5–6.5 × 0.5–2	i–ii/2–12	0.5–8, subterete	2.5–12.5	Axillary	0.9–1.5	1.75–3	8		Oblong, straight, compressed, glabrous.	Craspedium with typical dehiscence.	16–60 × 10–16.5	1–7	
	<i>M. ostenii</i>	No glandular trichomes.	Infrastipular, geminate, recurved.	Present	Oblong to oblanceolate.	3–11.5 × 0.5–4	i/4–11	(1)3–12(22), subterete	(6) 8–40.5	Axillary	0.75–1.5	2–3.5	8		Oblong, compressed, straight, glabrous.	Craspedium with typical dehiscence.	24–61 × 8–16	2–9	
	<i>M. castanoclada</i>	Reddish, sessile/ subsessile, glandular trichomes	Infrastipular, geminate, rect or slightly recurved.	Present	Oblong to oblanceolate.	1–1.7 × 0.2–0.5	i/3–6	1.5–4, subterete	2.5–5	Axillary	0.3–0.6	2–3	8		Oblong, compressed, straight, glabrous/ glandular.	Craspedium with typical dehiscence.	25–32 × 7–9	4	

*M. onilahensis*, *M. ikondensis* and *M. waterlotii* modified from Villiers 2002.

Other Malagasy species which have similar leaf formula to *Mimosa dupuyana* are *M. onilahensis* Viguier (1949: 339), *M. ikondensis* Villiers (1991: 227), and *M. waterlotii* Viguier (1949: 342). These species have leaves with few pairs of pinnae and leaflets, but they differ from *M. dupuyana* in several characters. *M. onilahensis* has constantly 1–jugate leaflets which are significantly larger than leaflets of *M. dupuyana* (up to  $32 \times 30$  and up to  $7 \times 4$  mm, respectively). In addition, the leaflets in *M. onilahensis* are broadly obovate to suborbicular with 3–5 pairs of primary nerves. Regarding to *M. ikondensis*, it has leaves with 1–2 pairs of pinnae with ample ( $3\text{--}14 \times 2\text{--}14$  mm) and suborbicular leaflets. *M. waterlotii* has larger, spatulate leaflets and pseudoracemose inflorescences. Unlike *M. dupuyana*, *M. onilahensis*, *M. ikondensis*, and *M. waterlotii* have straight or falcate and dorsiventrally compressed craspedia and terete or subterete petioles (Table 1).

In comparison with the remainder Malagasy species of *Mimosa*, *M. dupuyana* is quite different, due to its xeromorphic characters: small leaves, few-jugate pinnae, axillary inflorescences crowded with leaves on the brachyblast and constricted between seeds, and unarmed craspedia. In contrast, the remainder Malagasy *Mimosa* have generally ample, plurijugate leaves, combined with all or some of the following characters (Villiers 2002; Lefèvre & Labat 2006): climbing shrubs or vines, craspedia with armed, straight replum, exerted or subterminal inflorescences, and stems armed sometimes with cat's claw aculei.

It is very interesting to point out that the entire morphology of *M. dupuyana* resembles the Neotropical *Mimosa* section *Batocaulon* series *Farinosae*. This similarity is also notable in the sympatric allied *M. delicatula*, which shows great similarities especially with the species of series *Farinosae* belonging to clade D of Simon *et al.* (2011), such as *M. farinosa* Grisebach (1874: 134), or related to this, such as *M. castanoclada* Barneby & Fortunato (1987: 167). Both groups of species, the studied Malagasy species and ser. *Farinosae*, are xerophytic shrubs or trees with inflorescences and leaves clustered on brachyblasts, reduced leaves, indumentum with sessile to subsessile glandular trichomes, and tetramerous flowers (Table 1).

The presence of sessile to subsessile glandular trichomes in both groups of species, ser. *Farinosae* and xerophytic Malagasy species, appears to be interesting to analyze in the context of the evolutionary history of these groups. *M. farinosa* is the member of ser. *Farinosae* with more visible (even secretory) glandular trichomes, like the Malagasy xerophytic species (*M. dupuyana*, *M. grandidieri*, and *M. delicatula*). Coincidentally, *M. farinosa* belongs to the ancestral clade of Malagasy species (Simon *et al.* 2011). In opposition, other member of ser. *Farinosae*, such as *M. detinens*, appears in the phylogeny in a different clade (more distant from Malagasy species, according to Simon *et al.* (2011)), and it has not functional glandular trichomes. Presence of visible glandular trichomes can be observed also in other South American phylogenetically related to *M. farinosa* species, such as some representants of series *Bimucronatae*.

