Research Article

Antibacterial Activity of *Sesbania grandiflora* Leaf Extracts against Various Pathogens

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ABSTRACT

The World Health Organization (WHO) recognizes traditional medicine, particularly plant medicine as an important alternative healthcare delivery system for most of the world's population. In recent years, drug resistance to human pathogenic bacteria has been commonly reported all over the world**.** There is a need to develop alternative antimicrobial drugs for the treatment of infectious diseases. One approach is to screen local medicinal plants for possible antimicrobial properties. Plant materials remain an important resource to combat serious diseases in the world. There is a growing demand for plant based medicines, health products, pharmaceuticals, food supplements and cosmetics. *Sesbania grandiflora* is a multipurpose tree with edible flowers and is a source of one of the medicinal products. *S. grandiflora* has unique medicinal properties and used as a herbal drug for its antibiotic, anthelmintic, anti-tumor and contraceptive properties. The present study intends to provide their pharmacological actions. A comparative antibacterial activity of dried leaf extracts of *S. grandiflora* were evaluated against five gram positive and gram negative bacterial pathogens namely *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli and Klebsiella pneumonia* by disc diffusion method. The leaf extracts of *S. grandiflora* were found to have antibacterial activity. The results suggest that the ethanolic leaf extract exhibits highest inhibitory zone of 20 mm against *Staphylococcus aureus.*

Keywords: Inhibitory activity, Pharmaceuticals, Antihelmintic, Herbivorous, Phytomedicine.

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INTRODUCTION

Before the introduction of chemical medicines, man relied on the healing properties of medicinal plants. Some people value these plants due to the ancient belief which says plants are created to supply man with food, medical treatment, and other effects. Medicinal plants are the "backbone" of traditional medicine, which means more than 3.3 billion people in the less developed countries utilize medicinal plants on a regular basis[1]. Since ancient times, people have been exploring the nature particularly plants in search of new drugs. This has resulted in the use of large number of medicinal plants with curative properties to treat various diseases[2]. Nearly 80% of the world's population relies on traditional medicines for primary health care, most of which involve the use of plant extracts.

In India, 95% of the prescriptions were plant based in the traditional systems of Unani, Ayurveda, Homeopathy and siddha[3]. The study of plants continues principally for the discovery of novel secondary metabolites. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions and to defend against attack from bacteria, fungus and other pathogens. The great sanskrit writings such as the Rig Veda and Atharva Veda are some of the earliest available documents detailing the medical knowledge that formed the basis of some plants that are used for medicinal purposes. Chemical compounds in plants mediate their effect on human body for healing purposes. The presence of bioactive compounds indicates the medicinal value of plants. Antioxidant and antimicrobial properties of various extracts from many plants have recently been of great interest both in research and food industry, because of their possible use as natural additives to replace synthetic antioxidants and antimicrobials with natural ones[4]. Phytochemicals are antibiotic properties of plants and have been reported to possess antibacterial, antifungal and anti-inflammatory activities[5]. Thus medicinal plants play an important role in the development of newer drugs due to their effectiveness, less side effects and relatively low cost when compared to synthetic drugs[6,7].

Plant secondary metabolites can be divided into three chemically distinct groups such as Terpenes, Phenolics and nitrogen containing compounds[8]. Another defensive response of plants towards infection is the synthesis of hydrolytic enzymes that attack the cell wall of pathogens. Plant products have been part of phytomedicines since time immemorial. These can be derived from any part of the plant like bark, leaves, flowers, seeds etc.[9] *Sesbania grandiflora* one of the medicinal plants used for antioxidant activities. It contains

several kinds of alkaloids, flavonoids, saponins, tannin, triterpenoids, glycosides and phenols. Many researchers have evaluated that these phytochemical substances have major impact on diabetes mellitus.[10] Leaves of *Sesbania grandiflora* have the potential to be used as a remedy for thrombosis, diarrhea, and inflammatory diseases and against few important bacterial pathogens.[11,12] The juice of the leaves of *S. grandiflora* has been reportedly used in the treatment of bronchitis, cough, vomiting, wounds ulcers, diarrhea and dysentery. The flowers have reported antimicrobial activity. Powdered roots of this plant are mixed in water and applied externally as a poultice or rub for rheumatic swelling.[13] The leaves are traditionally used to treat nasal catarrh, nyctalopia and cephalagia. Studies shows that, *S. grandiflora* possess antioxidant, antiurolithiatic, anticonvulsive, anti-arthritic, anti-inflammatory, antihelminthic, antibacterial and anxiolytic activity.[14-16] Thus the present study aims to evaluate the antibacterial activity of *Sesbania grandiflora* leaf extracts against various pathogens.

