

An Examination of the Biological Overview, Nitrogen Fixation, Chemical Constituents, Pharmacological Approach of MIMOSA PUDICA Linn.

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Abstract: For ages, nature has provided a comprehensive storehouse of remedies to cure all of humanity's ailments. With more than 500 species, Among the largest genera in the legume family is Mimosa. Its habitats include desert, grassland, wetland, lowland tropical rainforest, mid-elevation subtropical forest, thorn scrub, savanna, and tropical and subtropical dry forests. It is abundant in amino acids, glycosides, flavonoids, tannins, and plant hormones. Mimosa pudica is an important medical plant, as evidenced by its many therapeutic applications and medicinal qualities, as well as by the separated active ingredients it contains. About their major and minor constituents, there is scientific data. The future of research on M. pudica, the vital, objective and powerful natural approach, is bright. Hidden are M. pudica's uniqueness and usefulness. The use of contemporary scientific concepts like nanotechnology should be used to overcome such obstacles.

Keyword: Mimosa pudica, Nitrogen fixation, chemical component, pharmacological approaches.

Introduction: Mimosa pudica is the name given to such plant since "mimic" means to allude and "pudica" implies shy. A shrubby, sprawling plant of to the Mimosaceae family, Mimosa pudica has lilac pinkish axillary flower heads, glandular hairs, spinout stipules, companulate calyxes, and bipinnate leaves. The upright stems have several branches¹. The Fabaceae family includes the tiny to medium-sized tree Mimosa pudica Linn, which is grown throughout India and reaches a height of around 1.5 m (5 ft). In Ayurveda ,it is referred to as lajjalu and has been demonstrated to possess asthmatic, analgesic, aphrodisiac, anti-eruptive, and depressive properties. Many ailments, including diarrhoea, dysentery, insomnia, tumours, alopecia and other urogenital infections, were treated with M. pudica. It also is recognised to possess tonic, emetic as well as sedative properties. Phytochemical studies of M. pudica² have identified alkaloids, the flavonoids C-glycosides, sterols, terpenoids, tannins,non-protein amino acid mimosine and fatty acids.². It has been demonstrated that its leaf extract contains a substance that is similar to adrenaline. The presence of Palmitic and stearic acids, ascorbic acid, crocetin, D-glucuronic acid, linoleic acid, linolenic acid, mimosine, D-xylose, and b-sitosterols³ was integrated by a phytoconstituent analysis of the root of M. pudica.

According to reports, sitisterol was created by seeds⁴. "Root is a remedy, an alternative, and helpful in bilious fevers, piles, jaundice, leprosy, and other conditions caused by blood impuritie and bile," according to the Unani medical system. Aqueous solutions of plant roots have been demonstrated to significantly lessen the lethality of monocled cobra venom. It appears to inhibit the enzyme activity and myotoxicity of cobra venom⁵..



Figure 3: Plant of M.P.



Figure 2: Flower of M.P.



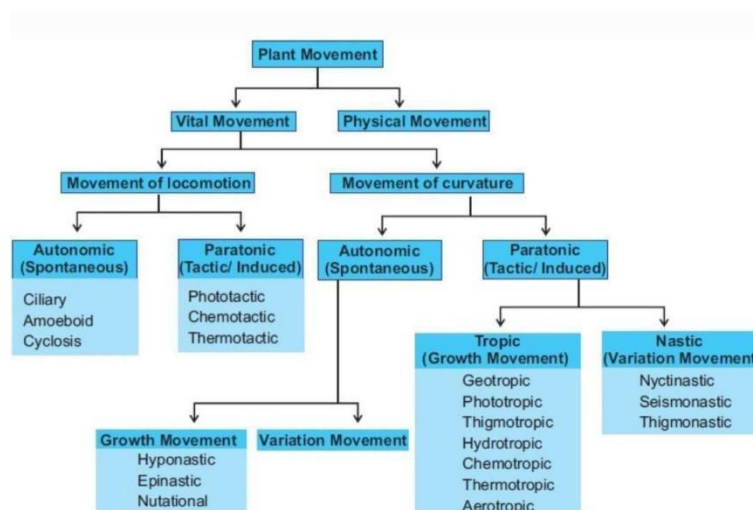
Figure 3: Leaf of M.P.

