Crop Protection Compendium - *Mimosa pigra* L.

Pierre Binggeli 2005

NAMES AND TAXONOMY

Preferred scientific name

Mimosa pigra L., nom. cons.

Taxonomic position

Domain: Eukaryota
Kingdom: Viridiplantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Dicotyledonae
Order: Fabales
Family: Fabaceae
Subfamily: Mimosoideae

Other scientific names

Mimosa pigra var. *pigra* (A.Gray ex Torr.); B.L.Turner
Mimosa asperata L. (1759)
Mimosa asperata (Willd.) Humb. et Bonpl.
Mimosa polyacantha Willd.
Mimosa hispida Willd.
Mimosa pallida Humb. & Bonpl. ex Willd.

BAYER code

MIMPE (*Mimosa pellita*)
MIMPI (*Mimosa pigra*)

Common names

English:
catclaw mimosa
giant sensitive plant
mimosa
giant mimosa
thorny sensitive plant
bashful plant
black mimosa

Spanish:
zorzon
zarzon
zarza
espino
zaraz
pigra
aqüiste
dormilona

French:
amourette violet
amourette riviére
banglin

South Africa:
raak-my-nie

USA:
shamebush

Notes on taxonomy and nomenclature

Two varieties of *M. pigra*, var. *pigra* and var. *berlandieri*, have been recognized in Mexico; these varieties differ slightly in pod morphology. The distribution of var. *berlandieri* is restricted to southern Texas and north-east Mexico whereas that of var. *pigra* extends from the USA to Argentina. Only var. *pigra* has been introduced to tropical regions. The taxonomic status of the *M. pigra* complex is unresolved Barneby, 1989, 1991; Verdcourt, 1989). The name *M. pigra* is used for collections previously identified as *M. pigra* var. *pigra*; it is also used by most workers in the field (Evans et al., 1995).

HOST RANGE

Notes on host range

The principle crop attacked by *M. pigra* is rice (Waterhouse, 1993).

List of hosts plants

Major hosts
Oryza sativa (rice), *Polyphagous* (polyphagous)

HABITAT

In Costa Rica, *M. pigra* is found on the banks of large rivers, lake shores, marsh edges and roadsides. In Australia, it is spreading into sedgeland and grassland communities on open floodplains and Melaleuca forest fringing these floodplains.

M. pigra can spread into pasture land, fallow rice paddies, immature oil palm plantations and fruit orchards.

Habitat descriptors
Principal weed in: agricultural land; wetlands; riverbanks

GEOGRAPHIC DISTRIBUTION

Notes on distribution

M. pigra has until recently been under-reported both in the native and invaded ranges. Furthermore, taxonomic uncertainties throw doubt as to the actual native range of the species in the neotropics. Recently, Rejmánek (2002) has stated that *M. pigra* is not native to Central America.

Distribution List

Asia				
Cambodia	present	introduced		Kassulke et al., 1990
[China]				
Taiwan	localized			EPPO, 2005
India	localized	introduced		Lonsdale et al., 1989; EPPO, 2005
Indonesia	localized	introduced	invasive	Waterhouse, 1993; EPPO, 2005
Java	present	introduced	invasive	Lonsdale et al., 1989
Sumatra	present	introduced	invasive	Lonsdale et al., 1989
Laos	widespread	introduced		Kassulke et al., 1990; EPPO, 2005
Malaysia	localized	introduced	invasive	Waterhouse, 1993; Anwar, 2001; EPPO, 2005
Peninsular Malaysia	present	introduced	invasive	Lonsdale et al., 1989
Myanmar	widespread	introduced	invasive	Kassulke et al., 1990; EPPO, 2005
Philippines	localized			EPPO, 2005
Singapore	widespread	introduced		Wee & Corlett, 1986; EPPO, 2005
Sri Lanka	localized	introduced	invasive	Marambe et al., 2001; EPPO,

