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Antibacterial Activity of Aqueous Extract of *Mimosa Pudica* L. against Selected Wound Infecting Bacteria

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ABSTRACT

Aqueous extract of *Mimosa pudica* is utilized by certain Sri Lankans as a wound cleaning agent. The present investigation was conducted to detect the *invitro* antibacterial activity of an aqueous extract of *Mimosa pudica* qualitatively against selected four wound infecting bacteria with agar dilution method at Gampaha Wickramarachchi Ayurveda University, Sri Lanka. Washed and Shade dried whole plant of *Mimosa pudica* was boiled with distilled water for 15 minutes and the cold extract was filtered with gauze to prepare the aqueous extract (neat solution). The neat solution as well as a serial dilution of it up to a quarter were used with Mueller-Hinton agar separately to prepare a series of culture plates. Wounds infecting pathogens such as *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA) were inoculated separately into the culture plates. Plates were incubated overnight at 37 °C. For the negative control, plates were prepared with distilled water and Mueller-Hinton agar in place of plant extract. For the positive control, extract was replaced with ampicillin. Except *Escherichia coli,* all the other bacteria were sensitive to the extract. *Pseudomonas aeruginosa,* was sensitive only to the neat solution. The other two strains were sensitive even in the half neat solution. Thus, the aqueous extract of *Mimosa pudica* has an antibacterial effect on tested bacteria including MRSA. On outcome, scientists may launch further investigations on the plant for harnessing the natural resources effectively for universal health.

Key words: Antibacterial effect, *Mimosa pudica*, MRSA, Wound

Introduction

The use of natural herbs as a remedy for most illnesses has become a trend in modern society.

This could be due to the financial burden as well as drug resistance, such as certain antibiotics (Mahajan et al., 2024). In addition, certain herbal preparations have immunomodulatory effects too (Plaeger, 2003). *Mimosa pudica* (Nidikumba) is such a plant, and its aquatic extract is used by certain Sri Lankan villagers as an antiseptic solution to wash fresh wounds, accelerating the healing process. Thus, the present investigation was carried out to qualitatively detect the antibacterial effect of the watery extract of *Mimosa pudica* used by villagers against common wound infecting bacteria in the laboratory.

The plant is native to tropical America and is also found in Asian countries such as Sri Lanka, India, Singapore, Bangladesh, Thailand, Nepal, Indonesia, Taiwan, Malaysia, the Philippines, Vietnam, Cambodia, Laos, and Japan. *Mimosa pudica* is also named sleeping grass, touch me not, or action plant. In Tamil, it is called Tottal-vadi or Alavananki. The plant belongs to the family Fabaceae (Nature serve explorer, 2024).

The plant taxonomy is as follows (Pansare et al., 2023).

Kingdom : Plantae

Division : Magnoliophyta

Class : Magnoliopsida

Order : Fabales

Family : Mimosaceae

Subfamily: Mimosoideae

Genus : *Mimosa*

Species : *Mimosa pudica*

Mimosa pudica is a diffused undershrub or woody herb and grows up to 1 m high. Often, it is flattened by trampling. Stems are sparingly prickly and accompanied with long bristles from bulbous base. Leaves are sensitive to mechanical movements (Ayurvedic medicinal plants of Sri Lanka, 2024). *Mimosa pudica* is used in Ayurveda for curing various clinical conditions such as diarrhea, bronchitis, bleeding wounds and ulcers, bladder stones, and urinary diseases (Ayurvedic medicinal plants of Sri Lanka, 2024).

It is very important to carry out more scientific investigations on the plant to explore its pharmacological values. Thus, the study was conducted to achieve the object, the antibacterial effect of *Mimosa pudica* watery extract against selected common wound infecting bacteria such as *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA), hence harnessing the natural resources effectively in health.

Not only as a medicinal plant, *Mimosa pudica* is also important in traditional agriculture in Sri Lanka. The root nodules of the plant contain bacteria that can fix air nitrogen into usable compounds such as ammonia and relevant compounds (Rajalingam, 2017). Nitrogen is a vital element for plant reproduction, photosynthesis, and growth. Thus, *Mimosa pudica* indirectly raises the crop of agriculture.

Home remedies or folk remedies can be simply defined as "prepared medication or tonic often of unproven effectiveness administered without prescription or professional supervision" (Mirihagalla and Fernando, 2021). *Mimosa pudica* plant is used in the preparation of home remedies and is traditionally used to heal piles, bleeding ulcers, bleeding wounds, swellings, and fistulas. All the parts of this plant, such as stems, flowers, leaves, flowers, fruits, and roots, are used in this regard. This sensitive plant is also traditionally used for bleeding disorders like menorrhagia, dysentery, and various skin diseases.

