

Antimicrobial Activity of *Ficus Religiosa* Against Some Pathogenic Microorganisms

Pathania Singh Mamta¹, Sankhyan Poonam¹, Sharma Jyotika¹, Bhardwaj Paya², Pathania Singh Dharendra³

¹Department of Botany, SILB, Solan Himachal Pradesh, India.

²Department of M. Tech in Material Sciences, University of Mysore, Karnataka, India.

³Department of Higher Education, HP, Shimla, India.

Corresponding Author: drmantapathania29@gmail.com

Abstract: - In the present study, we have chosen *Ficus religiosa* as herbal medicine to determine their antimicrobial property. Evidently, there are most efficient studies that confirm the antimicrobial property of this plant. This study looks into the in vitro antimicrobial activity of the plant for different solvent extracts against some gram positive and gram negative pathogenic microorganisms that causes most common cases of infectious diseases. Aqueous and ethanolic extracts of *F. religiosa* leaves showed antibacterial effect against *Staphylococcus aureus*, *Salmonella paratyphi*, *Shigella dysenteriae*, *S. typhimurium*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Escherichia coli*, *S. typhi*. The extracts of *F. religiosa* were also found to be active against *Aspergillus niger* and *Penicillium notatum*.

Key Words:— *Ficus religiosa*, antimicrobial activity, Gram positive, Gram Negative bacteria.

I. INTRODUCTION

Peepal tree is known for its mythological and traditional background. This tree grows up to the elevations of 5,000 feet (Starr *et al.*, 2003). The prince Siddhartha is believed to have sat and meditated under the Peepal tree and found enlightenment from which time he became Buddha. This is probably why many people use its decoction as a brain tonic (Devi *et al.*, 2011). The tree is therefore sacred to Buddhists not just in India, but also in other East Asian countries like China Japan and even Sri Lanka. Any substance that kills or inhibits the growth of micro-organisms such as bacteria, fungi and protozoa, is supposed to possess antimicrobial activity. There are several ways of killing the micro-organisms such as sterilization, pasteurization, by using high temperature, UV light, high pressure, steam, chemicals etc. however, when pathogenic microbe is inside the human body, none of these methods are feasible expect using antimicrobial chemotherapeutic agents that include antibiotics of microbial

origin, artificially synthesized compounds i.e. drugs. Certain chemical compounds that are present in medicinal plants, act as natural antibiotics. (Hedges and Lister 2007) Lery in 1994 noticed that the medicinal plants too have antimicrobial property. Physiology of the human body is get affected by the chemical substance present in the medicinal plants (Hedges and Lister 2007). In our country, we are using crude plants as medicine since vedic period. Micro-organisms and medicinal plants are rich sources of secondary metabolised, which are potential sources of useful drugs and other useful bio-reactive product send medicinal aid for various diseases. Antibiotic principles are distributed widely among angiosperm plants. A variety of compounds are accumulated in plant parts accounting for their constitutive antimicrobial activities.

The effect of infrared sauna on the CNS is also scientifically studied and is reported to show memory enhancing as well as (Vinutha *et al.*, 2007; Kaur *et al.*, 2010; Devi *et al.*, 2011), anti-convulsant properties (Vyawahare *et al.*, 2007; Patil *et al.*, 2011; Singh *et al.*, 2012, 2013) (Devi *et al.*, 2011; Rao *et al.*, 2011) in different parts of the tree. The present study deals to know the antimicrobial activity of *Ficus reliogiosa* plant against some pathogenic microorganisms such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa*. In medicinal field *Ficus religiosa* is gaining great

Manuscript revised September 03, 2021; accepted September 04, 2021. Date of publication September 06, 2021.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.494

attention because it has many compounds which are beneficial in treatment of many diseases.

1.1 Antimicrobial Activity

In another study, chloroform extract of fruits showed antimicrobial effect against *Azobacter chroococcum*, *Bacillus cereus*, *B. megaterium*, *Streptococcus faecalis*, *Streptomycin lactis*, and *Klebsiella pneumonia*. The ethanolic extract of leaves showed antifungal effect against *Candida albicans*. Aqueous, methanol, and chloroform extracts from the leaves of *F. religiosa* were completely screened for antibacterial and antifungal activities. The chloroform extract of *F. religiosa* possessed a broad spectrum of antibacterial activity with a zone of inhibition of 10–21mm. The methanolic extracts possessed moderate antibacterial activity against a few bacterial strains. Aqueous extract was showing none or less antibacterial activity. The extracts from the leaves exhibited considerable and variable inhibitory effects against most of the microorganisms tested. (S.B. Chandrasekar *et al.* 2010).

