

**ANTIMICROBIAL ACTIVITIES OF *TECTONA GRANDIS* LEAF AND BARK EXTRACTS**Suseela Lanka<sup>a\*</sup> and Parimala<sup>b</sup><sup>a</sup>Department of Biotechnology, Krishna University, Machilipatnam, 521001, Andhra Pradesh, India.<sup>b</sup>Department of Biochemistry, Krishna University Dr. MRAR PG Centre, Nuzvid, 521 201, Andhra Pradesh, India.**\*Corresponding Author: Suseela Lanka**

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**ABSTRACT**

*Tectona grandis* is one of the most famous timber plants in the world and is a major exotic species found in tropical regions. It belongs to the family Verbenaceae. The common name of this plant is teak and locally known as sagon, sagwan. The wood of this plant is renowned for its extreme durability, dimensional stability and hardness which also resist decay even when unprotected by paints and preservatives. The extracts of this plant also found applications in many of the traditional medicines. The present study was carried out to characterize pharmacological potential of ethanolic, methanolic, ethyl acetate and water extracts from leaf and bark of teak plant. The Antimicrobial activity of leaf and bark extracts from *Tectona grandis* were checked by disc diffusion assay.

**KEYWORDS:** *Tectona grandis*, leaf and bark extracts, antimicrobial activity, disc diffusion assay.**INTRODUCTION**

Since time immemorial plants are indispensable sources of medicine. Many safe and effective drugs were prepared using extracts obtained from different parts of the plant owing to their rich wealth of phytochemicals. 25% of the medicinal drugs prepared in the developed countries, are based on plants and their derivatives.<sup>[1,2]</sup> *Tectona grandis* is one of the most famous timber plants in the world and is a major exotic species found in tropical regions. It belongs to the family Verbenaceae. The common name of this plant is teak and locally known as sagon, sagwan. Timber value of teak has been well known from decades. It is commonly found in many South-East Asian countries and in India.<sup>[3,4]</sup> The timber from teak is well known for its durability and insect resistance from olden times. The quality of the timber is mainly attributed to the accumulation of certain quinones and quinone derivatives.<sup>[5]</sup> Apart from its wide spread application as timber plant, teak is also considered as a major constituent in many traditional medicines. The extracts prepared from various parts of teak are found to be effective against biliousness, bronchitis, diabetes, leprosy, anthelmintic, astringent etc., and thus shows expectorant, anti-inflammatory, anthelmintic properties. The plant extracts are also well known for analgesic, diuretic activity, gastroprotective activity, anti-haemolytic anaemia activity, Hair growth activity, Antioxidant activity etc. They are also used for treating inflammatory swelling.<sup>[6,7]</sup>

Though some of the researchers studied on pharmacological potential of this timber plant, a more detailed characterization is necessary to bring out a clear picture on medicinal value of the plant.<sup>[8,9,10]</sup>

The present study is mainly aimed to screen extracts from leaves and bark of *Tectona grandis* prepared using various solvents for antimicrobial activities.

**MATERIALS AND METHODS****Samples and preparation of samples****Plant material**

The plant (*Tectona grandis*) leaves and bark were collected from Krishna University Dr MRAR PG Centre campus, Nuzvid. Leaves were washed and shade dried for one week. The dried leaves were then crushed into fine powder and then used for further study.

**Solvent extraction**

Solvent Extraction is the first step in the analysis of medicinal plants, because it is necessary to extract the desired chemical components from the plant materials for further separation and characterization. Leaf and Bark extracts were prepared by adding 0.5gm of dried powder into 10ml of various solvents (ethanol, methanol, ethyl acetate and water) kept at room temperature for 24 hrs to 78hrs. The filtrate was then collected by filtering the mixture using Whatman filter paper No.1 and stored at 4°C until further use.

**Test organisms: Bacteria** – Test bacteria that were used in the current study include *P. aeruginosa*, *S. aureus* and *B. subtilis*. The strains were procured from local Government hospital.

**Fungi:** Standard fungal species available in the lab such as *Aspergillus niger*, *Trichoderma viride* and *Aspergillus flavus* were used as Test fungi.

#### Antimicrobial activity

The ethanol, methanol, ethyl acetate and water extracts of leaf and bark were tested for the antimicrobial activities against test bacteria and fungi mentioned above. Antimicrobial activity was carried out by Disc diffusion method. Whatman filter paper (No. 1) was cut into small discs and the discs were incubated in the corresponding extract for 1 hour before placed onto the petriplate. The plates were incubated for overnight to study antibacterial activities and for a period of 72 hrs to study anti fungal activities.

The antimicrobial activity was observed in terms of zone of inhibition around the disc produced by respective extract.

#### RESULTS AND DISCUSSION

Antibiotic resistance is a major concern and development of new agents from plants could be useful in meeting the

demand for new antimicrobial agents with improved safety and efficacy. The current research is mainly focused to find out the antimicrobial activity of *Tectona grandis* leaf and bark extracts prepared using ethanol, methanol, ethyl acetate and water. Resistance of microorganisms against drugs has increased due to the frequent use and misuse of drugs. Consequently, scientist's increasingly recognizing plant remedies as very important low cost alternatives to industrially produced antibiotics. Several plants serve as sources of therapeutic agents owing to their rich wealth of phytochemicals.