The morphological similarities between Malagasy and South American clades of *Mimosa* could be explained by evolutionary convergence of characters. Both groups of species occur at similar latitudes, in subtropical seasonally dry forests and savannas (Matías Morales unpublished data) and it was observed genetic divergence between them (Simon *et al.* 2011). According to the phylogenetical framework, morphologic characters such as trichomes and habit, appear to be independently evolved in both continents but in a similar way.

According to Barneby's classification (Barneby 1991), *M. dupuyana* and *M. delicatula* should be included in ser. *Farinosae*. However, the recent controversy about monophyly of several infrageneric groups of *Mimosa* (Bessega & Fortunato 2011; Simon *et al.* 2011) prevents us to include these species in some section or series. It is still necessary to clarify the circumscription of the infrageneric groups of *Mimosa* based in coherent and cohesive, morphological and molecular phylogenies.

*Mimosa dupuyana* also resembles other xerophytic species of Neotropical *Mimosa*, which are not phylogenetically close to Malagasy species of the genus. On that exhibits some similarities with North American section *Batocaulon* series *Boreales* Barneby (1991: 110), especially the set of species with similar leaf formula and phyllodineous petioles: *M. borealis* Gray (1849: 39), *M. unipinnata* Parfit & Pinkava (1978: 72), and *M. turneri* Barneby (1986: 4). However, these three species are easily distinguished from *M. dupuyana* by pentamerous flowers and bullate craspedia with armed replum.

The presence of flattened, dorsiventrally compressed, succulent (and sometimes also phyllodineous) petioles, leaf-stalks, and rachises in the genus *Mimosa* seems to have evolved independently more than one time, since it is observed in several groups which are not phylogenetically close, such as *M. ser. Boreales*, *M. ser. Fagaranthae* Barneby (1991: 180), and *M. ser. Paucifoliatae* Benthams (1842: 412) (Barneby 1991; Simon *et al.* 2011).

