

Crop Protection Compendium - *Mimosa pudica* L.

Updated by **Pierre Binggeli 2005**

NAMES AND TAXONOMY

Preferred scientific name

Mimosa pudica L.

Taxonomic position

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

BAYER code

MIMPU (*Mimosa pudica*)

Common names

English:

sensitive plant
action plant
mimosa
shame bush
touch-me-not
dead-and-awake
humble plant
live-and-die

Spanish:

zarzón
zarza
espino
dormilona
zarza dormilona
dormidera
mirame y no me toques
hierba púdica
mimosa vergonzosa

American Samoa:

vao fefe
vao tuitui

Bangladesh:

lajjabati
lajjabati lata

Belau:

mechiuaiuu

Brazil:

dorme-dorme
dormilona
malicia de mulher
malicia
moriviví
ti-marie dormidera
vergonzosa

Cambodia:

paklab
sampeas
Cook Islands:
paope ävare
pikika'a
rākau 'avarevare
rākau 'avare
rākau pikika
rākau pikika'a
tiare pikika'a
titā pikika'a

Cuba:

dormidera

Dominican Republic:

moriviví

Federated states of

Micronesia:

limemeihr

Fiji:

cogadrogadro

French Guiana:

sensitive epineuse
sensitive

French Polynesia:

pohe ha'avare
pope ha'avare
teitahakaia
tetahakina

Guam:

betguen sosa

Haiti:

honte

Hawaii:

hilahila
pua hilahila
pua-hilahila
sleeping grass

India:

lajjavathi

lajja

lajkuli

lajwanti

mutlamurike

thotta surungi

thottavadi

Indonesia:

boedjang kajit

daven kagat-kaget
 koetjingan
 pis kucing
 putri malu
 si kejut
Java:
 kuchingan
 randelik
 ri sirepan
Malaysia:
 Keman
 Kembang gajah
 Kemunchup
 Malu-Malu
 Melamu
 Puteri malu
 Rumput rimau
 Semalu
 malu-malu
Mexico:
 pinahul-huixtle
 quecupatli
 vergüenza
Nicaragua:
 dormidera
Niue:
 memege
Pakistan:

chui mui
 lajwanti
Philippines:
 babain
 huya-huya
 kirom-kirom
 makahiyang babae
 makahiya
 sipug-sipug
 torog-torog
 tuyag-tuyag
Ryukyu Archipelago:
 Ojigi-Sô
Samoa:
 vao fefe
 vao fefe
 vao tuitui
South Africa:
 humble plant
 kruidjie-roer-my-nie
 kruidjie-roer-my-nie
 shame plant
 shame weed
Sri Lanka:
 dedinnaru
 nidi-kumba
 thodda-chinunki
 thodda-vadi-kodi

thoddal-vadi
Suriname:
 kruidje-roer-me-niet
 sien sien
 sjeng sjeng tap joe kotto
 sjensjen
Taiwan:
 han hsui tsau
 hau hsui tsau
Thailand:
 mai yarap
 ra ngap
 yaa pan yot
Tonga:
 mateloi
 mateloi
United States Virgin Islands:
 grishi grishi
 gritchee
 sensitive plant
Venezuela:
 dormidera
Vietnam:
 mäs cö
Zanzibar:
 Kifyauwongo

Notes on taxonomy and nomenclature

Mimosa comes from the Greek word mimikos, which means 'to mimic' or 'counterfeit', through the Latin word mimus and suffix -osa, which means 'abounding in', and refers to the many flowers that appear to be a single flower (Parsons and Cuthbertson, 1992). *Pudica* is from the Latin word that means 'modest' or 'bashful' (Holm et al., 1977).

HOST RANGE

List of hosts plants

Major hosts

Acacia mangium (brown salwood), *Ananas comosus* (pineapple), *Arachis hypogaea* (groundnut), *Camellia sinensis* (tea), *Carica papaya* (papaw), *Citrus*, *Cocos nucifera* (coconut), *Coffea arabica* (arabica coffee), *Elaeis guineensis* (African oil palm), *Glycine max* (soyabean), *Gossypium hirsutum* (Bourbon cotton), *Hevea brasiliensis* (rubber), *Lycopersicon esculentum* (tomato), *Mangifera indica* (mango), *Musa x paradisiaca* (plantain), *Oryza sativa* (rice), *Saccharum officinarum* (sugarcane), *Sorghum bicolor* (sorghum), *Zea mays* (maize)

HABITAT

Although it is often grown as an annual ornamental, *M. pudica* grows as a perennial in the tropical or subtropical regions of the world, in a wide range of soils, from sea level up to an elevation of about 1300 m, in crops, pastures, lawns, roadsides, gardens, disturbed soils and waste places (Holm et al., 1977; Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992). Typically, *M. pudica* is found in heavily disturbed areas (e.g. volcanoes, mining sites) or disturbed forests, but disappears in the early stages of vegetation succession (Uphof, 1924; Swaine and Hall, 1983). It tolerates full sun or heavy shade, but is usually found in moist places (Kostermans et al., 1987).