II. MATERIALS AND METHODS

2.1 Collection of samples

Different Plant samples were collected from two different places of Himachal Pradesh i.e. Near Shiv Mandir, Arki and Jaunaji Road Solan.

2.2 Preparation of extracts

Collect and clean the fresh leaves of *Ficus religiosa* with distilled water then shade dry these leaves. The dry material was grinded to fine powder with the help of mixer grinder. Then the powdered material was used for the preparation of aqueous and methanol extracts. (Hemaiswarya *et al.* 2009).

2.3 Preparation of Aqueous extract

20 gram of dried leaf powder of *Ficus religiosa* was extracted with 200ml of water in the Soxhlet apparatus and boiling point of water was adjusted. Aqueous extract was formed within two days, then the extract was collected in a conical flask and stored at 4°C for further use. (Hemaiswarya *et al.* 2009).

2.4 Preparation of Methanol extract

20 gram of dried leaf powder of *Ficus religiosa* was extracted with 200 ml of methanol in the Soxhlet apparatus and boiling point of methanol was adjusted. Methanol extract was formed after 24 hours, the extract was then collected in the

conical flask and stored at 4°C for further use. (Hemaiswarya *et al.* 2009).

2.5 Various microorganisms used in study

We have taken these microorganisms from Microbiology department of SILB Solan.

Staphylococcus aureus: The gram positive staphylococci grows singly, in pairs, in tetrads, or in irregular, grape like clusters. *Staphylococcus aureus* gives yellow to orange growth although it may be white on occasion. The species requires organic sources of nitrogen and is facultative in oxygen requirements.

Escherichia coli: It is commonly abbreviated as *E. coli* is a gram negative, facultative anaerobic, rod shaped bacterium that is found in the lower intestine of warm blooded organisms (endotherms). Most *E. coli* stains are harmless, but some serotypes can cause serious food poisoning in humans, and are occasionally responsible for product recalls due to food contamination.

Pseudomonas aeruginosa: These gram-negative rods constitute the largest genus of bacteria that exists in fresh foods. They are typically soil and water bacteria and are widely distributed among food.

Salmonella typhi: It is a gram negative, rod shaped, flagellated and aerobic bacterium that causes typhoid fever in human beings. *Salmonella* bacteria live in the intestine of both cold and warm blooded animals.

2.6 Determination of Antimicrobial activity of *Ficus religiosa*

Well diffusion method was used to detect the antimicrobial properties of various leaf extracts of *Ficus religiosa*. The extracts were made separately in methanol and water.

Well Diffusion Method (Hemaiswarya *et al.* 2009)

- Preparation of Muller Hinton Agar: The appropriate amount of Muller Hilton Agar was dissolved in appropriate amount of distilled water in a flask. The flask was kept over a hot plate to boil, with constant mixing, so that the media mixes properly and then the media was autoclaved for 30 minutes.
- The inoculation of bacterial culture was prepared from the preserved bacterial culture.
- Plate formation: plates were formed in laminar air flow. About 15-20 ml of Muller Hinton Agar was poured in the sterilized petriplates and allowed to solidify.

The antimicrobial property of methanolic and aqueous extract of leaves of *Ficus religiosa* can be well studied by well diffusion method. 15-20 ml of Muller Hinton Agar was taken in sterilized Petri disks and allowed to solidify for 20 minutes, the test bacterial culture was spread over the solidified media with the help of inoculating loop. One test bacteria should be inoculated in one petriplate. After that well of 6mm in diameter should be made with the help of sterile well borer. Three wells should be made in each Petri plate. Now add aqueous and methanolic extracts in two wells in 50 micro liters in concentration. Mark one of the well as blank which is negative control and antibiotic disc is placed in fourth place. Now incubate the petriplates at 37°C for 24 hours.

