Ficus Religiosa-Where Spirituality Meets Science: A Review of Phytochemistry and Medicinal Uses

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***Abstract*—*Ficus religiosa* (Aswattha/Peepal), a sacred fig of the family Moraceae, holds deep spiritual, cultural, and medicinal importance across South Asia. Revered in Hinduism, Buddhism, Jainism, and Sikhism, it is honored as the Bodhi tree symbolizing enlightenment, wisdom, and spiritual transformation. Medicinally, *F. religiosa* is widely used in Ayurveda, with all parts of the plant-leaves, bark, roots, fruits, seeds, and latex-traditionally employed to treat respiratory, cardiac, digestive, skin, metabolic, and reproductive disorders. Phytochemical studies reveal bioactive compounds including phenols, flavonoids, tannins, alkaloids, terpenoids, saponins, glycosides, steroids, phytosterols, and essential oils, supporting its antioxidant, antidiabetic, anti-inflammatory, antimicrobial, hepatoprotective, and wound-healing properties. Key constituents include *β*-sitosteryl-D-glucoside in root bark and flavonols such as quercetin and kaempferol in fruits. Integrating religious and phytomedicinal perspectives, this paper highlights its religious significance, rituals, and cultural reverence.**

***Index Terms*—Phytochemical, Ayurveda, Phytomedicinal Perspectives, Anti-inflammatory, Antimicrobial**

I. INTRODUCTION

The genus *Ficus* (family: Moraceae) represents one of the most diverse and widespread groups of flowering plants, comprising more than 800 species of trees, shrubs, epiphytes, climbers, stranglers, and lithophytes distributed throughout the tropical and subtropical regions of the world [1-2]. The Asian-Australasian region harbours the richest diversity with nearly 500 species, whereas Africa and the Neotropics support approximately 110 and 130 species, respectively. Nearly half of all *Ficus* species are monoecious, while the remainder are functionally dioecious. A defining characteristic of the genus is the unique inflorescence known as the syconium (fig), which hosts an obligate mutualistic relationship with pollinating fig-wasps (family: Agaonidae), making *Ficus* a classic model for co-evolutionary studies [3-9].

Among the species of this genus, *Ficus religiosa* L., commonly known as the Sacred Fig or Peepal/Bodhi tree, holds exceptional cultural, spiritual, and medicinal significance. Native to the Indian sub-Himalayan plains, Bengal, and central India, it has been widely cultivated across Asia and other tropical regions. The species often begins its life epiphytically on a host tree, eventually sending down aerial roots that envelop and sometimes strangle the host, enabling it to grow independently. It thrives up to 1500 m altitude, tolerates extreme temperatures (below 0°C to above 40°C), and grows in regions receiving 50-500 cm annual rainfall [10-11]. The epithet *"religiosa"* reflects the sacred status of this tree in South Asian traditions. It is revered in Hinduism, Buddhism, and Jainism, and is believed to be the very tree under which Prince Siddhartha attained enlightenment, becoming Gautama Buddha-hence the name "Bodhi Tree." *F. religiosa* is prominently mentioned in ancient Indian scriptures including the Vedas, Upanishads, Puranas, Ramayana, Mahabharata, and Arthashastra, Bhagavad Gita, and Buddhist texts, highlighting its mythological and medicinal relevance since antiquity.

Traditional systems of medicine, such as Ayurveda, Siddha, and Unani, recognize *F. religiosa* as potent Rasayana plant-rejuvenative herbs that enhance physical and mental health by modulating the nervous, endocrine, and immune systems. Almost all parts of the tree-leaves, bark, roots, fruits, and latex-are utilized in indigenous medicine. Folk healers and Ayurvedic practitioners recommend it for disorders of the central nervous system (e.g., epilepsy, anxiety, migraine), endocrine system (e.g., diabetes), gastrointestinal ailments (e.g., ulcers, constipation,

liver disorders), reproductive problems, respiratory conditions (e.g., asthma, cough), and various infections including skin diseases, leprosy, gonorrhea, tuberculosis, chickenpox, and scabies.

