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Antimicrobial Activity of *Swietenia mahagoni* L (Leaf) Against Various Human Pathogenic Microbes

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ABSTRACT

Different organic and aqueous extracts of leaves of *Swietenia mahagoni* L (Meliaceae) were screened for their antimicrobial activity against seven human pathogenic bacteria and two fungal strains by plate hole diffusion assay to determine the growth inhibition of microorganisms. The medicinal plant appear to have a broad antimicrobial activity spectrum, they could be useful in antiseptic, disinfectant and other antimicrobial agent formulation. Among the various micro organisms, the methanolic extract was more active against *Bacillus subtilis*, *Klebsiella pneumoniae* and *E. coli*. In antifungal activity of the methanolic extract shows positive results for fungus.

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INTRODUCTION

Natural products especially medicinal plants have been prescribed in traditional medicine for treating various diseases. The importance of herbs in the management of human ailments cannot be over emphasized[1]. During the last two decades, the development of drug resistance as well as the appearance of undesirable side effects of certain antibiotics has lead to the search of new antimicrobial agents mainly among plant extracts with the goal to discover new chemical structures, which overcome the above disadvantages[2].

Current research on natural molecule and products primarily focuses on plants since they can be sourced more easily and be selected based on their ethno-medicinal uses[3]. The plant *Swietenia mahagoni* (Meliaceae) is a large, deciduous, and economically important timber tree native to the West Indies. It has been extensively planted in southern Asia (India, Srilanka, Bangladesh) and in the pacific (Malaysia, Philippines, Indonesia and Fiji), and has been introduced into cultivation in West Africa[4]. Traditionally, various parts of this plant have been used in the treatment of various diseases and cancer. The plant is popularly known as West Indian Mahagony in English. The aim of present study was to evaluate the antimicrobial activity of the various extracts of *Swietenia mahagoni.*

MATERIALS AND METHODS

Materials:

Collection and authentication of plant material:

The leaves of *Swietenia mahagoni* Linn were collected from Lalbagh Botanical Garden, Bangalore, Karnataka, India. The authentication of the plant was done by Dr. Jagadeesh. M.Sc. Botany, Vice President, Lalbagh Botanical Garden, Bangalore, Karnataka.

Preparation of plant extract[5]:

The leaves were cleaned with deionized water, oven dried at 50^{o} C for 48 hours and powdered in a grinder. The plant material (200 gm) was sequentially extracted with different solvents (petroleum ether, benzene, chloroform, methanol and water) (2000 ml) according to their increasing polarity by using Soxhlet apparatus for 24 hours at a temperature not exceeding the boiling point of the respective solvent. The obtained extracts were

filtered by using Whatmann No. 1 filter paper and then concentrated under vacuum at 40^{o}C by using a rotary evaporator. The extract was then lyophilized (Allied Frost lypholizer) to powdered form at - 55^{o}C under vacuum conditions. The extractive value of the extracts (percentage yield, water-soluble extractive and alcohol soluble extractive) was calculated. The residual extracts were stored in refrigerator in small and sterile plastic bottles.

Phytochemical Studies[7]:

The preliminary phytochemical screening of *Swietenia mahagoni* L was carried out for the decoction of various phytoconstituents using standard procedure of Harbone. The following solvents were used for the study petroleum ether, benzene, chloroform, methanol and water. The methanol extract was found to contain more constituents. The preliminary phytochemical screening of methanol extract reveals the presence of Alkaloids, Flavonoids, Tannins, Glycosides and Triterpenoids.

Preparation of test samples:

Test samples of the plant extracts were prepared by dissolved in DMSO (Dimethyl Sulfoxide) (100 mg/ml, 50 mg/ml, 25 mg/ml).

