WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 13, Issue 23, 503-513. Review Article ISSN 2277–7105

REVIEW ON PHYTOCHEMISTRY, PHARMACOLOGICAL PROPERTIES AND TRADITIONAL USES OF *FICUS RELIGIOSA* (PEEPAL)

***Akash S. Jumble, Sneha V. Wasade, Gauri A. Deshmukh, Ashwini Aswar and Dr. Harigopal S. Sawarkar**

Dr. Ranjendra Gode College of Pharmacy, Amravati, Maharashtra, India.

Article Received on
07 October 2024,

Revised on 28 October 2024,
Accepted on 18 Nov. 2024

DOI: 10.20959/wjpr202423-34754

***Corresponding Author**
Akash S. Jumble
Dr. Ranjendra Gode College of Pharmacy, Amravati, Maharashtra, India.

ABSTRACT

Ficus religiosa L., known as the peepal tree, belongs to the Moraceae family and has been traditionally utilized for its healing properties, including antiulcer, antibacterial, antidiabetic effects, and for treating gonorrhea and various skin conditions. Traditional medicine often employs diverse plant extracts or bioactive constituents for therapeutic purposes. Ethnomedicinal studies are invaluable in the search for new, cost-effective medicinal plants. In India, herbs have long served as primary medicinal agents, with therapeutic benefits derived from the complex chemical substances present as secondary metabolites in different parts of the plant. *F. religiosa*, also known as the "Bo tree," is historically significant as it provided shelter to Buddha during his enlightenment. This review focuses on recent insights into its phytochemistry, pharmacological properties, and traditional uses. Revered in Indian culture and known as the "sacred fig," "Bo tree," "Peepal," or "Ashwattha" in Sanskrit, this tree is widely distributed across India and is often worshipped by Hindus. Various parts of the *F. religiosa* tree including the bark, fruit, leaves, seeds, and latex serve as essential natural remedies for numerous ailments.

KEYWORDS: *ficus religiosa*, phytochemistry, pharmacological properties, traditional uses.

INTRODUCTION

Ficus religiosa (L.), a large, long-living tree with smooth bark in its youth, is found widely across the Indian plains, thriving at altitudes up to 170 meters in the Himalayan region. Commonly planted along roadsides and near temples, this tree holds deep mythological,

religious, and medicinal significance within Indian culture.[1] Its uses in traditional Indian medicine span a broad range of For example, its bark has been traditionally valued for its antibacterial, antiviral, astringent, and antidiarrheal properties, as well as for treating conditions like gonorrhea and ulcers, while the leaves have been used to manage skin conditions and possess antivenom properties. In addition, the leaves are said to help regulate menstrual cycles. In Bangladesh, *F. religiosa* is commonly used to treat diseases such as cancer, inflammatory conditions, and infections. For high fevers, tender branches are even used as natural toothbrushes, while the fruits act as a laxative, the latex as a tonic, and fruit powder as a remedy for asthma.[2]

In India, traditional systems like Ayurveda, Siddha, Unani, and Homeopathy have long relied on herbal treatments, with medicinal plants forming a critical part of this cultural heritage. Extracts from natural sources continue to be valuable for developing new drugs, with traditional systems using various plant parts—such as stem bark, root bark, aerial roots, buds, leaves, fruits, and latex—to treat a wide array of ailments. Across many cultures, herbs and plant-derived medicines remain important, with plant compounds being favored for their natural origin over synthetic options. India is rich in medicinal plant diversity, supporting approximately 25,000 plant-based formulations in traditional medical literature, and about 25% of modern drugs are derived from plant-based compounds or synthetic versions of them.[3]

F. religiosa, often called the "Bodhi tree" or "Tree of Life," holds special reverence in Southeast Asia, particularly around temples, due to its sacred association with both Buddhist and Hindu traditions. Known by names like the Tree of Wisdom and the Sacred Tree, this species has notable medicinal properties. Six parts of the tree—bark, leaves, seeds, fruits, roots, and latex—are utilized for their therapeutic potential, while the porous wood itself is not used medicinally. These parts are often combined with other herbs for enhanced benefits, and each plays a role in traditional medicine, contributing to the plant's valued role in health and wellness.[4]