				2005
Thailand	widespread	introduced	invasive	Napompeth, 1982; EPPO, 2005
Vietnam	localized	introduced		Kassulke et al., 1990; EPPO, 2005
Africa				
Benin	present	introduced		Kossou et al., 2001
Congo	widespread			EPPO, 2005
Djibouti	present	introduced		Lonsdale et al., 1989
Egypt	widespread	introduced		Sheded & Hassan, 1999; EPPO, 2005
Ethiopia	present	introduced		Thulin, 1989
Ghana	localized	introduced		Irvine, 1961; EPPO, 2005
Guinea	present	introduced		Hutchinson & Dalziel, 1958
Kenya	present	introduced		Brenan, 1959
Madagascar	localized	introduced		Holm et al., 1979; EPPO, 2005
Mauritania	widespread			EPPO, 2005
Mauritius	localized	introduced		Holm et al., 1979; EPPO, 2005
Nigeria	present	introduced		Hutchinson & Dalziel, 1958
Senegal	present	introduced		Hutchinson & Dalziel, 1958
Sierra Leone	present	introduced		Hutchinson & Dalziel, 1958
South Africa	present, few occurrences	introduced	invasive	Holm et al., 1979
Tanzania	present	introduced		Brenan, 1959
Zanzibar	present	introduced		Brenan, 1959
Uganda	present	introduced		Brenan, 1959
Central America & Caribbean				
Costa Rica	localized	native		Janzen, 1983; EPPO, 2005
Cuba	localized	introduced	invasive	Uphoff, 1924
El Salvador	present	native		Holm et al., 1979
Guatemala	widespread	native		Holm et al., 1979; EPPO, 2005
Honduras	widespread	native		Holm et al., 1979; EPPO, 2005
Jamaica	localized	introduced		Adams, 1976
Puerto Rico	present	introduced	invasive	Francis, 2004
North America				
Mexico	localized	native		Holm et al., 1979; EPPO, 2005
USA	localized			EPPO, 2005
Florida	localized	introduced	invasive	Center & Kipker, 1991; Sutton & Langeland 1993
Hawaii	present			EPPO, 2005
Texas	present	introduced		Center & Kipker, 1991
South America				
Argentina	present	native		Wiggins & Porter, 1971
Brazil	present	native		Lonsdale et al., 1989

Colombia	widespread	native		Napompeth, 1982; EPPO, 2005
Ecuador	present	native		Wiggins & Porter, 1971
Galapagos Islands	localized	introduced	invasive	Tye, 1999
Paraguay	present	native		Wiggins & Porter, 1971
Oceania				
Australia	localized	introduced	invasive	Lonsdale et al., 1989; EPPO, 2005
Australian Northern Territory	present	introduced (ca 1891)	invasive	Smith & Miller, 1991; Lonsdale & Miller, 1993
New South Wales	present	introduced		Smith & Waterhouse, 1988
Fiji	localized			EPPO, 2005
Papua New Guinea	localized	introduced	invasive	Kuniata, 1994; EPPO, 2005

HISTORY OF INTRODUCTION AND SPREAD

The species is now widely distributed in Africa and Asia but it is unclear how the weed was transported from tropical America. Although the species is thought to be introduced to Africa, Sheded and Hassan (1999) described it as 'endangered shrub' in Egypt, presumably considering it as a native species.

It was introduced, as an ornamental or seed contaminant, to the Darwin Botanic Gardens of Australia's Northern Territory before 1891. It remained an occasional nuisance around Darwin until the late 1950s. When it reached the open, treeless floodplains in the 1970s, *M. pigra* spread considerably to form monotypic stands.

It was introduced to Thailand in 1947 as green manure and as a cover crop. It was thought that the prickliness of the weed would restrict access to the banks of waterbodies and reduce erosion. It has now spread extensively and covers large areas of standing waters and the banks of waterbodies. *M. pigra* is also spreading in Indonesia, Peninsular Malaysia and Papua New Guinea. In Malaysia it was first noted by the Peninsular state of Kelantan by farmers, who claimed that it had been introduced from Thailand to cure snake bites. The Department of Agriculture only recorded it in 1980 (Anwar, 2001).

