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PHYTOPHARMACOLOGICAL REVIEW OF *FICUS RELIGIOSA (PEEPAL TREE)*: EVIDENCE-BASED INSIGHTS INTO A SACRED MEDICINAL TREE

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ABSTRACT

Ficus religiosa L. (Moraceae), commonly known as the sacred fig, is revered in traditional medicine for its wide-ranging therapeutic properties. Extensive scientific investigations have validated its diverse pharmacological activities, including analgesic, anti-inflammatory, antioxidant, antidiabetic, immunomodulatory, anticonvulsant, antimicrobial, anti-ulcer, anti-amnesic, and wound healing effects. Extracts from different parts of the plant, particularly the bark and leaves, demonstrate significant bioactivity through mechanisms such as enhancing insulin secretion, improving lipid profiles, and reducing oxidative stress in experimental models. These effects are attributed to the rich presence of bioactive compounds like flavonoids, tannins, and polyphenols. Furthermore, *F. religiosa* exhibits immunostimulant and anti-acetylcholinesterase properties, broadening its therapeutic potential. Collectively, these findings underscore the plant's promise as a source of natural medicinal agents and highlight the need for further clinical research to fully harness its benefits.

KEYWORDS: Ficus religiosa, Peepal, Pharmacological properties, Ethnopharmacology, Phytochemical constituents.

INTRODUCTION

For centuries, medicinal plants have held a crucial place in traditional healthcare systems across the world. Their remarkable role in promoting health and enhancing the quality of life is deeply rooted in human history. These plants have been widely used not only for their therapeutic properties but also as essential ingredients in foods, beverages, cosmetics, and natural dyes. Across diverse cultures, countless plant species have been known to produce compounds beneficial to both human and animal health. With the advancement of modern science, there is now an ever-growing

interest in discovering and developing new drugs from plant sources, those which are more effective and safer, with minimal or no side effects.

Among these valuable medicinal plants, the genus *Ficus* (family Moraceae) stands out. It is one of the most extensive genera of flowering plants, encompassing over 800 species and around 2000 varieties, primarily thriving in tropical and subtropical forests across the globe.One particularly significant species is *Ficus religiosa*, commonly known as the Peepal tree (Fig. 1 and 2). This tree holds profound religious, cultural, and medicinal importance in Indian traditions.[1]

Fig. 1: Peepal Tree.

Fig. 2: Leaves and Fruits.

The Peepal tree has attracted considerable attention due to the presence of numerous bioactive compounds that offer a wide range of therapeutic benefits. It has been traditionally used in the treatment of various ailments, including diabetes, skin disorders, respiratory conditions, neurological issues, and gastrointestinal problems.[2,5]

MATERIAL AND METHODS

This review was compiled through an extensive and systematic exploration of both modern scientific and classical Unani literature concerning *Ficus religiosa* (Peepal), with the objective of evaluating its phytochemical constituents and pharmacological activities. A comprehensive search was conducted using electronic databases such as PubMed, Scopus, Google Scholar, ScienceDirect, ResearchGate, and the Directory of Open Access Journals (DOAJ) to retrieve peer-reviewed articles published between 2000 and 2024. The search strategy included a combination of keywords such as "*Ficus religiosa*," "Peepal tree," "phytochemistry," "pharmacological activity," "ethnomedicine," "antidiabetic," "antioxidant," "antimicrobial," "wound healing," and "Unani medicine." Information was extracted and categorized under:

- Botanical classification,
- Traditional uses,
- Phytochemical constituents,
- Pharmacological activities (e.g., antidiabetic, antimicrobial, antioxidant, immunomodulatory),
- Toxicity and safety evaluations.