Fig 1:- *ficus religiosa.*

Phytochemical Constituents

Preliminary analysis of *Ficus religiosa* bark has shown the presence of tannins, saponins, flavonoids, steroids, terpenoids, and cardiac glycosides. Phytosterols such as lanosterol, β-sitosteryl-D-glucoside, bergapten, bergaptol, and stigmasterol have been isolated from petroleum ether and alcoholic extracts of the bark. The bark also contains around 8.7% tannins, along with phenolic compounds, acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent lignin (ADL), and saponins. Additional compounds identified in the inner bark include wax, saponin, leucocyanidin-3-0-β-D-glucopyranoside, leucopelargonidin-3-0-β-D-glucopyranoside, leucopelargonidin-3-0-α-L-rhamnopyranoside, lupeol, ceryl behenate, lupeol acetate, α-amyrin acetate, leucoanthocyanidin, and leucoanthocyanin.[5]

Constituent of fruit

The fruit pulp of *F. religiosa* primarily contains amino acids, with asparagine and tyrosine being the most abundant. The fruits are also rich in flavonoids such as kaempferol, quercetin, and myricetin, along with other phenolic compounds.[6]

Constituents of the Leaves

The leaves of *F. religiosa* contain a variety of phytochemicals, including campestrol, stigmasterol, isofucosterol, α-amyrin, lupeol, tannic acid, and a wide range of amino acids (arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tyrosine, methionine, valine, isoleucine, leucine). Other components include hydrocarbons such as n-nonacosane and n-hentricontane, as well as compounds like hexa-cosanol and n-octacosan.[7]

Constituents of the Seeds

The seeds of *F. religiosa* contain phytosterolin, β-sitosterol, and its glycoside, as well as albuminoids, carbohydrates, fatty materials, coloring agents, and caoutchouc in concentrations ranging from 0.7% to 5.1%. Additionally, active phytochemical structures found in *F. religiosa* are documented for their therapeutic importance.[8]

isoleucine and phenylalanine. The seeds of *Ficus religiosa* contain albuminoids, carbohydrates, fatty compounds, coloring substances, and caoutchouc in concentrations ranging from 0.7% to 5.1%. The fruits of *F. religiosa* are rich in flavonols, including kaempferol, quercetin, and myricetin. Additionally, both leaves and fruits contain essential nutrients such as carbohydrates, proteins, lipids, calcium, sodium, potassium, and phosphorus.[9]

Constituent of bark

The stem bark of *F. religiosa* includes phenols, tannins, steroids, alkaloids, flavonoids, β-sitosteryl-D-glucoside, vitamin K, n-octacosanol, methyl oleanolate, lanosterol, stigmasterol, and lupen-3-one. The root bark's primary active compound, β-sitosteryl-D-glucoside, has demonstrated hypoglycemic effects in animal studies, specifically in diabetic and fasting rabbit and rat models. The fruits contain about 4.9% protein, including essential amino acids like.[10]

The dried bark of *F. religiosa*, when extracted with water, has shown the presence of phytosterols, flavonoids, tannins, and furanocoumarin derivatives like bergapten and begaptol. The fruit contains significant levels of total phenolics, flavonoids, and demonstrates a high percentage of linoleic acid inhibition, which suggests strong antioxidant properties. Studies indicate that extraction using aqueous organic solvents results in higher yields of phenolic compounds and antioxidant activity compared to absolute organic solvents. Although the refluxing extraction technique generally yields a larger extract volume, the shaker technique tends to produce extracts with higher total phenolic content and enhanced antioxidant activity.[11]