Tested microorganisms:

Antimicrobial activity of leaves extract were investigated against seven registered bacterial isolates and two fungal strains. These included two Gram-positive bacteria including *Staphylococcus aureus* (NCIM 2468), *Bacillus subtilis* (ATCC 15830), five Gram-negative bacteria *Escherichiae coli* (ATCC 15830), *Proteus vulgaris* (NCIM2581), *Klebsiella pneumoniae* (ATCC 11229), *Pseudomonas aeruginosa* (NCIM 2984), *P. mirabilis* (NCIM 8268) *and* fungi *Aspergillus fumigatus* (NCIM 1207) and *Candida albicans* **(NCIM 3484).**

The tested microorganisms were cultured on Nutrient agar (HiMedia, Mumbai) (for bacteria at 35±2^{0}C for 24 hours) and on Sabouraud Dextrose Agar (HiMedia, Mumbai) (for fungus at 28±2^{0}C for 48- 72

hours). The reference strains of bacteria and fungi were maintained on Nutrient agar (HiMedia, Mumbai) and on Sabouraud Dextrose Agar (HiMedia, Mumbai) slants respectively. The cultures were sub cultured regularly (every 30 days) and stored at refrigerator.

ANTIMICROBIAL STUDY

Antibacterial study (Plate hole diffusion method)[8]

Antibacterial study (Plate hole diffusion) assay was used to determine the growth inhibition of bacteria by plant extracts. Bacteria were maintained at 4^0C on nutrient agar plate before use. Nutrient agar medium was prepared and each universals containing 20 ml was poured. The universals with the broth were inoculated with different bacterial species and incubated at 37^0C for 24 hours. A total of 25 ml of Molten Hinton (MH) agar was poured into sterile universals. Each universal was inoculated with 0.2 ml of different bacterial species mixed well with the MH into sterile petri dishes and allowed to set. A well was prepared in the plates with the help of a cork-borer (6 mm) four holes per plates were made into the set agar containing the bacterial culture.

A total of 0.2 ml of plant extract was poured into the wells with concentration 100mg/ml, 50mg/ml, 25mg/ml. For each bacterial strain controls were maintained where pure solvents, instead of extract. The plates were incubated overnight at 37^0C. The results were obtained by measuring the diameter of the zone of inhibition. The result was compared with standard antibiotic Streptomycin (1mg/ml).

Antifungal activity[9]

Saubouraud dextrose agar medium (SDA) was prepared and 25 ml of each was poured in to sterile universals. The universals with the broth were inoculated with different species of fungus and incubated at 28^0C overnight. A total of 25 ml of medium was poured into each sterile universal. Each universal was inoculated with 200 µl of different fungal species spread well and allows to set. Using a sterile cork borer 6 mm diameter, four holes per plate were made into the set medium containing fungal culture. A total of 0.2 ml of plant extracts were poured into the wells and one containing distilled water. The plates were incubated overnight for 36 to 48 hours and the diameter of the zone of inhibition was then recorded if greater than 6 mm.

RESULTS AND DISCUSSION:

The tested bacterial strains showed different patterns of inhibition (**Table 1**). The extract showed a broad spectrum of antibacterial activity against gram-positive and gram-negative bacteria. The Methanol extract of *Swietenia mahagoni* L at a concentration of 100mg/ml showed maximum inhibition against all microbes. The Methanolic extract showed the highest inhibition zones against *Bacillus subtilis* and E. coli. The *Swietenia mahagoni* L Methanolic extract showed significant zone inhibition on *Aspergillus niger* and *Candida albicans*. The results were showed on (**Table 2**). The known antimicrobial mechanisms associated to flavonoids may explain the antimicrobial potency of these compounds from the crude extract. Under this study the extract capability to penetrate the cell walls with hydrophobic and hydrophilic environment. Plant showing significant activity may be due to the presence of alkaloids, flavonoids, tannins and polyphenols. Since the medicinal plant appear to have a broad antimicrobial activity spectrum, they could be useful in antiseptic and disinfectant formulation.