MATERIALS AND METHODS

Collection of plant material

The fully matured fresh leaves of *S. grandiflora* (L) were collected from Marthandam area and were identified with the help of herbarium. The leaves were rinsed thrice with distilled water followed by double distilled water to remove the dust and other contaminants. Then dried at room temperature to remove the moisture.

Plate 1: *Sesbania grandiflora*

Test organisms and preparation of leaf extract

Gram negative bacterial strains *Escherichia coli* (MTCC 443), *Pseudomonas aeruginosa* (MTCC 424), *Klebsiella pneumoniae* (MTCC 618) and gram positive strains *Staphylococcus aureus* (MTCC 3160), *Bacillus subtilis* (MTCC 5981) were used for the present study. The dried powdered leaves were extracted with five different solvents such as methanol, ethanol, acetone, aqueous and butanol. For aqueous extraction, 10 gram of the powdered leaves were mixed with 100ml of distilled water, boiled for about two hours and filtered. Whereas methanol, acetone, ethanol and butanol extracts were prepared by mixing 10 gram of powdered leaf samples with 100ml of each solvent separately in mechanical shaker for about 48 hours at room temperature. Extracts were filtered, concentrated, dried and stored in the refrigerator at 4°C for future use. The final extract was prepared at a concentration of 0.1g/ml.

Antibacterial activity - Disc diffusion method

Antibacterial activity of methanol, ethanol, acetone, aqueous and butanol extract of *Sesbania grandiflora* leaf were tested against the different bacteria by disc diffusion method. Agar medium were poured in to the plates to uniform depth of 5mm and allowed to solidify. The microbial suspensions were spread over the surface of media using sterile L-rod to ensure the confluent growth of organisms. The disc used was Whatman number 1 filter paper 5mm in diameter. 5µl aliquots of the methanol extract of leaf were impregnated on filter paper disc, which were then aseptically applied to the surface of the agar at well spaced intervals. The plates were incubated at 37˚C for 24 hours and observed the growth. Antibacterial activity was assayed by measuring the diameter of the inhibition zone in millimeters formed around the well. [17]

RESULTS AND DISCUSSION

The antibacterial activity of the *Sesbania grandiflora* were tested against different microorganisms including a range of gram positive and gram negative bacteria using the paper disc method. Five organisms were selected for the present study. Maximum antibacterial activity was observed due to presence of secondary metabolites. All the extracts from *Sesbania grandiflora* display antibacterial activity against all tested strains. The extract such as methanol, acetone, ethanol, butanol and aqueous showed varying levels of antibacterial activity with different species. Superior activity was measured in ethanol extract which resulted in 20mm zone against *Staphylococcus aureus* (Table1, Figure 1) Another superior activity was measured at 18mm zone against *Escherichia coli* (Table1, Figure 1). Moreover good to moderate activity was observed against *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia* with the zone of inhibition 4 mm, 17mm and 14mm respectively. High inhibition percentage were also recorded against bacterial pathogens, *Staphylococcus aureus* and *Escherichia coli*. Furthermore acetone, butanol and aqueous extracts exhibited moderate to less activity against most of the bacterial strains used. The methanol extract exhibited good zone of inhibition against *Staphylococcus aureus* and *Pseudomonas aeruginosa*.

