

## Use and management of *Mimosa* species in the Tehuacán-Cuicatlán Valley, a tropical semi-arid region in Mexico (Fabaceae-Mimosoideae)

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**Abstract:** We report on the use of 15 *Mimosa* species within the Tehuacán-Cuicatlán Valley, south-central Mexico. Seven of these species are endemic to Mexico, and four species and one variety are endemic to the Valley. We reviewed historical, ethnobotanical and floristic manuscripts, and conducted field studies. Several herbaria were consulted, as well as the BADEPLAM data base. Field work in the Valley has been done from 1994 to date. Most of the *Mimosa* species occur in the arid tropical scrub and the tropical deciduous forest, which are considered the most endangered vegetation types of the Valley. Our findings show that *Mimosa* species are used as fodder (45%), fuel (31%), living fences (14%) and construction material (7%). Only one species is used as medicine. *Mimosa* species are “multipurpose” shrubs/trees of the agrosilvopastoral system of this region. Rev. Biol. Trop. 52(4): 845-851. Epub 2005 Jun 24.

**Key words:** Agrosilvopastoral systems, biosphere reserve, conservation, Mexico, natural resources, semiarid region.

Mexican deserts possess a high plant and animal diversity, and are considered the center of origin and evolution of many taxa (Rzedowski 1962, Challenger 1998). Since pre-Columbian times they have also been home to and supported the livelihood of different ethnic and local communities (Rzedowski 1978, Valiente-Banuet 1990).

The Tehuacán-Cuicatlán Valley (part of it a Biosphere Reserve since 1998) is a semi-arid region located in South-central Mexico (17°20'-18°53'N, and 96°55'-97°44'W), with a surface area of ca. 10 000 km<sup>2</sup>, within the states of Puebla and Oaxaca. Plant diversity is high, with ca. 3 000 species, of which 30% are estimated to be endemic (Smith 1965, Villaseñor *et al.* 1990, Dávila *et al.* 1993). The Fabaceae family comprises 10% of the plant

species of the zone, 72 legume genera (288 species) have been reported (Dávila *et al.* 1993). Fifteen of the legume species recorded belong to genus *Mimosa* L.; seven of these species are endemic to Mexico, and other four species and one variety are endemic to the Valley (Martínez-Bernal and Grether 2003).

On the other hand, in addition to the most customary production systems developed within the Valley (irrigated and shifting rain-fed agriculture, and extensive goat grazing), local communities commonly make use of the available natural resources (Zavala-Hurtado and Hernández-Cárdenas 1998), although very little is known concerning the use of these resources. General field observations have pointed to a major use of *Mimosa* species as part of the traditional agrosilvopastoral systems

within the Tehuacán-Cuicatlán Valley. The aim of this study is to report on and analyze the different uses of *Mimosa* species within the Valley, and to discuss the importance of the genus as a natural resource for the region and as part of the conservation and management strategies planned within the Valley and the Reserve Management Program.

## MATERIAL AND METHODS

Field work included surveys, plant collections and market visit in the Valley from 1994 to date; voucher specimens are deposited at the Herbario Metropolitano (UAMIZ) of the Universidad Autónoma Metropolitana-Iztapalapa. Other sources of information included herbaria consultations (CODAGEM, ENCB, IEB, IMSSM, MEXU and UAMIZ). Because most of the information about the uses of *Mimosa* species is disseminate, the revision of historic documents, and ethnobotanical, floristic and ecological studies was done. The Mexican Plants Ethnobotanical Information Data Base (Banco de Información Etnobotánica de Plantas Mexicanas, BADEPLAM) of the Jardín Botánico, Instituto de Biología, Universidad Nacional Autónoma de México, was also consulted.

## RESULTS

Although several Mimosoideae species were used since pre-Columbian times (e.g. *Acacia* spp., *Calliandra* spp., *Enterolobium* spp., *Leucaena* spp., *Prosopis* spp.), there was not enough evidence to associate any *Mimosa* species as one of the species mentioned in the historical reviews (e.g. Annals of the National Medical Institute 1894-1912, Sahagún 1548, Hernández 1570-1576, Clavijero 1787), except in the manuscript of De la Cruz (1552), which mentions a plant called “huihuitzyocochizihuitl”, positively identified as *Mimosa* sp. and whose leaves are used to heal insomnia. Recent ethnobotanical, floristic and ecological studies

(e.g. Martínez 1969, Del Amo 1979, Mendieta and del Amo 1981, Cedillo-Portugal 1990, Martínez-Alfaro *et al.* 1995, Soto-Núñez and Sousa 1995, Camargo-Ricalde 2000) register some useful *Mimosa* species; and Camargo-Ricalde *et al.* (2001) present a preliminary list of the useful Mexican *Mimosa* species.