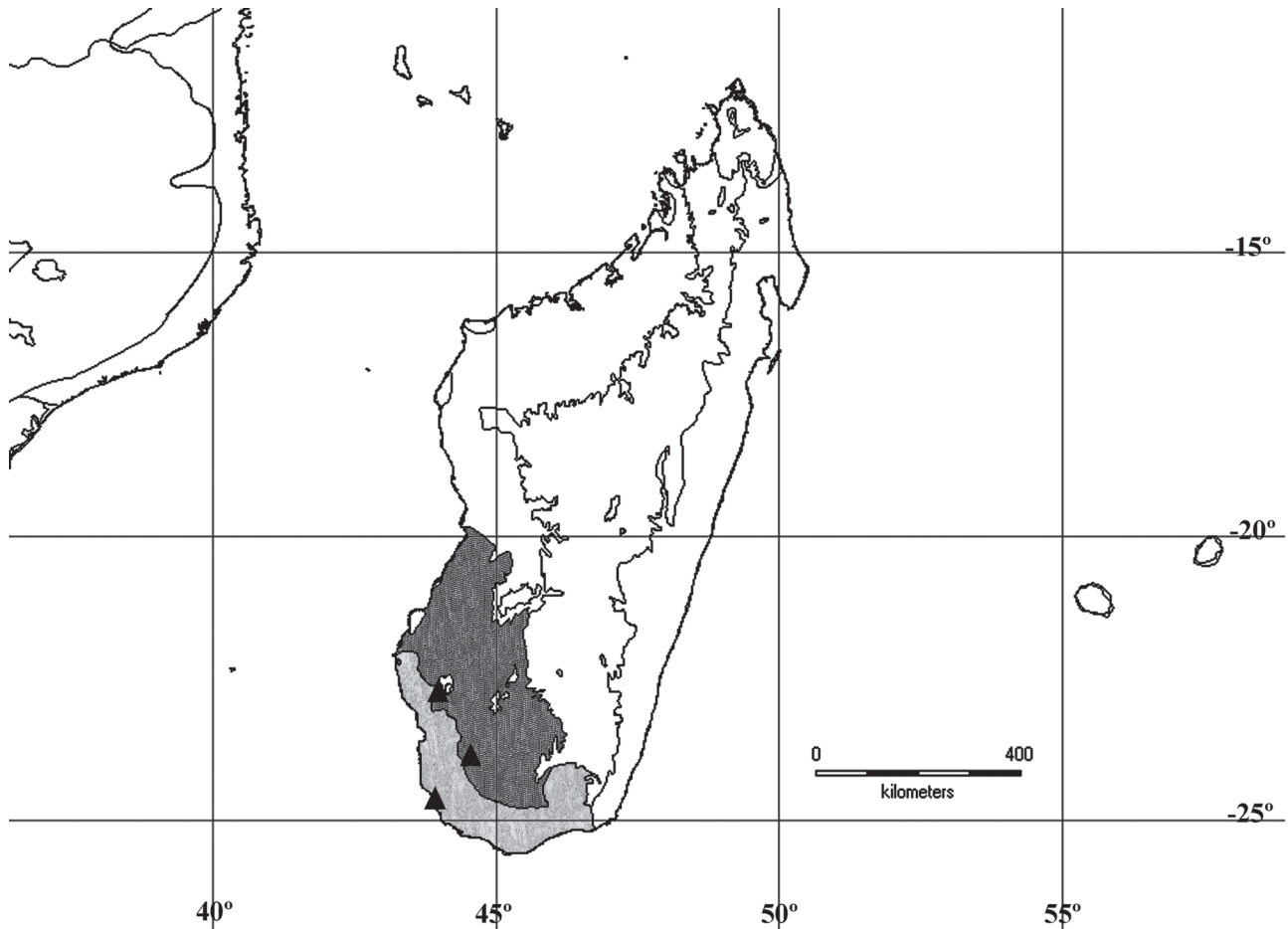
Due to the great morphological similarities between Malagasy and Neotropical xerophytic species of *Mimosa*, we present here a key for identification and a table including all the similar species of *M. dupuyana* from both continents. Inclusion of American species seems to be necessary because specimens with unknown or uncertain geographic provenance would be very difficult to identify if taxonomic treatments only include xerophytic representatives from one of these two regions.

**Geographic distribution and ecology:**—*Mimosa dupuyana* occurs in southwestern Madagascar (Toliara Province), in sandy soils from the coast of Indic Ocean and inner land. This species grows in similar environments that *M. delicatula*, in the Succulent Woodlands and Spiny Tickets ecoregions (classification of ecoregions according to Olson *et al.* 2001). The area of distribution of *M. dupuyana* is located between 22° and 25°S, and it is characterized by the presence of subtropical, seasonally dry forests (Fig. 2).

**Phenology:**—Flowering occurs from November to March. Specimens with fruits were collected in March.

**Etymology:**—The name of this new species is dedicated to the botanist David J. Du Puy, collector of the type specimen and recognized collector and specialist in Malagasy legumes.

**Representative specimens examined:**—MADAGASCAR. Toliara: Recolté le long de la route entre Betioky et Efoetsy, 21 November 2002, *R. Ranaivojaona 497* (MO 5714388!; P[photo!]); southern coast at Itampolo, 27 March 1997, *D. J. Du Puy, L. L. Dreyer, J. Andriantiana & A. Rakotobe M1031* (MO 6255059!; P [photo!]).



**FIGURE 2.** Geographic distribution of *M. dupuyana*. Dark grey: Succulent Woodlands ecoregion. Light grey: Madagascar Spiny Tickets ecoregion. Northern extreme and intermediate points represents Betioky and an intermediate locality in the route from Efoetsy to Betioky, delimitating the possible area of collection of the specimen *Ranaivojaona 497*.

### Key to identify xerophytic Malagasy and ser. *Farinosae* species of *Mimosa*<sup>1</sup>

This group of species is identified within the genus by its tetramerous, diplostemonous flowers, presence of brachyblasts in at least some branches, indumentum of reddish sessile to subsessile, glandular or non-secretory and granular trichomes, leaves with 1–4 pairs of pinnae, spheroid racemes, and craspedia constantly unarmed.

