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# Preliminary Phytochemical Screening and Antimicrobial Analysis of *Mimosa pudica (Linn.)*

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## Contents



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## Abstract

Medicinal properties of plants are the most precious gift of Mother Nature to mankind. India has several traditional medicinal systems, such as Ayurveda and Unani, which has survived through more than 3000 years mainly using plant based drugs. The primary benefits of using plant derived medicines are that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and affordable treatment. The *Mimosa pudica* invites attention of the researchers worldwide for its pharmacological activity such as anti diabetic, antitoxin, antihepatotoxin, antioxidant and wound healing activity. According to different researches done, *Mimosa Pudica* is used to relax the mind and relieve depression, mental distress, irritability, severe palpitations and amnesia. It is a mood enhancer and improves circulation of blood. The present investigation was carried out to identify the phytochemicals present in *Mimosa pudica* and to study the antimicrobial activity shown by various extracts of the plant. Phytochemical screening of various extracts of *Mimosa pudica* showed the presence of secondary metabolites such as alkaloids, tannins, saponins, flavonoids etc. The methanolic and ethanolic extracts showed better antimicrobial activity.

**Keywords:** Phytochemicals, *Mimosa pudica*, Secondary metabolites

## 1. Introduction

Medicinal plants are a major source of drugs for the treatment of various health disorders especially in rural areas of Pakistan, India, China, Afghanistan, Iran and other countries of these regions. The use of plant based medicines (local medicines) dates back to 4000-5000 B.C. *Mimosa pudica* invites attention of the researchers worldwide for its pharmacological activity such as anti diabetic, antitoxin, antihepatotoxin, antioxidant and wound healing activity.

According to different researches done, *Mimosa Pudica* is used to relax the mind and relieve depression, mental distress, irritability, severe palpitations and amnesia. It is a mood enhancer and improves circulation of blood.

*Mimosa pudica* contains Mimosine, which is a toxic alkaloid. Adrenalin like substance has been identified in the extract of its leaves. Some workers have reported the presence of Crocetin dimethyl Ester in the extract of the plant. Roots contain tannin up to 10 per cent. Seeds contain a mucilage which is composed of d-xylose and d-glucuronic acid. The plant extract contains green yellow fatty oil up to 17 per cent. The plant is reported to contain tubuline and a new class phytohormone turgorines is found to be active in the plant. The periodic leaf movement factors are reportedly the derivatives of 4-α-(b-D-glucopyranosyl-6-sulphate)gallic acid. The preliminary phytochemical screening of the *M. pudica* leaf extract showed the presence of bioactive components such as terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins (Tapsell *et al.,* 2006).

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, fatigue and blood diseases (Volkov *et al*., 2008). In 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 (Verma *et al*.,1993). Many antioxidant compounds naturally occurring from plant sources have been identified as free radical or active oxygen scavengers. Recently interest has increased considerably in naturally occurring antioxidants for the use of food or medicinal materials (Joseph *et al.,* 2013).

Arokiaraj *et al.* (2012) has screened the methanol extracts of *M. pudica* against two gram positive and four gram negative bacteria, which exhibited significant antibacterial effect against *Bacillus subtilis* (10 mm), *Staphylococcus aureus* (12 mm), *Klebsiella pneumoniae* (30 mm), *Escherichia coli* (11.5 mm) and *Salmonella typhi* (16 mm). The highest zone of inhibition was recorded against *Klebsiella pneumoniae*. M. pudica and A. nilagirica inhibited the bacterial growth. In a similar study by Baby Joseph *et al.* (2013), the antimicrobial activity of methanolic extract of *Mimosa* was tested against *Aspergillus fumigatus, Citrobacter divergens* and *Klebsiella pneumonia* at different concentrations of 50, 100 and 200 µg/disc.

