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MIMOSA PUDICA LINN- A SHYNESS PRINCESS: A REVIEW OF ITS PLANT MOVEMENT, ACTIVE CONSTITUENTS, USES AND PHARMACOLOGICAL ACTIVITY

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Keywords:

Mimosa pudica, plant movement, turgorins, pharmacological activity, uses

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ABSTRACT: To cure all aliments of mankind, nature provides a complete store house of remedies for time honored period. In legume family, *Mimosa* is one of the largest genera which distribute more than 500 species. This article aims to provide a comprehensive review on plant movement, chemical constituents, pharmacological activities and uses on *Mimosa pudica*, sensitive plant. Its habitat are lowland tropical rainforest, savanna, tropical and subtropical dry forest and thorn scrub, mid-elevation subtropical forest, desert, grassland, and wet land. It is a rich source of flavanoids, tannins, plant hormones, amino acids and glycosides. The innumerable medicinal properties and therapeutic uses of *Mimosa pudica* as well as its isolated active constituents prove its importance as a valuable medicinal plant.

INTRODUCTION: "Mimic" means to allude and "pudica" means bashful, results the name *Mimosa pudica* to that plant.[1] In legume family, *Mimosa* is one of the largest genera which distribute more than 500 species. Lowland tropical rainforest, savanna, tropical and subtropical dry forest and thorn scrub, mid-elevation subtropical forest, desert, grassland, and wet land are habitat of Mimosa. To cure all aliments of mankind, nature provides a complete store house of remedies for time honored period. In Indian conditions it is opt to collect plant during September to march.

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Active constituents from plant improve health and lighten illness. It gains attention because it is money-spinning, environmental, and true relief from illness.

Mimosa pudica (Mimosaceae) is a shrubby plant with the bipinnate leaves, glandular hairs, spinouts stipules, Companulate calyxes and lilac pinkish axilary flower heads. The stems are erect and well branched.[1]

In Indian condition it flowers and fruits in the month of August to October. It contains active constituent like an alkaloid mimosine, mucilage, tannins, non- protein amino acid (mimosin), flavonoid C- glycosides, sterols, terpenoids, tannins and fatty acids. *M. pudica* shows certain movements like nyctinastic movement, thigmonastic movement and seismonastic movement.[2]

Nitrogen fixing bacteria are habitat in root nodules of *Mimosa pudica*.

FIG. 1: LEAVEAS OF *MIMOSA PUDICA*

FIG. 3: FLOWERS OF *MIMOSA PUDICA*

FIG. 2: SEEDS OF *Mimosa pudica*

TABLE 1: SCIENTIFIC CLASSIFICATION:

Kingdom	**:**	**Plantae**
Division	:	Magnoliophyta
Class	:	Mangnoliopsida
Order	:	Fabales
Family	:	Fabaceae/ Mimosaseae
Sub – family	:	Mimosoideae
Genus	:	*Mimosa*
Species	:	*Pudica*

TABLE 2: SYNONYMS: [3, 37]

Lanuage	**Vernacular name**	**Meaning**
Sanskrit	Namaskari	-
Ayurveda	Lajjalu	Sensitive plant, humble plant, shame plant, sleeping grass, touch me not
Hindi	Chue mue Lajawanti	Unique property to drop
Tamil	Tottal sinungi	Acts when touch
Bengali	Lojjaboti	Shy virgin
Malayalam	Thottavadi	Wilts by touch
Marathi	Lazalu	Shy
Kannada	Muttidare muni	Angered by touch
Urdu	Chui – mui	
Chinese	Betguen sosa (guam) Memege (niue) Mechiuaiu (palau) Limemeihr (phonpei) Ra Kau Pikikaa (cook islands)	Shyness grass
Philippines	Makahiya	Maka- quite/ tendency to be Hiya- shy/ shyness
West Indies	Mori vivi	
Indonesia	Putri malu	Shy Princess
Mayanmar (Burma)	Hti ka yoan	Crumbles when touched
Latin	Pudica	Shy shrinking
Tonga	Mateloi	False death
Malaysia	Pakok semalu	Shy plant
European	Naa - me – toque	Touch me not
	Sensitive	Sensitive
	Dormideira	Roughly “sleeper”
Spanish	Mori – vivi	“I died , I lived”
Central America	Dormilona	Sleepy head

MECHANISM OF PLANT MOVEMENTS:

Plants are rooted in one place hence they are immobile. Time laps photography makes known that parts of plants habitually move. Most plants move too slowly for the passerby to notice. Ecological stimuli such as: light, gravity and mechanical disturbances make a plant to move such as tropisms and nastic movements.

Tropisms:

It is firmed by the direction of an ecological stimulus. Movement towards the stimulus is positive tropism, and away from a stimulus is negative tropism.

Nastic movements:

Plants responses to stimuli (e.g. temperature, humidity, light irradiance) in a non directional way and the movement can be due to changes in turgor or changes in growth.

TABLE 3: TYPES OF STIMULUS TRIGGERING THE MOVEMENT

Type of stimulus triggering the movement	Designation
Shaking	Seismonastic
Touching	Thigmonastic
Wounding	Traumatonastic
Light	Photonastic
Heat	Thermonastic
Downward-bending	Epinastic
Movements at night or in the dark	Nyctinastic
Response to chemicals or nutrients	Chemonastic
Response to water	Hydronastic
Response to gravity	Geonastic /Gravinastic
Response to contact	Haptonastic

Nyctinastic movement:

Most leguminous plants have power over nyctinastic movement. In fourth century B.C much attention towards the nyctinastic movement in *Mimosa pudica L* based on the surveillance the biological clock was discovered. Under continuous darkness in cave the French chemist maintained nyctinastic leaf movement and discovered an intrinsic rhythm controls the leaf movement.

In *Mimosa pudica* the pinnules close and open at the usual time was observed by the astronomer de Mairan in 1729 and Hallberg coined the term 'Circadian Rhythm' (circa =approximately, diem = day; hence circadian). According to a circadian rhythm leaves close at night and open in the daytime which is represented as nyctinasty[2].

