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Research Article

Antibacterial Activity of *Adansonia digitata* L.: A Globally Endangered Tree

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ABSTRACT
The tree species of *Adansonia digitata* L. possesses wide range of medicinal properties effective against various infectious diseases. The present work has been under taken to study the antibacterial activity of different extracts of *A. digitata* against pathogenic bacteria. Antibacterial activity of methanolic extracts of leaf, flower and fruit wall extracts of *A. digitata* has been studied to find out their activity against pathogenic bacteria viz., *Escherichia coli*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Enterobacter aerogenus.* The activity of these extracts of different plant parts against both positive as well as negative pathogenic bacterial strains was screened through well diffusion technique by using minimum inhibitory concentration (MIC) method. According to our observations, all the extracts of *A. digitata* exhibited antibacterial activity against all the pathogenic bacteria under study except the fruit wall extracts which didn't show any inhibition against *K. pneumonia*. Thus, results provided evidence that the species *A. digitata* can be used as a potential source of antibacterial agent in the treatment of various infectious diseases.

Keywords: *A. digitata*, Methanolic extracts, pathogenic bacteria, MIC.

INTRODUCTION

The traditional and folk medicines are popular in the treatment of common infectious diseases among the people of rural areas of many developed and developing countries because it is considered to be cheaper and more effective with least side effects compared to synthetic medicines. The use of plants to heal diseases, including many infectious illnesses, has been extensively applied in indigenous medicine from time immemorial and the literature survey reveals that the medicinal plants are of great potential for therapeutic treatment, in spite of the fact that they have not been completely investigated[1,2].

For a long period of time, plants have been a valuable source of natural products for maintaining human health, especially in the last decade, with more intensive studies for natural therapies in the search for antibacterial compounds mainly from plants, which continue to be a major source of biologically active metabolites that may provide lead structures for the development of new drugs[3]. One mechanism for disease resistance in plants is their ability to accumulate low-molecular-weight compounds (secondary metabolites) with high antimicrobial activities, such as alkaloids, coumarins, isoflavonoids, polyacetylenes, quinones, tannins and terpenes.

Even though pharmaceutical companies have produced a number of new antibacterial compounds in the last years, resistance to these drugs has increased and has now become a global concern[4]. The development of antimicrobial compounds from natural sources is considered to be a promising approach**.**

The species *Adansonia digitata* L. is a multipurpose tree, widely used for food and medicine. The species is a globally endangered and medicinally important tree commonly called as *Baobab tree* belonging to the family Bombacaceae[5]. It has multi-purpose uses, as it produces food and non-food products such as medicines, fuel, timber, fodder[6].

According to a review[7], *A. digitata*, the *Kalpavriksha* or giant *baobab* has numerous medicinal and non medicinal uses and is called "*The small pharmacy or chemist tree*"[8-11]. The tree is a resource of great economic value as all the parts like leaves, bark, fruits and seeds have numerous health benefits related to possession of bioactive compounds[12]. According to Shukla *et al*[13], the tree contains an alkaloid '*Adansonin'* used to treat malarial fever and also being employed in the treatment of *Herpes simplex*, *Sindbis* and *Polio*[14].

Root, stem bark, leaves, flowers, seeds and fruit wall extracts of this valuable tree *A. digitata* are known to possess bioactive compounds[15] and found to be rich in phenolics and flavonoids[16]. The different parts of this tree are known for their potential applications and being employed in the preparation of medicines used in the treatment of an enormous range of ailments such as iron deficiency, digestive system disorders and skin diseases.

In view of this medicinal importance, the present investigation has been attempted to evaluate antibacterial

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Table 1: Antibacterial activity of methanol extract of different parts of *A. digitate* through agar-well diffusion method.

Test Organism	M I C (in mm)		
	Leaf extract	Floral extract	Fruit wall extract
E.coli	6.50	4.25	7.00
K. pneumonia	21.25	6.25	-
S. aerius	7.50	8.25	23.75
P. vulgaris	8.25	8.75	7.75
E. aerogenus	5.85	10.80	18.65

Showing the zone of inhibition (ZI -in mm)
S. areus = Staphylococcus aerus
E.coli = Escherchia coli
K. pneumonia = Klebsiella pneumonia
P. vulgarius = Proteous vulgaris
E. aerogenus =Enterobacter aerogenus

activity of different solvent extracts of various parts of *A. digitata* by using some human pathogenic bacteria.

METHODOLOGY

Collection of Plant material

The different parts of the plant, i.e., leaves, flowers, fruits and bark were collected from the tree growing at DKW College for Women, Nellore, Nellore District, Andhra Pradesh, India.

Preparation of the extracts

The collected plant material was dried under shade for 45 days, separately. The dried plant parts were made into fine powder using an electronic blender then sieved using a muslin cloth and stored in air tight containers for future use. The hard fruit wall was broken to collect the fruit pulp and seeds. They were powdered and subjected to cold extraction using methanol in the shaking condition. The shade dried powder (25gm) was used for the extraction with 150 ml 80% methanol for 24 hours by Soxhlet equipment and filtered through 0.45 µm membrane filter. This filtrate was evaporated under reduced pressure and dried in a rotator evaporator at 55°C. Dried extracts were stored in screw cap bottles at -20°C separately and used as stock.

Antibacterial activity

Antibacterial activity of the extracts of *A. digitata* was tested using MIC method[17-19]. The test organisms were supplied by the Department of Microbiology, Kakatiya Medical College, Warangal. For the present study, gram positive bacterium (*Staphylococcus aureus*) and gram negative bacteria (*E. coli*, *Proteus vulgaris*, *Klebsiella Pneumoniae*, *Enterobacter aerogenus*) were used for the present study. These organisms were sub cultured on Nutrient Agar slants and stored at 4°C in a refrigerator until use for screening antibacterial activity.