The antimicrobial activity was attributed to the presence of bioactive constituents like terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins and coumarin. The antimicrobial activity of Mimosa was studied by Azmi *et al.* (2011) using well diffusion method. The activity was tested against *Aspergillus fumigatus, Citrobacter divergens* and *Klebsiella pneumonia* at different concentrations of 50, 100 and 200 µg/disc. With these as the background, the present investigation was carried out to perform preliminary phytochemical screening of *Mimosa pudica* and to evaluate its antimicrobial activity using selected bacterial and fungal strains.

## 2. Materials and Methods

**Collection of sample**

The leaves of *Mimosa pudica* were collected from healthy plants found in various areas of Palakkad district in Kerala, India.

**Preparation of the extract**

The leaves were washed properly and shade dried. This dried material was the powdered, passed through a sieve of 0.5 mm mesh size, packed in an air tight container and kept for soxhilation with various solvents such as Methanol, Ethanol, Petroleum ether, Chloroform, and water for 3 complete cycles.

**Preliminary phytochemical screening**

The leaf extract was taken in concentration of 1 mg/ml and testes were carried out for phytochemical screening according to the method described by Kumar *et al.,* 2009.

**Anti-microbial activity**

Antimicrobial activity of *Mimosa pudica* was analyzed by following the method of Tajuddin *et al.,* 2004.

***Microorganism used***

Five species of bacteria- 3 gram-positive (*Staphylococcus aureus, Klebsiella pneumoniae*) and 2 gram negative (*Escherichia coli and Pseudomonas aeruginosa* and *Serratia sp.)* and one fungal species (*Candida albicans*), were obtained from Kongunad arts and science College, Coimbatore and used for antimicrobial activity tests.

***Preparation of Inoculum***

A loopful of the microbial cultures was inoculated, each in 5 ml of nutrient broth in a test tube. It was incubated in a rotary shaker at 37°C for 24 hours (WHO drug information 1993).

***Preparation of Bacterial and fungal cultures***

Organisms such as *E.coli, Klebsiella pneumoniae, Bacillus subtilus, Staphylococcus aureus and Pseudomonas aeruginosa* were used inoculated on plates containing nutrient agar media at 37°C for 24 hrs. *Candida albicans* was inoculated on Potato dextrose agar and incubated at 37°C for 24 hrs.

***Bioassay***

The standard agar disc diffusion assay was adapted from the method of Peter *et al*., 2002. The media was prepared using sterile cotton swab from the seeded broth. Sterile discs of 5mm width, impregnated with 20 ml of the test extract in different concentrations were placed on the lawn of cultures. Erythromycin and Penicillin were used as standard. The plates were incubated overnight at 37°C. Anti-microbial activity of the plant extract was assayed by measuring the zone of inhibition formed around the disc.

## 3. Results and Discussion

The medicinal value of plants has been known from the ancient times. It is known for its pharmaceutical properties. Resistant to anti-microbial agents such as antibiotics is emerging in a variety of organisms and multi-drug resistant organisms pose serious threat to treatment of various infectious disease. Plants produce high diversity of secondary metabolites for defense and survival in the ecosystem. Medicinal herbs practiced in traditional folk medicine in India were screened for the treatment of many diseases dated back to pre-history and people of all continents have this old tradition. Plants are known to produce certain bioactive molecules which react with other organisms in the environment inhibiting bacterial growth.

**Phytochemical screening**

The phytochemicals have many ecological and physiological roles as widely distributed plant constituents. Phytochemicals exhibit wide range of biological effects as constituents with their own antioxidant properties. The phytochemical analysis of the extract indicated the presence of 11 compounds. The leaves showed a number of phytoconstituents in methanol extract. In a previous study, Tamilarasi *et al*. (2012) has reported the presence of 7 compounds in ethanol extract. Similar results were observed in this study also.

These compounds are known to be biologically active and therefore aid the antimicrobial activity. The alkaloid has strong anticancer properties; Tannins have been found to form irreversible complexes with highly rich protein resulting in the inhibition of cell protein synthesis (Dubey *et al*., 2004). They are known to react with protein to provide difficult tanning effect which is important for the treatment of influenced or ulcerated tissues. Herbs that that have tannins as the main component have astringent activity and are also used for treating intestinal disorder such as diarrhea and dysentery. The presence of tannin in *Mimosa pudica* is exploited in the traditional treatment for ailments (Savithramma *et al*., 2011).