Habitat descriptors

Serious weed in: managed grasslands; plantation crops; wastelands

GEOGRAPHIC DISTRIBUTION

Notes on distribution

M. pudica is of tropical American origin, but has become a serious weed throughout the world's tropical regions (Holm et al., 1977; Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992).

Distribution List

Bangladesh	widespread	introduced	invasive	Akbar, 1968; Holm et al., 1977; Moody, 1989
Bhutan	present	introduced		Parker, 1992
Brunei Darussalam	present	introduced		Waterhouse, 1993
Cambodia	present	introduced		Holm et al., 1977; Waterhouse, 1993
China	present	introduced		Holm et al., 1977; Yang-Han, 1983
Fujian	present	introduced		Chan et al., 2002
Guangdong	present	introduced		Chan et al., 2002
Guangxi	present	introduced		Chan et al., 2002
Hainan	present	introduced		Chan et al., 2002
Hong Kong	widespread	introduced (1851)	invasive	Corlett, 1992
Taiwan	widespread	introduced (1645)	invasive	Holm et al., 1977; Chang et al., 1982; Wu et al., 2003
Yunnan	present	introduced		Chan et al., 2002
Christmas Island (Indian Ocean)	widespread	introduced	invasive	PIER, 2004
India	widespread	introduced		Holm et al., 1977; Moody, 1989
Andaman and Nicobar Islands	widespread	introduced		Singh et al., 1989
Andhra Pradesh	present	introduced		Ramanujam & Khatija, 1991
Bihar	present	introduced		Sah & Pathak, 1988

Goa	present	introduced		Muniappan & Viraktamath, 1993
Gujarat	present	introduced		Muniappan & Viraktamath, 1993
Karnataka	widespread	introduced		Challa et al., 1991; Muniappan & Viraktamath, 1993
Kerala	widespread	introduced		Muniappan & Viraktamath, 1993
Maharashtra	present	introduced		Muniappan & Viraktamath, 1993
Tamil Nadu	present	introduced		Muniappan & Viraktamath, 1993
Indonesia	widespread	introduced		Holm et al., 1977; Moody, 1989; Waterhouse, 1993
Java	present	introduced		Holm et al., 1977
Kalimantan	present	introduced		Holm et al., 1979
Nusa Tenggara	present	introduced		Siregar et al., 1990
[Japan]				
Ryukyu Archipelago	widespread	introduced	invasive	Walker, 1976
Laos	widespread	introduced		Moody, 1989; Waterhouse, 1993
Malaysia	widespread	introduced		Moody, 1989; Waterhouse, 1993
Peninsular Malaysia	widespread	introduced		Ann, 1976; Holm et al., 1977; Baki & Prakash, 1994
Sabah	present	introduced		Holm et al., 1977
Sarawak	present	introduced		Holm et al., 1977
Maldives	present	introduced		PIER, 2004
Myanmar	present	introduced		Waterhouse, 1993
Nepal	widespread	introduced		Moody, 1989
Pakistan	widespread	introduced		Ali, 1973
Philippines	widespread	introduced		Holm et al., 1977; Moody, 1989; Waterhouse, 1993
Singapore	widespread	introduced	invasive	Waterhouse, 1993; AVA, 2001
Sri Lanka	widespread	introduced	invasive	Fairchild, 1902; Salgado, 1972; Holm et al., 1977; Moody, 1989
Thailand	widespread	introduced	invasive	Holm et al., 1977; Moody, 1989; Noda et al., 1994
Vietnam	widespread	introduced		Holm et al., 1977; Moody, 1989; Waterhouse, 1993
Africa				
British Indian Ocean Territory	present	introduced		PIER, 2004
Cameroon	widespread	introduced		Gaullier, 1986; Ngouajio & Daelemans, 1993
Comoros	widespread	introduced	invasive	Vos, 2004
Gambia	present	introduced		Hutchinson & Dalziel, 1954
Ghana	present	introduced	invasive	Holm et al., 1977
Madagascar	widespread	introduced (early 1900s)	invasive	Fishpool and Evans, 2001; Binggeli, 2003
Mauritius	widespread	introduced		Holm et al., 1977; Parsons &