However, only two studies report the use of *Mimosa* species within the Tehuacán-Cuicatlán Valley. Casas *et al.* (2001) recorded 104 useful legume species, including *M. albida* and *M. luisana*, and Martínez-Bernal and Grether (2003) reported the use of four *Mimosa* species (*M. albida*, *M. calcicola*, *M. luisana* and *M. polyantha*).

Field work and herbaria revision point out that the 15 *Mimosa* species found in the Valley are used by local people (Table 1). Most of the species occur in the “matorral xerófilo” (arid tropical scrub), the “selva baja caducifolia” (deciduous tropical forest) and the “matorral espinoso” (thorny scrub); just a few species can establish in the *Quercus*, *Pinus-Quercus* and *Juniperus* forests; though all of them are also found in secondary vegetation, along roads and in resting culture fields.

Nine species are shrubs (60%) and the other six are either shrubs or trees (40%); these species are mostly used as fodder for goats and as a source of wood for fuel and construction mainly of fences and animal shelters (Table 1, Fig. 1). Four species (*M. aculeaticarpa*, *M. dystachia*, *M. luisana* and *M. polyantha*) are used as living fences protecting corn fields.

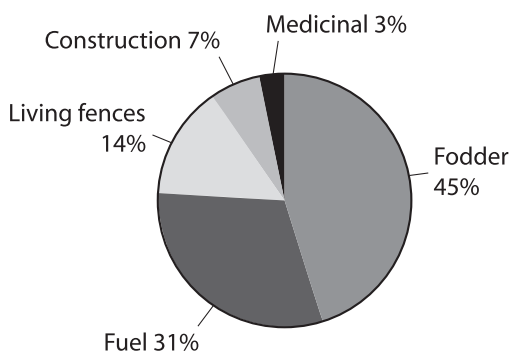


Fig. 1. Uses of *Mimosa* species within the Tehuacán-Cuicatlán Valley.

TABLE 1  
*Uses of Mimosa species within the Tehuacán-Cuicatlán Valley. Information about uses recorded in other regions of Mexico is added*

Species	Biological form (m)	Altitude (masl)	Type of vegetation	Uses													
				C	E	Fo	Fu	Fr	Lf	M	O	R	Sh				
* <i>M. aculeaticarpa</i> Ortega	Shrub (1.5-2.5)	1550-2600	<i>Quercus</i> , <i>Pinus-Quercus</i> , <i>Juniperus</i> forests. Secondary vegetation.	X				X									
* <i>M. adenanthoides</i> (M. Martens & Galeotti) Benth.	Shrub (1.5-2.0)	1920-2400	<i>Quercus</i> , <i>Pinus-Quercus</i> , <i>Quercus-Juniperus</i> forests. Arid tropical scrub. Secondary vegetation.	X													
<i>M. albidá</i> Humb. & Bonpl. ex Willd	Shrub (0.4-1.5)	1500-2170	<i>Quercus</i> , <i>Pinus-Quercus</i> forest, Deciduous tropical forest. Secondary vegetation. Culture fields.	→							•X						→
* <i>M. benthamii</i> J. F. Macbr.	Shrub/Tree (1.0-6.0)	1550-2050	Deciduous tropical forest, Arid tropical scrub. Secondary vegetation.	X				X									→
<i>M. biuncifera</i> Benth	Shrub (0.5-1.5)	1500-2530	Arid tropical scrub. Secondary vegetation.	→				X			→						→
** <i>M. brevispicata</i> Britton	Shrub (0.6-3.5)	690-1710	Deciduous tropical forest, Arid tropical scrub, Thorny scrub. Secondary vegetation.					X		X							
** <i>M. calcicola</i> B. L. Rob.	Shrub (0.3-1.8)	1000-2135	Arid tropical scrub, Thorny scrub. Secondary vegetation.					X									
<i>M. distachya</i> Cav.	Shrub (2.0-2.5)	1680	Arid tropical scrub. Secondary vegetation.					X		X	X						→
* <i>M. lacerata</i> Rose	Shrub/Tree (0.6-5.0)	1000-2250	<i>Quercus</i> , <i>Juniperus</i> forests, Arid tropical scrub, Thorny scrub. Secondary vegetation. Culture fields.					X		X							
* <i>M. lactiflua</i> Delle ex Benth.	Shrub/Tree (1.0-3.0)	1000-2120	<i>Quercus</i> forest. Deciduous tropical forest, Arid tropical forest. Secondary vegetation.					X		X							→
** <i>M. luisana</i> Brandege	Shrub/Tree (1.0-4.5)	500-1760	Deciduous tropical forest, Arid tropical scrub, Thorny scrub. Secondary vegetation. Culture fields.	X				X		X	X						
* <i>M. mollis</i> Benth.	Shrub/Tree (3.0-4.0)	700-2200	Deciduous tropical forest, Arid tropical scrub. Secondary vegetation.					X									→