Botanical Classification of Ficus religiosa

The scientific classification is depicted in table 1.[1,2,3]

Table 1- Botanical classification of *Ficus religiosa (Peepal)*	
Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Urticales
Family	Moraceae
Genus	Ficus
Species	religiosa Linnaeus

Vernacular Names of Ficus religiosa

Ficus religiosa is known by various common names or vernaculars across different cultures and geographical areas (Table 2).[2,3,4]

Table 2- Vernaculars of *Ficus religiosa (Peepal)*	
Arabic	Teen mukadas, teen asnam
Hindi	Pipala, Pipal
Sanskrit	Pippala
Gujarati	Piplo, Jari, Piparo, Pipalo
English	Pipal tree
Marathi	Pipal, Pimpal, Pippal
Kashmiri	Bad
Tamil	Ashwarthan, Arasamaram, Arasan, Arasu, Arara
Bengali	Asvattha, Ashud, Ashvattha
Oriya	Aswatha
Kannada	Arlo, Ranji, Basri, Ashvatthanara, Ashwatha, Aralimara, Aralegida

Botanical Description of *Ficus religiosa*

Ficus religiosa L., commonly known as the Peepal tree or Sacred Fig, is a large, semi-deciduous or fully deciduous tree belonging to the Moraceae family. It is a widely branched tree that can grow up to 30 meters in height, with a trunk circumference reaching about 1 meter. Its trunk is typically smooth and grey when young, becoming irregular and gnarled with age. Several roots may fuse into the main trunk, and although aerial roots are uncommon, they may occasionally develop.

The tree displays wide-spreading branches, and its canopy is often dense, providing ample shade. The stem is pale yellow and supports a robust root system. Reproduction occurs through seeds, cuttings, and layering, making it relatively easy to propagate.[3,4,6]

Leaves

The leaves of *Ficus religiosa* are one of its most distinctive features. They are broad, leathery, and heart-shaped at the base with a long, tapering “tail-like” tip, commonly referred to as a "drip-tip." This adaptation helps rainwater drain quickly from the leaf surface, protecting them from fungal damage during the monsoon season.

Leaves are arranged alternately on the branches and are attached to long, flexible petioles, which allow them to flutter even in a gentle breeze. When young, the leaves emerge in shades of red or pink, gradually turning coppery before maturing to a shiny dark green. They typically measure about 12–18 cm (5–7 inches) in length and feature 5–8 pairs of

lateral veins along with a fine network of minor veins. Due to this delicate venation, peepal leaves are often used in decorative crafts such as handmade greeting cards.[1,7,8]

Bark

The bark of the Peepal tree is grey or brownish-white, occurring in flat or slightly curved pieces that are about 1.0–2.5 cm thick. The outer surface appears rough due to exfoliation, while the inner surface is smoother and brownish in color. The bark is fibrous in texture and has an astringent taste. Traditionally, it has been used in Ayurvedic medicine for its therapeutic properties.[2,8]

Flowers and Pollination

Ficus religiosa produces very small, inconspicuous red flowers that typically bloom in February. These flowers are enclosed within a structure known as a syconium (a type of inflorescence). The species relies on a specific wasp, *Blastophaga quadraticeps*, for pollination. Without this symbiotic relationship, the tree is unable to set seed naturally, a key reason why it fails to naturalize in many regions outside its native range unless the pollinator is also introduced.[8,9]

Fruits

The tree bears small, rounded fruits known as figs. These figs are approximately 12–13 mm (about ½ inch) in diameter and are borne in pairs at the leaf axils or on scars left by fallen leaves. Initially green in color, the fruits ripen during the rainy season, turning black or purple, sometimes with reddish specks. Fruiting typically occurs in May and June. The ripe figs are a food source for a variety of birds and animals, making the tree an ecologically important species.[3,4,8]

Habitat and Distribution

Ficus religiosa is indigenous to the Indian subcontinent and Southeast Asia. It grows naturally in upland and plain regions, particularly across northern and eastern India, and at elevations of up to 1650 meters (around 5000 feet) in the Himalayas. Though native to India, it is widely cultivated throughout the tropical and subtropical regions of South Asia, including Nepal, Sri Lanka, Bangladesh, and Myanmar, and has also been introduced to many warmer parts of the world, from South Africa to Florida and Hawaii.

