

Studies on the Antimicrobial activity of medicinal plants against selected Human pathogens

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Abstract

The antimicrobial activity of some selected medicinal plants from the local area was investigated on some bacterial strains like *Staphylococcus aureus*, *Bacillus*, *Escherichia coli*, and *Pseudomonas*. Leaf and stem parts of the plants were extracted in different solvents like Ethanol, Methanol, Chloroform, and Dimethyl sulfoxide. The *in vitro* antibacterial activity was performed by the agar disc diffusion method. The most susceptible Gram-positive bacteria was found to be *Staphylococcus aureus*, while the most susceptible Gram-negative bacteria was *Escherichia coli*. The maximum activity was observed with *Hibiscus rosa-sinensis* L, and Lemon (*Citrus Limon* (L.) Osbeck) plants as compared to Krushna Tulasi (*Ocimum tenuiflorum* L.).

Nature is a rich source of medicinal agents from history and a number of modern drugs are derived from natural sources and are used in traditional medicines¹. Ayurveda is an ancient health care system and is practiced widely in India, Srilanka, and other countries². Medicinal plants are plants having applications in pharmaceuticals, cosmetics, and nutraceuticals⁶. They usually contain many biologically active ingredients and are used

primarily for treating mild or chronic ailments. According to World Health Organization (WHO), about 80% of the world population relies chiefly on plant-based traditional medicine, especially for their primary healthcare needs^{4,5}. Medicinal plants are rich sources of a wide variety of secondary metabolites such as tannins, alkaloids, terpenoids, and flavonoids³ having been found *in vitro* since they have antimicrobial properties and may

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serve as an alternative, effective, cheap, and safe antimicrobial for the treatment of microbial infections⁸. Plant-based antimicrobial compounds have great therapeutic potential as they have lesser side effects as compared with synthetic drugs and also little chance of developing of resistance⁷. Therefore present study has been carried out to study the antimicrobial activity of some medicinal plants collected from Nandurbar region against *Staphylococcus aureus*, *Bacillus* spp., *E. coli* and *Pseudomonas aeruginosa* by agar disc diffusion method.

Plant collection :

The fresh and healthy leaves of the medicinal plants namely Hibiscus (*Hibiscus rosa-sinensis* L.), Lemon (*Citrus limon* (L.) Osbeck), Krushna Tulasi (*Ocimum tenuiflorum* L.), were collected from various areas of Nandurbar district, Maharashtra and they all were identified and authenticated after critical examination in laboratory. Leaves and stem part of the plants were used to study its antimicrobial activity.

Preparation of plant extract :

Fresh matured leaves and stems (25 gm) were washed thoroughly with tap water and dried under shade. Plant samples were cut into small pieces and crushed in a mortar with 15 ml of sterilized Distilled Water, Ethanol, Methanol and Dimethyl Sulphoxide respectively. The extract was centrifuged in sterile centrifuge tubes to remove broken tissues and supernatant was transferred into a sterile test tubes to study its antibacterial activity.

The antibacterial potency of each plant

extract was evaluated using two strains of Gram-positive and two strains of Gram-negative bacteria. The bacterial strains used for the study of antimicrobial activity were *Staphylococcus aureus*, *Bacillus* spp., *E. coli* and *Pseudomonas* spp. The pure culture of each bacterial strain was suspended in nutrient broth and incubated for 24 h at 37°C. Nutrient agar (NA) and Potato-Dextrose Agar (PDA) were used for testing the antibacterial activity.

Determination of antibacterial activity :

The antimicrobial activity of different plants - leaf extract and stem extract was determined by the agar disc diffusion method. 0.1 ml of the freshly grown culture of test organisms was aseptically introduced and spread on the surface of sterile Nutrient agar plates. For the agar disc diffusion method, sterile filter paper discs (6mm) were soaked in plant extract prepared in sterile distilled water, ethanol, methanol, and dimethyl sulphoxide and placed at the surface of nutrient agar plate previously inoculated with the different test organisms. Control of the same solvent with the paper disc was kept as a positive control and the paper disc was soaked in Distilled water as a negative control. Plates were incubated at 37°C for 24-48 hours. Antibacterial activity was evaluated by measuring the diameter of the zone of inhibition against the tested bacterial pathogens.