The therapeutic potential of *F. religiosa* is strongly associated with its rich phytochemical profile. The bark is abundant in tannins, saponins, and flavonoids; leaves contain flavonoids, terpenoids, and phenolics; while fruits provide proteins and minerals. These phytoconstituents contribute to its antidiabetic, antimicrobial, anti-inflammatory, analgesic, acetylcholinesterase-inhibitory, and wound-healing activities. With increasing global interest in plant-based healthcare and the shift from synthetic to natural remedies-often described as a "Return to Nature"-*F. religiosa* continues to gain prominence as a multi-functional medicinal plant [12]. Given its widespread traditional uses and emerging scientific validation, this review attempts to consolidate comprehensive information on the ethnomedicinal relevance, phytochemistry, and pharmacological properties of *Ficus religiosa*, providing a holistic understanding of its therapeutic potential [13-14].

II. RELIGIOUS AND CULTURAL SIGNIFICANCE OF *FICUS RELIGIOSA*

Ficus religiosa, commonly known as the Peepal or Bodhi tree, holds profound religious, spiritual, and cultural importance across South Asia. It is revered in Hinduism, Buddhism, Jainism, and various indigenous traditions, symbolizing life, knowledge, enlightenment, and divine presence [15-17].

IN HINDUISM

In Hindu belief, the Peepal tree is considered a sacred embodiment of the Trimurti-the roots represent Brahma (the Creator), the trunk symbolizes Vishnu (the Preserver), and the leaves signify Shiva (the Destroyer). It is often worshipped as the physical form of Lord Vishnu, particularly on Saturdays and Ekadashi. Women circumambulate the tree, tying threads around its trunk while praying for fertility, longevity of family members, and the removal of obstacles.

The Atharvaveda describes the Ashvattha (Peepal) as a celestial tree linked to the heavens. Its sacred status is further seen in the Bhagavad Gita, where Lord Krishna declares:

"Among trees, I am the Ashvattha."

This highlights its divine representation and spiritually uplifting nature. The tree is frequently planted near temples, ghats, and sacred sites, believed to purify the environment and radiate positive energy.

IN BUDDHISM

Ficus religiosa holds the highest spiritual reverence in Buddhism as the Bodhi Tree. It is under this tree at Bodh Gaya that Prince Siddhartha meditated and attained Bodhi (enlightenment), becoming Gautama Buddha. Since then, the Bodhi tree has become a universal symbol of wisdom, liberation, and inner awakening.

A direct descendant of the original Bodhi tree, known as the Sri Maha Bodhi, was planted in Anuradhapura, Sri Lanka in 288 BCE and is considered the oldest human-planted tree with a recorded history. Pilgrims visit Bodhi trees worldwide, believing that prayers and meditations under its canopy bring clarity, peace, and spiritual growth.

IN JAINISM

In Jain tradition, the Peepal tree is equally revered. It is believed that Tirthankara Swami Neminath attained Kevala Jnana (supreme knowledge) under a Peepal tree. Jain scriptures describe the Ashvattha as one of the "Kalpavrikshas"-a wishes-fulfilling divine tree symbolizing spiritual prosperity, virtuous living, and liberation from the cycle of rebirth.

FOLK, TRIBAL, AND CULTURAL BELIEFS

- ✓ Beyond formal religions, the Peepal tree is deeply rooted in folk culture and indigenous traditions:
- ✓ It is regarded as a dwelling place of spirits, ancestors, and deities, often worshipped to appease protective forces.
- ✓ Lighting a lamp beneath the Peepal tree is believed to remove negativity and bring blessings, while cutting the tree is considered inauspicious.
- ✓ In rural and tribal communities, the tree functions as a community gathering point, where social meetings, panchayats, and rituals are held under its shade, symbolizing unity and wisdom.

III. BOTANICAL DESCRIPTION OF *FICUS RELIGIOSA*

Ficus religiosa is a large, semi-evergreen to deciduous tree that can attain a height of 25-35 m, and in some cases up to 30 m or more, with a broad, spreading crown. Young plants often begin as epiphytes. The trunk is generally straight, sometimes with low buttresses, and measures 1.5-2m in diameter when mature. Branches are pendulous, giving the tree a characteristic graceful appearance, and a few adventitious roots may develop [10-11].

The leaves are alternate, spirally arranged, leathery, and glossy dark green. Each leaf is 10-18 × 7.5-10cm, broadly ovate to cordate with a distinct elongated, tapering tip (linear-lanceolate) that extends almost half the length of the blade. The base is broadly cuneate to heart-shaped, with entire or slightly undulating margins. Secondary veins are 5-7 on either side of the midrib with finely reticulate venation. Young leaves appear pinkish. Petioles are slender, 7.5-10 cm long, and stipules are minute, ovate and acute.