#### Antibacterial activity of *Tectona grandis* leaf and bark extracts

Leaf and bark extracts of *Tectona grandis* prepared in solvents (ethanol, methanol, ethyl acetate and water) were tested for the antibacterial activity against test bacteria. The antibacterial activity of the extract was assessed by the presence or absence of zone of inhibition. Both leaf and bark extracts of *Tectona grandis* exhibited significant antibacterial activity as is evident by a clear zone of inhibition around the discs. Table 1 & 2 shows the antibacterial activity of teak leaf and bark extracts respectively as is evident by a clear zone of inhibition measured (in mm) around the discs.

**Table 1: Antibacterial activity of *Tectona grandis* Leaf Extracts.**

Test organism	Diameter of Zone of Inhibition (in mm)			
	Ethanol	Methanol	Ethyl acetate	Water
<i>P. aeruginosa</i>	18	10	10	10
<i>S. aureus</i>	16	12	12	11
<i>B. subtilis</i>	21	14	13	12

**Table 2: Antibacterial activity of *Tectona grandis* bark Extracts.**

Test organism	Diameter of Zone of Inhibition (mm)			
	Ethanol	Methanol	Ethyl acetate	Water
<i>P. aeruginosa</i>	15	12	14	11
<i>S. aureus</i>	17	14	10	13
<i>B. subtilis</i>	19	16	12	10

Anti bacterial activity of *T. grandis* bark extracts towards *S. aureus* and other bacterial strains was also reported by Rafullah and Suleiman.<sup>[11]</sup> The leaf extracts of *Tectona grandis* found to contain two quinones: naphthotectone and anthrathectone that were mainly responsible for the antibacterial activity and good antiradical properties.<sup>[8,12,13]</sup> The other active ingredient that contribute antibacterial activity was found to be 5-hydroxy-1,4- naphthalenedione (Juglone). Mahesh and Jayakumar<sup>[14]</sup> showed the antibacterial activity of leaf, bark and wood extracts of *T. grandis* against *Staphylococcus aureus* (ATCC 25923), *Klebsiella pneumoniae* (ATCC 700603), hospital strains of *Salmonella paratyphi* and *Proteus mirabilis* by disc diffusion assay. They also found that methanol extract of leaf and ethyl acetate extract of wood was also able to show fairly good activity against gram positive and

negative species. Srinivasan *et al.*,<sup>[15]</sup> also reported similar findings. The present results are also inconsistent with these findings. In the present study good antibacterial activity was found against both Gram positive (*S. aureus*, *B. subtilis*) and Gram-negative (*P. aeruginosa*) bacteria.

#### Antifungal activity of *Tectona grandis* leaf and bark extracts

The available literature reveals that tectoquinone, an anthraquinone from teak sawdust, possess antifungal activity.<sup>[16]</sup> Other phytochemicals reported from teak viz., juglone, lapachol and deoxylapachol (Naphthoquinones) also possess antimicrobial activity.<sup>[8,9]</sup>

In the present study leaf and bark extracts of *Tectona grandis* prepared in solvents (ethanol, methanol, ethyl acetate and water) were tested for the antifungal activity against test fungi available in the lab. The antifungal activity of the extract was assessed by the presence or

absence of zone of inhibition. Table 3 & 4 shows the antifungal activity of teak leaf and bark extracts respectively as is evident by a clear zone of inhibition measured (in mm) around the discs.

**Table 3: Antifungal activity of *Tectona grandis* Leaf Extracts.**

Test organism	Diameter of Zone of Inhibition (in mm)			
	Ethanol	Methanol	Ethyl acetate	Water
<i>A. niger</i>	19	15	14	12
<i>T. Viride</i>	16	12	11	10
<i>A. flavus</i>	20	16	13	13

**Table 4: Antifungal activity of *Tectona grandis* bark Extracts.**

Test organism	Diameter of Zone of Inhibition (in mm)			
	Ethanol	Methanol	Ethyl acetate	Water
<i>A. niger</i>	20	18	15	13
<i>T. Viride</i>	21	14	11	12
<i>A. flavus</i>	18	15	16	15

Antifungal activity of *T. grandis* was also reported by Shalini and Rachana<sup>[17]</sup> and Florence *et al.*,<sup>[18]</sup> Antifungal and antibacterial activity of wood and bark of teak has been reported earlier.<sup>[16,19]</sup>

In this study, we found that both leaf and bark extracts of *Tectona grandis* prepared using ethanol, methanol, ethyl acetate and water were found to be efficient in inhibiting the growth of pathogenic bacteria and fungi. Among different extracts prepared using leaf and bark of teak plants, ethanolic extracts showed significant anti bacterial and antifungal activity.

From our observation, it was clear that *Tectona grandis* leaf and bark extracts were active in inhibiting the growth of bacteria and fungi.

## CONCLUSION

The present study clearly indicates the antimicrobial potential of leaf and bark extracts of *Tectona grandis*. Both the leaf and bark extracts were found to be effective in inhibiting the growth of gram positive, gram negative bacteria and against pathogenic fungi. Further investigations are needed to identify the bioactive components in the leaf and bark extracts obtained using different solvents.

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