In 1848 a treatise was done by Ernst Wilhelm Briicke on the movement of *Mimosa* leaves. In 1880 book entitled "The Power of Movement in Plants" includes nyctinastic ones represented by *M. pudica* which is published by Charles Darwin and his son Francis. As long ago as 1912, Weffer proposed that rapid loss of turgor is caused by an active contraction of the proto- plash, coupled with a simultaneous increase in membrane permeability. The potential set up between the vascular bundle and the turgescent parenchymal sheath and ascription of the periodically stimulated movements to movement of water in the parenchyma were a clear interpretation of plant movement. Pulvini are an autonomous organ houses with mechanoreceptors and photoreceptors located at the base of leaf stalks or petioles'? which induce nyctinastic leaf movement by the swelling and shrinking of motor cells. Anatomically it consists of a rod of sclerenchyma surrounded by collenchymas. In its extended position, the cells of the entire collenchymas are distended with water and surrounded by thin-walled motor cells which can undergo visible swelling and shrinking.

In analogy with animal joints, the motor cells on the lower site of the pulvinus are called flexor and on the upper site extensor cells. A lifting of the leaf is actuated by an increase in tugor pressure and volume caused by the uptake of K+ ions in the extensor cells. Upon darkness K+ channels in the extensor cells close but open in the flexor cells which loose turgor pressure and shrink, the pulvinus joint loses its rigidity and lets the leaf droop. Opposite in position from the extensors are the flexors.

When the extensors lose turgor, the flexor cells stretch. Together these reversible cell volume and shape changes enable elaborate leaflet and petiole movements. In *Mimosa* pulvini like in animal muscles flexor undergoes a measurable shortening upon stimulation by an action potential. Its response can be triggered by touch, sudden darkness and the arrival of action potentials[4].

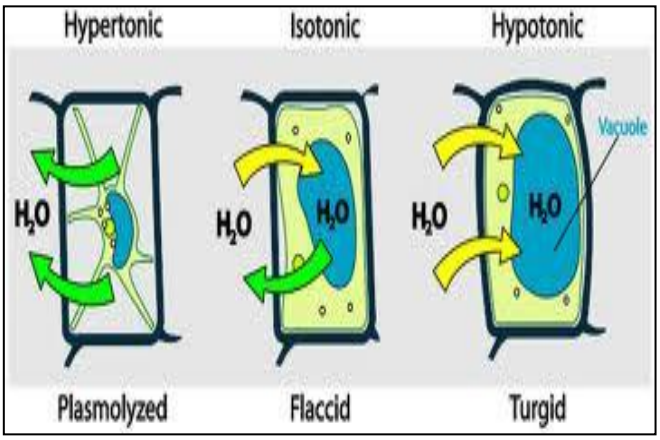


FIG. 4: TURGOR PRESSURE

Intrinsic rhythm:

Ethylene influences growth processes, germination of seeds, and the formation of buds, flowers, roots, and the ripening of fruit in intimate interaction with

the hormones namely the auxins, gibberellins, cytokinins, and abscisins. In 1983 Hermann Schildknecht successfully isolated a new class of phytohormone, turgorin, which believe to control leaf-closing movement of the plants. The turgorin molecule contains a strongly acidic free sulfuric acid group.

However, it was revealed that turgorins is not a genuine leaf movement factor. All phytohormones hold true in responsible for the rapid movement of fixed plants. The turgorins are phenolic and purine glycosides which is a direct consequence of the turgor effect. Being glycosides they have a strong affinity for water. Their production or accumulation at a particular site, therefore, brings about the 'flow' of water and its structuring as in ice formation (a result of hydrogen bonding).

The consequent change in water pressure produces an osmotic effect resulting, for example, in a shrinking of the pinnate leaf cells. The visible result is that the leaves close; they open up again when the turgorins are metabolized to inactive compounds.

Leaf-closing and leaf–opening substances were observed in several nyctinastic plants. Nyctinastic movement is regulated by a chemical substance that differs depending on the plant [2]. Every family or subfamily of plants has its own leaf movement factor that is effective only for plants belonging to its own family, although they have not identified any leaf movement factor.

The presence of leaf-opening substances indicates that nyctinastic movement is controlled not only by the change in the concentration of the leaf-closing factor, but also by the competitive interaction between leaf–closing and leaf–opening substances. When the concentration of the leaf-closing substance was higher than that of the leaf-opening substance, the leaves were closed during the day and vice versa.

The leaf-movement factors isolated from Mimosa pudica has been characterized as the S-riboglucoside of 2, S-dihydroxy- benzoic acid, indole-3- acetic acid ,adenosine 3'-monophosphate (3'-AMP) and guanosine 3' -monophosphate (3' -GMP).