The present work was carried out to investigate the antimicrobial activity of some medicinal plants against some human pathogenic microorganisms. Two Gram Positive organisms like *Staphylococcus aureus*, and *Bacillus* spp., and two Gram Negative organisms like

E. coli and *Pseudomonas* spp were selected for this study. The antimicrobial activity of leaf extract and stem extract was observed against these selected pathogens. Results obtained are revealed in the following table indicate that hibiscus leaves and lemon leaves showed better antimicrobial activity with leaf extract as compared to stem extract and as compared Krushna Tulasi. The maximum activity was observed against *Staphylococcus aureus* and *E.coli* spp.

Results obtained revealed that maximum zone of growth inhibition (11mm) was observed with leaf extract of Hibiscus (*Hibiscus rosa-sinensis* L.), plant against *Staphylococcus aureus* when methanol was used as a solvent for extraction, while very less zone of growth inhibition (5.0mm) was observed with *Pseudomonas*. Leaf extract was found to be more effective in antimicrobial properties as compared with stem extract of the *Hibiscus* plant.

Table-1. Antimicrobial activity of Leaf and stem extracts of different medicinal plants against human pathogens.

| S.N | Medicinal Plant | Organisms | Leaf extract | Stem extract |
|-----|---|----------------------|--------------------------|--------------|
| | | | Zone of inhibition in mm | |
| 1 | <i>Hibiscus (Hibiscus rosa-sinensis</i> L), | <i>S.aureus</i> | 11 | 6.0 |
| | | <i>Bacillus</i> spp. | 8.0 | 5.0 |
| | | <i>E. coli</i> | 6.1 | 6.3 |
| | | <i>Pseudomonas</i> | 5.0 | ND |
| 2 | Lemon (<i>Citrus limon</i> (L.) Osbeck) | <i>S. aureus</i> | 7.0 | 10 |
| | | <i>Bacillus</i> spp. | 8.0 | 11.3 |
| | | <i>E. coli</i> | 6.0 | 9.0 |
| | | <i>Pseudomonas</i> | ND | 7.0 |
| 3 | Krushn Tulsi (<i>Ocimum tenuiflorum</i>), | <i>S. aureus</i> | 7.0 | 6.5 |
| | | <i>Bacillus</i> spp. | 6.5 | 5.5 |
| | | <i>E. coli</i> | 8.0 | 6.7 |
| | | <i>Pseudomonas</i> | 6.2 | 6.1 |

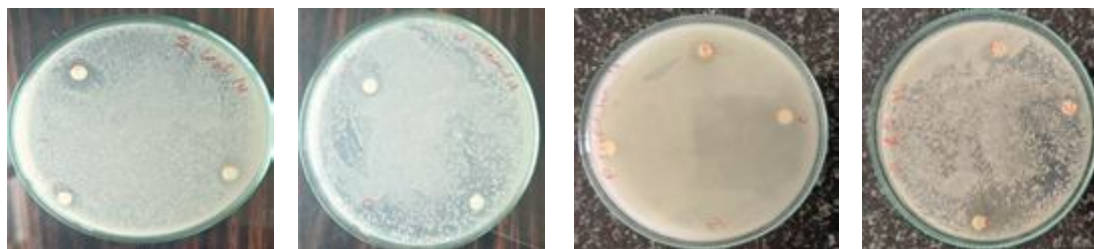


Figure 1. Zone of growth inhibition of pathogens by leaf and stem extract of *Hibiscus* plant.



Figure 2. Zone of growth inhibition of pathogens by leaf and stem extract of Krushna Tulasi plant.

Results obtained with the Lemon (*Citrus Limon*) plant revealed that the stem extract of the plant was found to be most effective against *Bacillus Spp* as compared to leaf extract with the zone of growth inhibition found as (11.3 mm) followed by a zone of growth inhibition (10mm) against *Staphylococcus aureus*. *Pseudomonas* was found as the most resistant organism for inhibition by both plants *Hibiscus* and Lemon.

Data obtained with Krushn Tulsi (*Ocimum tenuiflorum*) plant revealed that maximum zone of growth inhibition was observed in *E. coli* with zone diameter (8mm) in leaf extract of the plant followed by 7.0 mm in *S.aureus*. The antimicrobial activity of medicinal plants may be due to the presence of important phytochemical constituents in plants that inhibit the growth of microbes.

Results obtained with different solvents used for extraction also revealed that as compared to aqueous extract of the plant, extract in dimethyl sulphoxide has better antimicrobial activity comparable with ethanol and methanol extract of leaf and stem.

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