Chromosome Numbers of Some Southernmost Species of *Mimosa* L. (Leguminosae)

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Summary Chromosome numbers of 9 species of *Mimosa* which grow in the southern limit of the South American centre of diversification were determined, all of them are new reports except the one of *M. oligophylla*. *M. vellosiella*, *M. oligophylla* and *M. flagellaris* were diploids with $2n=2x=26$; *M. velloziana* and *M. adpressa* were tetraploids with $2n=4x=52$; *M. sprengelii*, *M. ramulosa* and *M. rocae* were octoploids with $2n=8x=104$; and one accession of *M. balansae* was diploid while the other was tetraploid. All of them were multiples of the basic chromosome number $x=13$. The polyploid species were more frequent at higher latitudes, this increment was also accompanied with a higher ploidy level of the polyploids southernward. All the polyploids found belong to the sections with most advanced characters of the genus, which supports the phylogeny proposed for *Mimosa* by Barneby. Data suggest that the extension of the genus toward the temperate zones might have been done mainly by polyploid species, which may have had advantages over the diploids in colonising habitats restricted to the latter.

Key words Chromosome numbers, *Mimosa*, Polyploidy.

The genus *Mimosa*, which comprise around 500 species and several subspecies and varieties, has 5 diversification centres. The largest centre is situated in South America, which extends from the South of the Brazilian Amazon and adjacent Paraguay through the rest of the continent until the southern temperate areas. The second largest centre is located in Mexico which extends to Central and North America. There are 3 other smaller centres located in Cuba, Orinoco river basin and Madagascar. The latter is the only extra Neotropical centre of diversification of the genus (Barneby 1991).

Chromosome numbers in *Mimosa* have been mainly reported for subtropical species. These numbers range from diploids $2n=26$ to octoploids with $2n=104$ (Fedorov 1974, Goldblatt 1984, 1985, 1988, Goldblatt and Johnson 1990, 1991, Moore 1973, 1977, Seijo 1993, 1999), which evidence that polyploidy had played an important role in the evolution of the genus.

In some groups of higher plants, variation of the ploidy level or the frequency of polyploids accompanied changes in latitude or altitude. The increment of polyploid frequency is also reported to increase with latitude when floras are considered as a whole (Löve and Löve 1957, Hanelt 1966). Nevertheless, other authors claim that these correlations are far from being a generalization (Faberger 1957, Stebbins 1971, Grant 1971).

Considering that, in the present work the chromosome numbers of the southern *Mimosa* species from Argentina and Uruguay were studied and the species ploidy level were analysed in relation to their distribution.

Materials and methods

The studied material and the localities of collection are detailed in Table 1. Vouchers of the

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Table 1. Chromosome numbers and localities of the studied material