<sup>1</sup> Steps 4 to 6 adapted from Barneby (1991)

1. Petioles (and frequently also rachis of pinnae) flattened, dorsiventrally compressed. Leaflets of largest pinnae 2–3-pairs, succulent. Craspedia constricted between seeds, reddish externally, coriaceous. Madagascar.....*M. dupuyana*
- Petioles and rachis of pinnae, terete or subterete. Leaflets of largest pinnae (4)5–9 pairs, papyraceous. Craspedia straight, brownish or whitish, chartaceous. Madagascar and South America.....2
2. Stems mainly armed with aculei solitary per node (rarely geminate, or internodes unarmed). Craspedia breaking into free falling articles or more rarely only with valvate dehiscence, and septa oblique.....*M. delicatula*

- Stems mainly armed with two or three aculei per node, sometimes the youngest stems unarmed. Craspedia breaking into free falling articles with septa perpendicular to the replum .....3
- 3. Branches sinuous. Stems armed (sometimes the youngest stems unarmed), with three aculei per node, straight, ascending. Inflorescences axillary and pseudoracemose. Madagascar ..... *M. grandidieri*
- Branches relatively straight, not markedly sinuous. Stems armed (sometimes the youngest stems unarmed) on the nodes with one or two aculei per node, rect to recurve. Inflorescences axillary. Southern South America (Ser. *Farinosae*).....4
- 4. Leaves with 2–3–pairs of pinnae. Paraguay and eastern Bolivia ..... *M. castanoclada*
- Leaves with 1 pair of pinnae, exceptionally in some leaves 2–pairs.....5
- 5. Indumentum with reddish, sessile to subsessile glandular trichomes. Calyx 0.3–0.7(–0.9) mm length. Pods generally 4–9.5 mm wide. Aculei generally straight and ascending. Northern Argentina, Paraguay and southern Bolivia..... *M. farinosa*
- Indumentum eglandular, or frequently with thickened, non secretory trichomes. Calyx 0.75–1.5 mm length. Pods generally 12–16 mm wide. Aculei generally recurved.....6
- 6. Branches, especially the youngest, and foliage glaucescent. Rachis of longer pinnae 3.5–12 mm length and the leaflets 4–6(–8)-jugate. Internodes generally lesser than 1 cm long. Southeastern Bolivia, Paraguay and northeastern Argentina ..... *M. detinens*
- Branches and foliage green. Rachis of longer pinnae 12–25 mm and the leaflets 7–12-jugate. Internodes 1–3 cm long. Central Argentina and Uruguay ..... *M. ostenii*

## Acknowledgments

We thank the curators of the cited herbaria for the access to the material studied, Angélica Marino for the illustrations, João Iganci for the assistance from North American material, and Roy Gereau for the critical reading and suggestions. CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina) supported the visit of Dr. Morales to the Missouri Botanical Garden and New York Botanical Garden.