The bark is smooth, grey to ash-coloured externally, exfoliating in irregular, rounded flakes. Beneath, the middle bark appears light brown to reddish brown, while the inner bark is yellowish to orange-brown with granular texture. It is odourless and characteristically astringent.

The figs are axillary on leafy branchlets, solitary or in pairs, globose to depressed-globose, 1-1.5cm in diameter, smooth, and turn red to purple on ripening. Each fig is supported on a short peduncle (4-5mm) with ovate involucral bracts. Male, gall (sterile female), and fertile female flowers are enclosed within the same syconium. *F. religiosa* is pollinated by a species-specific wasp, *Blastophaga quadraticeps* [18]. The male flowers are few, located near the ostiole, sessile, with a 2-3 lobed calyx and a single stamen. Gall flowers are pedicellate, with a 3-4 lobed calyx, globose ovary, short style and 2-lobed enlarged stigma. Female flowers are sessile, with a 4-lobed calyx, globose ovary, slender style and narrow stigma [19-20].

The species epithet *"religiosa"* denotes its sacred and cultural significance. The tree is traditionally believed to be the one under which Prince Siddhartha attained enlightenment, hence revered as the Bodhi tree.

IV. PHYTOCHEMISTRY

Phytochemical investigations on *Ficus religiosa* have revealed a rich diversity of bioactive compounds distributed across its various plant parts. Studies show that the tree contains phytosterols, amino acids, furanocoumarins, phenolic constituents, hydrocarbons, aliphatic alcohols, volatile compounds, and several other classes of secondary metabolites. Among these, phenolic compounds-particularly tannins and flavonoids-along with amino acids, are widely present throughout almost all parts of the plant. To date, reports indicate that its roots primarily contain polyphenolic substances [21-22].

Extensive extraction studies using different solvents have further clarified the phytochemical profile of *F. religiosa*. Petroleum ether and alcohol-based extracts from the bark yield important phytosterols such as lanosterol, β-sitosterol, β-sitosteryl-D-glucoside, and stigmasterol. Benzene extracts have been shown to contain substituted furanocoumarins, including bergapten (4-methoxy-7H-furo [3,2-g] chromen-7-one) and bergaptol (4-hydroxy-7H-furo[3,2-g] chromen-7-one). The bark also contains approximately 8.7% tannins [23-24]. Other notable constituents isolated from the bark using petroleum ether include vitamin K, methyl oleonate, lupen-3-one, and n-octacosanol, while alcoholic extraction yields inositol. Additionally, the inner bark is reported to contain acid detergent fibre, neutral detergent fibre, saponins, and acid detergent lignin, further contributing to its phenolic and structural composition [27-28].

MEDICINAL USES

Ficus religiosa has been shown to exhibit many pharmacological activities through its different plant parts. Some of these effects are summarized below [18,29-32].

ANTIBACTERIAL ACTIVITY

Leaves of *Ficus religiosa* possess strong antibacterial potential. Aqueous extracts inhibit several pathogenic bacteria, including *Salmonella typhi*, *S. typhimurium*, *Shigella dysenteriae*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis*, and *Staphylococcus aureus*. Chloroform extracts of the plant's fruit also suppress the growth of organisms such as *Azotobacter chroococcum*, *Bacillus cereus*, *Streptococcus faecalis*,

Bacillus megaterium, *Klebsiella pneumoniae*, and *Streptococcus lactis*. Furthermore, ethanolic leaf extracts demonstrate antifungal activity against *Candida albicans* [33].

ANTHELMINTIC ACTIVITY

Methanolic bark extracts have shown the ability to damage *Haemonchus contortus* worms, indicating strong anthelmintic effects. Studies conducted in vivo also reveal that bark extracts-and even steam-treated extracts-can effectively harm *Ascaridia galli*, a common parasitic worm [34-35].

ANTIASTHMATIC ACTIVITY

Research dating back to 1960 indicates that alcoholic bark extracts of *F. religiosa* help prevent asthma-related bronchospasms. When administered at doses between 300-400 mg/kg intraperitoneally or 75 mg/kg intravenously, the extract prevented aerosol-induced spasms in guinea pigs. In models involving acetylcholine and histamine, acetylcholine-induced symptoms were more effectively suppressed. Traditionally, a preparation using the inner bark mixed with rice pudding (milk, sugar, rice, and cardamom) has also been used to relieve asthma symptoms [36].