For well diffusion method, the (5x105 cells (cfu) of the test bacterial strain) culture (0.1ml) was swabbed on top of the solidified medium and allowed by drying for 15 min. Wells were punched in the Nutrient agar plates using sterile cork borer. 100µl of crude extract in DMSO was added into the wells and plates were incubated at 37˚C for 24 hrs.

Data analysis

Zone of inhibition (ZI) was measured with Himedia antibiotic scale and experiment was repeated thrice with three replicates. Sensitivity of organisms to antimicrobials was quantified by the minimum concentration required to inhibit their growth (minimum inhibitory concentration, MIC) or by the minimum concentration required to kill them within a specified period of time (minimum bactericidal concentration, MBC) because, they are easier to measure and apply to both bactericidal and bacteriostatic drugs. The values expressed were obtained from three independent experiments.

RESULTS AND DISCUSSION

Antibacterial activity of methanol extracts of leaf, flower and fruit wall extracts of *A. digitata* has been studied to find out their activity against pathogenic bacteria viz., *Escherichia coli*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Enterobacter aerogenus.* The results obtained from the investigations on stem, leaf, flower, bark and seed are presented in Table-1 and shown in Fig. 1.

The activity of the extracts of different plant parts against both positive as well as negative pathogenic bacterial strains was screened through well diffusion method and by measuring the zone of inhibition (ZI) around the disc. According to our observations, all the extracts of *A. digitata* exhibited antibacterial activity against all the pathogenic bacteria under study except the fruit wall extract which didn't show any inhibition against *K. pneumonia*.

Similarly, considerable number of studies have been conducted on the antimicrobial activity of medicinal plants such as *Psidium guava*, *Terminalia chebula*, *Oroxylum indicum*, and *Annona reticulata* showed promising potency against multi-drug resistant microorganisms[20-23]. The present investigation has also been proved that extracts of medicinally valuable tree species *A. digitata* are potent against all pathogenic bacteria used for the study. Thus, medicinal plants are expected to be the future alternative source of new antimicrobials. As all the parts of this tree namely roots, leaves, fruits, seeds and bark are used medicinally for an enormous range of ailments, such as iron deficiency, digestive system disorders, infections and skin disorders used in both human as well as in veterinary medicine to treat many infectious diseases[24-26].

Thus from our present findings it is evident that the extracts of different parts of *A. digitata* can be used as a potential source of antibacterial agents to combat the infectious diseases.

CONCLUSION

In conclusion, the present investigation envisages that the different extracts of *A. digitata* contain potential antimicrobial compounds that may be of great use for the development of antibacterial agents against various infectious diseases.

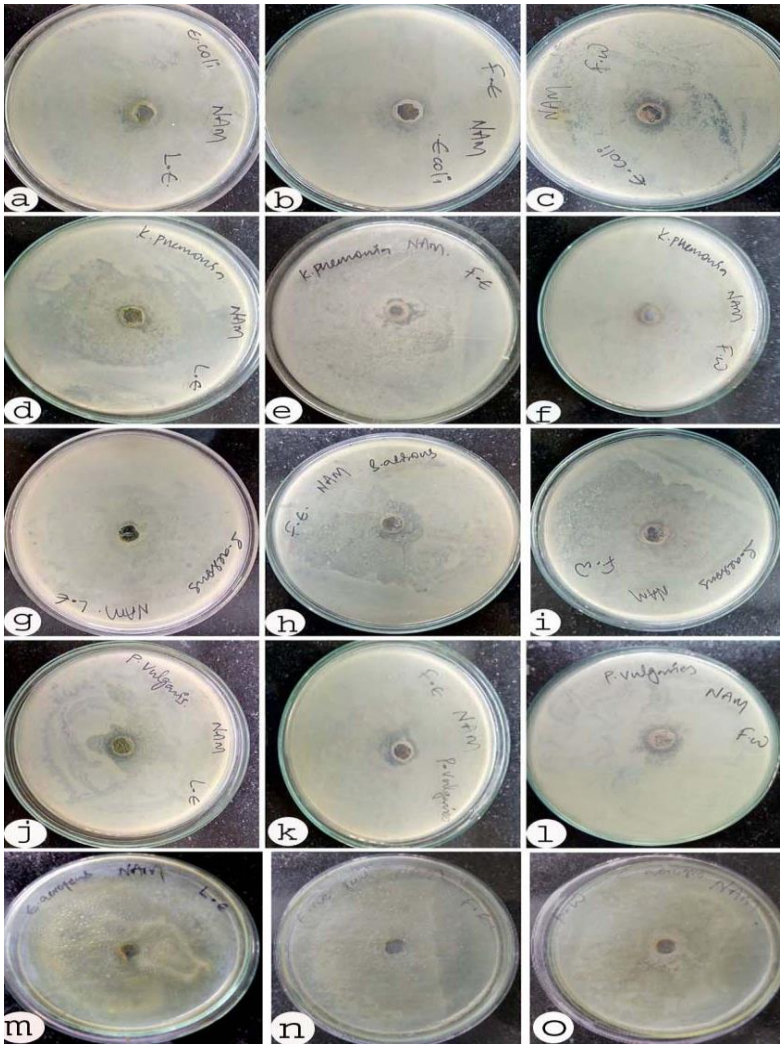

Figure 1: Antibacterial activity of methanol extract of different parts of *A. digitate.*
a-c. ZI shown by various extracts of *A. digitata* against *E. coli*; d-f. *P. neumoniae;*
g-i. *S. aureus*; j-l. *P. vulgaris*; m-o. *E. aerogenous* respectively.

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