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Review paper

Antimicrobial Activity of Some Medicinal Important Plants

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Abstract

The emergence and spread of antibiotic resistance, as well as the evolution of new strains of disease causing agents, are of great concern to the global health community. Frequently used medicinal plants could be an exceptional source of drugs to scrap off this dilemma. Medicinal plants are traditionally used for the treatment of human infections. The present study was undertaken to investigate Apples, Amla and clove for the potential activity against human bacterial pathogen including *Escherichia coli, Pseudomonas aeruginosa* and *Bacillus subtilis* using agar well diffusion method. The results indicated that most of the extracts exhibited antimicrobial properties. Among the three medicinal plants, the highest potential was observed in the extract of *Syzygium aromaticum* (clove) against *Staphylococcus aureus* (2.8 cm) followed by *Escherichia coli*and *Bacillus subtilis* (2.0 cm), *Phyllanthus emblica* (Amla) extract displayed maximum potential activity against *Pseudomonas aeruginosa* (3.8 cm). In addition to these extracts, extract of *Malus domestica* (apple fruit) also exhibited antimicrobial activity against bacterial pathogens. The experiment confirmed the effectiveness of selected plant extracts as a natural antimicrobials and suggested the likelihood of employing them in drugs for the treatment of infectious diseases

Keywords: Antibacterial activity, Plant Extracts, *Malus domestica, Phyllanthus emblica, Syzygium aromaticum* and bacterial pathogens.

Introduction

From the last many decades, plants are essential source of natural products to hold human health. In the last few decades, the studies of natural product or treatment are increased. Nowadays the use of plants products as medicines is continually increasing in many countries. According to WHO, plants having medicinal properties are useful or best sources to obtain or to form various varieties of drugs or medicines (1). Plants are the source of antimicrobial agents in many countries (2). More than 70% of the public in the developing countries use medicines which are formed by the use of plants materials. Traditionally, pure plants extracts are used in herbal medicines for the treatment of many infective diseases (3). In plants, there are various phytochemicals present in high amounts i.e., saponins, tannins, phenolic, flavonoids, etc. which are found in testing in the laboratory to know their antimicrobial properties (4, 5). In most of the cases, mode of action and capacity of plant extracts is not still validated scientifically (6, 7).

Bacteria cause most of the disease is general problems for human beings (8). Bacterial

agents cause most of the infectious disease include *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis* (9, 10). Antimicrobial agents are significant in decreasing the effects of infective diseases (11). The present study was carried out to examine the activity of five medicinal plants Apple fruit(*Malusdomestica*), Amla(*Phyllanthusemblica*)and clove(*Syzygiumaromaticum*)against human pathogenic bacteria.

Material & Methods

The antibacterial activity of medicinal plants was carried out against pathogenic bacterial strains (*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus* and *Bacillus subtilis*) in Helix biogenesis laboratory Noida.

Subculturing of bacteria

Nutrient broth was used for subculturing of bacterial strains. The media was prepared according to manufacturer's instructions (Helix biogenesis laboratory). Bacterial cultures were inoculated on nutrient broth and incubated overnight at 37 °C.

Collection of plant material and preparation of powder for antimicrobial activity

Plant materials from three medicinal plants including *Malusdomestica* (Apples), *Phyllanthusemblica* (Amlas) and *Syzygiumaromaticum* (Cloves) were obtained from different locations of Delhi. The ethno botanical study of these plants was studied and confirmed by Dr. Ravi prof. Hindu Collage. The collected plant materials were dried under shade and then mashed with the help of mortar and pestle.

Extraction procedure and antibacterial activity of plant extracts:

The powder of plants was processed for extraction in soxhlet extraction unit. In soxhlet extraction unit, 10gm powder of each plant was taken separately and 350ml ethanol was added in soxhlet extraction unit's beaker.The extracted liquid was collected in Petri plate after 24 hr. Subsequently with the aim of drying, collected liquid was put in hot air oven for 1-2 days and stored in eppendrofs for further use. Following plant extraction, antibacterial activity of these extracts against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis* was determined by agar well diffusion method as described (12).On the surface of agar plates, wells were prepared in the inoculated media (200 µl of culture was spreaded) with the help of sterile cork borer. Each well was filled with 150 µl extracts from different plants. It was allowed to diffuse for about 30 minutes at room temperature and incubated for 24 hours at 37^0C. After incubation, plates were observed for the formation of clear zone around the well which corresponds to the antimicrobial activity of tested compounds. The zone of inhibition was observed and measured in cm.