## References

- Baillon, H.E. (1883) *Mimosa grandidieri*. *Bulletin Mensuel de la Société Linnéenne de Paris* 1 (45) : 357.
- Baillon, H.E. (1886) *Mimosa delicatula*. In: Grandidier, A. (Ed.) *Histoire Physique, Naturelle et Politique de Madagascar* vol. 30. L'Imprimerie Nationale, Paris, pl. 24.
- Barneby, R.C. (1986) Notes on some *Mimosae* (Leguminosae: Mimosoideae) of the Chihuahuan Desert Akin to *M. zygothylla*. *Brittonia* 38 (1): 4–8.  
<http://dx.doi.org/10.2307/2807409>
- Barneby, R.C. (1991) *Sensitivae Censitae*: A description of the genus *Mimosa* Linnaeus (Mimosaceae) in the New World. *Memoirs of the New York Botanical Garden* 65: 1–835.
- Barneby, R.C. & Fortunato, R.H. (1987) Four new diplosmenonous species of *Mimosa* (Mimosaceae) from Paraguay and eastern Bolivia. *Brittonia* 39 (2): 165–174.  
<http://dx.doi.org/10.2307/2807367>
- Benthams, G. (1841) Notes on Mimoseae, with a short synopsis of species. *Journal of Botany* 4: 243–392.
- Benthams, G. (1842) Notes on Mimoseae, with a short synopsis of species. *Journal of Botany* 4: 393–418.
- Benthams, G. (1875) Revision of the suborder Mimoseae. *Transactions of the Linnean Society of London* 30: 335–664.  
<http://dx.doi.org/10.1111/j.1096-3642.1875.tb00005.x>
- Benthams, G. (1876) *Mimosa*. In: Martius, C.F.P., Eichler, A.W. & Urban, I. (Eds.) *Flora Brasiliensis* vol. 15, pt. 2.I. F. Fleische, München and Leipzig, pp. 294–390.
- Besega, C. & Fortunato, R.H. (2011) Section *Mimadenia*: its phylogenetic relationships within the genus *Mimosa* (Leguminosae, Mimosoideae) using plastid *trnL*–F sequence data. *Australian Systematic Botany* 64 (2): 104–110.  
<http://dx.doi.org/10.1071/SB10022>
- Brenan, J.P.M. & Brummitt, R.K. (1970) *Mimosa* L. In: Brenan, J.P.M. (Ed.) *Flora Zambesiaca*, vol. 3. Royal Botanic Gardens Kew Publishing and Flora Zambesiaca Managing Committee, London, pp. 47–53.
- Gray, B.A. (1849) *Plantae Fendlerianae Novi-Mexicanae*. *Memoirs of the American Academy* 4: 1–116.
- Grisebach, A.H. (1874) *Plantae Lorentzianae*. *Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen* 19: 1–231.
- Lefèvre, G. & Labat, J.N. (2006) A New Species of *Mimosa* (Fabaceae, Mimosoideae) from Madagascar. *Novon* 16: 74–77.  
[http://dx.doi.org/10.3417/1055-3177\(2006\)16\[74:ANSOMF\]2.0.CO;2](http://dx.doi.org/10.3417/1055-3177(2006)16[74:ANSOMF]2.0.CO;2)
- Linné, C. (1753) *Species plantarum*. Vol. 1. Impensis Laurentii Salvii, Holmiae, 560 pp.
- Luckow, M. (2005) Mimoseae. In: Lewis, G., Schrire, B., Mackinder, B. & Lock, M. (Eds.) *Legumes of the world*. Royal Botanic Gardens,

Kew, pp. 162–183.

- Olson, D.M., Dinerstein, E., Wikramanakaye, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R. (2001) Terrestrial ecoregions of the World: a new map of life on earth. *Bioscience* 51: 933–938.  
[http://dx.doi.org/10.1641/0006-3568\(2001\)051\[0933:TEOTWA\]2.0.CO;2](http://dx.doi.org/10.1641/0006-3568(2001)051[0933:TEOTWA]2.0.CO;2)
- Parfit, B.D. & Pinkava, D.J. (1978) A new species of *Mimosa* (Leguminosae) from Coahuila, Mexico. *Brittonia* 30 (2): 172–174.  
<http://dx.doi.org/10.2307/2806646>
- Simon, M.F., Grether, R., Queiroz, L.P., Särkinen, T.E., Dutra, V.F. & Hughes, C.E. (2011) The evolutionary history of *Mimosa* (Leguminosae): toward a phylogeny of the sensitive plants. *American Journal of Botany* 98 (7): 1201–1221.  
<http://dx.doi.org/10.3732/ajb.1000520>
- Viguier, R. (1949) Leguminosae Madascarienses Novae. *Notulae Systematicae. Herbarium du Muséum de Paris. Phanérogamie* 13: 333–369.
- Villiers, J.-F. (1991) Nouvelles espèces de *Mimosa* L. (Leguminosae-Mimosoideae) à Madagascar. *Bulletin du Muséum National d'Historie Naturelle. Section B, Adansonia* 12 (3–4): 227–232.
- Villiers, J.-F. (2002) *Mimosa*. In: Du Puy, D.J. (Ed.) *The Leguminosae of Madagascar*. Royal Botanic Gardens, Kew, London, pp. 170–194.