TABLE 1 (Continued...) *Uses of Mimosa species within the Tehuacán-Cuicatlán Valley. Information about uses recorded in other regions of Mexico is added*

Species	Biological form (m)	Altitude (masl)	Type of vegetation	Uses													
				C	E	Fo	Fu	Fr	Lf	M	O	R	Sh				
* <i>M. polyantha</i> Benth.	Shrub (1.0-4.0)	550-2270	Deciduous tropical forest, Arid tropical scrub. Secondary vegetation. Culture fields.			X	X				X						
** <i>M. purpusii</i> Brandegee	Shrub (0.2-1.0)	1900-2400	Arid tropical scrub. Secondary vegetation.				X										
** <i>M. texana</i> (A. Gray) Small var. <i>fillipes</i> (Britton & Rose) Bameby	Shrub/Tree (1.5-3.0)	1700-2270	Deciduous tropical forest, Arid tropical scrub. Secondary vegetation. Culture fields.		→	X	X										→

\* Species endemic to Mexico, \*\* Species endemic to the Valley. X Uses recorded within the Valley; • BADEPLAM; → Uses recorded out of the Valley (Camargo-Ricalde *et al.* 2001). C, construction; E, edible; Fo, fodder; Fu, fuel; Fr, furriery; Lf, living fences; M, medicinal; O, ornamentals; R, rake; Sh, source of honey.

The leaves, branches and roots of *M. albida* are used in traditional medicine to heal stomach diseases, insomnia and body pain. In addition, these plants have not been found in any market of the zone as a “product”, hence people do not get any economic benefits directly from them.

In different parts of Mexico, other uses have been recorded for seven species found in the Valley (Camargo-Ricalde *et al.* 2001) (Table 1, Fig. 2). *M. texana* is consumed by humans in the state of Guanajuato (no specification of the edible part); *M. biuncifera* is used in the furriery industry and as a farm tool (Camacho-Morfin *et al.* 1998); *M. albida* and *M. mollis* as ornamentals, and *M. benthamii* as a source of honey for bees. In the N-NW of the country the bark of *M. dystachia* is used for healing skin wounds and to harden teeth gums; *M. lacerata* for healing fever eruptions in the mouth (not more data specified), and in Guanajuato *M. texana* is used for healing headaches, fever, rheumatism and fatigue (no information found about which parts of the plant are used) (Camargo-Ricalde *et al.* 2001). It is important to note that *Mimosa* species contain high levels of tannins in all shoot parts, substances usually regarded as unpalatable to animal and human taste. However, tannins are also astringents favoring the healing of skin wounds.

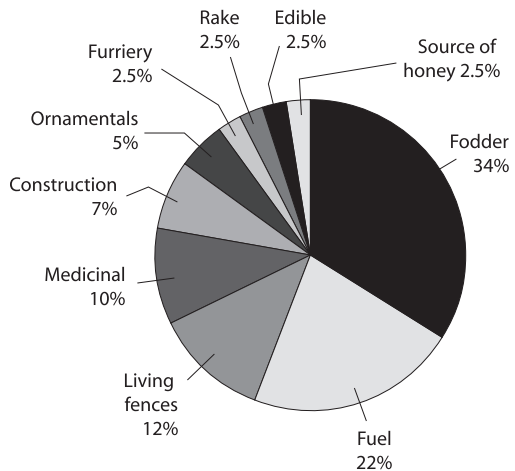


Fig. 2. Uses recorded in Mexico for the *Mimosa* species that occur in the Tehuacán-Cuicatlán Valley.

For all the uses reported for the 15 species studied, 60% are found within the Valley and the other 40% are recorded for other regions within Mexico.

## DISCUSSION

The 15 useful *Mimosa* species reported in this study represent ca. 50% of all the useful *Mimosa* species found in Mexico. For the first time, the use of *M. adenantheroides*, *M. brevispicata* and *M. purpusii* is reported, increasing the number of useful *Mimosa* species of Mexico from 32 (Camargo-Ricalde *et al.* 2001) to 35.