In Sri Lanka the weed was first noted in 1997 and now forms dense thickets along a 30- to 35-km strip of the Mahaweli River in the Central province (Kandy District) (Marambe et al., 2001).

M. pigra is probably now more common in Costa Rica than it was before European colonization.

There is a high risk of infestation for many wetland habitats in tropical countries where the shrub is absent.

BIOLOGY AND ECOLOGY

Genetics

Seijo (1999) reported the chromosome number of *M. pigra* var. dehiscens as 2n = 26 and

that of *M. pigra* var. *pigra* as 2n = 52.

Physiology and Phenology

Flowering may start within a year of germination. Anthesis takes place about 8 days after bud formation. The spherical inflorescences, containing up to 100 flowers, last one day. One inflorescence is produced daily on main branches for 5 months during the rainy season. In evergreen forests, a few flowers and fruits are found throughout the year. Flowering occurs all year round in open and permanently moist sites. The fruits ripen in about 3 months and when mature, they fragment into indehiscent 8 to 24 one-seeded segments.

Reproductive Biology

In Australasia, on average, <5% of flower buds produce seeds; most of the seeds are produced by autogamy, although wind pollination may also occur.

In northern Australia, the soil seed banks can reach up to 12 000 seeds per square metre and the seeds remain viable for more than 2 years (Lonsdale et al., 1988). The seeds here generally germinate when they are first wetted and the rate of germination is high. However, some workers have suggested that scarification is needed for high germination and Dillon and Forcella (1985) showed that the scarification effect was produced by alternating temperatures, an amplitude of 20°C having a much greater effect than 10°C. In Sri Lanka, 100% of seeds remained viable after storage at room temperature (28°C) and at 8°C, and 99% of the seeds germinated after sand scarification (Marambe et al., 2001).

Although *M. pigra* is adapted to seasonally flooded habitats, where fibrous adventitious roots are formed around the base of the multiple stems, it can also regenerate under some degree of canopy cover. The plants resprout freely after natural fires but *M. pigra* does not naturally reproduce vegetatively.

Once established as monotypic stands, *M. pigra* can regenerate under its own canopy. In these stands, the half life of plants taller than 20 cm varies between 13 and 22 months, depending on soil type.

For further information, see Janzen (1983) and Lonsdale et al. (1989).

Environmental Requirements

M. pigra is found in tropical regions with >750 mm annual rainfall but is not found in tropical rain forest areas with a rainfall of >2250 mm. In areas of <750 mm annual rainfall, it may grow around dams and watercourses. *M. pigra* does not have any soil type preferences (Lonsdale et al., 1989). In Sri Lanka the species is currently found at an altitude of around 500 m above sea leavel (Marambe et al., 2001).

Associations

Mycorrhizae have sometimes been found associated with a few strains of Rhizobium, although the importance of these associations to the nitrogen budget is not known.

Climatic amplitude (estimates)
- Mean annual rainfall: 750 - 2250 mm
- Rainfall regime: summer; bimodal;

Soil descriptors
- Soil texture: medium; heavy
- Soil drainage: impeded; seasonally waterlogged
- Soil reaction: acid; neutral

MEANS OF MOVEMENT AND DISPERSAL

Natural Dispersal (Non-Biotic)

The bristles covering the pods facilitate floating and enhance dispersal along river systems.

Vector Transmission (Biotic)

Cattle transportation traffic is an effective means of long-distance dispersal.

Accidental Introduction

The seeds of *M. pigra* are spread by road construction equipment and the plant is thus typical of roadsides.

Intentional Introduction

The species is still viewed to be beneficial in parts of the tropics and germplasm distributed when circumstances are believed not to be conducive to its weediness.

Transport pathways for long distance movement
- Conveyances (transport Vehicles)

NATURAL ENEMIES

A number of chrysomelid beetle species feed on the leaflets of *M. pigra* but the plant is avoided by cattle and horses. In Mexico, many insects feed on new growth and inside the reproductive structures.