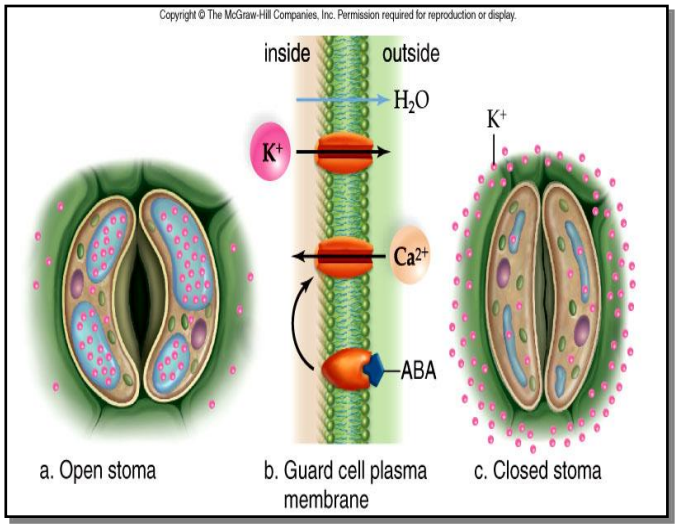


FIG. 5: MECHANISM OF OPENING AND CLOSING

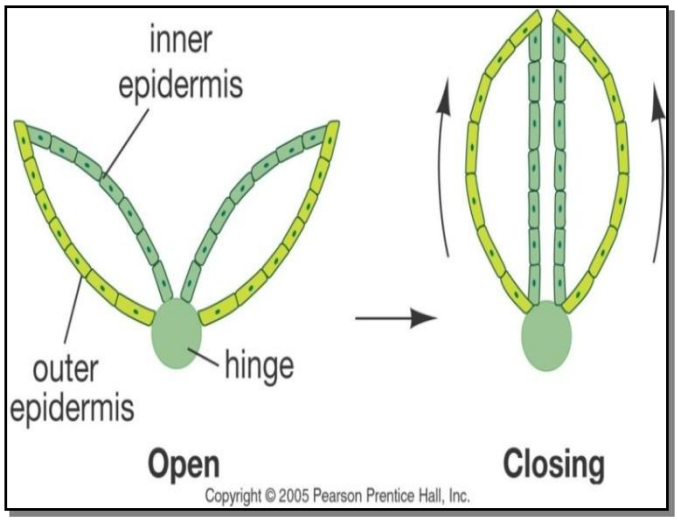


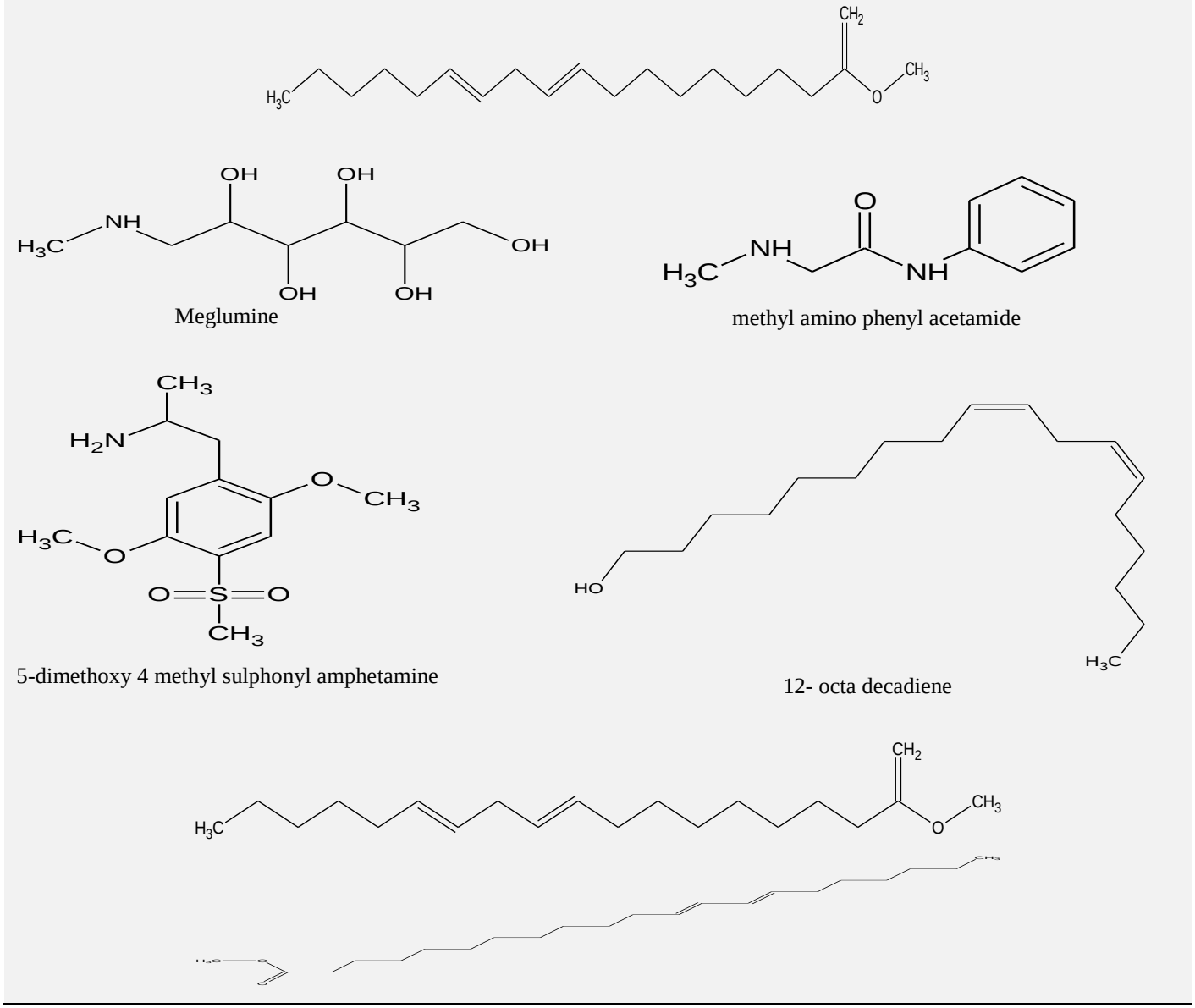
FIG. 6: OPENING AND CLOSING OF THE STOMATA

Thigmonastic (thigma is the Greek word for touch)**/ seismonastic movement:**

By touch:

FIG. 7: NYCTINASTIC MOVEMENT OF *MIMOSA PUDICA*

TABLE 4: CHEMICAL STRUCTURE OF THE ACTIVE CONSTITUENTS



A touch stimulation results in a very rapid folding up of the small leaflets composing the doubly compound leaves. Remarkably, the touch response is not restricted to the stimulated leaflet, but can propagate to all the neighboring leaflets of the leaf.

A complex electrical signal can be responded by the epidermal cell of plants and animals and capable of sensing mechanical touch which is essential for an organ to function. Sensory hairs found in the surface extrusions enhance the sensitivity e.g. the lower part of leaf joints of *Mimosa pudica* or sensory papillae. The peripheral vertical cells just below the bending zone experience an increased pressure, which they convert into an electrical receptor potential.