Biological overview: The pea/legume family Fabaceae includes the creeping annual or perennial flowering plant *Mimosa pudica*, commonly known as sensitive plant, touch-me-not, touch-and-die, shame plant, or drowsy grass. This species is frequently grown for its curiosity value and is frequently used as an example of quick plant migration because of its delicate, complex leaves that instantly fold inward and droop when touched or moved, then reopen a few minutes later. Like other plant species, it experiences "sleep" or syntactic movement, which are changes in leaf orientation. The foliage closes in the dark and opens again in the light.. Moreover, *M. pudica* exhibits specific motions such as seismonastic and thigmonastic movements.

Table 1: Classification of Mimosa Pudica

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae/ Mimosaceae
Sub-Family	Mimosoideae
Genus	Mimosa
Species	Pudica

Table 2: Types of plant movement



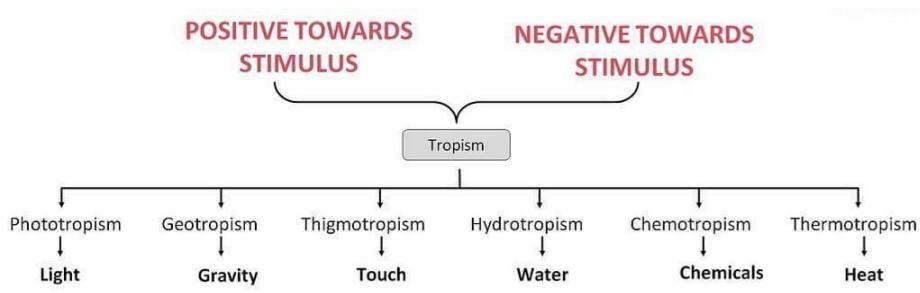


Table 3: Several stimuli that cause the movement of plant.

When a plant is young, its stem is upright; as it ages, it becomes creeping or trailing. If it hangs too low, it could become floppy. With a maximum length of 1.5 m (5 ft), the stem is slender, branched, and sparsely to densely thorny. It is common for *M. pudica* to grow up to 30 cm (1 ft). The leaves are bipinnately complex, with one or two pairs of pinnae and 10–26 leaflets per pinna. Additionally, their petioles are thorny. Pedunculate, or stalked, flower heads of pale pink or purple are produced in midsummer by the leaf axils, and the quantity of blooms increases with the age of the plant. Less than a day passes before a single blossom dies, and it usually does so by the following day. *Mimosa pudica* has delicate, fragile flowers. With the stamens excluded, the globose to ovoid heads have a diameter of 8–10 mm (0.3–0.4 in). Upon close inspection, The floret petals' upper part is crimson, while the filaments range in colour from pink to lavender. Pollens are round and have a diameter of around 8 microns. The fruit is composed of two to eight pod clusters, each 1-2 cm (0.4-0.8 in) long and spiky on the edges. Within the pods, which divide into 2-5 segments, are the pale brown seeds, which are around 2.5 mm (0.1 in) in length. Insects and the wind both pollinate the blossoms⁷. The seeds are primarily stimulated to break out of dormancy by high temperatures⁸. In the rhizosphere of *Mimosa pudica*, the production of carbon disulphide by the roots inhibits the growth of some mycorrhizal and pathogenic fungi⁹. Osmotic pressure and soil acidity are less of a hindrance to germination since the seeds have robust seed coats. This enables the plant's roots to develop a large number of nodules that are home to endosymbiotic diazotrophs, which fix atmospheric nitrogen and transform it into a form that the plant can use¹⁰. There are two copies of the tetraploid *Mimosa pudica* ($2n=52$). Spider mites and mimosa webworms are two of the many natural predators of *Mimosa pudica*¹¹. The leaflets are unable to close responsively because of the webs the two insects make around them.. After an attack, webbed leaves become brown, fossilised fragments that are easily identified¹¹. And, Dry thickets could start a fire in the tropical region.

