

**REVIEW ARTICLE**

**A PHARMACOGNOSTICAL AND PHARMACOLOGICAL REVIEW OF *Ficus bengalensis***

**Sugandha G. Chaudhari<sup>\*1</sup>, Preetesh A. Mishra<sup>2</sup>, Aditya Adam<sup>2</sup>, Harsha Chaudhari<sup>2</sup>,  
Jigar Desai<sup>2</sup>, Pallavi Duvvuri<sup>2</sup> and Archana Shendkar<sup>2</sup>**

<sup>1</sup>*Assistant Professor; Department of Pharmacology, Dr.L.H. Hiranandani College of Pharmacy,  
Ulhasnagar, India.*

<sup>2</sup>*Student; Department of Pharmacology, Dr.L.H. Hiranandani College of Pharmacy,  
Ulhasnagar, India.*

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**ABSTRACT**

*Since ancient times, plants have been an ever dependent source of medicine. Ayurveda and other Indian literature have mentioned the use of plants in the treatment of various human disorders. Ficus bengalensis Linn is a large evergreen tree found throughout various forests in India. It is a well known and popular plant in the indigenous systems of medicine like Ayurveda, Siddha, Unani and Homeopathy. Traditional system of medicine has used different parts of this plant such as stem bark, roots, aerial roots, vegetative buds, leaves, fruits and latex are used in prevention and treatment of different disorders. The aqueous or alcoholic extract of various parts of this plant were found to have activities such as, antidiabetic, hypolipidemic, anthelmintic, antibacterial, immunomodulatory, antistress and antiallergic, antioxidant, anti-inflammatory, antidiarrhoeal, analgesic and antipyretic, antiatherogenic, wound healing and growth promoting. The present review is therefore, an effort to give a detailed survey of the literature on its pharmacognosy, phytochemistry, traditional and pharmacological uses.*

**Keywords:** *Ficus bengalensis, Banyan, Vada, Pharmacognosy, Phytochemistry, Traditional medicine, Pharmacology.*

**I. INTRODUCTION**

Plants have been playing the role of major source of drugs in Indian as well as other ancient systems of medicine in the world. Earliest descriptions of curative and preventive properties of medicinal plants found in Rig-Veda, Charaka Samhita and Sushruta Samhita give extensive details on various medicinal herbs. India having an ancient heritage of traditional medicine, by the means of materia medica, provides a great deal of information on the traditional aspects of therapeutically important natural products obtained from herbs. Indian traditional medicines have their roots well spread in various systems of medicines including Ayurveda, Siddha, Unani and Homeopathy. The herbal drugs are primarily evaluated on the basis of their phytochemical, and pharmacological aspects. Various techniques used to do the same include various instrumental techniques such as chromatography, microscopy and others. With the ever increasing worldwide interest in adopting and studying traditional systems, and exploiting their potential based on different health care systems, proper scientific evaluation of the rich heritage of traditional medicine in India has become very essential [1]. *Ficus bengalensis* (FB) (Moraceae) one of the most frequently seen plant in India, is commonly known as Banyan tree or Vata or Vada tree in Ayurveda. There are more than 800 species and 2000 varieties of *Ficus* species, most of which are native to the old world tropics [2]. It is endemic to Bangladesh, India and Sri Lanka. It is also known as Bengal fig, Indian fig and East Indian fig, Indian Banyan or simply Banyan (English), borh, nyagrodha (Sanskrit), Bat, Bargad and Bar (Hindi). The English name 'Banyan' is given by the Britishers to this tree because under this very tree Banias that is, the Hindu merchants used to assemble for their business. The triad Ganges, the Himalayas and the Banyan tree symbolizes the image of India. Hence, it is considered as the National tree of India. *Ficus* means fig and *bengalensis* means belonging to or is of Bengal [3]. It is a member of four sacred trees *Nalpamara* (*Ksirivrkas*) meant to be planted around the home and temples [4].

**Corresponding author: Sugandha G. Chaudhari<sup>\*1</sup>**

<sup>1</sup>*Assistant Professor; Department of Pharmacology, Dr. L. H. Hiranandani College of Pharmacy,  
Ulhasnagar. E-mail: [chaudharisg@gmail.com](mailto:chaudharisg@gmail.com)*

## II. TAXONOMIC CLASSIFICATION:

**Table 1:** Taxonomic classification of *F. Bengalensis* [5].

KINGDOM	PLANTAE
Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Hamamelidae
Order	Urticales
Family	Moraceae
Genus	Ficus
Species	<i>F. Bengalensis</i>

## III. HABITAT:

The plant is a large evergreen tree distributed all over India from sub Himalayan region to the deciduous forest of Deccan and south India. It is also grown in gardens and road sides for shades. It is found throughout India [6].