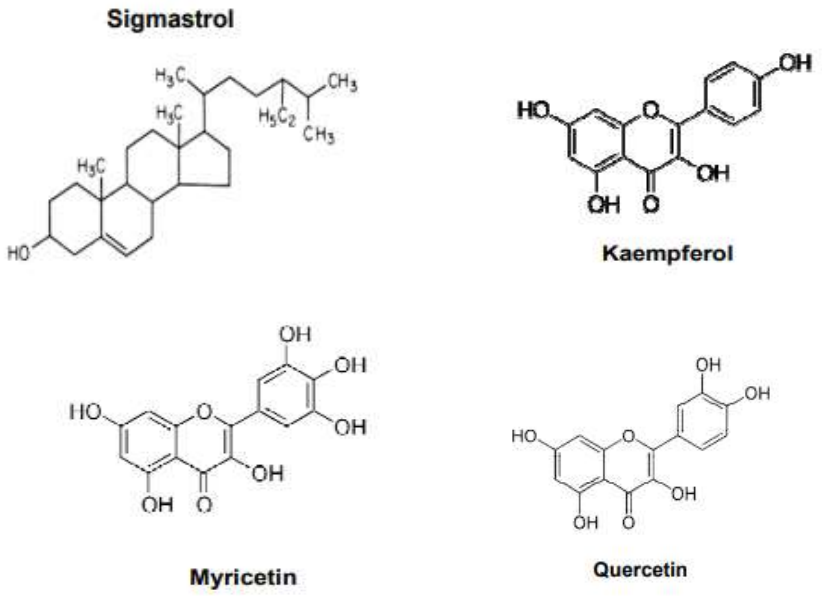

Fig.2: Constituent of seed.

Pharmacological Properties

Antioxidant Activity

Studies have shown that *Ficus religiosa* bark and fruit extracts exhibit antioxidant activity when prepared using various solvents. The extracts' ability to scavenge free radicals has been demonstrated through their oil stability index against 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals.[12] Antioxidant properties are crucial in managing chronic diseases like rheumatoid arthritis, atherosclerosis, and diabetes, where oxidative stress often damages tissues. In diabetic rats, oxidative stress reduces antioxidant capacity and heightens free radical toxicity. However, administering *F. religiosa* aqueous extract to type 2 diabetic rats has been shown to reduce oxidative stress. Diabetic rats, which typically experience weight loss due to reduced glucose utilization and increased fat oxidation, gained weight when treated with the extract.[13]

Furthermore, the aqueous extract of *F. religiosa* affects superoxide dismutase (SOD) activity and reduces catalase (CAT) activity, potentially due to lower NADPH availability. Additionally, it upregulates catalase and glutathione peroxidase (GSH-Px) activities.[14] Methanolic extracts of *F. religiosa* leaves have been observed to inhibit nitric oxide production and pro-inflammatory cytokines in lipopolysaccharide (LPS)-induced conditions, demonstrating significant anti-inflammatory properties. This activity, especially in microglial cells, suggests that the extract contains anti-inflammatory compounds like cytokines and nitric oxide, providing neuroprotective benefits. Recent studies also indicate that the

methanolic extract *of F religiosa* shows neurotrophic effects and inhibitory action on acetylcholinesterase, further supporting its potential in neuroprotective applications.[15]

Antibacterial Activity

The antibacterial properties of *Ficus religiosa* leaves have been evaluated against various pathogens, including *Salmonella paratyphi*, *Staphylococcus aureus*, *Shigella dysenteriae*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Escherichia coli*, using ethanolic and aqueous extracts. In another investigation, chloroform extracts of the fruits demonstrated antimicrobial effects against *Azotobacter chroococcum*, *megaterium Bacillus*, *Bacillus cereus*, *Streptomyces lactis*, *Streptococcus faecalis*, and *Klebsiella pneumoniae*.[16] Additionally, the antifungal activity against *Candida albicans* was assessed using ethanolic leaf extracts. The chloroform extract of *F. religiosa* exhibited a broad spectrum of antibacterial activity, inhibiting bacterial growth by 10 to 21 mm. However, methanolic extracts showed limited antibacterial effects, and aqueous extracts displayed no activity. The extracts of *F. religiosa* also demonstrated efficacy against *Aspergillus niger* and *Penicillium notatum*, with varying degrees of inhibition noted across different microorganisms when leaf extracts were utilized. Research by Kumara and Sreedharamurthy indicated that the leaf extracts did not exhibit antifungal activity against plant pathogenic fungi, but when combined with petroleum ether and methanol extracts, they showed moderate to significant antifungal activity against *C. albicans*.[17]