Rodriguez Island	present	introduced		PIER, 2004
Nigeria	present	introduced		Holm et al., 1977
Réunion	present	introduced		PIER, 2004
Senegal	present	introduced		Hutchinson & Dalziel, 1954
[Seychelles]				
Aldabra	present	introduced		PIER, 2004
Sierra Leone	present	introduced		Hutchinson & Dalziel, 1954
South Africa	widespread	introduced	invasive	Wells et al., 1986
Tanzania	present	introduced		Legère, 2003
Zimbabwe	widespread	introduced	invasive	Henderson, 2003
Central America & Caribbean				
Antigua and Barbuda	widespread	native	invasive	Loveless, 1960
Barbados	present	native		Holm et al., 1977
Belize	widespread	native	not invasive	Kellman, 1973
Costa Rica	widespread	native		Holm et al., 1977; Barneby, 1991
Cuba	widespread	native		Holm et al., 1977; Perez et al., 1988
Dominican Republic	present	native		Holm et al., 1977
El Salvador	present	native		Barneby, 1991
Greater Antilles	present	native		Holm et al., 1979
Guadeloupe	widespread	native		Torregrossa, 1983
Guatemala	present	native		Holm et al., 1977
Haiti	present	native		Anon., 2004
Honduras	present	native		Holm et al., 1977
Jamaica	widespread	native	invasive	Asprey and Robbins, 1953; Holm et al., 1977; Williams & Mansingh, 1993
Lesser Antilles	present	native		Holm et al., 1979
Nicaragua	widespread	native		Taylor, 1963; Holm et al., 1977
Panama	widespread	native		Anon., 1950; Pinzon et al., 1989
Puerto Rico	widespread	native		Gonzalez-Ibanez, 1977; Holm et al., 1977
Saint Kitts and Nevis	present	native		Alexander, 1901
Trinidad and Tobago	widespread	native		Holm et al., 1977; Waterhouse & Norris, 1987
North America				
Mexico	widespread	native		Holm et al., 1977
USA	present	introduced		Holm et al., 1977
Hawaii	widespread	introduced		Parsons & Cuthbertson, 1992
Pennsylvania	present, few occurrences	introduced	not invasive	Moldenke, 1946
South America				
Bolivia	present	native		Holm et al., 1977

Brazil	present	native		Holm et al., 1977; Waterhouse & Norris, 1987
Amapa	present	native		Lorenzi, 1982
Amazonas	widespread	native		Lorenzi, 1982; Dias-Filho, 1990
Bahia	present	native		Lorenzi, 1982
Ceara	present	native		Lorenzi, 1982
Espirito Santo	present	native		Lorenzi, 1982
Goiás	present	native		Lorenzi, 1982
Maranhao	present	native		Lorenzi, 1982
Matto Grosso do Sul	present	native		Lorenzi, 1982
Matto Grosso	present	native		Lorenzi, 1982
Minas Gerais	present	native		Lorenzi, 1982
Parana	present	native		Lorenzi, 1982
Pará	present	native		Lorenzi, 1982
Piauí	present	native		Lorenzi, 1982
Rio de Janeiro	present	native		Lorenzi, 1982
Roraima	present	native		Miranda et al., 2002
Santa Catarina	present	native		Lorenzi, 1982
Sao Paulo	present	native		Lorenzi, 1982
Colombia	widespread	native		Holm et al., 1977; Barneby, 1991
Ecuador	present	native		Barneby, 1991
French Guiana	widespread	native		Barneby, 1991; Reynaud and Thioulouse, 2000
Guyana	present	native		Barneby, 1991
Peru	widespread	native		Holm et al., 1977; Ordonez & Reyes, 1984
Suriname	present	native		Barneby, 1991
Venezuela	present	native		Holm et al., 1977
Oceania				
American Samoa	widespread	introduced	invasive	Waterhouse & Norris, 1987
Australia	present	introduced		
Australian Northern Territory	localized	introduced		Parsons & Cuthbertson, 1992
New South Wales	localized	introduced		Parsons & Cuthbertson, 1992
Queensland	widespread	introduced	invasive	Parsons & Cuthbertson, 1992
Belau	present	introduced		PIER, 2004
Cook Islands	widespread	introduced	invasive	Purea, 1985; Waterhouse & Norris, 1987
[Federated states of Micronesia]				
Caroline Islands	widespread	introduced	invasive	Waterhouse & Norris, 1987
Fiji	widespread	introduced	invasive	Patel, 1972; Holm et al., 1977; Mandal, 1977
French Polynesia	widespread	introduced	invasive	Florence et al., 1983; Waterhouse &

		(1845)		Norris, 1987; Meyer, 2003
Guam	widespread	introduced	invasive	McConnell & Muniappan, 1991
New Caledonia	widespread	introduced	invasive	Waterhouse & Norris, 1987
Niue	widespread	introduced	invasive	Waterhouse & Norris, 1987
Northern Mariana Islands	present	introduced		PIER, 2004
Papua New Guinea	widespread	introduced	invasive	Holm et al., 1977; Parsons & Cuthbertson, 1992
Samoa	widespread	introduced	invasive	Reynolds, 1981; Waterhouse & Norris, 1987
Solomon Islands	widespread	introduced	invasive	Steel & Whiteman, 1980; Waterhouse & Norris, 1987
Tokelau	widespread	introduced	invasive	Waterhouse & Norris, 1987
Tonga	widespread	introduced	invasive	Waterhouse & Norris, 1987
Vanuatu	widespread	introduced	invasive	Waterhouse & Norris, 1987; Simonnet, 1990
Wallis and Futuna	widespread	introduced	invasive	Waterhouse & Norris, 1987

HISTORY OF INTRODUCTION AND SPREAD

This species is native from southern Mexico to middle South America and the Caribbean. It is likely that the species has been introduced to some of the extreme parts of the New World range. Also, some of the varieties have been introduced beyond their pre-Columbian distributions (Barneby, 1991). In the neotropics vars. *unijuga* and *tetrandra* are the most widespread and their distributions somewhat overlap. The former variety occurs throughout the Caribbean, central and northern South America whereas var. *tetrandra* is mainly found in Columbia and Venezuela and its presence in southeast Brazil probably results from introductions. The var. *hispida* is scattered throughout the Americas and may have arisen from southwestern Mexico and then introduced elsewhere in the neotropics. The var. *pastoris* is sparsely distributed in and around the Guyanas (Barneby, 1991).