Mimosa pudica has antibacterial phytochemicals such as mimosine, toxic alkaloid (Mirihagalla and Fernando, 2021), as well as tannins (Bhawana and Husain, 2015). Further, compounds such as phenolic and flavonoid compounds, which diminish bacterial growth, have also been isolated from the plant (Mandal et al., 2022). The compounds such as 7,8,3,4-tetrahydroxyl-6-C-beta-D Glucopyrano-sylflavone, 5,7,3,4-tetrahydroxyl-6-C-beta-D Glucopyranosyl flavones, mimosine, tyrosine, mmimosinamine, and mimosinicacid have also detected in the plant (Pansare et al., 2023).

The outcome of the study could provide a good platform for scientists to study more comprehensive future works of this medicinal plant.

Materials and Methods

As the aim of the study is to test the antibacterial effect of the watery extract of *Mimosa pudica* against wound infecting bacteria, in the present study, five inhabitants of the areas where the extraction is used heavily (central and north western provinces where the plant is mainly confined) were met and collected data on the preparation of the extract. The final method of preparation of plant watery extract was setup according to the details collected from villagers and references similar to the study (Abdullahi and Mainul, 2020) (Cao-Ngoc et al., 2020). Plants (*Mimosa pudica*) were harvested from the Gammpaha District of Sri Lanka and identified by a qualified Botanist and academician.

Figure 1: *Mimosa pudica* plant with a flower

Mimosa pudica whole three plants (100 g) were collected, cleaned, washed, and air dried. Then, the Plant materials were placed in a 2 L of round bottom flask and mixed with 500 mL of distilled water. The mixture was boiled (100 °C) for fifteen minutes. The watery extract in the round bottom flask was cooled and filtered with a gauze filter. As the study aimed to detect the antibacterial effect of *Mimosa* watery extract qualitatively (whether there is an effect or not), the filtrate (neat solution) was directly used to prepare the culture plates (plant-based culture media), according to the agar dilution method (Sadiki and Ibnsouda, 2015). The agar dilution method was used because it is user friendly, cheaper and less cumbersome.

The neat aqueous extract, 160 mL, was mixed with 6.08 g Mueller Hinton agar /MHA. Then the acidic mixture was adjusted to 7.4 with potassium hydroxide (KOH). The mixture was sterilized with steam at atmospheric pressure (100 °C**,** 1 atm, 90 min) **(**Sharmam, 20220). The method was used to reduce the destruction of phytochemicals of the plant. A total eight (08) culture plates were prepared with melted MHA which contained a neat solution

of plant extract. The plant extract was replaced by amphicillin (100 mcg/mL) (HiMedia, Mumbai, India) in the preparation of positive control plates (Alam et al., 2019). The plant extract was replaced by distilled water in the preparation of negative control plates.

Plates with a half-neat solution were prepared as follows:

A neat solution of plant extract (80 mL) was diluted with 80 mL of distilled water and mixed with 6.08 g of Mueller Hinton agar (MHA). The mixture was sterilized, and plates were prepared.

The same procedure was followed in the preparation of control plates.

The plates with a quarter-neat solution were prepared with the same procedure by adding 40 mL of neat concertation of plant extract with 120 mL of distilled water. The same procedure was followed in the preparation of control plates.

Stock cultures of bacterial strains of *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA), which were maintained in the main laboratory were identified by the senior technical officer and the principal investigator. Then, two pure colonies of each bacterial strain were sub cultured in 5 mL of nutrient broth, and incubated at 37 °C for four hours (04 hrs.) to prepare broth cultures. Then, each broth culture was adjusted to 0.5 McFarland standard, and 10 microliters from each were inoculated separately into the series of plates that had been prepared previously. The total of four plates were streaked out and incubated at 37 °C overnight.

The same procedure was adopted for the set of control plates. The bacteria used in control were *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA). The test was duplicated.

Result and Discussion

Table 1- The result of *aqueous extract of Mimosa pudica* whole plant (Neat solution)

Bacterial strain	Result		
	Test	Positive Control	Negative Control
Pseudomonas aeruginosa	Sensitive	Resistant	Resistant
Escherichia coli	Resistant	Sensitive	Resistant
Staphylococcus aureus	Sensitive	Sensitive	Resistant
Staphylococcus aureus (MRSA)	Sensitive	Sensitive	Resistant

Table 2- The result of *aqueous extract of Mimosa pudica* (Half neat solution)

Bacterial strain	Result		
	Test	Positive Control	Negative Control
Pseudomonas aeruginosa	Resistant	Resistant	Resistant
Escherichia coli	Resistant	Sensitive	Resistant
Staphylococcus aureus	Sensitive	Sensitive	Resistant
Staphylococcus aureus (MRSA)	Sensitive	Sensitive	Resistant

Table 3- The result of *aqueous extract of Mimosa pudica* (Quarter neat solution)