In Costa Rica, the seeds are heavily predated by the larvae of a number of beetle species, including *Acanthoscelides zebrata*, *A. pigrae* and *A. pigricola* (Janzen, 1983). In Honduras, Habeck and Passoa (1983) collected 60 species of phytophagous insects. Adults of *Chalcodermus serripes* were common and their larvae fed on the seeds of *M. pigra*. An uncommon Coreid, *Pachylis laticornis*, also caused significant damage to the seeds.

In northern Australia, apart from some post-dispersal seed predation, insect herbivory is limited and large ungulates have little impact on stands of *M. pigra*.

Natural enemies of *M. pigra* in Thailand and Indonesia are listed in Napompeth (1983).

Natural enemies listed in the database

The list of natural enemies has been reviewed by a biocontrol specialist and is limited to those that have a major impact on pest numbers or have been used in biological control

attempts; generalists and crop pests are excluded. For further information and reference sources, see About the data. Additional natural enemy records derived from data mining are presented as a separate list.

Natural enemies reviewed by biocontrol specialist		
Natural enemy	**Pest stage attacked**	**Biological control in:**
Pathogens:		
Microstroma ruizibelinii	Leaves	
Mycosphaerella mimosae-pigrae	Leaves	
Phloeospora mimosae-pigrae		Australian Northern Territory
Sphaerulina mimosae-pigrae	Leaves	
Herbivores:		
Acanthoscelides pigrae	Seeds	
Acanthoscelides pigricola	Seeds	
Acanthoscelides puniceus	Seeds	Australian Northern Territory; Thailand
Acanthoscelides quadridentatus	Seeds	Australian Northern Territory; Thailand
Acanthoscelides zebrata	Seeds	
Apion aculeatum	Inflorescence	Australian Northern Territory
Carmenta mimosa	Stems	Australian Northern Territory
Chalcodermus serripes	Seeds	
Chlamisus mimosae	Leaves	Australian Northern Territory; Thailand
Coelocephalapion pigrae		Australian Northern Territory
Neurostrota gunniella	Leaves	Australia; Australian Northern Territory
Pachylis laticornis	Seeds	
Risbecoma pigrae		
Sibinia fastigata	Seeds	
Sibinia ochreosa	Inflorescence	
Sibinia peruana	Inflorescence	
Sibinia seminicola	Seeds	

Additional natural enemies (source - data mining)		
Natural enemy	**Pest stage attacked**	**Biological control in:**
Pathogens:		
Lasiodiplodia theobromae (diplodia pod rot of cocoa)		

IMPACT

Economic impact

In Thailand, *M. pigra* interferes with irrigation systems by causing the accumulation of sediment, affects access to electric power lines and is a safety hazard along roads. It also spreads readily into fallow rice paddies increasing reclamation efforts and costs.
In Malaysia it encroaches into immature oil palm plantations and fruit orchards and it is feared that the shrub will spread to the rice bowl states of Kedah/Perlis with serious

repercussions (Anwar, 2001).

In northern Australia, *M. pigra* poses a threat to the cattle industry as it is spreading into buffalo pasture. The spread of *M. pigra* into pasture land reduces herbaceous vegetation and greatly reduces the grazing capacity of the land.

Environmental impact

The occurrence of *M. pigra* along irrigation systems increases sediment accumulation and restricts water flow.

Social impact

It restricts access to waterways, particularly to fishermen. If the spread of *M. pigra* is not halted, it may affect the touristic value of the Kakadu National Park in Northern Territory, Australia, as many visitors come to see the wetland's birdlife.

Impact on biodiversity

The shrub completely alters floodplain and swamp forest. The main impact of the weed is to reduce the number of birds and lizards, and the level of herbaceous vegetation; it also hinders tree regeneration.

For further information, see Janzen (1983), Lonsdale et al. (1989), Wilson et al. (1990) and Braithwaite et al. (1989).