Being widely kept as a curiosity, it was widely introduced to the Old World tropics and cultivated in greenhouses in temperate regions. Although in the USA the species has been reported as occurring on disturbed grounds from Florida to Texas, the only voucher specimens collected have been from indoor cultivation (Anon., 1950; Isely, 1971). The history of its introduction is obscure, but in most of the tropics it must have taken place during the 19th century. However, the plant is known to have been spread in Asia from mission to mission by Jesuit fathers (Barneby, 1991), thus it was introduced prior to 1800. Wu et al. (2003) state that it was introduced to Taiwan as early 1645. In Hong Kong it was reported as being only in cultivation in 1857, but became a rampant weed soon after that. By the late 19th century it was considered a 'pest' in Thailand (Culbertson, 1894). By 1900 it had become a troublesome weed, in coconut groves and tea plantations in particular, in Sri Lanka (Fairchild, 1902). It is believed that the introduced material is essentially uniform over extensive areas. In the Philippines and southern Africa all materials appear to belong to var. *hispida*, rare in its native range, whereas in Hawaii they reflect the characteristics of var. *unijuga* (Barneby, 1991; Henderson, 2003). In Australia, Cunningham et al. (2003) listed var. *tetrandra* as invasive although they considered it doubtful that the different varieties could be differentiated. Being now so well established it is not a candidate for eradication. In the Northern Territory it is declared a noxious weed requiring its growth and

spread to be controlled (Miller, 2003). In Hong Kong it is still used as an ornamental (Chan et al., 2002).

BIOLOGY AND ECOLOGY

Genetics

The reported chromosome number is $2n=52$ (Berger et al., 1958).

Attempts to select spineless types for use in pastures have failed because homozygosity has not been achieved and the plants revert to the spiny form.

Physiology and Phenology

M. pudica is generally perennial in warmer climates, although it is often cultivated as an annual in temperate areas. The plant grows rapidly and stems branch profusely. Flowering commences about 3 months after germination.

Investigations in the lowland forests of Costa Rica, a region with a dry season spanning from mid-November to mid-May, showed that leaf flushing occurred between May and November. Flowering lasted from March to November and mature fruits were observed between October and December, and between February and April (Opler et al., 1980). In the Philippines the plants flower all year round (Holm et al., 1977). In Hong Kong flowering occurs between March and October and fruiting lasts from May to November (Chan et al., 2002).

Leaf Movement

Perhaps its most striking characteristic is its ability to move its leaves rapidly in response to stimulation. Stimulating agents that can induce rapid leaf movements include shock and shaking, localized applied pressure, sudden temperature changes, increase in hydrostatic pressure, increase in light intensity, X-rays, electrical stimulation, chemical agents and physical injuries (Roblin, 1979). Fairchild (1902) reported that as a train advanced along a railway line embankment, he observed the quick falling of the leaves like the progress of a roller on the sea coast. The leaflets close and the petiole falls within a couple of seconds of stimulation, while the recovery takes an hour or more (Charnley et al., 1975), although Hitchcock (1893) reported that in Jamaica the leaves recovered from a shock in 9 to 11 minutes. When one part of the plant receives sufficient stimulation, a 'wave' of some kind of excitation spreads over the plant with a velocity of up to 10 mm/s, evident as movements of parts of the plant. The primary mode of conductance of the excitation is thought to be electric (Tinz-Fuchtmeier and Gradmann, 1990). The plant is able to adapt to constant stimulation, such as during rainfall, by reopening its leaves (Applewhite, 1972).

Motor organs or 'pulvini' form true articulations between different parts of the plant. The primary pulvinus is the joint between the stem and the whole leaf, the secondary pulvini allow the pinnae to move at the tip of the petiole, and the tertiary pulvini form the junctions of the pinnules with the rachises (Roblin, 1979). When the leaves are closed, their photosynthetic rate declines by 40%, probably due to a reduced leaf area available to receive incident illumination (Hoddinott, 1977).

The circadian leaf movement, controlled by a biological clock, of *M. pudica* is initiated by the regulated balance of leaf opening and closing substances, and has been reported in detail by Ueda and Yamamura (2000).

Reproductive Biology

The inflorescence is a head of small flowers that only lasts half a day, typically blooming from 8.00 am to noon. Food is present in the form of pollen and solitary bees have been observed to forage for pollen (Percival, 1974). According to Raw (1976) in Jamaica the pollen of *M. pudica* was the most common in samples from bees, *Exomalopsis globosa* and *E. similis*. Although, they are accessible to all pollinators they only appear to be visited by Apidae (Leppik, 1956).

In French Guiana, *M. pudica* reproductive success is negatively affected by the invasive African honeybee. Fruit set was reduced by 6% and seed set declined by 26% when honey bees represented 74% of the flower visitors when compared to forest populations almost exclusively visited by native bees (Butz Huryn, 1997).