These cells are the genuine mechanosensors in the system designed to transform the mechanical signal into a hydraulic signal, the pressure signal into a receptor potential which - when strong enough - is then transmitted to the rest of the leaf cells in the form of an action potential. Note that the mechanic stimulus is transmitted by the hair structure to the mechano-sensing cell

By release of calcium:

Protoplasmic contraction, permeability increase, and intracellular osmotic pressure decrease are the

3 principal theories proposed to explain the sudden turgor loss in the lower pulvinar cells. The correct parameter describing water movement is the reflection coefficient (σ) derived from the theory of irreversible thermodynamics. In plant cells tannin vacuoles attributes rapid thigmonastic movement. Perturbed plants tannin vacuoles store Ca^{2+} and release it as a secondary messenger [cell signaling compound]. The releases of ca ions cause leaf movement through the same mechanism of nyctiasty[5].

By sugar concentration:

When sugar is loaded to apoplast from phloem initiates the touch-induced extensor cell volume changes in *Mimosa.* The increased sugar concentration in the apoplast decreases the water potential and triggers the efflux of potassium ions from the surrounding cells. This is followed by an efflux of water, resulting in a sudden change of turgor pressure in the cells of the pulvinus. The process is similar to the mechanism of stomatal closure.

By osmosis:

Proton pumps set strong electrochemical gradients enabling rapid ion movements across plasma membranes. *Mimosa* motor cells have an abundance of H + - ATPase proteins, perhaps to accommodate a requirement for high pump activity. The osmotically driven cellular water loss is extensive, with up to a 25% volume change, and rapid, occurring within 1 s. Such a fast and dramatic loss of water from pulvinar cells is likely facilitated through transporters such as aquaporins or solute-water cotransporters [6].

PHYTOCHEMICAL SCREENING:

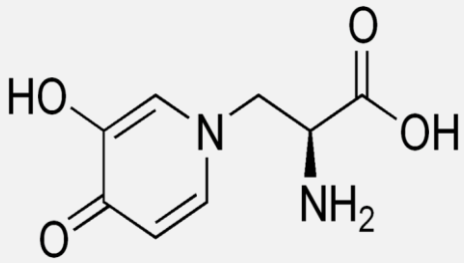
Presence of flavonoids, phytosterol, alkaloids, amino acids, tannins, glycoside and fatty acids were detected by phytochemical studies.

TABLE 5: MATERIALS AND METHODS

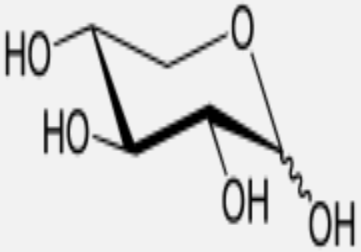
Plant material obtained from	Extract	Authenticaticated by/ at	Doses mg/kg	Models used
1. Jawaharlal Nehru Krishi Vishwavidyalaya Jabalpur	Ethanol	Prof. (Mrs) Karuna S. Verma, Senior Botanist, Department of Post Graduate Studies & Research in Biological Sciences Rani Durgawati Vishwavidyalaya, Jabalpur.	250 and 500	Wistar Albino rats 150-200g Standard pethidine-4mg/kg Hotplate method Tail flick method Acetic acid induced writhing test Aspirin 200mg/kg as standard Anti-inflammatory activity Carrageen induced hind Paw oedema Indomethacin as standard.[7]
2. Near Solapur district, Maharashtra in month of August	Ethanol, aqueous and Petroleum Ether	Botanist	100,200 & 500	Anthelmintic activity Indian earthworm's Pheretima posthuma Albendazole as standard .[8]
3. Coimbatore	Alcoholic Aqueous	Prof. Parthiban, Associate, Prof. (Forestry), TNAU, Tamil Nadu, India.	1g/kg	Antioxidant activity Lipid peroxidation Male albino Wister rats (150 gm).[9]
4. Thaniparai hills, watrap, tamilnadu Month of May 2008	Methanol Chloroform Diethyl ether	By Dr. Stephen, Dept of Botany, The American college, Madurai	100 and 200 100	Antiulcer activity Standard Ranitidine 20 mg/kg Aspirin and Alcohol induced gastric ulcer Pylorus ligation induced ulcer Wistar albino rats of either sex weighing between 150-200 g .[10]
5. In and around Bhopal	Ethanol	Department of Pharmacy Barkatullah university Bhopal.	100, 250 & 500	Aphrodiasic activity Sildenafil citrate 5 mg/kg.[11]
6. Cherlapally adjacent regions, Nalgonda, AP, India during Aug-sept., 2010.	Petroleumether Ethanol Aqueous	Dept. of Botany, Kakatiya University ,Warangal AP.	50,100,200	Anti-inflammatory activity Male albino rats, weighing 150-200g. Carrageenan - induced rat paw oedema.[12]
7. Thailavaram (near SRM University) month of February 2009	Methanol	By Dr D Narashiman. Centre for Floristic Research, Department of botany	200	Hepatoprotective activity Wistar albino rats weighing 175-225g of either sex