Summary of impact

Negative impact on: biodiversity; environment; fisheries and aquaculture; rare or protected species; native fauna; native flora; tourism

PHYTOSANITARY SIGNIFICANCE

M. pigra has been declared a noxious weed in Florida and Hawaii, USA, northern Australia, Thailand and South Africa. The plant must either be eradicated or its spread controlled in these areas. In Western Australia and Queensland, legislation exists to prohibit the introduction of the plant. In Malaysia, the shrub was gazetted in as an A2 pest in the 4th Schedule of the Agriculture Pest and Noxious Plants (Import/Export) Regulation (Anwar, 2001).

In other parts of the tropics *M. pigra* still appears to be planted outside its native range despite its invasive tendencies but some caution appears to be shown by seed suppliers. For instance, Richardson (1998) reported that "ICRAF does not routinely supply *M. pigra* unless it appears that strict procedures will be implemented" although he does not indicate what these 'strict procedures' entail and how they can be successfully implemented.

SUMMARY OF INVASIVENESS

M. pigra is a small prickly shrub that infests wetlands and is also an agricultural weed in rice fields in many parts of the old world tropics. In natural wetlands the shrub alters open grasslands into dense thorny thickets and negatively impacts on native biodiversity.

Risk and Impact Factors

- invasive in its native range: no
- proved to be invasive outside its native range: yes
- highly adaptable to different environments: no
- high reproductive potential: yes
- highly mobile locally: yes
- its propagules remain viable for more than one year: yes
- tolerates cultivation, browsing pressure, mutilation, fire etc.: yes
- competitive in crops or pasture: yes
- affects ecosystem: yes
- adversely affects natural communities: yes
- adversely affects community structure: yes
- adversely affect human health: no
- has sociological impacts on recreational patterns, aesthetics, property values: yes
- harmful to animals: no
- produces spines, thorns or burrs: yes
- host or vector of pests or diseases: no
- likely to be accidentally transported internationally: yes
- likely to be deliberately transported internationally: no
- difficult to identify or detect as a commodity contaminant: no
- difficult to identify or detect in the field: yes
- difficult or costly to control: yes

MORPHOLOGY

Plant type: succulent; woody; seed propagated; perennial.

M. pigra is a spreading, multi-stemmed, thorny shrub usually up to 2 m tall, but occasionally up to 6 m, with a maximum lifespan of about 5 years.

The plant is evergreen and bears bipinnate, sensitive leaves, up to 18 cm in length. Recurved spines (to 7 mm long) are located on the undersides of the petioles, petiolets and stems.

The inflorescences, containing up to 100 flowers, are spherical (about 1 cm across) and pink. The species is androdioecious with both male and hermaphrodite flowers bearing eight short and long stamens. These flowers exhibit an intra-specific pollen polymorphism (El Ghazali et al., 1997). The flat pods of *M. pigra* are hairy and up to 15 cm long and clustered (up to seven pods) at the stem tips. They contain between 8 and 24 seeds. Each seed is about 5 x 2.4 mm and weighs 0.09 mg. The fruits ripen in about 3 months and, when mature, fragment into indehiscent one-seeded segments. The pods are covered with bristles which facilitate floating and enhance dispersal along river systems.

SIMILARITIES TO OTHER SPECIES

M. pigra grows with a number of other *Mimosa* species and is difficult for untrained personnel to identify (Kuniata, 1994). In Australia, it has been misidentified as other *Mimosa* species such as *M. pudica* (Lonsdale et al., 1989). These species can be distinguished by the number of pairs of pinnae per leaf; *M. pigra* has 6-14 pairs and *M. pudica* has 1-2 pairs (Lonsdale et al., 1989). M. pudica also differs in being very much less robust, rarely over 0.5-1 m high. *M. invisa* is also a densely piny shrub, much larger than

M. pudica, differing from *M. pigra* in having narrow pods up to 5 mm wide, compared with at least 1 cm in *M. pigra*.

M. pigra may also be confused with *Leucaena leucocephala*, *Aeschynomene* spp., *Sesbania* spp. and juveniles of *Acacia pachyphloia*, but is readily distinguished from these species by its sensitive leaves (Lonsdale et al., 1989). Confusion with the sensitive species, *Neptunia dimorphantha*, is also possible, but this species lacks stem prickles and a leaf rachis.