The phytochemicals of leaf extracts of *Mimosa pudica* was analyzed for the compounds. The primary phytochemical analysis revealed the presence of 11 compounds. Various tests have been performed to find out the phytochemical constituents. Results for the phytochemical analysis of *Mimosa pudica* Linn is presented in Table 1. From the results it can be clearly stated that the methanolic and ethanolic extracts showed maximum number of phytochemicals. The petroleum ether extracts showed few constituents followed by the aqueous extracts. Chloroform extract showed the least number of phytochemicals. Secondary metabolites like phenols have been identified as a free radical or active oxygen scavengers and can prevent damage of oxidative stress.

**Table 1:** Phytochemical analysis of *Mimosa pudica* Linn.

| Phytochemicals | Methanol | Ethanol | Petroleum ether | Chloroform | Water |
|---|---|---|---|---|---|
| Alkaloids | +++ | - | + | + | + |
| Antraquinons | + | + | + | - | - |
| Cardiac glycosides | + | + | + | - | + |
| Carbohydrates | ++ | ++ | + | + | + |
| Emodins | - | - | - | - | - |
| Flavanoids | ++ | + | + | - | - |
| Phenols | ++ | ++ | + | - | - |
| Proteins | +++ | +++ | + | - | + |
| Saponins | + | + | - | + | ++ |
| Steroids | - | + | - | - | - |
| Tannins | ++ | + | + | - | - |
| Terpenoids | + | + | - | - | - |

**Anti-microbial activity**

The leaf extracts of *M. pudica* were analyzed against bacterial pathogens such as *Staphylococcus, Klebsiella, Serratia sp., E.coli and Pseudomonas,* using Ampicillin (commercial antibiotic) as control.

**Table 2:** Antibacterial activity of *Mimosa pudica Linn.*

| Organisms | Methanol (mm) | Ethanol (mm) | Petroleum Ether (mm) | Chloroform (mm) | Water (mm) |
|---|---|---|---|---|---|
| *S.aureus* | | | | | |
| Control | 12 | 12 | 12 | 12 | 12 |
| 100% | 9 | 8 | 2 | 0.5 | 0 |
| 50% | 10 | 9 | 1 | 0 | 0 |
| 25% | 5 | 3 | 0 | 0 | 0 |
| Solvent | 2 | 1 | 0 | 0 | 0 |
| *E.coli* | | | | | |
| Control | 13 | 13 | 13 | 13 | 13 |
| 100% | 12 | 7 | 2 | 1 | 2 |
| 50% | 9 | 3 | 0 | 0 | 1 |
| 25% | 8 | 3 | 0 | 0 | 0 |
| Solvent | 2 | 2 | 0 | 0 | 0 |
| *Serratia* | | | | | |
| Control | 3 | 3 | 3 | 3 | 3 |
| 100% | 2 | 1 | 0 | 0 | 0 |
| 50% | 1 | 1 | 0 | 0 | 0 |
| 25% | 1 | 1 | 0 | 0 | 0 |
| Solvent | 1 | 1 | 0 | 0 | 0 |
| *P. aerogenosa* | | | | | |
| Control | 11 | 11 | 11 | 11 | 11 |
| 100% | 9 | 9 | 3 | 1 | 0.5 |
| 50% | 5 | 4 | 3 | 0 | 0 |
| 25% | 6 | 2 | 0 | 0 | 0 |
| Solvent | 5 | 2 | 0 | 0 | 0 |
| *K. pneumoniae* | | | | | |
| Control | 5 | 5 | 5 | 5 | 5 |
| 100% | 3 | 3 | 0 | 0.5 | 0 |
| 50% | 2 | 4 | 0 | 0 | 0 |
| 25% | 1 | 2 | 0 | 0 | 0 |
| Solvent | 1 | 2 | 0 | 0 | 0 |

Among the pathogens selected for this study the first two were found to be gram positive and the other three were gram negative. One fungal species, *Candida albicans* was tested with the control Erythromycin. After 24 hrs the minimum inhibitory zone was measured. A maximum activity (12 mm zone of inhibition) was seen against *E.coli* and least activity was measured against *Serratia sp.*. In general, the methanol extract showed maximum activity against bacteria (Figure 1) as well as fungi (Figure 2).

