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EFFICACY OF TERMINALIA CATAPPA L.WOOD AGAINST SOME BACTERIAL PATHOGENS

V. Mathiyarasi[1], P. Venkatalakshmi*[1] and P. Brindha[2]

[1]P.G. and Research Department of Biochemistry, S.T.E.T Women's College, Sundarakkottai, 614006.

[2]Department of CARISM, SASTRA University, Thirumalaisamudhram, Thanjavur.

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***Correspondence for Author**
P. Venkatalakshmi
P.G. and Research Department of Biochemistry, S.T.E.T Women's College, Sundarakkottai, 614006

ABSTRACT

The present study was carried out to evaluate the anti bacterial activities of the aqueous, ethyl acetate and hexane extracts of Terminalia catappa wood against some pathogenic bacteria. Anti bacterial activity was assessed by agar disc diffusion method. Among the three extracts, aqueous extract exhibited potent antibacterial activity against all the selected bacterial pathogens even at minimum concentration. The activity of the extracts was compared with a standard antibiotic Chloramphenicol.

KEYWORDS: Antibacterial activity, Agar disc diffusion, Terminalia catappa L. wood.

INTRODUCTION

Nature has bestowed upon us a very rich botanical wealth. The search for eternal health and longevity and for remedies to relieve pain and discomfort drove early man to explore his immediate natural surroundings and led to the use of many plants, animal products and minerals for the development of a variety of therapeutic agents.[1]

In the recent past, the frequency of life threatening infections has increased dramatically. Even though antibiotics serve as the most powerful and successful treatment strategy to control infectious diseases, the rate of resistance of pathogenic microorganisms to conventionally used antimicrobial agents is increasing with an alarming frequency.[2,3,4] In addition to this problem antibiotics are sometimes associated with adverse side effects on the host, which include hypersensitivity, depletion of beneficial gut and mucosal

microorganisms, immunosuppression and allergic reactions.[5] The emergence and spread of multidrug-resistant bacterial pathogens have substantially threatened the current antibacterial therapy.[6]

Therefore, it is necessary to search the other alternatives that can potentially be effective in the treatment of these problematic bacterial infections. Plants are one of the bedrocks for modern medicine to attain new principles.[7] The usefulness of plant extracts for antimicrobial therapy and/or other diseases have been observed to be promising remedies since ancient time in Ayurveda and other traditional medicinal practices. Plant based antimicrobials represent a vast untapped source of medicine with enormous therapeutic potential and can serve the purpose without any side effects.

Terminalia catappa, is an important medicinal plant with diverse pharmacological spectrum. There are a number of phytochemicals present in this plant such as gallic acid, ellagic acid, corilagin and unidentified tannins which are responsible for many of the pharmacological activities. Due to the presence of number of phytoconstituents, the different extracts have exhibited anti-inflammatory and antioxidant[8,9], antibacterial[10,11], antidiabetic[12], antifungal[13], antitumor[14] activities. Since evidences are lacking about the antibacterial activity of wood, in the present study attempts are made to evaluate the antibacterial activity of aqueous, ethyl acetate and hexane extracts of T.catappa wood.

MATERIALS AND METHODS

Collection of plant material

Fresh wood of Terminalia catappa was collected from Mannargudi, Thiruvarur Dt, Tamil Nadu, India, which was carefully identified and authenticated in the department of CARISM, SASTRA University, Thirumalaisamudhram, Thanjavur. The wood was cut into pieces and washed thoroughly 2-3 times with running water and once with sterile distilled water, then the plant material was air-dried on sterile blotter under shade.

Microorganisms

Microorganisms such as Escherichia coli, Bacillus subtilis, Klebsiella pneumoniae, Salmonella typhi, Proteus vulgaris, Streptococcus pyogenes and Staphylococcus aureus were obtained from SASTRA University, Thirumalaisamudhram, Thanjavur. Each Bacterial strain was suspended in Muller Hinton broth and incubated for 24 hrs at 37^{o}C.

Extraction of plant Material

The coarse powder of Terminalia catappa wood was used for the extraction purpose. Extraction process was carried by soaking the coarse powder in Distilled water, Ethyl acetate and N - Hexane kept in shaker for 48 hrs, the extracts were filtered through whattman filter paper and evaporated the extracts using water bath.

Determination of Antimicrobial Activity[15]

Agar well diffusion method was followed to determine the antimicrobial activity. Mullar Hinton agar (Hi media) medium plates were prepared by sterilizing the medium with the use of autoclave at 121^{o} C and 15 lbs pressure for 15 minutes; petriplates were also sterilized using autoclave. After sterilization the cooled medium was poured into petriplates of about 25 ml and allowed to solidify. Muller Hinton agar medium plates were swabbed (sterile cotton swabs) with 24 hrs broth culture of bacteria. Four wells (10mm diameter) were made in each of these plates using sterile cork borer. The test solution was prepared by dissolving 1mg of extract in 1 ml of DMF. About 50, 100, 150 µl from 1µg / l µl concentration of aqueous, ethyl acetate and N - Hexane extracts of T. catappa wood , DMF (control) were added using micropipette into the wells and allowed to diffuse at room temperature for 2 hours. Chloramphenicol was used as standard antibiotic. The plates were incubated at room temperature for 24 hours. Diameters of the inhibition zones were recorded in mm.