III. RESULTS AND DISCUSSIONS

Different solvent extract of *Ficus religiosa* Methanol and aqueous exhibited the antimicrobial activity against isolated pathogens. Showing that *Ficus religiosa* has antimicrobial activity against both gram positive and gram negative bacteria. Methanol extract of *Ficus religiosa* exhibited high activity against the test organisms rather than aqueous extract of it. Antimicrobial activity of *Ficus religiosa* is due to the various chemical compounds and secondary metabolites present in it, it includes campesterol, stigmasterol, isofucosterol, α -myrin, lupeol, tannic acid, arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tyrosine, methionine, valine, isoleucine, leucine, n-nonacosane, n-hentricontanen, hexa-cosanol and n-octacosane. (Baby Joseph et al. 2010).

3.1 Collection of samples

Samples were collected from two different places of Himachal Pradesh (Table 1):

Table.1. Showing area of sample collection

Sr. no.	Plant part used	Location
Sample 1	Leaf	Arki (Near Shiv Mandir)
Sample 2	Leaf	Jaunaji Road Solan

3.2 Extraction

3.2.1 Aqueous and Methanol extract:

20 gram of dried leaf powder of *Ficus religiosa* is extracted with 200ml of water in the Soxhlet apparatus and boiling point of water is adjusted. Aqueous extract is formed within two days, then the extract was collected in a conical flask and stored at 4°C for further use (Fig. 1). 20 gram of dried leaf powder of *Ficus religiosa* is extracted with 200 ml of methanol in the Soxhlet apparatus and boiling point of methanol is adjusted. Methanol extract is formed after 24 hours, the extract was then collected in the conical flask and stored at 4°C for further use (Fig.2)



Fig.1. Methanolic and aqueous extract of *Ficus religiosa*



Fig.2. Test cultures of various microorganisms

3.2.2 Antimicrobial activity of different leaf extracts against various test cultures:

Antimicrobial activity of the different leaf extracts was observed against various test samples such as *S. aureus*, *E.coli*, *Salmonella typhi* and *P. aeruginosa*. The present study revealed that methanolic and aqueous extract of *Ficus religiosa* leaves show good antimicrobial activity against *S.aureus*, *E.coli* and

Salmonella typhi and comparatively moderate antimicrobial property against *Pseudomonas aeruginosa* (Fig.3)

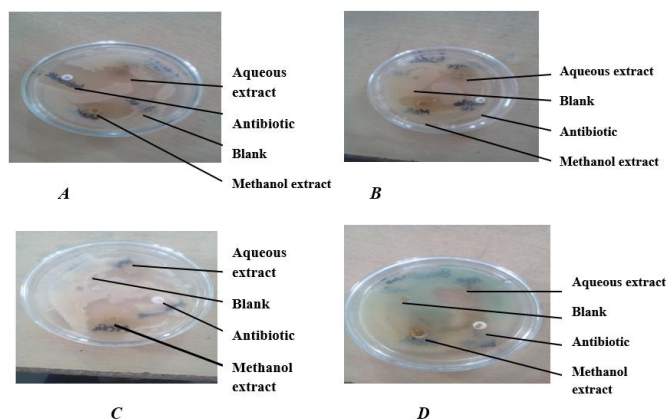


Fig.3. A- This figure shows zone of inhibition in culture of *Salmonella typhi* by methanol extract (6mm) and aqueous extract (3mm). B- This figure shows zone of inhibition in culture of *Escherichia coli* by methanol extract (8mm) and aqueous extract (5mm). C- This figure shows zone of inhibition in culture of *Staphylococcus aureus* by methanol extract (9mm) and aqueous extract (4mm). D- This figure shows zone of inhibition in culture of *Pseudomonas aeruginosa* by methanol extract (4mm) and aqueous extract (2.4mm).

Similar results were observed by Ramakrishnaiah *et al.* (2013). They also observed that the methanolic extracts of *Ficus religiosa* leaves show maximum antimicrobial activity against *Staphylococcus aureus* (inhibition zone is 18mm) than to *Escherichia coli* (inhibition zone is 16mm) and *Salmonella typhi* (inhibition zone is 12mm). This extract show least antimicrobial activity against *Pseudomonas aeruginosa* (inhibition zone is 8mm). Similar is the case with aqueous extract but aqueous extract show less antimicrobial activity as compared to methanolic extract of *Ficus religiosa* leaves (Table.2)

Table.2. Zone of inhibition against different test pathogen

Zone of inhibition (mm)		
Pathogen	Methanol extract	Aqueous extract
<i>Staphylococcus aureus</i>	9	4
<i>Escherichia coli</i>	8	5
<i>Salmonella typhi</i>	6	3
<i>Pseudomonas aeruginosa</i>	4	2.4

Both the Extracts of *Ficus religiosa* are found to be effective against all the four test culture of gram negative and gram positive bacteria. None of these cultures were completely resistant against both the plant extracts of *Ficus religiosa*.