Moderate to less activity was monitored against *Bacillus subtilis, Escherichia coli* and *Klebsiella pneumoniae*. The results were tabulated in table 1 and presented in figure 1. All the extracts from *Sesbania grandiflora* display antibacterial activity against all tested strains. Among these five extracts ethanol extract showed maximum inhibitory activity due to the presence of alkaloids, tannins, saponins, phenol and steroids. These secondary metabolites are responsible for the antimicrobial activity. Tannins are responsible for antimicrobial, astringency [18,19]

and phenol compounds has the biological activity of such as antiapoptosis, anticarcinogen and antiinflammation[20], as well as inhibition of angiogenesis and cell proliferation activities. Ethanol extracts showed the maximum zone of inhibition in all organisms especially Staphylococcus sp. The results were conformed with reports of Padmalochana *et al.* and same result were found in the present investigation. This proved that S*esbania grandiflora* leaves exhibit the highest activity due to the presence of phytochemicals and thus S*esbania grandiflora* leaves are potentially used as natural drug.[21]

Table 1: Zone of inhibition in different extracts

Sl.No.	Pathogens	Zone of the inhibition(mm)				
		Methanol	Acetone	Ethanol	Butanol	Aqueous
1	*Bacillus subtilis*	14	13	14	13	14
2	*Staphylococcus aureus*	16	12	20	14	15
3	*Pseudomonas aeruginosa*	15	12	17	10	10
4	*Escherichia coli*	14	12	18	11	15
5	*Klebsiella pneumoniae*	13	9	14	9	11

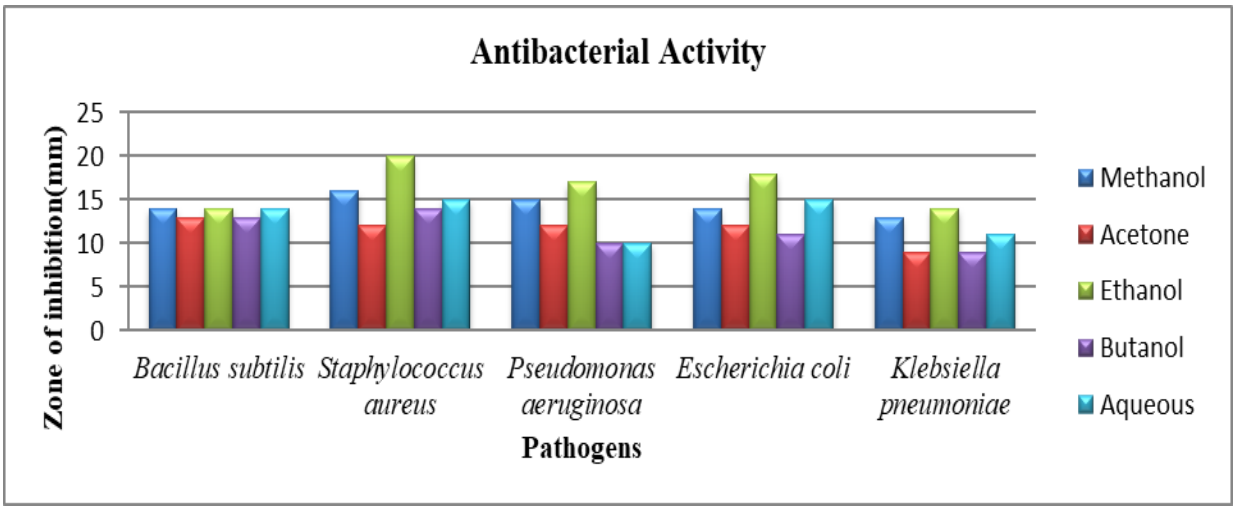

Figure 1: Antibacterial activity of Sesbania grandiflora leaf extracts against selected pathogenic microbes.

CONCLUSION

Medicinal plants are a significant source of synthetic and herbal drugs. The present study examines the antibacterial activity of *Sesbania grandiflora* leaves. The antibacterial activity of *Sesbania grandiflora* against both gram positive and gram-negative bacteria indicated that the plants are the potential source for production of drugs with a broad spectrum of antibacterial activity. The ethanol leaf extract showed better antibacterial activity against all test pathogens. While methanol extract was found to be better than acetone, butanol and aqueous extract. From the results of this study, it is concluded that the leaf extracts of *Sesbania grandiflora* may be helpful in treatment of many infectious enteric diseases, as the extracts of the major part of *Sesbania grandiflora* were effective in controlling the growth of entero pathogenic bacteria. Based on the results, it is concluded that the ethanol extract of *Sesbania grandiflora* leaves potentially act as antimicrobial agent. Therefore future research should be addressed on the application of using *S. grandiflora* leaves as natural remedy and to protect against infectious diseases.

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