Data analysis

All the experiments were independently repeated more than one time, and average zone of inhibition of test extracts relative to negative control was calculated using Microsoft Excel 2007 software.

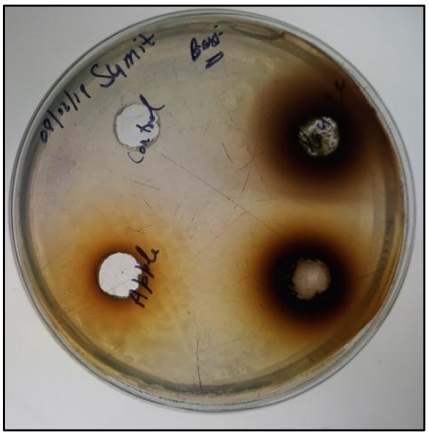
Results

In the present study, antibacterial activity of *Malus domestica*, *Phyllanthus emblica* and *Syzygium aromaticum* was recorded against *Escherichia coli, Pseudomonas aeruginosa, S.*

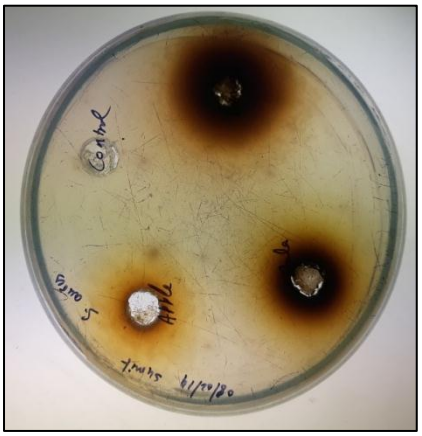
aurens and Bacillus subtilis. The zones of inhibition (cm) exhibited by plant extracts are listed in Table 1 and Fig. 1. The extract of *M. domestica* (apple) showed a zone of inhibition (1.7 cm) against *B. subtilis* followed by *Pseudomonas aeruginosa* (1.6 cm), *E. coli* and *S. aureus* (1.5 cm). Whereas plant extract of *Phyllanthus emblica* (amla) showed inhibition zone of 3.8 cm, 2.0 cm, 1.7 cm and 1.4 cm against *P. aeruginosa*, *S. aureus*, *B. subtilis* and *E. coli*, respectively. When *Syzygium aromaticum* (Clove) extract was used against different bacterial strains, it showed a zone of inhibition (2.8 cm) against *S. aureus* followed by *Pseudomonas aeruginosa* (2.3 cm), *E. coli* and *B. subtilis* (2.0 cm).

Table 1 Comparison of different extracts against different bacterial strains

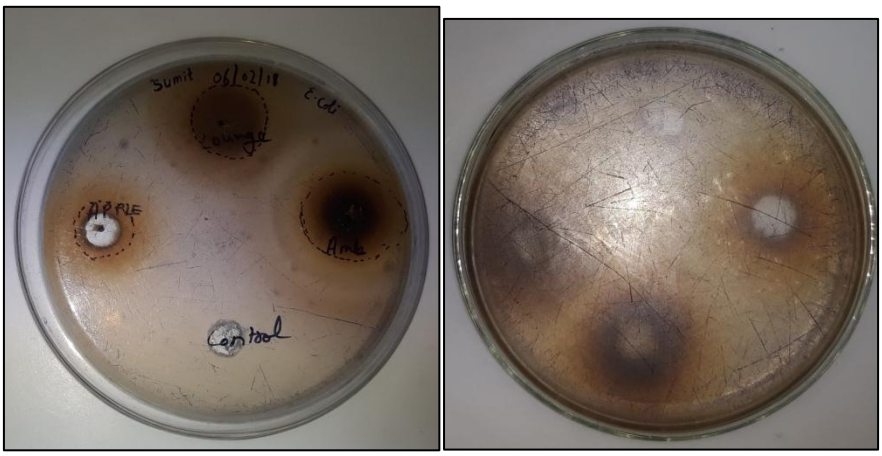
Bacterial strains	**Plants**		
	Zone of inhibition (cm)		
	Apple (*Malus domestica*)	**Amla** (*Phyllanthus emblica*)	**Clove** (*Syzygium aromaticum*)
Escherichia coli	**1.5**	**1.4**	**2.0**
Pseudomonas aeruginosa	**1.6**	**3.8**	**2.3**
Staphylococcus aurens	**1.5**	**2.0**	**2.8**
Bacillus subtilis	**1.7**	**1.7**	**2.0**