Hypoglycemic Activity

The root bark of *F. religiosa* contains β-sitosterol-D-glycoside, which has been associated with hypoglycemic effects.[18] Oral administration of *F. religiosa* bark extract at doses of 25, 50, and 100 mg/kg was studied in glucose-loaded and streptozotocin (STZ)-induced diabetic rats as well as in normal rats. The results revealed a significant reduction in blood glucose levels at all three doses, particularly at 50 and 100 mg/kg compared to 25 mg/kg. The bark extract also led to a notable increase in body weight, serum insulin levels, and glycogen content in the skeletal muscle and liver of STZ-induced diabetic rats, while decreasing total cholesterol and serum triglyceride levels. Furthermore, *F. religiosa* diabetic rats, highlighting its potent antidiabetic properties, especially in the aqueous extract demonstrated a considerable antilipid-peroxidative effect on the pancreas of STZ-induced diabetic rats, highlighting its potent antidiabetic properties, especially in the aqueous extract of the bark.[19]

Hypolipidemic Activity

The dominant components of *Ficus religiosa* include lignin, dietary fiber (peepalbanti), and cellulose. When rats were fed a diet containing 10% peepalbanti, they exhibited a significant resistance to hyperlipidemia compared to those consuming cellulose. Hemicellulose in the diet showed an inverse correlation with liver cholesterol and serum levels while positively correlating with bile acid excretion. The presence of dietary fiber affected the levels of triglycerides, cholesterol, phospholipids, and total lipids in the liver. The stem bark of *F. religiosa* is utilized in treating hyperlipidemia associated with diabetes mellitus.[20]

Wound-Healing Activity

The hydro-alcoholic extract of *F. religiosa* leaves has demonstrated wound healing capabilities in rats with incision, excision, and burn wounds. Concentrations of 5% and 10% of the leaf extract were applied topically to the wounds. The extract resulted in a significant improvement in the healing process for both incision and burn wound models when compared to controls. These findings suggest that the efficacy of the wound healing activity is dose-dependent with respect to the leaf extract of *F. religiosa*. Additionally, in a study by *Patil* et al., various *Ficus* species—including *Ficus racemosa*, *Ficus inspida*, *Ficus religiosa*, *Ficus elastica*, *Ficus indica*, and *Ficus carica*—were evaluated for their anti-allergic and anti-stress properties in asthma models involving milk-induced leucocytosis and eosinophilia. Among these, the mentioned species exhibited anti-inflammatory activity, while *Ficus bengalensis* did not show any such effects.[21]

Anthelmintic Activity

The methanolic extract of *Ficus religiosa* bark exhibits strong activity against *Haemonchus contortus* worms. Additionally, extracts from the bark and stem of *F. religiosa* have demonstrated effectiveness against *Ascaridia galli* in vitro. The latex from the tree also shows anthelmintic properties against parasites such as *Syphacia obvelata*, *Aspiculuris tetraptera*, and *Vampirolepis nana*. The anthelmintic effects of the methanolic extracts are attributed to ficin, a proteolytic component present in the plant.[22]

Immunomodulatory Activity

An alcoholic extract of *F. religiosa* bark has been shown to have immunomodulatory effects in experimental rats, assessed through various serological and hematological tests. Mice were sensitized with sheep red blood cells as an antigenic challenge, and the administration of the

extracts enhanced both cellular and humoral antibody responses. The immune-stimulant properties of the extract contribute to its immunomodulatory effects.[23]

Anti-Convulsant Activity

The anti-convulsant properties of *F. religiosa* were evaluated against picrotoxin-induced seizures and maximum electroshock (MES), demonstrating no neurotoxic effects based on the dosage of the methanolic fruit extract. Significant protection against convulsions in both the picrotoxin and MES models was observed with varying doses of the extract (25, 50, and 100 mg/kg). In the MES model, treated mice showed a marked decrease in the time required for hind limb extension compared to the control group. The anti-convulsant effect of the extract parallels that of phenytoin. While an increase in latency was noted in the 50 and 100 mg/kg doses, it was still lower than that of the control group. The extract appears to exert its effects through modulation of glutamatergic neurotransmission, suggesting its potential role in the inhibition of epileptic activity, as influenced by cyproheptadine treatment.[24]