- Growth form - prostrated
- Leaf arrangement - Alternate
- Leaf type - compound
- Type of Compound leaf type - Bipinnate
- Latex - Compound
- Stem section - Round
- Root type - Taproot
- Hollow or Solid stem - Solid stem
- Stipule type - Lanceolate stipule
- Leaf attachment type - with petiole
- Fruit type - Pod
- Pod type - compressed pod in section
- Cotyledon type - Truncate
- Lamina base - Asymmetric
- Lamina margin - Hairy
- Lamina apex - apiculate
- Upperface pilosity - Glabrous
- Lowerface pilosity - Glabrous
- Lamina section - Flat
- Lamina venation - pennate
- Flower colour - Pinkish
- Inflorescence type - Pedonculate glomerule
- Stem pilosity - Dense hairy
- Stem hair type - Prickle
- Life form - Broadleaf plant

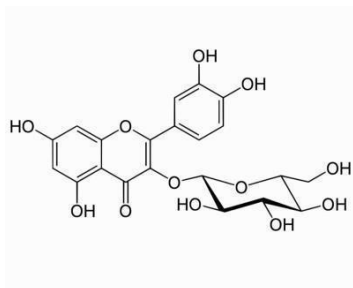
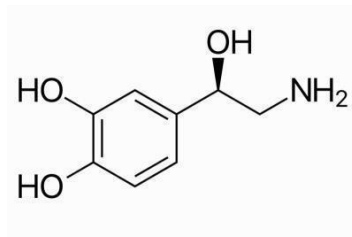
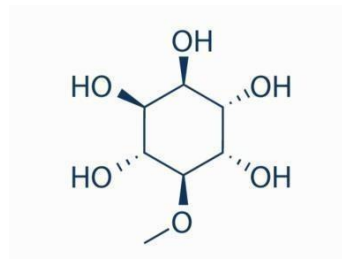
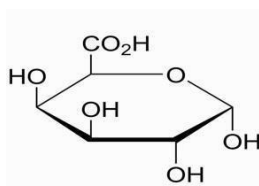
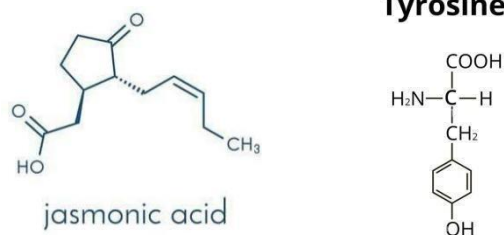
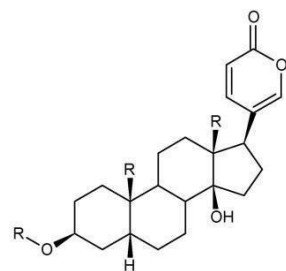
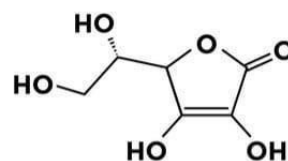
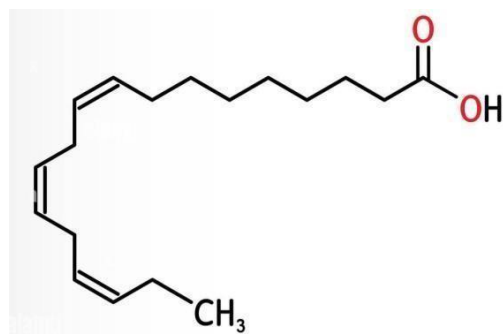
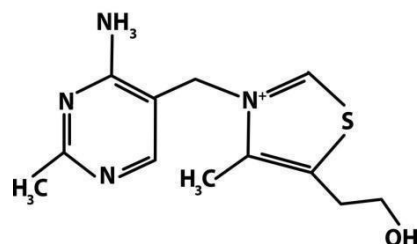
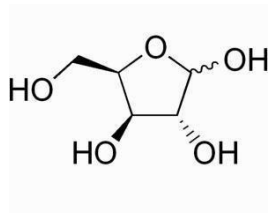
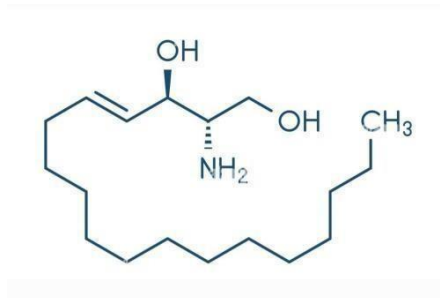
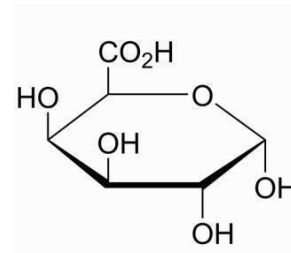
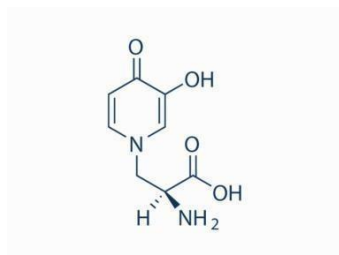
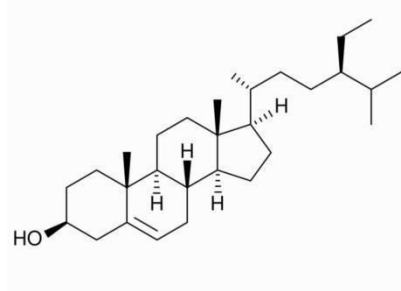
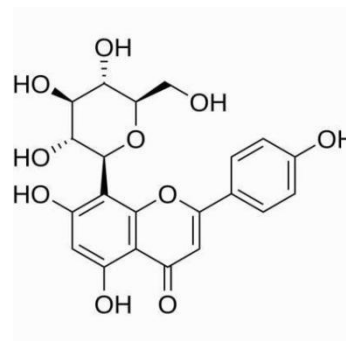