## Appendix

### *Mimosa delicatula*

**Representative specimens examined:**—MADAGASCAR. Fianarantsoa: Isalo Massif, region of Nanuoza, N of the “Piscina”, 15 February 1990, *Du Puy et al. M467* (MO6250880, P seen on digital image). Toliara: About 5 km E of Beheloka, on road from coast to Betioky, 14 January 1989, *Du Puy et al. M56* (MO 5556376); along Route 13, from Ambovombe to Antanimora, 21 February 1975, *Croat 31998* (MO 2580275); along route between Tsiohambe and Ambondro, 18 February 1975, *Croat 31652* (MO 2588266); BasiBasy, Tsiloakarivo, 12 March 2007, *Razanatsoa et al. 342* (MO 6350012); Beza Mafady Reserve, near Betioky. Between Parcelle 1 and 2, 18 November 1987, *Phillipson 2588* (MO 3662663); Beza Magafaby Reserve near Betioky. Parcelle 2, 18 April 1987, *Phillipson 1663* (MO 3514717); ca. 100 km NE of Toliara, Sakaraha, 16 January 2006, *Anderberg et al. 94* (MO 4804729); ca. 8 km W of Amboasary towards Fort Dauphin, Route Nat. 13, 16 January 2006, *D. J. Dupuy and B. P. Dupuy M407* (MO 6250890); Ifaty, Andranobe sikile, 15 March 2006, *Labat et al. 3619* (MO 5944223); just NE of Ankoba Village, near E edge of Andohahela National Park, Parcel 1, 4 January 2008, *Lowry 6989* (MO); Mahafoby Plateau, ca. 48 km SW of Amparrihy, route to Androka, 07 February 1990, *Du Puy et al. 443* (MO 6250887); Menabe area, c. 12 km north of Belo sur Tsiribihina, route from Bekopaka, 31 March 1990, *Du Puy et al. M520* (MO 6250862); road from Betioky to Toliara, 30.5 km SE of Andranovory, 18 January 1989, *Du Puy et al. M467* (MO 5553223); Sud, Vegetation tres degradés entre Ampanihy, 13 December 1969, *Capuron 29000SF* (MO 4848253); SW of Ampanihy, on route to Androka, between Ambarinhy and PK10, 19 February 1975, *Croat 31393* (MO 2588280).

### *M. grandidieri*

**Representative specimens examined:**—MADAGASCAR. Toliara: 6 km S of Ankilimalinika, roadside 48 km N of Toliara (RN9) near the coast, 25 January 1989, *Du Puy et al. M97* (MO 6250897); about 5 km E of Beheloka, on road from coast to Betioky (Titambono Corridor), 14 January 1989, *Du Puy et al. 96* (MO 5556376); Beza Mahafaly Reserve, near Betioky, 14 November 1987, *Phillipson 2561* (MO3662990); ca. 27 km from Betioky, on road to Lake Tsimanampetsotsa and the Itambono Corridor, 10 January 1989, *Du Puy et al. M37* (MO 5553241); ca. 3 km N of Reakaly, ca. 20 km W of Ampanihy (SE of Tulear), 31 January 1999, *Du Puy et al. 122* (MO 5556372); environs de Tuléar, dunes d'Ankibe [Ankilibe], 01 March 1960, *Keraudren 611* (P); Mahafaly Plateau, ca. 40 km SW OF Ampanihy, route to Androka, 06 February 1990, *Du Puy et al. 436* (MO 6250884, 6250885); Near Ankazomateila village, on road from Beheloka to Ambatry, 21 May 2004, *Rogers 551* (P); Plateau au Sud des gorges du Fiherenana, entre Andranohinaly et Andranovory, no date, *Humbert 20107* (P); Tsimanampetsotsa, village le plus proche: Foetsy, Firaisina : Beheloky, Fivondronana : Ejeda Tsimanampetsotsa, 13 March 1987, *SFM 31301* (P); Tongobory, 01 April 1966, *J. Peltier and M. Peltier 5860* (MO 4848256).

### *M. ikondensis*

**Representative specimens examined:**—MADAGASCAR. Toliara : Near Toliara town, N of La Table, 2343BD, 28 January 2001, *Phillipson et al. 5274* (MO 5598028); Vallée de l'Ikonda au Nord d'Ambovombé, 30 April 1931, *Decary 8907* (MO, P seen in digital image).



*M. onilahensis*

**Representative specimens examined:**—MADAGASCAR. Toliara: 20 km S of Betioky on road to Ejeda, 05 October 1990, *Phillipson et al.* 3696 (MO, P seen in digital image); a la base d'Isalo, aux environs de Benenitra (Onilahy), August 1925, *H. Perrier de la Bâthie* 17384 (MO, P seen in digital image).