Anti-Ulcer Activity

The ethanolic extract of *Ficus religiosa* leaves has demonstrated anti-ulcer effects by inhibiting stress-induced ulcer formation. In studies comparing the effects of the extract with the standard anti-ulcer medication ranitidine, no significant changes in gastric secretion volume were observed in rats treated with the *F. religiosa* extract at a dosage of 500 mg/kg. Microscopic examination revealed complete ulceration in the stomachs of untreated animals, while those treated with ranitidine and the extract showed protective effects against ulceration. The leaf extract exhibits substantial anti-ulcer activity in animal models and is non-toxic even at moderately high concentrations. Flavonoids present in the extract are believed to be responsible for its anti-ulcer properties. Research by Parameswari et al. confirmed the presence of flavonoids in the methanolic extracts through chemical tests and thin-layer chromatography (TLC). Additionally, the extract inhibits hydrazine activity, a compound linked to liver damage in rats, leading to decreased biliary secretion and increased lipid peroxidation in liver cells.[25]

Traditional Uses

Ficus religiosa has been widely utilized in traditional medicine for a variety of ailments. Its bark, fruits, leaves, roots, latex, and seeds are used in various forms, often in conjunction with other herbs. The bark is a key ingredient in several Ayurvedic formulations, such as “Pancha Valkaladi Tailum” (an oil that includes *F. religiosa*, *Ficus benghalensis*, *Ficus*

glomerata, *Ficus infectoria*, *Azadirachta indica*, *Curcuma longa*, and *Hemidesmus indicus* and *"Pancha Valkala Kashaya"* (a decoction containing similar ingredients). In Ayurvedic practice, *F. religiosa* is characterized by properties such as being astringent (kashaya), heavy (guru), dry (ruksha), cold (shita), and pungent (katu). Its therapeutic actions include pigmenting (varnya), pain relief (vedana sthaapana), reduction of swelling (shotha hara), and blood conservation (rakta samgrahaka).[26] Ayurvedic medicine is founded on the principle that health arises from a balance among the three *doshas: Vata, Pitta, and Kapha*. An imbalance in these doshas can lead to various diseases. Vata is associated with bodily movement, Pitta governs metabolic processes, and Kapha is linked to the structural integrity and strength of the body. Classical texts attribute numerous diseases to Pitta and Kapha imbalances, and *F. religiosa* is often prescribed to alleviate disorders related to these imbalances, including respiratory issues, ulcers, stomatitis, hiccups, arthritis, gout, skin conditions, allergies, inflammation, bone fractures, and diabetes. In traditional medicine, specific parts of *F. religiosa* are frequently used alongside other herbs or vehicles to enhance therapeutic effects while minimizing side effects. For example, the leaves may be applied to inflammatory ulcers using butter fat, which aids in deeper penetration of the treatment by swelling the skin and stimulating internal tissues.[27]

CONCLUSION

Ficus religiosa, commonly known as the "Bo tree," holds historical significance as the tree under which Buddha attained enlightenment. This review explores recent findings on its phytochemistry, pharmacological properties, and traditional uses. Revered in Indian culture, it is also known as the "sacred fig," "Bo tree," "Peepal," or "Ashwattha" in Sanskrit. Widely distributed across India, the tree is frequently worshipped by Hindus. Different parts of F. religiosa, including the bark, fruit, leaves, seeds, and latex, are used as natural remedies for a variety of ailments.

REFERENCE

1. Ayurvedic pharmacopeia of India. Ministry of health and family welfare, department of Ayush, New Delhi, 2001; 17-20.
2. Shah NC. Herbal folk medicines in northern India. J Ethnopharmacol, 1982; 6: 293-301.
3. Goel RK, Singh D, Lagunin A, Poroikov V. PASS-assisted exploration of 1028 new therapeutic potential of natural products. Medicinal Chemistry Research, 2010; 1029.