Nitrogen Fixation: In the presence of nitrogen-fixing bacteria, *Mimosa pudica* may create root nodules that the bacteria can reside in¹². In this case, microbes can change atmospheric nitrogen into a form that plants can use. The Fabaceae family of plants shares this characteristic. Both plant growth and reproduction depend on nitrogen. Since nitrogen is a part of chlorophyll, it is also necessary for plant photosynthesis. Both the plant and the soil around its roots receive nitrogen from nitrogen fixation¹³. Because nitrogen fixation is an adaptive feature, the bacteria and plants's parasitic relationship has evolved into a mutualistic one. The concurrent enhancement of multiple symbiotic characteristics in both bacteria and *Mimosa Pudica* illustrates the changing dynamics of this connection. Enhanced "competitive nodulation, nodule development, intracellular infection, and bacteroid persistence" are some of these characteristics¹⁴. Bacteria that fix nitrogen dioxide provide around 60% of the nitrogen in *Mimosa pudica*. Apart from *M. pudica*, the beta-rhizobial diazotroph strains *Burkholderia phymatum* STM815T and *Cupriavidus taiwanensis* LMG19424T are also quite good at fixing nitrogen. In soils that lack nitrogen, such those found in Cerrado and Caatinga, *Burkholderia* has also demonstrated itself to be a potent symbiotic partner of *Mimosa pudica*¹⁰.