Bacterial strain	Result		
	Test	Positive Control	Negative Control
Pseudomonas aeruginosa	Resistant	Resistant	Resistant
Escherichia coli	Resistant	Resistant	Resistant
Staphylococcus aureus	Resistant	Resistant	Resistant
Staphylococcus aureus (MRSA)	Resistant	Resistant	Resistant

According to the outcome of the study, it is obvious that aqueous extract of *Mimosa pudica* is sensitive for *Pseudomonas aeruginosa,* Methicillin resistant *Staphylococcus aureus* (MRSA) and *Staphylococcus aureus* at its neat concentration. Further, *Stiaphylococcus aureus* also sensitive at half neat concentration of *Mimosa* extract. Anyway, the finding is very important as the MRSA is considered as a troublesome agent in hospital sector as it is

resisted to most of the common antibiotics. Further, *Pseudomonas* which is resistant to Ampicillin also has become sensitive to extract where the feature is significant in producing novel antibiotics.

In a study carried out in Nepal, it was found that the *Mimosa* contained phenolic and flavonoid compounds, which diminish the bacterial growth. Further, the scientists have found a phytochemical, L-mimosine from the plant which has a potent antibacterial effect (Mandal et al., 2022). These findings should be utilized to discover novel antibacterial drugs to combat antibiotic resistance. In addition to these explorations, *Mimosa* extract has been screened against four bacteria with agar gel diffusion method and discovered that all four bacteria naming *Staphylococcus aureus, Bacillus cereus, Escherichia coli, Klebsiella pneumoniae,* are susceptible to the plant.

In an Indian study (Abirami et al., 2015) several human pathogenic bacteria such as *Pseudomonas aeurogiosa*, *Escherichia coli*, *Lactobacillus, Salmonella typhi, Staphylococcus aureus* and plant pathogenic fungus such as *Pestalotiafoedians,Fusariumoxysporum, Paecilomycesvariotii* have been screened against various solvent extract of *Mimosa* to test the inhibitory effect of plant and found out that the acetone extract of plant showed a maximum inhibitory effect against *Staphylococcus aureus*. In the fungal study, ethyl acetate extract of plant showed a maximum zone of inhibition against *Fusariumoxysporum*. The current study also found the same result under the aquous exact of the *Mimosa* and has found a great inhibitory effect against the same bacteria (*Staphylococcus*) and additionally *Pseudomonas*. Thus, the studies show that the method of villagers where use of *Mimosa* plant extracts for healing wounds as an antibacterial solution is effective.

Another Indian study (Balsaraf and Chole, 2014) which was carried out to screen the efficacy of *aqueous extract* of *Mimosa pudica* whole plant against *Streptococcus mutans* was found to have no efficacy of the plant extract against bacteria. Anyway, in this study the bacteria tested was *Streptococcus mutans* and not the *staphylococci* which was tested in our study.

In a further foreign study (Bhawana and Husain, 2015), *Mimosa pudica* leaf extract was used for antimicrobial activity towards bacteria such as *Bacillus subtilis, Pseudomonas aeruginosa* and *Klebsiella pneumonia* with the disc diffusion method and the result was similar to the current study. Further, the study mentions that the antibacterial activity of *Mimosa* is due to the phytochemicals such as alkaloids and tannins.

The bacteria such as *Bacillus subtilis, Staphylococcus aureus, Klebsiella pneumoniae* and *Pseudomonas fluorescens* were tested against *Mimosa* extract by agar well diffusion method (Chitra et al., 2012) to find out the plant efficacy against bacteria, and it was similar to the present study. The finding of our study is confirmed further by the outcome of this study.

Overall, *Escherichia coli, Staphylococcus aureus, Staphylococcus albus, Proteus vulgaris, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B, Shigella flexneri, Klebsiella pneumonia*, and *Pseudomonas aeruginosa* were considered for antibacterial activity of *Mimosa* and found to have that every pathogen was inhibited by the plant extract. This outcome is once more evidence that the findings of our study are fairly true (Ahamad et al., 2012).

Conclusion

Except, *Escherichia coli*, other wound infecting bacteria such as *Pseudomonas aeruginosa, Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* were sensitive qualitatively to the neat watery extract of the tested plant done under agar dilution method. Except *Pseudomonas aeruginosa*, the other two bacterial strains were sensitive to the plant extract even at half neat concentration. Aquatic extract of whole *Mimosa* plant has been used by villagers as an antiseptic solution to wash wounds for a long time. The outcome of the study may give a clue about its success. Further, the finding of the study is very important as the MRSA is also sensitive to the extract which is considered as a troublesome agent in the hospital sector due to its antibiotic resistance. Hence the outcome of this study indirectly supports to improve the public health. Thus, extracting particular phytochemicals may lead to the production of new antibiotics. Moreover, the research may act as a platform for scientists to do more studies on the plant and find its wound healing effect other than the antibacterial effect.

Declaration of Conflict of Interest

No conflict of inters to declare

Declaration of Honour

We declare on our honour that our results are not fake and made up.

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