Despite its wide cultivation, the tree generally does not become naturalized outside its native range due to its dependence on the pollinator wasp *Blastophaga quadraticeps*. One notable exception is Israel, where the wasp has been successfully introduced, allowing the tree to reproduce naturally.[10,11]

Mizaj (Temperament) of *Ficus religiosa*

According to the principles of Unani medicine, *Ficus religiosa* (Peepal tree) is considered to possess a **Mizaj** of **Hot in the second degree** and **Dry in the second degree (Har^2 Yabis^2)**.

This temperament indicates that the plant has moderate heating and drying effects on the body. Such a mizaj is beneficial in balancing **phlegmatic** (Balghami) and **melancholic** (Saudawi) temperaments and is often useful in conditions associated with excess moisture or coldness in the body.

Muzir Asraat (Adverse Effects)

As mentioned in various classical Unani texts, *Ficus religiosa* may cause certain side effects in some individuals. It is particularly harmful in individuals with cold temperament (Baarid Mizaj). The most commonly reported adverse effects include.[12,13,14,15]

- **Headache** (especially in cold-temperament individuals)

Musleh (Correctives)

To counteract the adverse effects of *Ficus religiosa*, the following substances are recommended as **Musleh** (correctives).[12,14,15]

- Sandal (*Santalum album*)
- Rose (*Rosa damascena*)
- Samagh-e-Arabi (*Acacia arabica* gum)
- Filfil Siyah (Black pepper – *Piper nigrum*)

These agents help balance the dryness and heating effects, and reduce potential harm to cold-tempered individuals.

Badal (Substitutes)

In the absence of *Ficus religiosa*, the following substitutes (**Badal**) can be used, which share similar pharmacological actions.[12,13,14,15]

- Filfil Safed (White pepper)
- Zanjabeel (Ginger – *Zingiber officinale*)
- Zaranbaad (*Curcuma zedoaria*)
- Chaal-e-Babool (Bark of *Acacia arabica*)

Phytochemical Constituents of *Ficus religiosa* Plant Parts [2,4,16]

1. Bark

The bark of *F. religiosa* is one of the most chemically diverse parts of the tree. Studies have identified numerous compounds such as:

- **Phytosterols**: Lanosterol, β-sitosteryl-D-glucoside, bergapten, bergaptol, stigmasterol
- **Flavonoids**: Quercetin is the most abundant
- **Triterpenoids**: Lupeol, lupeol acetate, α-amyrin acetate
- **Others**: Leucoanthocyanidins, leucoanthocyanins, ceryl behenate, wax, and saponins

The bark contains about **8.7% total tannins**, and also comprises acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent lignin (ADL), and other phenolic components.

2. Leaves

The leaves of *F. religiosa* yield a variety of phytochemicals, including:

- **Sterols**: Campestrol, stigmasterol, isofucosterol
- **Triterpenes**: α-amyrin, lupeol
- **Tannins**: Tannic acid
- **Amino Acids**: Arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tyrosine, methionine, valine, isoleucine, leucine
- **Hydrocarbons and Alcohols**: Nonacosane, n-hentricontane, hexa-cosanol, n-octacosan

These constituents are believed to contribute to the leaf's antioxidant, anti-inflammatory, and antimicrobial properties.

3. Fruits

The fruits, or figs, of *F. religiosa* contain notable levels of:

- **Amino Acids**: Asparagine and tyrosine
- **Flavonoids**: Kaempferol, quercetin, and myricetin
- **Phenolic Compounds**: Which contribute to antioxidant activity

These compounds play a role in the plant's anti-diabetic, cardioprotective, and anti-aging potentials.

4. Seeds

Seeds of the tree also exhibit phytochemical richness, including:

- **Phytosterols**: Phytosterolin, β-sitosterol and its glycoside
- **Other Components**: Albuminoids, carbohydrates, fatty matter, coloring substances, and 0.7–5.1% caoutchouc (a form of natural rubber)

The seed constituents are considered helpful in various traditional remedies.