Chemical constituent: Phytochemical analyses identified the flavonoids, phytosterol, alkaloids, amino acids, tannins, glycosides, and fatty acids.

Chemical constituent of MP parts.

The different parts of the plant contains different chemical constituents in it. They are:

1. **The Aerial Part** of the plant contains O-glycosyl flavonoids from the plant's aerial portion, including isoquercitrin, avicularin, and apigenin-7-O-glucoside, and also four C-glycosyl flavonoids, cassiaoccidentalinal B, orientin, and isoorientin²⁸
2. **The Leaves** consists alkaloids—mimosine³⁰, terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins^{4,31}, polyunsaturated fatty acid, sphingosine³², nor-epinephrine, d- pinitol, b-sitosterol²⁹, [β -D-apiose-(1 $\rightarrow$ 4)] 5-MeO-DMT³, 5,7,3',4'-tetrahydroxy-6-C-- β -D-glucopyranosyl flavone, tyrosin, isovitexin, orientin, and isorientin.
3. **Seeds** of this plant contains D-glucuronic acid and D-xylose b-D-glucoronide³³, 4-O-(3, 5-dihydroxybenzoic acid), Tubulin³⁴, C-glycosylflavones³⁵, phenolic ketone³⁶, buffadienolide³⁷
4. **Roots** possess Ascorbic acid, crocetin, D-glucuronic acid, linoleic acid, linolenic acid, palmitic acid, stearic acids, L-mimosine, D-xylose, β - sitosterols, flavonoids, phytosterol, alkaloids, amino acids, tannins, glycoside, and fatty acids³³.
5. **Stem of M.pudica** contains β -[N-(3-hydroxypyridone-4)]- α -aminopropionic acid³⁹, 5-MeO-DMT³, L-Mimosine
6. **Whole plants** consists of crocetin, dimethyl ester⁴⁰, 7,8,3',4'-tetrahydroxyl-6-C-[α -l-rhamnopyranosyl-(1 $\rightarrow$ 2)]-b-D-glucopyranosyl flavones, 5,7,4'- trihydroxyl-8-C-[α -l-rhamnopyranosyl-(1 $\rightarrow$ 2)]-b-D-glucopyranosyl flavones.

Chemical structure:**Isoquercitrin****Nor-epinephrine****D-pinitol****Absciscic acid****Tyrosine****ASCORBIC ACID - Vitamin C****Bufadienolide****alpha-Linolenic acid****Thiamine****D-xylose****Sphingosine****D-glucuronic acid****L-mimosine****B-sitosterol****Isovitexin**

Pharmacological approach:

Anti-ulcer activity: *Mimosa pudica* is rich in flavonoids, tannins, and alkaloids, which have shown promising anti-ulcer efficacy in several preclinical studies and are primarily responsible for its antioxidant, cytoprotective, and anti-inflammatory properties. By increasing the production of mucus, decreasing the production of gastric acid, and scavenging free radicals that can harm the stomach lining, these substances aid in the protection of the gastric mucosa. An ethanolic extract of *Mimosa pudica*, for instance, dramatically decreased the development of ulcers in rats given aspirin and ethanol, according to a study published in the *Journal of Ethnopharmacology*. Similar to the common anti-ulcer medication ranitidine, the extract increased the integrity of the stomach mucosa and decreased the ulcer index⁴².

Anti-oxidant property: *Mimosa pudica*'s high concentration of bioactive substances such as flavonoids, phenolics, and tannins contributes to its potent antioxidant qualities. These substances aid in the neutralisation of free radicals, which are erratic chemicals that can harm cells and tissues by causing oxidative stress. According to a study published in the *International Journal of Pharmaceutical Sciences*, the methanolic extract of *Mimosa pudica* showed strong antioxidant activity in DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging tests, indicating its ability to donate hydrogen and neutralise free radicals. The extract was found to have an antioxidant effect comparable to that of conventional antioxidants such as ascorbic acid. This activity supports its potential to protect against oxidative stress-related illnesses, including diabetes, cancer, and neurological disorders⁴².