(A)



(B)



(C) (D)

Fig. 1 Plates showing zone of inhibition exhibited by Apple, Amla and Clove against

(A) *Bacillus subtilis*
(B) *Staphylococcus aureus*
(C) *Escherichia coli*
(D) *Pseudomonas aeruginosa*

Discussion

Worldwideload of infectious diseases caused by bacterial agents is a stringent threat to public healthiness (13). Antibiotic treatment is chosen to treat bacterial infections; however, emergence of antimicrobial resistance and toxicity concern disintegrate the utilization of antibacterial agents. Safety and effectiveness related limitations to antibiotics augment biological research on the antimicrobial role of plants caused by comparable toxicity and efficacy (14). In the present study, we have investigated the antibacterial activity of three medicinal plants: *Malus domestica*, *Phyllanthus emblica* and *Syzygium aromaticum*. The biological activity of these plant extracts was tested against known human bacterial pathogens: *Bacillus subtilis, Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa.*

Findings from the current study revealed that *Syzygium aromaticum* (Clove) was the most effective among the three plant extracts tested. The extract of clove was found to possess broad spectrum antimicrobial potential against *Bacillus subtilis, Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa,* which was in accordance with the result of Gislene *et al* (15). Some studies reported the antimicrobial property of clove against *Staphylococcus aureus*and *Pseudomonas aeruginosa* similarly to our findings (16).However, contrary to our results, researchers also reported varied antibacterial activity of clove against *S. aureus*, *B. cereus* and *E. coli*. The difference in result could be due to the use of plant extract in different concentrations as compared to that used by them (17).Plant extract of *Phyllanthus emblica* (amla) showed inhibition zone of 3.8 cm, 2.0 cm, 1.7 cm and 1.4 cm against *P. aeruginosa*, *S. aureus*, *B. subtilis* and *E. coli*, respectively. This result was similar to those of other studies that reported antibacterial activity of amla extract (18).

The extract of *M. domestica* (apple) showed highest zone of inhibition (1.7 cm) against *B. subtilis* followed by *Pseudomonas aeruginosa*

(1.6 cm), *E. coli* and *S. aureus* (1.5 cm). According to literature, the antimicrobial activity could be influenced by the phenolic compounds. Morever, Alberto (19) reported that there is a direct relationship between phenolic content and antimicrobial effect in four apple cultivars and their polyphenol extracts had stronger inhibition effects on the bacteria. Jelodarian (20) also reported that *Malus domestica* fruit is effective against a number of organisms.

Conclusion

The results from the study suggested that the fruits of apples(*Malusdomestica*), amlas(*Phyllanthusemblica*), and (*Syzygiumaromaticum*) Cloves showed higher zone of inhibition in *E.coli., S.aurens* and *Bacillus* but in *Pseudomonas* Amla show higher zone of inhibition and antimicrobial activity against different bacterial species. They could be used as alternatives to common antimicrobial agents for treatment of bacterial infections. Further phytochemical analysis of these plants would be useful for elucidation of lead molecules. Supplementary studies are required to investigate the novel antibacterial bioactive molecules.

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Conflict of interest

Authors declares no conflict of interest

Compliance with Ethical Standards

The authors declare that they have no conflict of interest. This article does not contain any studies involving animals or human participants performed by any of the authors

Author contributions

SS: designed the study and prepared manuscript

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