Traditional Uses

The traditional uses of various parts of *Ficus religiosa* (Peepal) are summarized in Table 3[4]

Table 3- Traditional uses of various parts of *Ficus religiosa* (Peepal)

Plant parts	Traditional uses (as/in)
Bark	Diarrhoea, dysentery, anti-inflammatory, antibacterial, cooling, astringent, gonorrhoea, burns
Leaves	Hiccups, vomiting, cooling, gonorrhoea
Shoots	Purgative, wounds, skin disease
Leaf juice	Asthma, cough, diarrhoea, gastric problems
Dried fruit	Fever, tuberculosis, paralysis
Seeds	Refrigerant, laxative
Fruit	Asthma, digestive

Therapeutic Relevance

Due to its vast range of phytochemicals, *Ficus religiosa* is regarded as a valuable medicinal plant. Almost every part of the tree, except the wood is utilized in different traditional systems of medicine. These include applications in treating:

- Diabetes
- Skin disorders
- Respiratory ailments
- Gastrointestinal issues
- Nervous system disorders

Its natural abundance of flavonoids, alkaloids, and sterols contributes to its antioxidant, anti-inflammatory, and immunomodulatory activities, making it a promising candidate for further pharmacological investigations.

Pharmacological and Pharmacognostic Activities of *Ficus religiosa*

1. Analgesic Activity

Methanolic extracts of the *F. religiosa* stem bark were assessed for analgesic potential using the acetic acid-induced writhing model in mice. Compared to aspirin as a standard, the extract significantly decreased the number of writhes by 71.56% at 250 mg/kg and 65.93% at 500 mg/kg. These results suggest a peripheral analgesic effect, potentially mediated through the inhibition of prostaglandin pathways involved in pain perception.[17]

2. Anti-inflammatory Activity

Experimental models using Wistar rats demonstrated that the methanolic bark extract of *F. religiosa* significantly inhibited carrageenan-induced paw edema. The anti-inflammatory efficacy was found to be comparable to indomethacin, a standard non-steroidal anti-inflammatory drug. Analgesic effects were also observed in Swiss albino mice via the writhing test. Additionally, the extract displayed noteworthy lipid peroxidation inhibition in vitro, suggesting potential for managing inflammation-associated oxidative stress.[18,19]

3. Antioxidant Activity

The antioxidant potential of *F. religiosa* was explored in streptozotocin-induced diabetic rats using aqueous bark extracts. Administered at doses of 100 and 200 mg/kg, the extract resulted in a significant reduction in fasting glucose levels and a concomitant improvement in body weight. Biochemical assays indicated an increase in catalase (CAT) and glutathione peroxidase (GSH-Px) activity, along with restoration of erythrocyte superoxide dismutase (SOD) levels. These findings reflect the extract's capacity to mitigate oxidative stress by modulating key antioxidant enzymes.

In another study, the methanolic extract exhibited strong free radical scavenging activity in the DPPH assay (EC_{50} = 11.75 µg), comparable to pyrogallol. Superoxide scavenging activity was also evident (EC_{50} = 50.65 µg), and reducing power peaked at 400 µg/ml, aligning with the effects of known antioxidants like gallic acid.[17,20,21]

4. Antidiabetic Activity

The aqueous bark extract of *F. religiosa* (FRAE) was tested in both glucose-loaded normoglycemic rats and streptozotocin-induced diabetic models. Doses of 50 and 100 mg/kg were more effective than 25 mg/kg in lowering blood glucose. Notably, the extract enhanced serum insulin levels, increased hepatic and muscular glycogen content, and improved body weight. It also contributed to a reduction in serum triglycerides and total cholesterol, while displaying protective effects against pancreatic lipid peroxidation.[22,23]