In a lowland mixed-dipterocarp forest in Sabah, Malaysia, the pollen composition of stingless bee (*Trigona collina*) pellets contained 3.7% *M. pudica* type pollen (Eltz, 2001).

Reproduction is only by seeds and each plant may produce upwards of 700 seeds. The bristled seed segments can be readily carried on animal fur or on clothing. Some seeds germinate rapidly in moist soil, but others may remain dormant and viable in the soil for many years. Under laboratory conditions 80% germination has been obtained in four weeks at alternating temperatures of 20° and 30°C and scarification of seeds with sulfuric acid enhanced germination. After 19 years of storage, 2% of the seeds germinated (Holm et al., 1977). Germination rate in Petri dishes is around 90% and is only slightly lower (80%) when seeds are placed in water (Morinaga, 1926). In Belize, Kellman (1978) observed a seedbank with up to 400 seeds/m² in 10% of investigated pastures. In Queensland, Australia, only seven seeds were found in the seed bank of one of four investigated pastures (Navie et al., 2004).

Environmental Requirements

It is usually abundant in open lowland areas, such as in Panama, but it also occurs at higher elevations (Anon., 1950). In the Comoros, it reaches an altitude of 800 m (Ibrahim, 2003). The plant is usually associated with wetter grounds and can grow on a wide variety of soils. It is typically light demanding but appears to be able to tolerate a certain degree of shading.

Associations

In Belize, *M. pudica* is widespread in pastures (37 out of 78 sample sites) but of low local abundance. It is a main component of the weed community of farmland, but is not associated with crop fields (Kellman, 1973). In other parts of Central America it may be found in grassland with a scattered shrub layer, or in salt meadows and savanna vegetation near Nicaragua's Pacific coast (Taylor, 1963). It is also readily found in disturbed areas, such as along railways, for instance in the Mexican Chiapas region (Matuda, 1950).

M. pudica is a nitrogen-fixing legume and possesses root nodules housing Rhizobium bacteria (Allen and Allen, 1981).

Soil descriptors

- Soil texture: light; medium; heavy
- Soil drainage: impeded

MEANS OF MOVEMENT AND DISPERSAL

Propagules readily stick to mammals' fur and human clothing and thus may be dispersed over large distances.

Transport pathways for long distance movement

- Travellers And Baggage: Sticks To Clothing

NATURAL ENEMIES

In Fiji, *M. pudica* is attacked by four widely polyphagous scale insects and the polyphagous cluster caterpillar (Hinckley, 1963, quoted in Waterhouse and Norris, 1987). Preliminary surveys in Brazil and Trinidad have found a number of mainly polyphagous insects attacking the plant (Yaseen, 1971, 1972, quoted in Waterhouse and Norris, 1987). In Panama the plant is palatable to the leaf-cutting ant *Atta colombica* (Rockwood, 1976). It is a larval food plant of the butterflies *Eurema nise* and *E. Lisa* (Percival, 1974). Initial tests in Cuba with larvae of the butterfly *Hemiargus hanno filenus* indicate that it feeds readily on *M. pudica* seeds, is particularly active in spring when most seed is produced, and appears to be host-specific (Perez et al., 1988). Also in Cuba, *M. pudica* acts as an alternative host of the pest nematode *Meloidogyne* sp. in coffee plantations, necessitating control of the weed (Izquierdo et al., 1987). For details of recent studies of the natural enemies of *M. pudica*, see Waterhouse (1994).

A leaf spot fungus, *Cercospora pudicae*, which is associated with leaf scorching and blackening was described from Puerto Rico. It has since been shown to be widespread and is common in India (Evans, 1987).

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
Pathogens:	
<i>Cercospora pudicae</i>	Leaves
Herbivores:	
<i>Hemiargus hanno filenus</i>	Seeds

IMPACT

Economic impact

M. pudica is a serious pest of crops and pastures throughout the tropics (see Host Range). It was regarded by Holm et al. (1977) as one of the world's 76 worst weeds, although Waterhouse and Norris (1987) consider it to be somewhat less of a problem than *M. invisa*. It is regarded as being among the 10 worst weeds in French Polynesia, Guam, the Solomon

Islands and Tonga (Waterhouse, 1985). The plant can survive mowing and when dead can be a fire hazard (Waterhouse and Norris, 1987). Hand weeding is a hazardous practice because prickles can break off in the skin and cause serious septic sores (Holm et al., 1977; Kostermans et al., 1987; Waterhouse and Norris, 1987). In direct-sown upland rice in Kerala, India, infestations of *M. pudica* can lead to a 10-70% reduction in grain yield (Joseph and Bridgit, 1993).