ANALGESIC AND ANTI-INFLAMMATORY ACTIVITIES

Alcoholic extracts of the bark and stem show significant anti-inflammatory and pain-relieving properties. In carrageenan-induced paw edema tests, the extract reduced swelling, and at 250 mg/kg, its effectiveness was comparable to standard drugs like indomethacin (5 mg/kg) and aspirin (100 mg/kg). Aqueous bark extracts also exhibit anti-inflammatory effects in both acute and chronic experimental models [37-38].

ANTIOXIDANT ACTIVITY

Extracts from the fruit and bark demonstrate strong antioxidant activity in multiple solvent systems, verified through DPPH radical-scavenging assays and oil-stability tests. In type 2 diabetic rat models, aqueous extracts lowered oxidative stress and partially prevented diabetes-related weight loss by improving metabolic function and decreasing fatty acid oxidation. Alcoholic extracts have also shown neurotrophic and anticholinesterase effects [39].

ANTICONVULSANT ACTIVITY

Leaf extracts administered prior to pentylenetetrazol exposure provided 80-100% protection against seizures. However, because the data is limited, the full anticonvulsant potential of the leaf remains uncertain. Although the fruit contains serotonin, which can influence seizure activity, fruit extracts did not show anticonvulsant effects in tested animal models [40].

HYPOLIPIDEMIC ACTIVITY

The plant contains dietary fibres-such as cellulose, lignin, and hemicellulose-that help regulate lipid levels. When included as 10% of the diet in experimental animals, these fibres improved resistance to hyperlipidemia. Hemicellulose was particularly effective in lowering serum and liver cholesterol while increasing the excretion of bile acids. Overall, total cholesterol, phospholipids, triglycerides, and lipids were positively influenced by these fibres [41-42].

IMMUNOMODULATORY ACTIVITY

Alcoholic bark extracts show potential to enhance immune function. In mice sensitized with sheep red blood cells, the extract promoted both humoral and cell-mediated immune responses. A dose of 100 mg/kg exhibited activity comparable to vitamin E (150 mg/kg). More extensive preclinical and clinical research is required to validate these findings [43].

NOOTROPIC EFFECT

Because *F. religiosa* fruits contain high levels of serotonin-a neurotransmitter involved in learning and memory-the plant has been explored for its nootropic effects. Preliminary studies show potential for improving memory or preventing cognitive decline, but detailed investigations are still needed [44-45].

PARASYMPATHETIC MODULATORY EFFECTS

The alcoholic extract of the bark displays parasympatholytic properties. In isolated tissue studies, the extract reduced contractions in rat and guinea pig ileum and rabbit uterus. In vivo experiments showed that doses of 25 mg/kg reduced arterial pressure, while 35-75 mg/kg blocked cardio-inhibitory responses in dogs. The extract's ability to inhibit acetylcholinesterase provides further evidence of its parasympathetic regulatory effects [46-47].

WOUND-HEALING ACTIVITY

Leaf extracts incorporated into ointments at 5% and 10% concentrations accelerated healing in excision, incision, and burn wound models. Hydroalcoholic leaf extracts containing tannins and glycosides also enhanced tissue repair in animal studies. Combined herbal formulations containing *F. religiosa* with *Curcuma longa*, *Tamarindus indica*, and *Ageratum conyzoides* exhibited strong wound-healing activity. The plant's antimicrobial properties help counteract factors such as infection, hypoxia, and edema, which typically delay healing. More research is needed to clarify the detailed mechanism of wound repair.[48]

V. CONCLUSION

Ficus religiosa emerges as a remarkable species that bridges ancient spiritual beliefs with modern scientific relevance. Rooted deeply in the cultural and religious traditions of South Asia, the tree continues to hold symbolic and spiritual significance while simultaneously demonstrating substantial medicinal value. Its diverse phytochemical composition forms the basis of a wide array of pharmacological activities validated through traditional practices and contemporary research. The documented antibacterial, antidiabetic, anti-inflammatory, antioxidant, immunomodulatory, and other therapeutic properties confirm its potential as a versatile medicinal resource. Despite extensive traditional use, several pharmacological actions require deeper mechanistic studies, standardized formulations, and clinical validation to fully harness its therapeutic benefits. Overall, *F. religiosa* stands as a promising candidate for novel drug discovery and integrative healthcare, reinforcing the continued importance of ethnobotanical knowledge in advancing plant-based medicine.

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