		Plantbiology & Plantbiotechnology, Madras Christian College, Tambaram, Chennai, Tamilnadu.		Silymarin as standard 100mg/kg Carbontetrachloride-induced hepatotoxicity.[13]
8. Pattukkottai Month of February 2010	Methanol	Botonist	*In-vitro*	DPPH Assay (Badami S *et al*, 2005) ABTS radical cation decolourisation assay (Re R, Pellegrini N *et al*, 1999) Scavenging of hydrogen peroxide (Jayaprakash GK *et al*, 2004) Scavenging of nitric oxide radical (Marcooci L *et al* 1994) *Standard ascorbic acid and arutin.* [14]
9. Mathar, Kanyakumari district, tamilnadu at 4. 00 pm	Petroleum ether Methanol Chloroform ether	At The institute of sidha medicine, tamil university, tanjavur	150-200g/kg	Wound healing activity Gentamycin as standard Wister Albino rats (150-200gms). [15]
10. Thailavaram (near SRM University) month of February 2009	Chloroform	By Dr D Narashiman. Centre for Floristic Research, Department of botany Plantbiology & Plantbiotechnology, Madras Christian College, Tambaram, Chennai, Tamilnadu.	200	Hypolipidemic Activtty Wistar albino rats weighing 175-225g of either sex standard drug Atorvastatin (dose of 1.2 mg/kg body weight per oral).[16]
11. University college of Pharmacy, Cheruvandoor Month of January to march	ethanol	By Joby paul, Mahatma Gandhi University	500	Wistar albino rats weighing 150-200 g of either sex Piracetam standard 50mg/kg Scopolamine induced model of dementia Aluminum chloride induced model of dementia Elevated plus – maze test Novel object recognition (NOR) test.[17]
12. Pattukkottai	ethanol	Botonist	*In-vitro*	Antibacterial activity Antifungal activity Preliminary phytochemical screening Disc diffusion method.[18]
13. Kalingavaram (KrishnagiriDt). Leaves and root	ethanol	Botonist	Chemical test	Phytochemical analysis.[19]
14. Month of April 2007, from Thamaraipatti village, Madurai District, Tamilnadu.	Petroleum ether 40-60 chloroform	By Dr.Stephen Botanist Professor in American college, Madurai and herbarium specimen deposited at K.M.College of Pharmacy, Madurai	*In-vitro*	Enzyme inhibitor activity Salivary amylase- Mercuric chloride standard Amylase assay- Mercuric chloride standard Assay of Urease- Para chloro mercuric benzoate. [20]

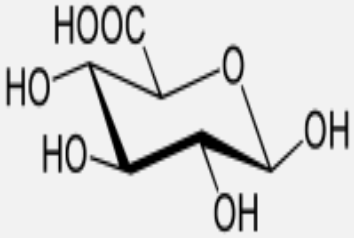
TABLE 6: ACTIVE CONSTITUENTS



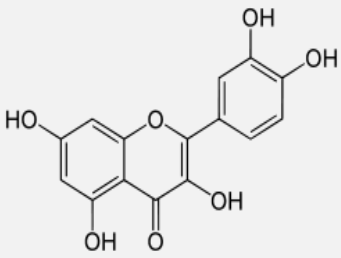
alkaloid mimosine [30]



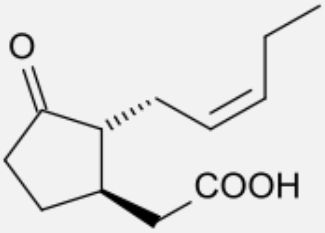
d – xylose



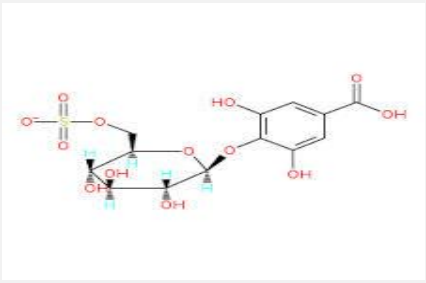
d- glucuronic acid



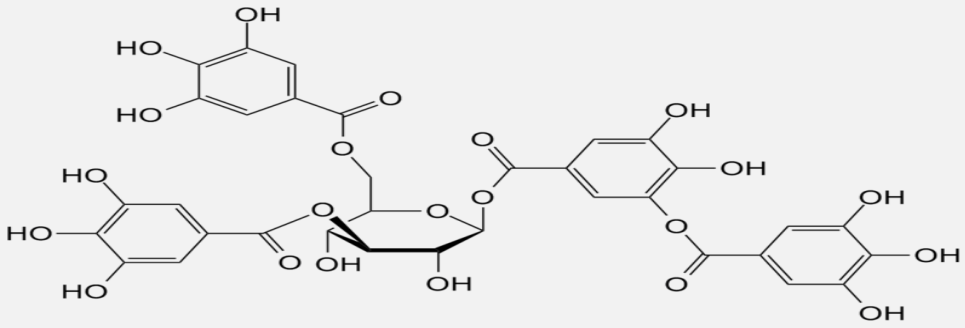
Quercetin [10]



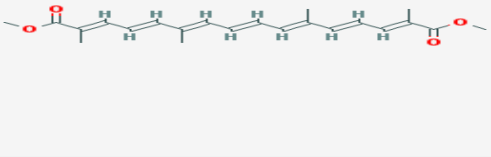
Jasmonic acid



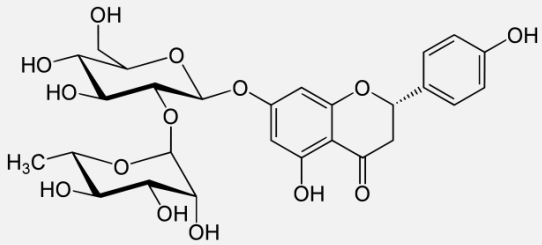
Turgorin –plant harmone



Tannins



Corcetin dimethyl ester



Naringin

Flavanoids, Phenolic constituents, Saponins[10], Glycosides[10], Gums, Tubuline, Phytosterol, Adrenaline like substances (leaf extract), Green yellow fatty oil -17%,Terpenoids, Coumarins, Quinines ,derivatives of 4-α-(b-d-glucopyranosyl-6-sulphate) gallic acid , c- glycosylflavone, Phenolic ketone[34], Jasmonic acid, Nor-epinephrine, d-pinitol (3-mono-methyl ether of inositol), b-sitosterol. [30]