5. Anticonvulsant Activity

The anticonvulsant effect of *F. religiosa* was studied using fig extracts in models of maximal electroshock (MES), picrotoxin, and pentylenetetrazol (PTZ)-induced seizures. The extract significantly reduced seizure duration in MES and delayed the onset of convulsions in the picrotoxin model. Notably, it was ineffective in PTZ-induced seizures. High-performance liquid chromatography (HPLC) confirmed the presence of serotonin in the figs, and pre-treatment with cyproheptadine—a serotonin antagonist—diminished the extract’s effects. These results support the hypothesis that serotonin modulation may underlie the anticonvulsant action of *F. religiosa*.[23]

6. Antimicrobial Activity

The antimicrobial efficacy of *Ficus religiosa* has been demonstrated against various pathogens. Ethanolic leaf extracts showed inhibitory effects on bacterial strains such as *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, though the antifungal activity against *Candida albicans* and *Aspergillus niger* was relatively mild. Bark extracts, especially methanolic ones, exhibited inhibitory zones of 8.00–14.00 mm against *E. coli* in disc diffusion assays, indicating moderate antibacterial potency.

Further investigations comparing 22 medicinal plants from India found that *F. religiosa* exhibited intermediate antibacterial action and minimal antifungal response. Aqueous-ethanol extract (70%) demonstrated complete inhibition

of *Helicobacter pylori* at a concentration of 500 µg/ml, with a minimum bactericidal concentration (MBC) ranging from 125–250 µg/ml. Chloroform extracts were active against enteric pathogens like *Salmonella typhi*, *S. typhimurium*, and *Proteus vulgaris*, displaying low MIC values between 5–39 µg/ml.[4,24,25]

7. Immunomodulatory Activity

The immunomodulatory activity of the alcoholic extract of *F. religiosa* bark was studied in mice using various hematological and serological parameters. The extract significantly enhanced both cellular and humoral immune responses, demonstrating strong immunostimulant potential.[26]

8. Wound Healing Activity

In excision and incision wound models, *F. religiosa* leaf extract ointment (10%) accelerated wound contraction, enhanced epithelialization, and increased skin-breaking strength in rats. Tannins in the extract likely enhanced collagen content, promoting wound healing.[27]

9. Anti-amnesic Activity

The methanolic extract derived from *Ficus religiosa* figs demonstrated notable memory-enhancing effects in murine models of scopolamine-induced amnesia, including the elevated plus maze (EPM) and modified passive avoidance (MPA) tasks. These effects were observed in a dose-dependent manner. The involvement of serotonergic pathways was confirmed, as the co-administration of cyproheptadine, a serotonin receptor antagonist attenuated the cognitive improvement. Piracetam was used as a standard.[28]

10. Anti-acetylcholinesterase Activity

Methanolic stem bark extract inhibited acetylcholinesterase (ID50 = 73.69 µg/ml), suggesting potential in Alzheimer's disease therapy by increasing acetylcholine levels in the brain.[29]

12. Anti-ulcer Activity

Ethanol extract of stem bark showed anti-ulcer activity in models of indomethacin and cold-restraint stress-induced ulcers and pylorus ligation. Doses of 100–400 mg/kg significantly reduced ulcer index, gastric volume, acidity, and increased gastric pH, supporting its use in gastrointestinal disorders.[24,26]

13. Bronchospasm Activity

Methanolic extract of *F. religiosa* fruits did not delay histamine-induced bronchospasm in guinea pigs but potentiated the effects of histamine and acetylcholine in isolated tracheal and ileum preparations. This suggests bronchodilator activity via peripheral mechanisms, though not via direct antihistaminic effect.[30]

CONCLUSION

Ficus religiosa, a sacred and medicinally important tree in traditional systems of medicine, has demonstrated a broad spectrum of pharmacological properties. Modern scientific investigations validate many of its traditional uses, revealing its potent antidiabetic, antioxidant, anti-inflammatory, antimicrobial, wound healing, immunomodulatory, and neuroprotective activities. The presence of diverse phytochemicals such as flavonoids, tannins, alkaloids, and saponins contributes to its diverse therapeutic effects.

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