Steroidal compounds present in *Mimosa pudica* extracts are important due to their relationship with various anabolic hormones including sex hormones. *Mimosa pudica* extracts have also been shown to exhibit antibacterial activity and antiviral activity. Flavonoids were found to have effective antibacterial activity, probably due to their ability to form a complex with their extracellular complex protein with their cell wall. The results represented in Table 2 and 3 indicate that there is a significant difference between control and test samples. Ampicillin and Erythromycin was used as control and one disc was introduced with the crude solvent.

**Table 3:** Antifungal activity of *M. pudica*.

| Organism | Methanol | Ethanol | Petrolium ether | Chloroform | Water |
|---|---|---|---|---|---|
| *Candida* | | | | | |
| Control | 4 | 4 | 4 | 4 | 4 |
| 100% | 1.5 | 1.5 | 0.5 | 0 | 0 |
| 50% | 0.5 | 0.5 | 0 | 0 | 0 |
| 25% | 0.5 | 0.5 | 0 | 0 | 0 |
| Solvent | 0.5 | 0.5 | 0 | 0 | 0 |

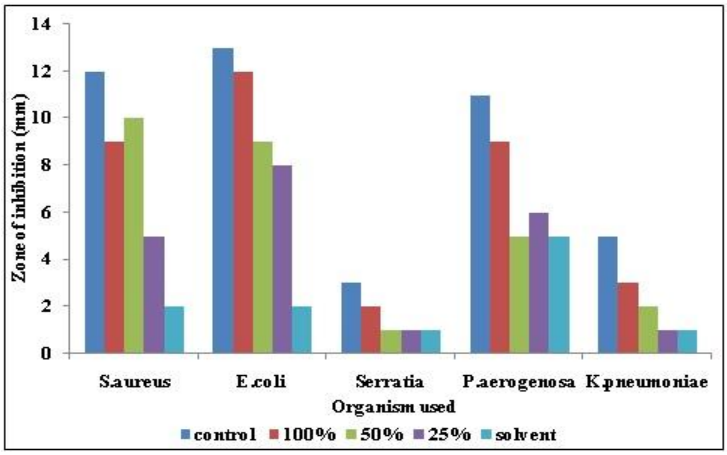


**Figure 1:** Antibacterial activity of Methanol extract of *Mimosa pudica Linn*

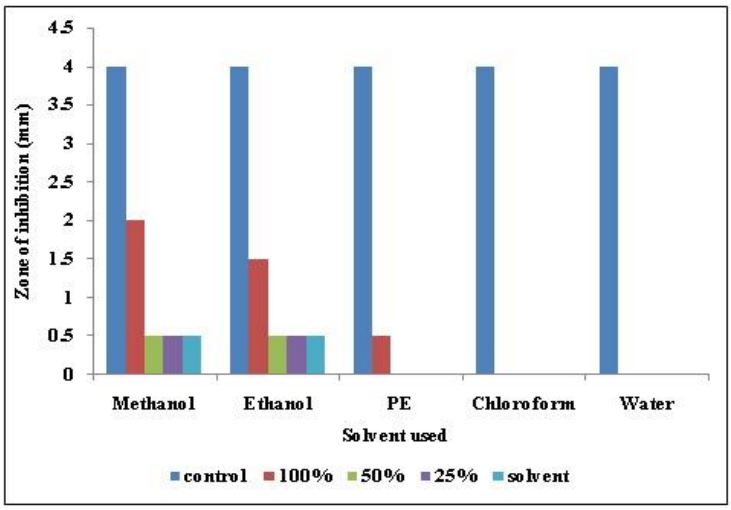


**Figure 2:** Antifungal activity of *Mimosa pudica Linn*

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