## IV. PHARMACOGNOSTICAL CHARACTERISTICS:

### Macroscopical

It is a very large tree upto 30 m in height, found throughout the year. It grows in an evergreen environment, except in dry localities where it is a leafless for a short time. It is hardy and drought-resistant; withstands mild frost. It is epiphytic when young. It develops from the seeds dropped by birds on old walls or on the other trees and is therefore, considered destructive to forest trees, walls and buildings [5-9]. It has widely spread branches having many aerial roots functioning as prop roots. The bark gives greenish white appearance, leaves are simple, alternate, often in clusters at the ends of the branches, stipulate, 10 to 20 cm long in length and 5 to 12.5 cm broad. Leaves are broadly elliptic to ovate in shape, entire, and are strongly 3 to 7 ribbed from the base. The fruit recacles are axillary, sessile, occurring in pairs, globose in shape, brick red in colour when ripe, and enclose male, female and gall flowers; fruits are small, enclosed in the common fleshy receptacles [6].



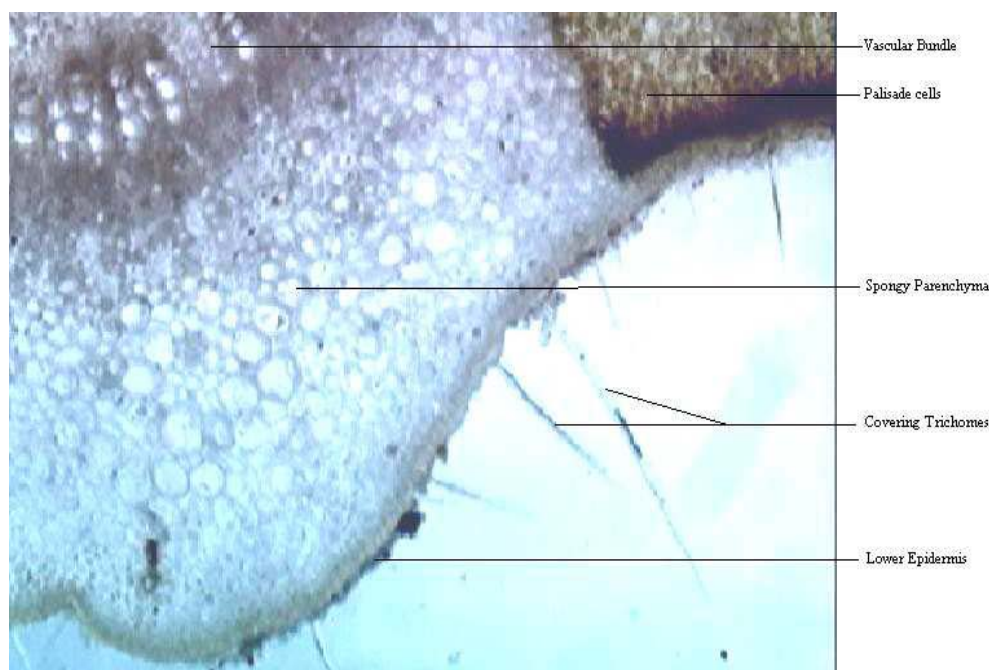
**Fig. 1:** *Ficus bengalensis* leaves and fruits.



**Fig. 2:** Bark of *Ficus bengalensis*.

### Microscopical

A transverse section of bark of *Ficus bengalensis* when studied reveals the outermost zone viz. the cork tissue composed of three to six rows of thick-walled rectangular cells nearly twice as long as broad. The cortex is fairly wide and composed of several rows of cells. A wide continuous band of sclereids appears at the periphery of the cortex. The stone cells are mostly oblong to rectangular, spherical or polygonal and have thick, pitted walls. In addition to this band of mechanical tissue, the cortex contained several, scattered, one to few celled groups of stone cells. The cortical parenchyma cells were thin-walled and more or less cubical to oblong. Many of them are loaded with compound starch grains, while others contain calcium oxalate crystals or tannin. The inner bark was found to be thin and consisted of radial segments of phloem alternating with two to five seriate medullary rays. The wood is composed of vessels, wood fibers, wood parenchyma and medullary rays. The wood parenchyma and medullary ray cells are pitted in the wood region, while vessels occur singly or in groups of two or three [10, 11].