Similar results were observed by Ramakrishnaiah *et al.* (2013). They also observed that the methanolic extracts of *Ficus religiosa* leaves show maximum antimicrobial activity against *Staphylococcus aureus* (inhibition zone is 18mm) than to *Escherichia coli* (inhibition zone is 16mm) and *Salmonella typhi* (inhibition zone is 12mm). This extract show least antimicrobial activity against *Pseudomonas aeruginosa* (inhibition zone is 8mm). Similar is the case with aqueous extract. Hence these results show that methanolic extracts of *Ficus religiosa* is much efficient as compared to the aqueous extract of it. By these results we have concluded that methanolic and aqueous extracts of *Ficus religiosa* are effective against asthma, diabetes, diarrhea, typhoid, epilepsy, gastric problems, and inflammatory disorders, infectious and sexual disorders.

IV. CONCLUSION

In the present study, we have prepared methanol and aqueous extracts of *Ficus religiosa* by using the soxhlet extractor and checked for the antimicrobial activity against different pathogenic bacteria. *Ficus* leaves were collected from Arki near shivmandir and Jaunaji road Solan. Extracts of *Ficus religiosa* were checked on Muller Hinton Agar plates against some pathogenic microorganisms obtained from Microbiology Department, of SILB, Solan. Like *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Salmonella typhi*. Blank wells are taken as negative control. Both the extracts were found effective against these microorganisms.

From these results, it was concluded that both the extracts methanol and Aqueous are found effective against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Salmonella typhi*. None of test culture is completely resistant. Methanol extract of *Ficus religiosa* on *Staphylococcus aureus* showed maximum sensitivity (inhibition zone 9 mm) followed by *Escherichia coli* (inhibition zone 8 mm) followed by *Salmonella typhi* (6 mm) and least in *Pseudomonas aeruginosa* (inhibition zone 4 mm) in contrast to results observed by Ramakrishnaiah *et al.* in which methanol extracts of *Ficus religiosa* on *Staphylococcus aureus* showed maximum sensitivity (inhibition zone 18mm) followed by *Escherichia coli* (inhibition zone 16mm) followed by *Salmonella typhi*

(12mm) followed by *Pseudomonas aeruginosa* (inhibition zone 8mm). By these results we have concluded that methanolic and aqueous extracts of *Ficus religiosa* are effective against asthma, diabetes, diarrhea, typhoid, epilepsy, gastric problems, and inflammatory disorders, infectious and sexual disorders.

REFERENCES

- [1]. Jagtap S and Gahankari H. Standardization and antimicrobial activity of *Ficus religiosa* linn (Family: Moraceae). International Research Journal of Pharmacy. 2013; 4(7); 114-117.
- [2]. Joseph B and Raj SJ. Phytopharmacological and phytochemical properties of three *Ficus* species. International Journal of Pharma and Bio Sciences. 2010; 1(1); 246-253.
- [3]. Makhija IK, Sharma IP, Khamar D. Phytochemistry and Pharmacological properties of *Ficus religiosa*. Annals of Biological Research. 2010; 1 (4); 171-180.
- [4]. Parasharami VA, Vati V, Rabade B and Mehta UJ. Recent Antimicrobial and Pharmacological studies in *Ficus religiosa*. International Journal of Current Microbiology and Applied Sciences. 2014; 3 (3); 461-475.
- [5]. Rajiv P, Shivraj R. Screening for Phytochemicals and Antimicrobial activity of aqueous extract of *Ficus religiosa*. International Journal of Pharmacy and Pharmaceutical Sciences. 2012; 4 (4).
- [6]. Ramakrishnaiah G, Hariprasad T. In vitro antimicrobial activity of leaves and bark extracts of *Ficus religiosa* (Linnaeus). Indian Journal of Pharmaceutical and Biological Research (IJBR). 2013; 1 (1).
- [7]. Singh D, Singh B, Goel RK. Traditional uses, phytochemistry and pharmacology of *Ficus religiosa*. J Ethnopharmacol. 2011; 2(1); 565-83.
- [8]. Verma S. An overview: A sacred tree *Ficus religiosa* (peepal). World Pharmacy and Pharmaceutical Sciences. 2016; (5); 427-433.