Aphrodisiac effect: The molecular processes behind these effects have been investigated. Bioactive substances from *M. pudica*, including bufadienolide, stigmasterol, isovitexin, and apigenin, have been shown in silico studies to have high binding affinities to the phosphodiesterase type 5 (PDE5) enzyme, a target for therapies for erectile dysfunction.

Anti-inflammatory action: The aqueous extract of *M. pudica* demonstrated potent anti-inflammatory properties in a dose-dependent manner when tested on Swiss albino mice. Paw oedema was reduced most at 4 hours with the highest dose (400 mg/kg), which was comparable to the standard drug aspirin.

Anti-venom activity: The dried roots of *M. pudica* showed antivenom effectiveness in their aqueous extracts at dosages of 0.14 and 0.16 mg. *Bangarus caeruleus* and *Naja naja* are the animals utilised to determine the activity. The aqueous extract was examined for its ability to suppress the venoms of *Bangarus caeruleus* and *Naja naja*, as well as its phospholipase and hemorrhagic properties. The deadly activity of the venoms '2LD50' might be totally neutralised by the extracts. The hyaluronidase and protease activities were dose-dependently reduced by the *M. pudica* extract⁴².

Anti-malaria effect: *Plasmodium berghei* was used to investigate the ethanolic extract of *Mimosa pudica*'s antibacterial qualities. The activity is caused by the presence of phytocomponents like alkaloids, flavonoids, and terpenoids⁴².

Anti-fungal activity: Studies have demonstrated that *M. pudica* extracts, both ethanolic and aqueous, have antifungal qualities against a variety of fungal infections. One study, for example, assessed the antifungal efficacy of *M. pudica* extracts against the common fungal pathogen *Candida albicans*. The strong antifungal action of the aqueous thorn extract was demonstrated by a larger zone of inhibition than that of the ethanolic extract⁵⁵.

Anti-fertility property: In comparison to control rats, albino rats given 150 mg/kg body weight of *M. pudica* root powder intragastrically demonstrated a substantial decrease in normal ova and an increase in deteriorated ova. Additionally, a diestrous phase pattern that indicated ovulation suppression was found in the vaginal smear study.

Anti-diarrheal property: Using Wistar albino rats, a study that was published in the International Journal of Green Pharmacy assessed the ethanolic extract of *M. pudica* leaves' ability to prevent diarrhoea. Following the delivery of charcoal meal, the extract markedly decreased gastrointestinal motility, prevented prostaglandin E2 (PGE2)-induced enteropooling, and suppressed castor oil-induced diarrhoea. Doses of 200 and 400 mg/kg demonstrated notable efficacy equivalent to the common medication loperamide, demonstrating that these effects were dose-dependent. These antidiarrheal actions are thought to be facilitated by the extract's tannin and flavonoid content.

convulsant property: Decoction of *M. pudica* leaves had anticonvulsant qualities when given intraperitoneally at 1000–4000 mg/kg⁴⁶.

Carcinogenic potential: Alcoholic & aqueous extracts of MP's seeds are used to test *S. typhimurium*⁴⁸.

Wound healing property: Phenolic components found in the methanolic extract of *M. pudica* shoots have the capacity to promote wound healing. The methods used were excision, incision, and biochemical parameter evaluation⁴⁸.

Analgesic activity: Numerous studies on *M. pudica*'s analgesic properties were included in the World Journal of Pharmaceutical Research. The review emphasised that *M. pudica*'s ethanolic extract showed promise as an analgesic drug by considerably increasing the latency time in both hot plate and tail flick tests.