**Fig. 3:** Transverse Section of Leaf of *Ficus bengalensis*.

### Powder

*Ficus bengalensis* Linn is a pale green, fine, odourless powder having a slightly bitter taste. The powder microscopy revealed the presence of trichomes, epidermal cells exhibiting anticlinal walls, calcium oxalate crystals, and spiral thickenings. The various qualitative chemical tests of powder, and ethanol extract indicates the presence of sterols, flavonoids, phenols, tannins, and saponins in large amounts. The leaf extract of *Ficus bengalensis* showed total absence of aromatic acids, carbohydrates, triterpenoids, gums, mucilage, and volatile oils [12].

### Physical constants

Foreign matter about 3, total ash 11.63% w/w, acid insoluble ash 4.5% w/w, alcohol soluble extract 4.8% w/w and water soluble ash 7.56% w/w [12].

## V. TRADITIONAL USES

According to Ayurveda, *Ficus bengalensis* is astringent to bowels; useful in the treatment of ulcers, vomiting, vaginal complaints, fever, different kinds of inflammations, and leprosy. According to Unani system of medicine, the latex of this plant is aphrodisiac, tonic, vulnerary, and a maturant. The latex also lessens the inflammations, hence useful in piles, nose-diseases, gonorrhea, etc. The aerial root is found to be useful in syphilis, biliousness, dysentery, and in treating the inflammation of liver, etc [13]. Milky juice is used for targeting pains, rheumatism, lumbago and bruises. For the treatment of spermatorrhea, 2 drops of fresh latex in a lump of sugar are taken once daily on empty stomach early in the morning. Seeds are cooling and tonic in nature [14]. The leaf-buds of *Ficus bengalensis* are astringent in nature. Infusion of leaves is given in diarrhoea and dysentery, poultice of hot leaves is applied on abscesses. The bark is astringent and tonic and used in diabetes and leucorrhoea, lumbago, sores, ulcers pains and bruises [15]. Some important Ayurvedic marketed formulations formulated from *Ficus bengalensis* are Nyagrodhaadi churnam (Bhaishajya Rutnavali), Saarivaadya Chandanaasava, Dineshavalayaadi Taila (Sahasrayoga) [16].

## VI. PHYTOCHEMICAL CONSTITUTION

Phytochemical investigation of *F. bengalensis* led to the exploration of a wide variety of constituents which are responsible for its wide range of pharmacological activities. They include ketones, flavonoids, flavonols, sterols, pentacyclic triterpenes and triterpenoids, furocoumarin, tiglic acid ester and some other esters.

### - Ketones

Three ketones 20-tetratriacontene-2-one, 6- heptatriacontene-10-one, pentatriacontan-5-one were isolated from stem bark of *F. Bengalensis* [16].

### - Flavonols and flavonoids

Leaves of *F. bengalensis* contain Flavonols, responsible for the antioxidant effects of the plant. These flavonols include quercetin-3-galactoside and rutin. Stem bark of *F. bengalensis* also contains bengalenosides that is, glycosides or flavonoids, 5, 7 Dimethyl ether of Leucoperalgonidin-3-O- $\alpha$ -L-rhamnoside and 5, 3 dimethyl ether of leucocyanidin 3-O- $\beta$ -Dgalactosyl cellobioside, and 5, 7, 3 trimethoxy leucodelphinidin 3-O- $\alpha$ -L-Rhamnoside. All these flavonoids consist of various sugars attached with OH groups of Leucoperalgonidin, Leucodelphinidin and Leucocyanidin [16].

### - Terpenoids

Pentacyclic triterpenes and triterpenoids for example, friedelin, 3-friedelanol, beta sitosterol, 20-traxasten-3-ol, Lupeol or Betulinic acid and  $\beta$ -amyrin are present in the leaves of *F. Bengalensis* [16].

### - Coumarins

Coumarins (furocoumarins) have been identified from *F. bengalensis* Psoralen (also called psoralene) is a parent compound in the family of natural products which are known as *furocoumarins*. It is structurally related to coumarin by the addition of a fused furan ring, and can also be considered as a derivative of umbelliferone. Psoralen occurs naturally in the seeds of *F. bengalensis*. It has photosensitizing activity. Bergapten (5-methoxypsoralen) is a psoralen that was also explored from *F. Bengalensis*.