*M. waterlotii*

**Representative specimens examined:**—MADAGASCAR. Antsirirana: Track from Ivovona to Baie des Sakalana, ±1/2 km N of Ivovona, 30 November 1992, *Schrire et al.* 2551 (P seen in digital image); sous-préfecture de Vohemar, commune rurale de Daraina, Daraina, forêt d'Ampondrabe, 09 April 2004, *Ranirison* 611 (P seen in digital image).

*M. farinosa*

**Representative specimens examined:**—ARGENTINA. Jujuy: Santa Bárbara, Santa Cornelia, no date, *Schuel* 117 (BAB). Salta: Guachipas, 1 km al S de Guachipas en direcc. a El Cebilar, 16 March 2001, *Fortunato* 7180 (BAB). Catamarca: Balcones, Sierra de Ambato, 01 February 1941, *Parodi* 14091 (SI). Santiago del Estero: Guasayán, Ruta 64, sierra de Guasayán, 24 October 1988, *Pérez-Moreau and Petetin s.n.* (BAB); same locality, 14 May 1983, *Molina* 1444 (BAB). Tucumán: Cruz Alta: RP303, 6,5 km W de Las Cejas, 07 March 2004, *Pozner and Belgrano* 488 (SI); Tucumán, 27 September 1907, *Lillo* 7191 (SI); Burruyacú, Cerro del Campo, 14 September 1928, *Venturi* 7528 (SI).

*M. detinens*

**Representative specimens examined:**—PARAGUAY. Boquerón: 3 km NE of Campo Loa Proyecto Tagua on the road to Fortín Toledo, 17 February 2002, *Luckow et al.* 4491 (BAB); Filadelfia, 06 December 1983, *Hahn* 1856 (BAB). ARGENTINA. Catamarca: Paclín, El Molino, 17 November 1946, *Dimitri and Piccinini* 53 (BAB 68154). Salta: Anta, 54 km NE de J. V. González, camino a Puerta Blanca, 22 November 1994, *Krapovickas and Cristóbal* 46282 (BAB). Santiago del Estero: Añatuya, 27 January 1944, *Soriano* 572 (BAB).

*M. ostenii*

**Representative specimens examined:**—ARGENTINA. Entre Ríos: Federal, orillas del Gualeguay, 31 March 1927, *Molfino and Clos s.n.* (BAB 44264); Orillas del Gualeguay, primer puente desde Federal por Ruta Provincial 122, 10 January 2008, *Morales et al.* 617 (BAB).

*M. castanoclada*

**Representative specimens examined:**—BOLIVIA. Chuquisaca: Luis Calvo, San Isidro, 18 December 1992, *Saravia and Nelson Joaquín* 10903 (BAB). PARAGUAY. Alto Paraguay: 20 km al N del Puesto 4 de Mayo, por Línea 6, 24 October 1992, *Fortunato et al.* 3621 (BAB); Chaco, Línea 3 (Oeste), km 50, 09 December 1992, *Ramella et al.* 2911 (BAB).

*M. turneri*

**Representative specimens examined:**—UNITED STATES OF AMERICA. Texas: No clear locality, 29 August 1891, *Curleton s.n.* (SI). Alpine, June 1932, *Steiger* 1754 (NY); Hudspeth Co. South end of Quitman Mts., 5½ miles northeast of Indian Hot Springs, 01 July 1943, *Waterfall* 4841 (NY); Presidio Co. Along Rio Grande, 21 road miles upstream from Lajitas, 30 May 1985, *Barneby* 17970 (NY). MEXICO. Nuevo León: Nuevo León. 3 km from El Milagro and 10 km from Icamole on winding road, 05 July 1973, *Johnston et al.* 11614 (NY).

*M. unipinnata*

**Representative specimens examined:**—MEXICO. Coahuila: Cuatros Ciénegas Basin Lower canyon and bajada of Sierra de San Marcos opposite Laguna Grande, 14 August 1975, *Reeves et al.* P13073 (NY). Coahuila de Zaragoza: 15 km N of Rancho La Campana on the road to Cuatrociénegas (road runs N between San Marcos and Purísima), 21 March 1973, *Johnston et al.* 10329 (NY).

*M. borealis*

**Representative specimens examined:**—UNITED STATES OF AMERICA. Kansas: Clark County, 5 mi. N Ashland, 29 May 1967, *Stephens* 11193 (NY). Texas: Austin, on hills along Colorado, 18 April 1898, *Bray* 112 (NY).