M. pudica is an important weed of dry-seeded, wet-seeded, transplanted and upland rice in south-eastern Asia and the Pacific. It is reported to cause losses in Bangladesh, Fiji, India, Indonesia, Laos, Malaysia, Nepal, the Philippines, Sri Lanka, Thailand and Vietnam (Patel, 1972; Holm et al., 1977; Mandal, 1977; Kostermans et al., 1987; Moody, 1989; Joseph and Bridgit, 1993). It is considered a serious weed in field crops such as sugarcane in Mexico and Taiwan (Holm et al., 1977), sorghum and maize in Malaysia and Indonesia (Holm et al., 1977), soyabeans in the Philippines (Holm et al., 1977) and tomatoes, pineapples and cotton (Ann, 1976; Waterhouse and Norris, 1987).

Due to its ability to grow in partial shade, it is also a serious weed in plantation crops such as rubber in Mexico, Indonesia, Papua New Guinea and Malaysia (Holm et al., 1977), tea in Bangladesh (Akbar, 1968), southern India (Haridas and Sharma, 1973), Sri Lanka (Fairchild, 1902), and Indonesia (Holm et al., 1977), coconuts in Papua New Guinea (Henty and Pritchard, 1988), Indonesia (Kostermans et al., 1987) and Sri Lanka (Fairchild, 1902; Salgado, 1972), coffee in Cuba (Izquierdo et al., 1987), oil palms in Cameroon (Gaullier, 1986) and bananas, pawpaws and citrus (Waterhouse and Norris, 1987). In India, *M. pudica* is a predominant weed in mango nursery beds (Challa, 1984) and in southern Sumatra it is a weed in *Acacia mangium* plantations (Nazif, 1993).

M. pudica is most commonly and widely reported as a weed of pastures. It causes problems in Panama (Pinzon et al., 1989), Puerto Rico (Gonzales-Ibanez, 1977), the Caribbean (Hammerton, 1981), the Brazilian Amazon (Dias-Filho, 1990), the Peruvian Amazon (Ordonez and Reyes, 1984), Sri Lanka (Fairchild, 1902), Fiji (Partridge, 1986), Indonesia (Kostermans et al., 1987), Papua New Guinea (Henty and Pritchard, 1988) and the Solomon Islands (Steel and Whiteman, 1980). It also causes serious problems in lawns on Guam (McConnell and Muniappan, 1991).

In contrast, Reynolds (1981) has reported that long-term coconut yields can be maintained or even increased in Western Samoa when *M. pudica* is grown as a component of a grazed improved pasture within coconut plantations.

Seeds, leaves and other parts of *M. pudica* contain the non-protein amino acid mimosine (beta(N)[3 hydroxy-4 pyridone] alpha-amino propionic acid), which rumen microbes convert into a toxic compound that interferes seriously with thyroid gland function and causes hair loss and other toxic effects, particularly to ruminants, rats, mice, pigs and poultry (Ebuenga et al., 1979; Waterhouse and Norris, 1987). It is suspected of poisoning cattle in Papua New Guinea, especially when cut and dried (Henty and Pritchard, 1988) and has caused stunted growth in chickens in Indonesia (Kostermans et al., 1987).

Experimental transfer of other rumen bacteria can convert stock into animals not harmed by mimosine. *M. pudica* is grazed by cattle in Fiji, Australia, Samoa, the Solomon Islands and India (Reynolds, 1981; Watson and Whiteman, 1981; Smith and Whiteman, 1985; Waterhouse and Norris, 1987; Sah and Pathak, 1988). However, Partridge (1986) reported that *M. pudica* tended to reduce available feed for cattle in Fiji and subsequent cattle growth rates because the cattle tended to avoid the thorny stems and only nibble the growing tips. Gaullier (1986) considered it to be only moderately palatable to cattle in Cameroon. In mixed pastures in the Solomon Islands, *M. pudica* and *M. invisa* were both

grazed at moderate stocking rates and were maintained as small and manageable plants. At higher stocking rates bare areas of ground were induced, allowing invasion of woody weeds. At lower rates, steers were not forced to graze the *Mimosa* spp. and large impenetrable thickets developed (Smith and Whiteman, 1985). When cattle grazed mixed pastures, including *M. pudica*, under coconuts in Western Samoa, long-term coconut yields were maintained or even increased (Reynolds, 1981). Sheep are very fond of wild legumes, especially *M. pudica*, which invade coconut groves in Vanuatu (Simonnet, 1990), and goats fulfil the same role in Malaysia (Murken and Mukherjee, 1988).

In the Comoros the species hinders crop productivity and increases labour due to the need to weed the plant from crops. However, it is used by agriculturalists, like some other introduced weeds, as straw (Vos, 2004).

In Brazil, *M. pudica* is an important honey plant and in the North region it may even produce monofloral honeys (Barth, 2004).

Environmental impact

When dry, thickets of *M. pudica* may be a fire hazard and are said to prevent the regeneration of other species (PIER, 2004). In meadows it is reported "to kill out all other plants" (Fairchild, 1902).

Social impact

Because of its sensitive leaves the plant always has been a major horticultural curiosity, both in the tropics and in temperate glasshouses. It is sometimes cultivated as an ornamental plant in South Africa (Wells et al., 1986), Pakistan (Ali, 1973) and Hong Kong (Chan et al., 2002). However, when it spreads in tropical regions it is generally viewed as having a negative impact. In the Comoros, because of its curved spines, it causes serious problems to people clearing scrub dominated by this plant (Ibrahim, 2003).