Species	2n		Collectionist Localities and Herbaria
	Mitosis	Meiosis	
Sect. <i>Habbasia</i>			
<i>M. vellosiella</i> Burkart	26		S. 1006. Argentina, Chaco, Dpto. Iro. de Mayo. Colonia Benítez. (CTES, NY)
	26		S. 1015. Argentina, Chaco, Dpto. Cap. Antequeras. (CTES, LIL, BAB)
Sect. <i>Mimosa</i>			
Ser. <i>Pedunculosa</i>			
Subser. <i>Pedunculosa</i>			
<i>M. oligophylla</i> Micheli	26		S. 1021. Argentina, Corrientes, Dpto. Capital. Molina Punta. (CTES, MO)
<i>M. flagellaris</i> Benth.	26		S. 994. Argentina, Corrientes, Dpto. Mercedes. (CTES, BAB, NY)
Subser. <i>Polycarpae</i>			
<i>M. balansae</i> Micheli	26		S. 992. Argentina, Corrientes, Dpto. Mercedes. (CTES, UNSL, CANB)
	52	26 II	A. 6031. Argentina, Corrientes. Beron de Astrada. (CTES, CANB, NY)
Ser. <i>Mimosa</i>			
Subser. <i>Mimosa</i>			
<i>M. velloziana</i> Mart.	52	26 II	S. 1033. Argentina, Corrientes. Dpto. San Cosme. (CTES, ASU, CANB)
	52		K. 41913. Argentina, Corrientes. Dpto. San Cosme. Paso de la Patria. (CTES, HAS, SPF)
Subser. <i>Obstrigosae</i>			
<i>M. adpressa</i> Hook. et Arn.		26 II	S. 997. Argentina, Entre Ríos, Dpto. Concepción, Banco Pelay. (CTES, ICN, NY)
<i>M. ramulosa</i> Benth.		52 II	S. 999. R. O. Uruguay, Dpto. Minas. Cerro Verdún. (CTES, BAB, NY)
		52 II	S. 1003. R. O. Uruguay, Dpto. Lavalleja. (CTES, ICN, NY)
<i>M. sprengelii</i> DC.		52 II	S. 1002. R. O. Uruguay, Dpto. Lavalleja. (CTES, ASU, NY)
Sect. <i>Calothamnus</i>			
<i>M. rocae</i> Lorentz et Nied.	104		S. 110. Argentina, Bs. As. Pdo. Cnel. Suárez. Sa. de la Ventana. (CTES, MNES)

K.: Krapovickas, A.; S.: Seijo, G.; A.: Arbo, M.

studied specimens are kept in the herbarium of the Instituto de Botánica del Nordeste (CTES) and duplicates are retained in different herbaria (Table 1). For meiotic studies floral buds were fixed in 5 : 1 ethanol : lactic acid (Fernández 1973) for at least 24 h and kept in 70% aqueous ethanol until use. Pollen mother cells were stained with 3% acetic carmine and permanent slides were made using Venetian Turpentine as mounting medium. For determinations of somatic chromosome numbers, root tips of germinated seeds were pre-treated with 0.002 M 8-hydroxyquinoline for 4 to 6 h at room temperature, then fixed in ethanol : lactic acid (5 : 1) and kept in 70% aqueous ethanol. Roots were stained following the Feulgen technique and the meristems were macerated in a drop of 3% acetic orcein before squash. Permanent slides were prepared using Euparal as mounting medium.

Results and discussion

In this study the chromosome number of 13 accessions belonging to 9 species were determined (Table 1), all of them are new reports except the one for *M. oligophylla* which coincides with previous reports (Seijo 1999). *M. vellosiella* (Fig. 1A), *M. oligophylla* (Fig. 1B) and *M. flagellaris*

Fig. 1. Mitotic and meiotic chromosomes of *Mimosa*. A) *M. vellosiella*, $2n=26$, B) *M. oligophylla*, $2n=26$, C) *M. flagellaris*, $2n=26$, D) *M. velloziana*, $2n=52$, E) *M. adpressa*, diakinesis $2n=26$ II, F) *M. balansae*, diploid cytotype $2n=26$, G) *M. balansae*, tetraploid cytotype $2n=52$, H) *M. rocae*, $2n=104$, I) *M. sprengelii*, diakinesis $2n=52$ II, J) *M. ramulosa*, diakinesis $2n=52$ II. Bar indicates $5\ \mu\text{m}$.

(Fig. 1C) were diploids with $2n=2x=26$; *M. velloziana* (Fig. 1D) and *M. adpressa* (Fig. 1E) were tetraploids with $2n=4x=52$; *M. sprengelii* (Fig. 1I), *M. ramulosa* (Fig. 1J) and *M. rocae* (Fig. 1H) were octoploids with $2n=8x=104$; and one accession of *M. balansae* was diploid (Fig. 1F) while the other was tetraploid (Fig. 1G). *M. vellosiella* belongs to Sect. *Habbasia*, which species present intermediate characters between the ancestral and advanced Sections. The other studied species belong to Sect. *Mimosa* and Sect. *Calothamnus*, both situated at the top of the evolutive line proposed for the genus by Barneby (1991). The distribution of the ploidy level of the studied species is presented in Fig. 2.