Anti-hepatotoxic activity: In an investigation that was published in the International Journal of Current Research, Wistar albino rats that had liver damage from carbon tetrachloride (CCl₄) were used to test the hepatoprotective and antioxidant properties of the ethanol extract of *M. pudica* leaves. The results showed that the extract significantly increased total protein levels and reversed elevated serum levels of liver enzymes such as SGOT, SGPT, ALP, and total bilirubin when given for 14 days at a dose of 200 mg/kg body weight. Additionally, the extract boosted the activity of antioxidant enzymes like glutathione (GSH), catalase (CAT), and superoxide dismutase (SOD) and decreased lipid peroxidation, indicating that it could be able to counteract oxidative stress associated with liver injury.

Regenerative of sciatic nerve: Rats with experimental sciatic nerve damage were given *M. pudica* extract parenterally at a dosage of 1.6 mg/100g. *M. pudica* extract produced 30–40% better outcomes in the sciatic nerve regeneration procedure⁴⁶.

Effect of uterine bleeding: The activity was assessed using an aqueous extract of *M. pudica* root powder. Patients with dysfunctional uterine haemorrhage were used for the test⁴⁶.

Diuretic effect: *M. pudica* leaf decoction was efficacious at 200, 500, 1000, and 2000 mg/kg. The animals employed were rats and dogs. With a dosage of 2.5 mg/kg, hydrochlorothiazide was the most often used diuretic. Without influencing K⁺ excretion, Na⁺ and Cl⁻ excretion sharply declined⁴⁶.

Antidepressant activity: The Tail Suspension Test (TST) and Forced Swim Test (FST), two common techniques for evaluating the effects of antidepressants, were used in the study. The results showed a considerable reduction in immobility time in both tests, suggesting that the extract exhibits antidepressant-like properties similar to those of the popular drug imipramine.

Insecticidal & repellent activity: The ability of *M. pudica* extracts to resist and kill flat grain beetles (*Cryptolestes pusillus*). After being exposed for 72 hours, the root's chloroform extract showed the highest death rates, with an LD₅₀ value of 2.024 mg/cm². Furthermore, the root extract outperformed leaf and stem extracts in terms of potency and duration of impact, exhibiting considerable repellent activity⁵⁵.

Anti-bacterial activity: In addition to wounds, *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, and MRSA were among the pathogens put to the culture plates. For the whole night, the plates were incubated at 37 °C. Instead of using plant extract for the negative control, Mueller-Hinton agar and distilled water were used to produce the plates. Ampicillin was used in place of the extract for the positive control. Every other bacterium was susceptible to the extract, with the exception of *Escherichia coli*. Only the neat solution affected *Pseudomonas aeruginosa*. Even in the half-neat solution, the other two strains remained sensitive. As a result, the antibacterial properties of *Mimosa pudica* aqueous extract can affect tested microorganisms, such as MRSA. Depending on the findings, scientists might begin studying the plant more to see how best to utilise its natural resources for health⁵⁰.

CONCLUSION: *Mimosa pudica*, a plant known for its unusual tactile sensitivity, is an intriguing topic for scientific study because of its many biological, ecological, and pharmaceutical characteristics. Its distinctive nitrogen fixation properties, which are crucial for maintaining ecological balance and soil fertility, particularly in tropical and subtropical areas, are thoroughly highlighted in this review. The plant's diverse therapeutic potential is supported by its extensive chemical profile, which includes flavonoids, alkaloids, tannins, and terpenoids. Its traditional use in a variety of indigenous medical systems has been supported by extensive pharmacological tests that have proven its antibacterial, anti-inflammatory, antioxidant, antidiabetic, hepatoprotective, and wound-healing properties. Despite the breadth of research, there are still gaps in identifying active components, standardising extraction methods, and conducting clinical trials to verify safety and efficacy in humans. In order to provide new medications and sustainable agricultural applications, future research should try to close these gaps. In conclusion, MP is a versatile plant that's shows great promise into the fields of ecology & pharmacology. Unlocking its full potential for environmental and human health will require ongoing multidisciplinary research.

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