Impact on biodiversity

The impact of this plant on biodiversity appears to be as yet rather limited. In the Comoros, however, the species is viewed as being a real threat to the native flora (Ibrahim, 2003).

Summary of impact

Negative impact on: biodiversity; environment; crop production; livestock production; native flora

PHYTOSANITARY SIGNIFICANCE

Because of its sensitive leaves, *M. pudica* is still of great horticultural interest and thus can still be casually introduced by unaware gardeners. The dispersal mechanism of the species, i.e. propagules readily adhere to animals and human clothing, means that both long-distance dispersal by humans and secondary introductions are always a possibility unless strict quarantine measures are implemented.

SUMMARY OF INVASIVENESS

This annual or biannual sub-woody plant typically spreads in disturbed areas in much of the tropics. It can be readily and accidentally dispersed thanks to its propagules that stick to mammals' hairs and human clothing. It becomes extremely weedy in disturbed sites, often forming monotypic ground cover, and is a major weed of many tropical crops.

Risk and Impact Factors

- invasive in its native range: unknown
- proved to be invasive outside its native range: yes
- highly adaptable to different environments: no
- high reproductive potential: yes
- highly mobile locally: no
- 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: unknown
- adversely affects natural communities: unknown
- adversely affects community structure: yes
- adversely affect human health: no
- has sociological impacts on recreational patterns, aesthetics, property values: no
- harmful to animals: yes
- produces spines, thorns or burrs: yes
- host or vector of pests or diseases: no
- likely to be accidentally transported internationally: no
- likely to be deliberately transported internationally: yes
- difficult to identify or detect as a commodity contaminant: yes
- difficult to identify or detect in the field: yes
- difficult or costly to control: yes

MORPHOLOGY

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

The following description is largely gathered from Cardenas et al. (1972), Ali (1973), Holm et al. (1977), Kostermans et al. (1987), Waterhouse and Norris (1987), Henty and Pritchard (1988) and Parsons and Cuthbertson (1992).

M. pudica is a low-growing, much-branched, prickly, sprawling shrub. It grows 15-100 cm tall and is erect or more generally has a trailing growth habit. The stems are woody at the base, stiff, cylindrical, reddish-brown or purple, pubescent and bear scattered prickles along the internodes. The prickles are 3-4 mm long, compressed, slightly curved, hard and very sharp. The root is long and robust.

The leaves are dark green, bipinnate and hairy. The pinnae are in two pairs (sometimes only one pair) arising close together from the tip of the petiole so the arrangement appears palmate. The petiole is about 2.5 cm long and the pinnae are 2.5-5 cm long. There are 12-50 leaflets, each 6-12 mm long, 1.5 mm wide, oblong-linear and pointed, glabrous above but with a hairy margin and lower surface. The stipules are linear-lanceolate and 7-8 mm long. Leaflets and leaves fold up rapidly when touched and also close at night.

Flowers are bright purplish-pink with four prominent stamens and occur in globular or ovoid

heads about 9 mm in diameter. The calyx is minute and the corolla is four-lobed and about 2 mm long. The 12-25-mm-long peduncles arise from leaf axils, are densely hairy and carry prickles. Flowering can occur throughout the year in tropical countries.

Fruits are borne in clusters in the leaf axils. Each fruit is an oblong, flattened, recurved pod about 8-20 mm long and 2-6 mm wide containing 1-5 seeds. The pod is pointed at the apex, glabrous, edged with bristles and breaks into one-seeded segments which fall away from unbroken marginal sutures when mature. The one-seeded segments bear bristles which aid in dispersal by animals and man. The seed is light-brown, flattened, 2.5-3 mm in diameter and with a finely granular surface. Each plant can produce up to 700 seeds in a year.

SIMILARITIES TO OTHER SPECIES

M. pudica can be readily distinguished from most other plants by the rapid movements of its leaves and leaflets when they are touched. However, this test is of no use in distinguishing *M. pudica* from *M. invisa* [*M. diplotricha*], which is also sensitive to touch, is considered one of the world's worst weeds and occurs throughout the world's tropical regions (Holm et al., 1977). *M. diplotricha* has stems which are conspicuously four-angled, with numerous recurved prickles occurring along the angles of the stems. *M. pudica*, in contrast, has round stems with only occasional pairs of prickles. Where the bipinnate leaves of *M. pudica* generally have one or two pairs of pinnae, the leaves of *M. diplotricha* have four to nine pairs of pinnae.

M. pudica is quite similar to *M. polydactyla* but has a simpler leaf formula, broader stipules and longer filaments, and is distinguishable from the Mexican *M. affinis* only by a difference in legume setae (Anon., 1950; Barneby, 1991). *M. pudica* is a variable species and Barneby (1991) recognised four varieties that can only be keyed using flowering material. These are vars. *unijuga*, *tetrandra*, *pastoris* and *hispida*. The var. *pudica* refers to the single sterile Linnaean herbarium specimen that can not be positively identified (Barneby, 1991).