Crocetin dimethyl ester and tannin have been isolated from the plant. The mucilage from seed is composed of D-xylose and D-glucoronic acid 4-*O*-(3, 5-dihydroxybenzoic acid)-b-D-glucoronide. It has four flavones namely 7,8,3',4'-tetrahydroxyl-6-C-[alpha-l-rhamnopyranosyl-(1→2)]-b-D-glucopyranosyl flavone (I); 5,7,4'-trihydroxyl-8-C-[a-l-rhamnopyranosyl-(1→2)]- D-glucopyranosyl flavone (III) and catcher (IV)[31]. A saponin and a bufadienolide were reported in *M. pudica* seeds. P-Coumaric acid is a common plant constituent. Coumaric acid derivatives act as leaf-opening substances in other nyctinastic plants. C-glycosyl flavones present in aerial part. The leaves contain beta sitosterol and phenolic ketones. Oil extract contains amino acid and aminoacid derivatives like N-dl-Alanylglycine, dl-Alanyl-dl- Valine, d-Alanin, dl-Alanin ethyl ester, dl-Alanyl-dl-Valine and 1-Alanine ethyl amide .oil extact possess derivatives of fattyacid like 9, 12-Octadecadienoic acid (Z, Z), methyl ester, 11, 13-Eicosadienoic acid. The other constituents present in the oil extract are methyl ester, 2-methylamino-N- phenyl-acetamide, 1-Octanamine, N-methyl, 1-Butanamine, N-methyl, Meglumine, 2-methylamino-n-phenyl acetamide, - 1, 3-Dioxolane-4-methanol, 2, 5-Dimethoxy-4-(methylsulphonyl) amphetamines, 9.12-Octadecadien-1-ol and 11, 13-Eicosadienoic acid, methyl ester.[35]

TABLE 7: PREPARATION OF PLANT MATERIAL:

Extraction process	Weight of drug	Solvents used	Percentage yield w/w	weight obtained
Leaves Continuous hot extraction in soxhlet apparatus. [10]	500 g of *Mimosa pudica*	Methanol Chloroform Diethyl ether	18 % 16 % 13%	-
Extraction in a soxhlet apparatus [14]		Methanol	-	8.20 g
Extraction in Soxhlet apparatus [15]	250 g of *Mimosa pudica* shoot	Petroleum ether Chloroform Methanol Water	6.4% 8% 5.2% 7.2%	16 g 20 g 13 g 18 g
Extraction in Soxhlet apparatus [15]	250 g of *Mimosa pudica* root	Chloroform Methanol Water	7.4 % 5.6 % 6.6 %	18.5 g 14 g 16.5 g
Extraction in soxhlet apparatus [12]		Petroleum ether Ethanol Aqueous	5.46 % 10 % 10.24 %	-
Successive solvent extraction [11]	Roots of *Mimosa pudica*	Petroleum ether Benzene Chloroform Acetone Methanol Water	3.25 % 5.49 % 2.95 % 5.51 % 7.90 % 2.33%	-
Successive solvent extraction	Roots of *Mimosa pudica*	Petroleum ether Benzene Chloroform Acetone Methanol Ethanol	3.25 % 5.49 % 2.95 % 5.51 % 7.90 % 10.45 %	-
Extraction in soxhlet apparatus	leaves of plant *Mimosa pudica*	Petroleum ether, Benzene, Chloroform, Acetone, Ethanol	-	-
Hot continuous percolation using Soxhlet apparatus [20]	whole plant of *Mimosa pudica*	Petroleum ether Chloroform Methanol	-	-
Soxhlet apparatus	Leaves of *Mimosa pudica*	Petroleum ether Ethanol Aqueous	-	-

PHARMACOLOGICAL ACTIONS: [37]

Anti - ulcer activity: [10]

The extracts used for the activity were, 90% ethanol, methanol, chloroform and diethyl ether extract. The activity was investigated in albino rats. The models used were aspirin induced model, alcohol induced model and pylorus ligation induced ulcer and the parameters evaluated were ulcer protection, gastric ulcer protection and reduction in total volume of gastric juice, free and total acidity of gastric secretion, gastric ulcer respectively. 100 and 200 mg/kg dose levels of extract and 20 mg/kg of dose levels of standard drug Ranitidine were used orally. The extracts were found to be safe up to 2000mg/kg body weight- 100mg shown good activity.

Anti – inflammatory activity: [12]

The extracts used to find this activity was petroleum ether, ethanol and aqueous extracts. The animals used for the investigation of anti inflammatory activity were male albino rats. The models used were Carrageenan induced paw edema and cotton pellet granuloma in rats. Carrageenan induced rat paw edema was used for evaluating the reduction of edema induced by carrageenan.

Different doses like 50, 100 and 200 mg/kg of extracts were used and Indomethacin was the standard used at a concentration of 10 mg/kg. The route of administration was oral.

Anti-microbial activity: [18]
The Methanolic extract of Leaves of *M. pudica* was tested against micro organisms like *Aspergillus fumigates, Citrobacter divergens* and Klebsiella *pneumonia* at various concentrations like 50 , 100, 200 µg/ml. Terpenoids, flavanoids glycosides, alkaloids, quinines, phenol, tannins, saponins and coumarin were the active substances found in the extract which may be responsible for this activity.

Anti – malaria activity: [32]
Plasmodium berghei was the organism used to test the anti- microbial property of methanolic extract of *mimosa pudica.* The presence of active constituents like terpenoids, flavinoids and alkaloids may be responsible for the activity.

Antifungal activity: [32]
Methanolic extract and aqueous extract of leaves of *M. pudica* were tested against *Aspergillus fumigates* by well diffusion assay at various concentrations like 100, 200, and 500 mg.

Carcinogenic potential: [27]
Aqueous and alcoholic extracts of seeds of *Mimosa pudica* were tested against *S. typhimurium.*

Wound healing activity: [15]
The Methanolic extract of shoot of *M. Pudica* was found to have phenolic constituents which shows wound healing property. The methods used were excision, incision, and estimation of biochemical parameters.

Analgesic activity: [7]
The ethanolic extract of leaves of *M. pudica* shows activity at a concentration of 200 and 400 mg/kg. The active substance responsible for this activity is flavanoids. The models used in this activity are hot plate method, tail flick model and acetic acid induced writhing model. Oral administration of ethanolic extract at a dose of 500 mg/kg showed significantly reduction of writhing response induced by acetic acid.

Anti-convulsant activity: [32]
The decoction of leaves of *M. pudica* when given intra peritoneal at a concentration of 1000-4000 mg/kg showed anti convulsant activity.

Anti-diarrheal activity: [32]
Ethanolic extract leaves of *M. pudica* at doses of 200 and 400 mg/kg showed significant anti diarrheal activity. Tannins and Flavanoids were the bioactive constituents which were responsible for the activity. The models used were castor oil induced diarrhea and PGE2 induced enteropooling.