RESULTS AND DISCUSSION

The use of higher plants and preparations made from them to treat infections is a longstanding practice in a large part of the population, especially in the developing countries, where there is dependence on traditional medicine for a variety of ailments.[16] Interest in plants with antimicrobial properties increased because of current problems associated with the antibiotics.[17,18] Recently, the antimicrobial effects of various plant extracts against certain pathogens have been reported by a number of researchers.[19,20,21,22,23]

Disc diffusion method is the most widely used procedure for testing antimicrobial susceptibility.[24] The disc diffusion procedure (Kirby-Bauer method) has been accepted by the Food and Drug Administration (FDA) and as a standard by the National Committee for Clinical Laboratory Standards.[25]

Considering the vast potentiality of T. catappa, the current investigation was undertaken to screen the antibacterial activities of three different extracts of T. catappa wood against certain

pathogenic bacteria. The antibacterial activities of aqueous, ethyl acetate and hexane extracts of wood of Terminalia catappa were evaluated by the disc diffusion method against seven pathogenic organisms namely Escherichia coli, Bacillus subtilis, Klebsiella pneumoniae, Salmonella typhi, Proteus vulgaris, Streptococcus pyogenes and Staphylococcus aureus.

Aqueous extract of Terminalia catappa wood at various concentrations (50, 100, 150µl) were found to be effective against both gram positive and gram negative bacteria. The maximum inhibitory activity was observed for Bacillus subtilis (30mm) and then for Salmonella typhi (27mm) (Table 1). The activity of the herbal extract was compared with a standard antibiotic Chloramphenicol (10µg). Maximum inhibitory activity of the ethyl acetate extract was against Salmonella typhi (27mm/ 150 µg/ml). The extract has no effect against Streptococcus pyogenes (Table 2).

In the case of hexane extract, there is no inhibitory activity against Proteus vulgaris and Klebsiella pneumoniae (Table 3). Maximum activity was revealed against Bacillus subtilis (29 mm), Streptococcus pyogenes (28 mm).

The results of the present study showed that aqueous extract of T. catappa wood has more antibacterial activity than ethyl acetate and hexane extracts even at minimum concentration. . This might have been due to the capacity of water to extract the antibacterial principles present in T. catappa wood.

Table 1: Antibacterial activity of the aqueous extract of T.catappa wood

S.No.	Bacteria	Zone of Inhibition (mm)			
		50µg	100µg	150µg	DMF (Control)
1	Proteus vulgaris	12	15	22	-
2	Escherichia coli	16	20	24	-
3	Streptococcus pyogenes	13	18	23	-
4	Staphylococcus aureus	14	18	24	-
5	Klebsiella pneumoniae	17	21	25	-
6	Salmonella typhi	10	15	27	-
7	Bacillus subtilis	7	18	30	-

Table 2: Antibacterial activity of the Ethyl acetate extract of T.catappa wood

S.No.	Bacteria	Zone of Inhibition (mm)			
		50µg	100µg	150µg	DMF (Control)
1	Proteus vulgaris	-	20	22	-
2	Escherichia coli	10	14	18	-
3	Streptococcus pyogenes	-	-	-	-
4	Staphylococcus aureus	10	13	21	-
5	Klebsiella pneumoniae	10	15	21	-
6	Salmonella typhi	9	20	27	-
7	Bacillus subtilis	5	19	21	-

Table 3: Antibacterial activity of the Hexane extract of T.catappa wood

S.No.	Bacteria	Zone of Inhibition (mm)			
		50µg	100µg	150µg	DMF (Control)
1	Proteus vulgaris	-	-	-	-
2	Escherichia coli	-	16	23	-
3	Streptococcus pyogenes	-	17	28	-
4	Staphylococcus aureus	12	14	19	-
5	Klebsiella pneumoniae	-	-	-	-
6	Salmonella typhi	13	20	26	-
7	Bacillus subtilis	6	11	29	-

Table 4: Antibacterial activity of Chloramphenicol

S.No.	Bacteria	Zone of Inhibition (mm) Chloramphenicol (10µg/ml)
1	Proteus vulgaris	26
2	Escherichia coli	25
3	Streptococcus pyogenes	20
4	Staphylococcus aureus	12
5	Klebsiella pneumoniae	26
6	Salmonella typhi	56
7	Bacillus subtilis	49

CONCLUSION

The need of the hour is to find new antimicrobials because the microorganisms are getting resistant to the existing antibiotics. The persistent increase in multi drug resistant strains compels the search for new effective and affordable antimicrobial drugs. The results of the present study signify the potentiality of Terminalia catappa wood as a source of therapeutic agent which may provide leads in the ongoing search for antimicrobial botanicals.

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