CONTROL

Cultural Control and Sanitary Methods

M. pudica in pastures can be encouraged by overgrazing by cattle (Chadhokar, 1978), and insufficient grazing pressure can also lead to an increase in the weed, as the animals are not forced to eat it (Smith and Whiteman, 1985). When *M. pudica* is present under plantation crops, it can be kept in check by grazing with sheep (Simonnet, 1990) or goats (Salgado, 1972). Seeds can be readily transported by animals on their fur (Holm et al., 1977).

Very young plants can be uprooted by hand (Chadhokar, 1978), but older plants have woody stems and are difficult to pull up by hand (McConnell and Muniappan, 1991). Cuts caused by the sharp prickles when hand weeding can result in serious septic sores (Waterhouse and Norris, 1987). Hand weeding and hoeing are the practices commonly followed for weed control in upland rice areas in Kerala, India (Joseph and Bridgit, 1993).

Biological Control

There appears to be no work currently in progress on biological control of *M. pudica* (Waterhouse and Norris, 1987; Waterhouse, 1994). Biological control projects against *M.*

invisa [*M. diplotricha*] (Kuniata, 1994) and *M. pigra* (Wilson et al., 1996) have met with some success, and the prospects for similar success against *M. pudica* would seem to be good. *M. pudica* was susceptible and severely damaged by *Fusarium pallidoroseum* isolated from diseased *Mimosa diplotricha* in the Philippines (Baars, 2000). *Neurostrotta gunniella* (Gracillariidae) was introduced into Australia from Mexico in 1986 for the biological control of *M. pigra*. It bred readily on *M. pigra* and to a much lesser extent on *M. pudica* (Forno et al., 2000). Larvae of the moth *Psigida walkeri* tested as a biological control agent of *Mimosa diplotricha* was found to feed on a number of species, including *M. pudica* which suffered from severe defoliation, and thus was not released in Australia (Vitelli, 2001).

Chemical Control

Due to difficulties with hand weeding, chemical control is the most frequently used method of treating infestations of *M. pudica*. Foliar sprays of chemicals such as glyphosate are commonly used (Akbar, 1968; Wong, 1975; Mandal, 1977; Steel and Whiteman, 1980; Chang et al., 1982; Kostermans et al., 1987; Henty and Pritchard, 1988; Challa et al., 1991; Nazif, 1993) but wetting of the foliage must be thorough (Chadhokar, 1978; Henty and Pritchard, 1988). The amount of chemical used can be reduced by application to regrowth following slashing or burning (Chadhokar, 1978) and glyphosate can be mixed at a reduced rate with urea, without reducing the effectiveness of the chemical treatment (Purea, 1985). Spraying should be carried out after rain when the plants are actively growing (Chadhokar, 1978).

Other post-emergence herbicides active on *M. pudica* include dicamba, picloram and triclopyr (Parsons and Cutherbertson, 1992). 2,4,5-T, fenoprop and amitrole may also be used; apparently 2,4-D alone may not be fully effective, but mixtures with MSMA and with ioxynil are recommended (Kostermans et al., 1987). Pre-emergence herbicides effective against a range of weeds, including *M. pudica*, in a mango nursery included oxyfluorfen, diuron, atrazine and isoproturon (Challa, 1984). Post-emergence application of propanil + oxadiazon was reported to be effective in upland rice (Mandal, 1977).

USES

In China it is planted amongst young rubber trees where it successfully competes with and reduces the damage caused by *Imperata cylindrica* (alang-alang or blady grass) (Yang-Han, 1983). It has also been planted to control soil erosion.

The roots yield about 19% tannin (Allen and Allen, 1981) and the plant is used in the production of coating materials (Sah and Pathak, 1988). In Guadeloupe, Trinidad and Tobago, Cuba, India, Malaysia and the Philippines, *M. pudica* is an important source of pollen grains for Italian honeybees (*Apis mellifera*) and other bees (Torregrossa, 1983; Bootsma et al., 1988; Diaz-Millen and Moncada, 1988; Maishihah and Kiew, 1989; Payawal et al., 1991; Ramanujam and Khatija, 1991).

M. pudica is said to have medicinal properties in Pakistan (Ali, 1973) and India (Sah and Pathak, 1988); the seeds have emetic properties (Allen and Allen, 1981) and in the West Indies the plant is used as a folk antihelminthic medicine (Williams and Mansingh, 1993). Stems, leaves and roots are used to treat insomnia, spasms and convulsions in Vanuatu (Englert et al., 1994). Chan et al. (2002) reported that it is used as a medicinal plant in Hong Kong.

Extracts of the plant are known to have moderate insecticidal effects (Williams and Mansingh, 1993), inhibit mycelial growth, conidial germination and uredospore germination

of various plant pathogens and are toxic to certain other plants (Ebuenga et al., 1979).

PESTS

Pests listed in the database

Major host of:

Helicotylenchus dihystra (common spiral nematode)

Minor host of:

Chalara elegans (black root rot), *Maconellicoccus hirsutus* (pink hibiscus mealybug), *Megalurothrips distalis*

Wild host of:

Icerya seychellarum (Seychelles scale), *Megalurothrips usitatus* (bean flower thrips)

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