DETECTION AND INSPECTION

Survey techniques for the detection of *M. pigra* are discussed by Pitt and Miller (1988).

CONTROL

Introduction

A guide to the management of *M. pigra* is provided by Harley (1992); this guide covers all aspects of management, especially the control options.

Cultural Control

In Malaysia, recommended control include involves slashing and brushing the stem with herbicide to be repeated every 6 months to prevent regeneration (Anwar, 2001).

Mechanical Control

In Malaysia, recommended control includes digging and uprooting plants to remove stands (Anwar, 2001). Schatz (2001) investigated the impact of cutting height on mortality. Cutting plants off ca. 10 cm below ground level killed all plants whereas cutting off at ground level or 15 cm above ground level resulted in resprouting in most plants. Thus slashing and chaining is not effective in controlling the weed whereas blade ploughing, a method which cuts the plant below ground level, can be an efficient physical control method.

Chemical Control

Total control of *M. pigra* was achieved within 12 months using a range of herbicides in foliar, basal bark and soil applications, and stem injections in field trials in Thailand (Thamasara et al., 1991). Of 15 herbicides tested, nine killed all 6-8-week-old plants grown under greenhouse conditions (Creager, 1992); the most effective herbicides were picloram, tebuthiuron, hexazinone, sulfometuron, dicamba, triclopyr, linuron and glyphosate.

Chemicals are used to contain the spread of *M. pigra* in Australia and to eradicate new infestations. Aerial spraying of gelled gasoline, followed by fire, kills stands of *M. pigra* and soil surface seeds, but enhances buried seed germination (Lonsdale and Miller, 1993). Lane et al. (1997) tested tebuthiuron against seedlings. It proved to be ineffective, with at best, 43% of seedlings surviving. Effective control of *M. pigra* is difficult to achieve because of the large soil seed bank.

Biological Control

A number of biological control agents are currently being investigated for the control of *M. pigra* in Australia and Thailand (Napompeth, 1983; Wilson et al., 1990). The potential of seed-feeding bruchid species has been studied following field investigations of insects associated with *M. pigra* in the Americas (Kassulke et al., 1990). Fungal pathogens which may be useful in controlling this weed have recently been identified (Evans et al., 1995).

In Malaysia, four agents (*Acanthoscelides puniceus*, *A. quadridentatus*, *Carmenta mimosa* and *Coelocephalapion pigrae*) were introduced in the 1990s with limited success (Anwar, 2001).

Harley and Forno (1992) provide a valuable source of information on the biological control of weeds, and practical advice on undertaking a biological control programme. For further information on the potential for biological control of *M. pigra*, see Habeck and Passoa (1983).

Integrated Control

In Australia, Finlayson et al. (2001) reported that US$12 million had been spent on research and control of mimosa. Their recommended strategy for controlling *M. pigra* is to prevent initial invasion, eradicate small infestations by physical or chemical means and, for large infestations, to adopt an integrated approach involving biological control, herbicide application, mechanical removal, fire and pasture management. Finlayson et al. (2001) also stressed that some level of training and logistical support is required to implement such a management programme and identified key difficulties such as the lack of awareness of the problems that could occur if the weed is not effectively controlled, and discontinuity in control.

More specifically, work is being carried out to determine the optimal timing of herbicide application in order to optimize the effectiveness of biocontrol agents. Paynter (2003) found that treating regenerating *M. pigra* seedlings with herbicide at an optimal time can minimize the impact of the herbicide on the population of *Neurostrota gunniella*, a biocontrol agent that stunts plants.

USES

The species is used in a various herbal remedies and magic rites in Africa (Burkill, 1995). In Malaysia it is reported to be used to cure snake bites in traditional medicine (Anwar, 2001). It has also been used as a green manure, a cover crop, beanpoles, and for hedges and fuel wood.

PESTS

Pests listed in the database

Wild host of:
Paracoccus marginatus (papaya mealybug)

Host of (source - data mining):
Eurema hecabe (common grass yellow)

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