Three out of the 5 species collected in the north of Argentina (Chaco and Corrientes Provinces, between 27° and 29°S), *M. vellosiella*, *M. oligophylla* and *M. flagellaris*, were diploids; *M. velloziana* was tetraploid; and *M. balansae* had one diploid and one tetraploid accessions. *M. vellosiella* is a shrub which grows characteristically on muddy and sandy river banks and stuary shores, locally abundant along río Paraná from 22°S to the delta and the south shore of río de la Plata. *M. velloziana* is an opportunistic weed, which forms diffuse tangles of prickly or sarmentose stems; and has an ample distribution from Mexico to northern Argentina. *M. oligophylla*, *M. flagellaris* and *M. balansae* are herbs which grow in campos of northern Argentina and southern Paraguay and Brazil. The diploid cytotype of *M. balansae* is more robust than the tetraploid which is an hemifuse herb, however, both cytotypes are ecologically very similar and grow mainly in sandy roadsides.

Southernward, in Entre Ríos Province (Argentina) and Uruguay which are approximately at the same latitude (between 32° and 35°S), 3 species were studied. *Mimosa sprengelii* and *M. ramulosa* were octoploids while *M. adpressa* was tetraploid. *M. sprengelii* and *M. ramulosa* were collected in Uruguay's hills, the first one grows in stony campos and at edges of thickets at low elevations while the second on open stony hillsides. *M. adpressa* on the other hand was collected in Entre Ríos Province, Argentina, in an open shore of Uruguay river, where it was forming prickly thickets.

M. rocae was also octoploid and it was collected in Ventania Hills, the southernmost limit of distribution of the genus (38.5°S). It grows as a prostrate matted shrublet in places with thin stony soil and on exposed arenitic rock near 500 m high.

Considering the total of species studied in this report, polyploids were more frequent (66%) than diploids. The latter were collected in subtropical areas or near so, being predominant over the polyploids. In previous reports, it has been found that 4 out of 14 species studied from Misiones, one of the northernmost and subtropical Provinces of Argentina, were polyploids (Seijo 1993, 1999). This only represent 28% of polyploid species, which is significantly lower than the percentage found in this report.

The studied species showed that the frequency of polyploids increased with the latitude, being the southern species only polyploids. This fact was also accompanied by increments of the ploidy level. In the northern and central areas of the study, the species were diploids and tetraploids, while

Fig. 2. Map representing the ploidy level distribution of the studied species. Abbreviations of provinces names: B.A.: Buenos Aires, CH.: Chaco, CO.: Corrientes, E.R.: Entre Ríos, M.: Misiones.

at southern latitudes all species were octoploids. On the other hand, it appear to be no relationship between ploidy level and growth habit, since most of the ploidy levels were found both in herbs and shrubs.

All the species analyzed in the present report have chromosome numbers multiple of $x=13$, which has been previously proposed as the basic chromosome number for the genus (Isely 1971, Lewis and Elias 1981, Goldblatt 1981, Seijo 1993). Considering $x=7$ as the ancestral basic number for legumes, the diploid chromosome number $2n=26$ may be a paleotetraploid and $x=13$ may be a derived basic chromosome number originated from an aneuploid reduction of $2n=4x=28$ (Goldblatt 1981).

The results presented here show that in the analysed *Mimosa* species, the polyploids frequency as well as the ploidy level increase with the latitude. This relation can be interpreted at the light of the believed greater tolerance of polyploids to marginal ecological conditions. *Mimosa* is a genus constituted mainly by tropical and subtropical species, which might have extended toward temperate habitats mainly by polyploid species. This is in accordance with the common assumption that polyploids have higher ability to colonise environments restrained to the diploid or lower polyploid parental.

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