Anti-fertility:[32]
The air dried Methanolic root extracts of *M. pudica* at a dose of 300 mg/ kg body weight/ day was administered through oral route. This dose prolonged the estrous cycle. The extract of the root altered the estrdiol secretion and gonadotropin release. The animals used for determing the activity were Swiss albino rats.

The root powder of *M. pudica* when given intragastrically at a dose of 150 mg/kg body weight in female *Rattus norvegicus.* It altered the estrous cycle pattern. There was a significant reduction in the number of ova.

12. Antioxidant activity: [14]
The activity was tested using the Methanolic crude extract of aerial parts of *M. pudica*. The Methanolic extract's IC_{50} value is 296.92µ/ml. When compared to ascorbic acid whose IC_{50} value is 131.29µg/ml showed a moderate anti oxidant activity.

The Methanolic extract showed significant inhibition in Nitric oxide (IC50 values -78.1±1.75) and DPPH free radical (IC50 values - 35.00±1.15 g/ml). In the cases of ABTS and Hydrogen peroxide free radicals IC50 values were 81.00±3.85 and 449.60±2.55 g/ml respectively. The methods used for determing the activity are Scavenging of hydrogen peroxide, DPPH Assay, ABTS radical cation decolourisation assay, Scavenging of Nitric Oxide radical. The activity was assessed for parameters such as glutamate oxalo acetate transaminase, glutamate pyruvate transaminase, alkaline phosphate, bilrubin and total protein.

Anti- hepatotoxic activity: [9]

The ethanolic extract of *M .pudica* was given at a dose of 200 mg/kg body weight. The animal used was Wister albino rats. The extract showed dose dependent hepatoprotective effect in CCl_4 induced hepatic damage. The activity was assessed for parameters such as glutamate oxalo acetate transaminase, glutamate pyruvate transaminase, alkaline phosphate, bilrubin and total protein.

Antihelmintic activity: [7]

Various extracts of seeds of *M. pudica* like petroleum ether, ethanol and aqueous was used. The test worm used was *Pheretima posthuma.* The test was used in the concentrations of 100, 200, 500 mg/kg. The standard drug used was albendazole. Petroleum ether showed weak anthelmintic activity. An alcoholic and aqueous extract showed paralysis and also caused death in a dose dependent manner compared to standard Albendazole.

Aphrodisiac property: [10]

Ethanolic extract of roots of *M. pudica* were administered orally at a concentration of 100, 250, and 500 mg/kg. The standard drug used was sildenafil citrate. The animal used was Swiss albino male mice and female albino mice. The results indicated that the ethanolic extract of roots of *M. pudica* produced a significant and sustained increase in the aphrodisiac activity of normal male mice, without any adverse effects.

Anti hyperglycemic activity: [32]

The chloroform extract of leaves of *M. pudica* was used for determing the anti hyperglycemic activity. The animal used was Wister albino rats. The chloroform extract exhibited atherogenic index and protection against hyperlipidemic activity. The bioactive constituents responsible for this activity may be flavanoids, glycosides and alkaloids.

Antivenom activity: [28, 32]

The Aqueous extracts of dried roots of *M. pudica* showed antivenom activity at concentration*s of* 0.14 mg and 0.16 mg. The animals used for determing the activity are *Naja naja, Bangarus caerulus.* The aqueous extract was tested for inhibitory activity on lethality, phospholipase activity and hemorrhagic activity of *Naja naja* and *Bangarus caerulus* venoms. The extracts were able to completely neutralize the lethal activity of $2LD_{50}$ of the venoms. The extract of *M. pudica,* dose dependently inhibited the hyaluronidase and protease activities

Spasmogenetic potential: [32]

The ethanolic extracts of the whole plant of *M. pudica* was used to determine the spasmogenetic activity. The animal used was guinea pig.

Regeneration of sciatic nerve [32]

The extract of *M. pudica* was given at a concentration of 1.6mg/100g through parenteral route to rats having experimental injury of sciatic nerve. The extract of *M. pudica* showed 30–40% higher results in the process of regeneration of sciatic nerve.

Effect on uterine bleeding [32]

The aqueous extract of root powder of M. pudica was used for determing the activity. The test was carried in patients with dysfunction uterine bleeding.

Diuretic effect [32]

The decoction of leaves of *M. pudica* showed activity at doses of 200, 500, 1000, and 2000 mg/kg. The animals used were dogs and rats. The standard diuretic used was hydrochlorothiazide at a concentration of 2.5 mg/kg. There was significant reduction of Na^+ and Cl^- excretion without affecting K^+ excretion.

Antidepressant activity: [32]

Aqueous extracts from dried leaves of *M. pudica* was used to test the behavioral actions at various doses of 2, 4, 6 and 8 mg/kg. The animal used was rat. Diazepam at a conc. of 1.3 mg/kg was used as the standard drug. The methods used were elevated plus-maze and DRL-72 s test.

Folkloric uses:

The Whole Plants: [21, 23, 31]

- Treats leprosy, dysentery, vaginal and uterine complaints, burning sensation, asthma, leucoderma, inflammation, neurological problems, diabetic, fever, piles, bronchitis, cholera, cough, dyspepsia, fever, jaundice, smallpox, syphilis and tuberculosis biliousness, fatigue, blood

diseases, whooping cough, fevers in children and sore gum
- Used as a blood purifier.
- Vesicle calculi are treated internally.
- Externally used for odema, rheumatism, myalgia and tumors of the uterus.
- They are useful in vitiated conditions of pitta, leucoderma, vaginopathy, metropathy, ulcers, dysentery, burning sensation, hemorrhoids, asthma, fistula, small pox, strangury, spasmodic, affections and fevers.
- It arrests bleeding and fastens the wound healing process.
- It is mainly used in herbal preparations for gynecological disorder.
- It is also used in conditions like bronchitis, general weakness and impotence.
- This herb can replace contraceptive pills
- *Mimosa* can reduce the onset of baldness, due to its ability to promote healthy cell growth.
- It relieves the symptoms of rheumatoid arthritis.
- It possesses sedative, emetic, tonic properties and ability to treat alopecia, diarrhea, dysentery, insomnia, tumor, and various urogenital infections.
- Plant juice applied externally to fistulous sores.
- Whole plant is used for scabies and uterine tumor.