4. Ministry of health and family welfare, department of Ayush. New Delhi. Ayurvedic pharmacopeia of India, 2001; 17-20.
5. Agnivesha. Charaka Samhita. Varanasi: Choukamba Sanskrita Samsthana. Prameha Chikitsa, pp. 2001; 446–7.
6. Osima Y and Ito H. Vegetable tannins in Formosa III. Nippon Nogeikagaku Kaishi, 1939; 15: 634–635.
7. Husain A, Virmani OP, Popli SP, Misra LN, Gupta, MM, Srivastava, GN, Abraham Z and Singh AK. Dictionary of Indian Medicinal Plants, CIMAP, Lucknow, India, 1992; 546.
8. Oliver bever B. Oral hypoglycaemic plants in West Africa. J Ethnopharmacol, 1977; 2: 119-27.
9. Bushra S, Farooq A. Flavonols (kaempeferol, quercetin, myricetin) contents of selected fruits, vegetables and medicinal plants. Food Chem, 2008; 108: 879-84.
10. Swami KD and Bisht NPS. Constituents of Ficus religiosa and Ficus infectoria andtheir biological activity. Journal of the Indian Chemical Society, 1996; 73: 631.
11. Mali S and Borges RM. Phenolics, fibre, alkaloids, saponins, and cyanogenic glycosides in a seasonal cloud forest in India. Biochemical Systematics and Ecology, 2003; 31: 1221–1246.
12. Ali M and Qadry JS. Amino acid composition of fruits and seeds of medicinal plants. Journal of the Indian Chemical Society, 1987; 64: 230– 231.
13. Singh D, Singh B, Goel RK. Hydroethanolic leaf extract of Ficus religiosa lacks anticonvulsant activity in acute electro and chemo convulsion mice models. J Pharm Negative Results,. 2011; 2: 58-61
14. Ruby J, Nathan PT, Balasingh J, Kunz TH. Chemical composition of fruits and leaves eaten by short- nosed fruit bat, Cynopterus sphinx. J Chem Ecol, 2000; 26(12): 2825-41.
15. You T, Nicklas BJ. Chronic inflammation: Role of adipose tissue and modulation by weight loss. Curr Diabetes Rev, 2006; 2(1): 29-37.
16. Kirana H, Agrawal SS, Srinivasan BP. Aqueous extract of Ficus religiosa Linn: Reduces oxidative stress in experimentally induced type 2 diabetic rats. Indian J Exp Biol, 2009; 47: 822-6.
17. Swami KD, Bisht NP. Constituents of Ficus religiosa and Ficus infectoria and their biological activity. J Indian Chem Soc, 1996; 73(11): 631.

18. Farrukh A, Iqbal A. Broad-spectrum anti-bacterial and anti-fungal properties of certain traditionally used Indian medicinal plant. World J Microbiol Biotechnol, 2003; 19(6): 653-7.
19. Hemaiswarya S, Poonkothai M, Raja R, Anbazhagan C. Comparative study on the anti-microbial activities of three Indian medicinal plants. Egypt J Biol, 2009; 11(1): 52-4.
20. Kumara SK, Satish S. Bioprospecting of some medicinal plants explored for 48 antifungal activity. Pharmacogn J., 2016; 8(1): 59.
21. Ambike S, Rao M. Studies on a phytosterolin from the bark of Ficus religiosa. Indian J Pharm, 1967; 29: 91-4.
22. Agarwal V, Chauhan BM. A study on composition and hypolipidemic effect of dietary fibre from some plant foods. Plant Foods Hum Nutr, 1988; 38(2): 189-97.
23. Patil VV, Pimprikar RB, Patil VR. Pharmacognostical Studies and Evaluation of Anti-inflammatory Activity of Ficus bengalensis Linn. J Young Pharm, 2009; 1(1): 49-53.
24. De Amorin A, Borba HR, Caruta JP, Lopes D, Kaplan MA. Anthelmintic activity of the latex of Ficus species. J Ethnopharmacol, 1999; 64(3): 255-8.
25. Hansson A, Veliz G, Naquira C, Amren M, Arroyo M, Arevalo G. Preclinical and clinical studies with latex from Ficusglabrata HBK, a traditional intestinal anthel mintic in the Amazonian area. J Ethnopharmacol, 1986; 17(2): 105-38.
26. Mallurvar VR, Pathak AK. Studies on immunomodulatory activity of Ficus religiosa. Indian J Pharm Educ Res, 2008; 42(4): 343-7.
27. Parameswari SA, Chetty CM, Chandrasekhar KB. Hepatoprotective activity of Ficus religiosa leaves against isoniazid+rifampicin and paracetamol induced hepatotoxicity. Phcog Res, 2013; 5(4): 271-6.Bottom of Form.