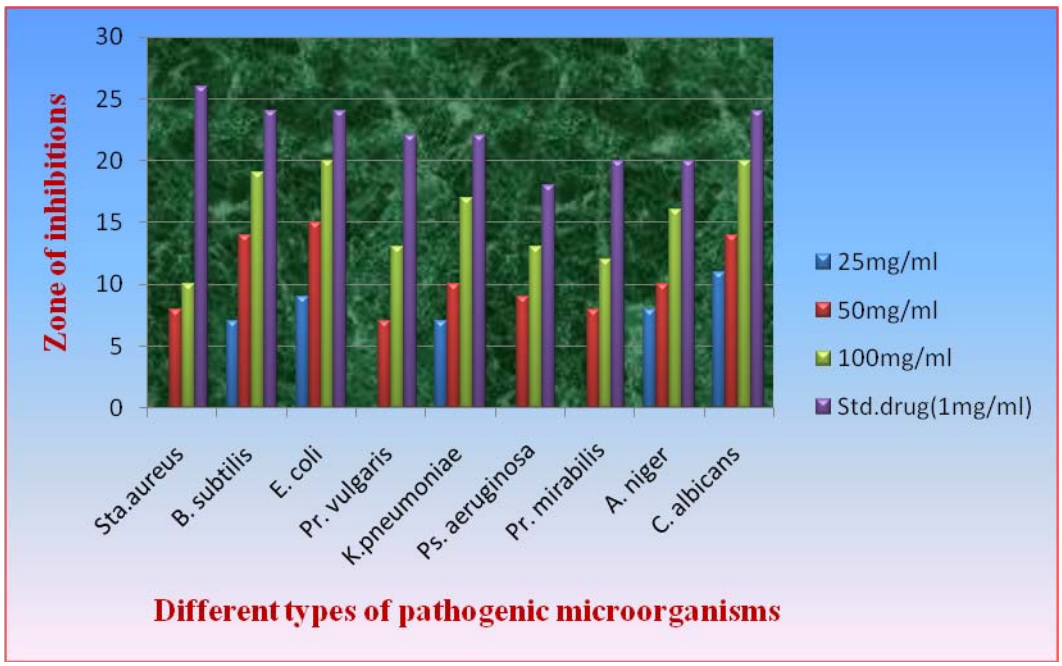
Two possibilities that may account for the higher antibacterial activity of alcoholic extracts are the nature of biological active components which may be enhanced in the presence of methanol and the stronger extraction capacity of Methanol that may have yielded a greater number of active constituents responsible for antibacterial activity. The anti microbial zone of inhibition showed on (**Figure 1 and Figure 2**).

Sl. No.	Microorganisms	100mg/ ml	50mg/ ml	25mg/ ml	Streptomycin (1mg/ml)
1	*Staphylococcus aureus* (NCIM 2468)	10	08	--	26
2	*Bacillus subtilis* (ATCC 15830)	19	14	07	24
3	*Escherichiae coli* (ATCC 15830)	20	15	09	24
4	*Proteus vulgaris* (NCIM2581)	13	07	--	22
5	*Klebsiella pneumoniae* (ATCC 11229)	17	10	07	22
6	*Pseudomonas aeruginosa* (NCIM 2984)	13	09	--	18
7	*Proteus mirabilis* (NCIM 8268)	12	08	--	20

Table 1: Anti bacterial study of methanolic extract of *Swietenia mahagoni* L.

Table 2: Anti-fungal study of methanolic extract of *Swietenia mahagoni* L

Sl. No	Micoorganisms	100mg/ml	50mg/ml	25 mg/ml	Ketocanozol (1mg/ml)
01.	*Aspergillus niger* (NCIM 1207)	16	10	08	20
02.	*Candida albicans (*NCIM 3484)	20	14	11	24



Antimicrobial study of methanolic extract of *Swietenia mahagoni* L

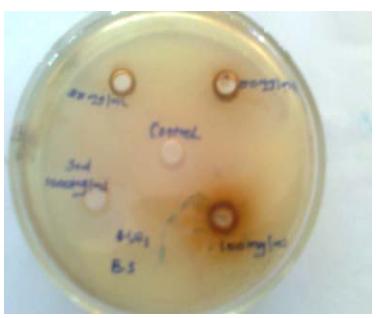




Figure 1 ` **Figure 2**

CONCLUSIONS:

Among the various microorganisms, the methanolic extract was more active against *Bacillus subtilis* and *E. coli*. This result suggests the presence of either good antibacterial activity or high concentration of an active principle in the extract. This antibacterial activity would support the folk therapy of infections. This effect enables the use of the respective antibiotic when it is no longer effective by itself during therapeutic treatment.

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