### - Esters

The tiglic acid ester of  $\psi$ -traxasterol has been isolated from the heartwood of *F. bengalensis*. Recently three new esters were isolated and characterized from methanolic extract of the bark of *F. bengalensis* along with linolyl glucoside and oleyl glucoside. These esters are Keto-n-cosanyl stearate, Hydroxypentacosanyl palmitate and Phenyl tetradecanyl oleate (Mohammad et al., 2010). CH<sub>3</sub>-(CH<sub>2</sub>)<sub>16</sub>-CO-O-CH<sub>2</sub>-(CH<sub>2</sub>)<sub>14</sub>-CO-(CH<sub>2</sub>)<sub>3</sub>-CH<sub>3</sub>, Keto- cosanyl stearate, CH<sub>3</sub>-(CH<sub>2</sub>)<sub>14</sub>-CO-O-CH<sub>2</sub> (CH<sub>2</sub>)<sub>17</sub>-CH-(OH)-(CH<sub>2</sub>)<sub>5</sub>-CH<sub>3</sub>, Hydroxypentacosanyl palmitate, CH<sub>3</sub>-(CH<sub>2</sub>)<sub>7</sub>-CH=CH-(CH<sub>2</sub>)<sub>7</sub>-CO-O-CH<sub>2</sub> (CH<sub>2</sub>)<sub>13</sub>-C<sub>6</sub>H<sub>5</sub>-OH, Phenyl tetradecanyl oleate

### - Carbohydrates

A galactose specific lectin was isolated from the seeds of *F. bengalensis* (Moraceae) fruits and designated as *Ficus bengalensis* agglutinin (FBA). Purification of this lectin was done by Affinity Repulsion Chromatography (ARC) on fetuin-agarose. It was found to be a monomer of molecular mass 33 kDa. Carbohydrate-binding activity of FBA was independent of any divalent cation, hence FBA did not bind with simple saccharides. However, sugar ligands with aromatic aglycons showed pronounced binding [17].

#### - Serine protease

A serine protease was purified to homogeneity from the latex of medicinal plant *F. bengalensis* by a single step procedure using anion exchange chromatography. The enzyme, named benghalensin, has a molecular mass of 47 kDa (MALDI-TOF and sodium dodecyl sulphate polyacrylamide gel electrophoresis-~~BGE~~SDS-PAGE). This enzyme has important biological roles in the plant [18].

#### - Other constituents

The bark of *F. bengalensis* also contains certain other constituents for example, alpha-D Glucose and mesoinositol [16].

## VII. PHARMACOLOGICAL ACTIVITIES

**Table 2: PHARMACOLOGICAL PROSPECTUS OF *F. Bengalensis* [19].**

PLANT PARTS	TYPE OF EXTRACT	PHARMACOLOGICAL ACTIVITY
Fruits, bark, and aerial roots	Ethanollic extracts	Hypoglycemic activity
Bark	Water extract	Hypolipidemic activity
Roots	Methanolic, Chloroform and Petroleum extracts.	Anthelmintic activity
stem bark	milky juice (latex) of stem bark	Anti-inflammatory activity
Leaves, aerial roots, and bark	aqueous and ethanollic extracts	Antibacterial activity
Aerial roots	Aqueous extract.	Immunomodulatory activity
Bark	Aqueous, Ethanollic, Ethyl acetate, Petroleum ether, and Chloroform extracts.	Antistress and antiallergic activity
Aerial roots	Aqueous extract	Antioxidant activity
Leaves, aerial roots, and bark	Aqueous, Ethanollic, Petroleum ether, and Chloroform extracts.	Analgesic and antipyretic activity
Hanging roots	Ethanollic extract.	Antidiarrhoeal activity
Bark	Aqueous and ethanollic extracts.	Antiatherogenic activity
Bark	Aqueous extract.	Antidiabetic and ameliorative activity
Leaves	Mixture of powdered leaves and Coconut oil.	Wound healing activity
Young prop roots	Alcohol and Aqueous extracts.	Growth promoting activity

## VIII. CONCLUSION

This review article reintroduced the National tree of India and dealt with phytochemical constitution, and pharmacological prospectus of *Ficus bengalensis* (Moraceae), a medicinal plant found throughout India. This plant has a great medicinal value as it has been reported to have versatile phytochemical constituents including ketones, flavonols, and flavonoids, terpenoids, coumarins, esters, carbohydrates, serine protease. It has important pharmacological activities such as antidiabetic, hypolipidemic, anthelmintic, antibacterial, immunomodulatory, antistress and antiallergic, antioxidant, anti-inflammatory, antidiarrhoeal, analgesic and antipyretic, antiatherogenic, wound healing and growth promoting. Thus, the plant can be considered as a great herbal asset for human beings.

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