Most of the *Mimosa* species occur in the “matorral xerófilo” (arid tropical scrub) and the “selva baja caducifolia” (tropical deciduous forest), which are considered the most endangered vegetation types of the Valley (Zavala-Hurtado and Hernández-Cárdenas 1998). Within these vegetation types, human activities mainly focus on rainfed agriculture and extensive goat grazing; hence, there is a high need to ecologically restore the area and, at the same time, allow people to continue their traditional agricultural activities. In the case of developing countries, management programs ought to focus on native species that are important in terms of diversity conservation, economic and cultural value for local people. *Mimosa* species fit these requirements as “multipurpose” plants. For instance, most of the species are already used as fodder, fuel production and living fences; they are also used for controlling soil erosion and for the regeneration of soil nutrients in abandoned culture and grazing fields. The presence of *Mimosa* species contribute to ameliorate soil nutrient conditions as well as other environmental factors (e.g. lower temperatures, higher humidity, shadow producers) under their canopy (Camargo-Ricalde *et al.* 2002) creating what it is called “resource islands” (Reynolds *et al.* 1999).

The use and management of “multipurpose” shrubs and trees (e.g. Miede 1986, Cony 1995) in agrosilvopastoral systems have shown

good results in terms of soil and vegetation restoration in diverse drylands of Central America (e.g. Budowski 1993, Kass *et al.* 1993) and other regions of the world (e.g. Gutteridge and Shelton 1993, Thomson *et al.* 1994, Pandey *et al.* 2000). For Latin America, five *Mimosa* species have partially been studied: *M. bahamensis* Benth (Grether and Camargo-Ricalde 1993), *M. biuncifera* and *M. monanctristra* Benth. (Grether 1982), *M. scabrella* Benth. (Kass and Somarriba 1999, Somarriba and Kass 2001), and *M. tenuiflora* (Willd.) Poir. (Nolasco and Landaverde 1988, Sampaio *et al.* 1993, Camargo-Ricalde and Grether 1998, Camargo-Ricalde 2000). Although more research is needed to characterize the fallow systems developed in the Valley, the use of *Mimosa* species is a real option for management strategies through the improvement of agrosilvopastoral systems within the Tehuacán-Cuicatlán Valley. Hence, our results point to the use of *Mimosa* species as an option for restoration processes in the semiarid Valley of Tehuacán-Cuicatlán.

Camargo-Ricalde *et al.* (2001) reported that 15% of all useful *Mimosa* species in the country are used in traditional medicine. The chemical compounds present in these plants require investigation. The bark (rich in tannins and other compounds) of *M. tenuiflora* has been used in the cosmetic industry (with two patents already recorded) within Mexico and other countries as France, Italy and Japan (Camargo-Ricalde 2000).

Though, *Mimosa* is the genus with the highest number of species (100-110), of which 60% are endemic, of all the Mexican Mimosoideae (Grether *et al.* 1996, Sousa and Delgado 1993), there is a huge gap of biological, ecological and biochemical information which needs to be filled to understand the potential of this genus as a natural resource for Mexico.

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## RESUMEN

En este trabajo se informa el uso de 15 especies del género *Mimosa* dentro de la Reserva de la Biósfera del Valle de Tehuacán-Cuicatlán, en la región centro-sur de México. De las 15 especies de *Mimosa* estudiadas, siete de ellas son endémicas de México y cuatro especies y una variedad son endémicas del Valle. Se revisaron manuscritos y documentos históricos, etnobotánicos y florísticos, y se llevó a cabo trabajo de campo. Se consultaron varios herbarios, así como la base de datos BADEPLAM. El trabajo de campo en el Valle se está realizando desde 1994 hasta la fecha. La mayoría de las especies de *Mimosa* se establecen en el matorral xerófilo, el cual está considerado como el tipo de vegetación que está más en peligro de todos los que se encuentran en la Reserva. Los resultados muestran que la mayoría de las especies de *Mimosa* se usan como forraje (45%) y como combustible (31%), así como en la formación de cercas vivas (14%) y como material para construcción (7%); mientras que sólo una especie presenta un uso medicinal. Las especies de *Mimosa* son arbustos y/o árboles "multipropósito" en los sistemas agrosilvopastoriles practicados en el Valle de Tehuacán-Cuicatlán.

**Palabras clave:** Sistema silvoagropastoril, reserva de la biosfera, conservación, México, recursos naturales, región semiárida.

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