Leaves: [21, 23]
- The juice of leaves is used in the treatment of diabetes mellitus.
- Paste of leaves is applied to hydrocele.
- Cotton impregnated with juice of leaves is used for dressing sinus.
- The leaves are bitter, sudorific and tonic, and are useful in hemorrhoids, fistula, scrofula, conjunctivitis, cuts and wounds and hemorrhages.
- The juice of leaves is useful in vaginal diseases, salutary in whooping cough, benevolent in diarrhea and also recommended as a panacea for viral hepatitis and cervical adenitis.
- The juice of leaves is used in dressings for sinus and also an application for sores and piles.
- A paste of the leaves is applied to glandular swellings.
- Leaf decoction showed moderate diuretic response.
- Bruised leaves applied to bruises.
- Decoction of leaves used for diabetics.
- The warmed leaf paste is applied around furuncle, abscess, and boils to burst and release of pus.
- The leaf paste is applied on the burst boils and itches for quick healing.
- The leaf paste is applied on forehead to get relief from headache and migraine.
- The leaf paste with honey is prescribed twice a day in empty stomach for 3–4 days for stomach ache and intestinal worms.
- Piles and fistula are treated by taking leaves with milk.
- Leaves used for hydrococle, hemorrhoids, fistula, scrofula, conjunctivitis, wounds and hemorrhages.
- Infusion of leaves used for dysentery and also as a bitter tonic
- Poultice of leaves is used for glandular swelling
- Decoction or infusion of leaves is used in asthma and as expectorant.
- Entire plant in decoction used as alternate and anti asthmatic.

Roots: [21, 23]
- In Western medicine, *Mimosa* root is used for treating insomnia, irritability, premenstrual syndrome (PMS), menorrhagia, hemorrhoids, skin wounds, and diarrhea.
- The warmed root paste is plastered with the help of a cloth on boils to get relief. The paste of root fried in castor oil is applied on deep cut wounds to stop bleeding and for healing.
- Decoction of root is used as gargle to reduce toothache.
- The roots have contraceptive properties.
- The paste of root fried in ghee is applied on caries teeth for relief from toothache.

- Root extracts are reported to be a strong emetic.
- The roots are bitter, astringent, acrid, cooling vulnerary, alexipharmic, resolvent, diuretic, antispasmodic, emetic, constipating, and febrifuge.
- A decoction of the root of the plant is considered useful in gravel and other urinary complaints.
- In the Philippines, roots are used as diuretics, and are used in dysentery and dysmenorrheal.
- Roots are used for leucoderma, vaginopathy, metropathy, ulcers, inflammation, jaundice, asthma, small pox, strangury and fevers.
- Root are considered aphrodisiac and used for bladder gravel and similar urinary complaints.
- Piles and fistula are treated by taking powdered roots.

Seeds: [21, 23]

- Powdered seeds are applied to sores and wounds.
- Seeds showed nematicidal activity against the second stage juveniles of meloidogyne incognita chitwood .
- Seeds are used as coffee substitute.

Sidha medicinal uses: [21, 23]

- The plant is sheetala (Sheetaveerya), tikta, kashaya; subdues deranged kapha and pitta beneficial in hemorrhagic diseases, diarrhea, and gynecological disorders.
- It is used in suppresses kapha and pitta heals wounds, Coagulates blood and sexual weakness
- For diabetics, the juice of samoolam of this plant is taken and given in dose of 20 – 30 ml in early morning.
- The leaves and roots are dried and powered and given in the dose of 2- 5 grms for diabetics.
- The leaves are boiled with water and are used for pain in the hip and kidney region.
- The juice of the plant is mixed in equal quantity of horse urine and externally applied for Pterygium.
- 10 ml of the juice of samoolam is given daily once for 2-3 days for the treatment of bronchial asthma.
- One part of the juice of this plant is boiled with ¼ of gingely oil and is used to treat skin infections.
- The samoolam of this plant is crushed and decoction is prepared. This is used to wash ulcer, diabetic ulcers, skin infection etc.

Ayurvedic and unani uses: [21, 23]

- This plant has been used in diseases arising from corrupted blood and bile, billious fever, piles, jaundice, leprosy, ulcers, small pox
- Ayurveda has declared that its root is bitter, acrid, cooling, vulnerary, alexipharmic, and used in the treatment of leprosy, dysentery, vaginal and uterine complaints, inflammations, burning sensation, asthma, leucoderma, and fatigue and blood diseases.
- Unani Healthcare System its root is resolvent, alternative, and useful in the treatment of diseases arising from blood impurities and bile, bilious fevers, piles, jaundice, and leprosy etc.
- It is very useful in diarrhea (athisaara), amoebic dysentery (raktaatisaara), bleeding piles and urinary infections.
- Some herbal doctors recommend it for general weakness and impotence.
- It is a mood enhancer and improves circulation of the blood.

USES: [20]

TABLE 8: SCIENTIFIC USES:

Antitoxin [37]	CNS Stimulant	Hypolipidemic [15]
Urolithiasis	Anti Diarrhoeal [32]	Anti-Convulsant [32]
Hyperglycemic [32]	Ovulation, Vibriocidal [37]	Antimalarial [32]
Estrogenic and Antiestrogenic Activities	Cytotoxic Properties & Anticancer [26]	Anticoagulant
Antioxidant[14]	Antiasthmatic [37]	Immunomodulatory effect
Anitdepressant Activity[32]	Nematicidal Activity	Analgesic [7]
Antipyretic	Antihepatotoxic activity [9]	Enzyme Inhibitory Hyaluronidase
Diuretic Actions [31]	Wound Healing Activity [15]	Anti Implantation
Anti-Ulcer [10]	Aphrodisiac [10]	Antidepressant [32]
Anti Bacterial [31]	Antispasmodic [31]	Protease Activities [29]
Anti-Inflammatory [31]	Hepatoprotective	

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