

**FICUS BENGALENSIS LINN.-AN OVERVIEW****VIKAS V. PATIL* AND VIJAY R. PATIL**

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ABSTRACT

Since ancient times, plants have been an exemplary source of medicine. Ayurveda and other Indian literature mention the use of plants in treatment of various human ailments. *Ficus bengalensis* Linn is a large evergreen tree found throughout forest tracts of India. It is popular indigenous system of medicine like Ayurveda, Siddha, Unani and Homeopathy. In traditional system of medicine various plant parts such as stem bark, root bark aerial roots, vegetative buds, leaves, fruits and latex are used in dysentery, diarrhea, diabetes leucorrhoea, menorrhagia, nervous disorders, tonic and astringent. According to Ayurvedic system of medicine *Ficus bengalensis* Linn (Banyan tree) is well known to be useful in diabetes. The present review is therefore, an effort to give a detailed survey of the literature on its Pharamacognosy, phytochemistry, traditional and pharmacological uses.

KEYWORDS

Ficus bengalensis, Banyan, Vada, Pharamacognosy, Phytochemistry, Traditional medicine, Pharmacology.

INTRODUCTION

Plants have been the major source of drugs in Indian system of medicine and other ancient systems in the world. Earliest description of curative properties of medicinal plants is found in Rig-Veda. Charaka Samhita and Sushrusa Samhita give extensive description on various medicinal herbs¹. Information on medicinal plants in India has been systematically organized¹⁻⁴.

India has an ancient heritage of traditional medicine. The materia medica of India provides a great deal of information on the folklore practices and traditional aspects of therapeutically important natural products. Indian traditional medicines based on various systems including Ayurveda, Siddha, Unani and Homeopathy. The evaluation of these drugs is primarily based on

phytochemical, pharmacological and allied approaches including various instrumental techniques such as chromatography, microscopy and others. With the emerging worldwide interest in adopting and studying traditional systems and exploiting their potential based on different health care systems, the evaluation of the rich heritage of traditional medicine is essential. In this regard, on such plant is ***Ficus bengalensis* Linn.** syn. *Ficus banyana* Oken. (Family-Moraceae). The plant is a large evergreen tree distributed all over India from sub Himalayan region and in the deciduous forest of Deccan and south India. It is a grown in gardens and road sides for shades⁵⁻⁶. It is a member of four sacred trees *Nalpamara* (*Ksirivrkas*) meant to be planted around the home and temples. It is found throughout the year, grows in evergreen except in dry localities where it is a leafless



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for a short time. It is hardy and drought-resistant; it withstands mild frost. It is epiphytic when young. It develops from seeds dropped by birds on old walls or on other trees and is therefore, considered destructive to forest trees, walls and buildings^{5, 7-9}. The tree is commonly found all over India from sea level to an elevation of about 3,000 ft. it is also reported from Sri Lanka, Pakistan now widely cultivated¹⁰. It is commonly known as Vada in Marathi, Banyan tree in English, Bar in Hindi and as Avaroha in Sanskrit^{1,11}.

The group of four *Ficus*, all yielding latex, according to ayurvedic texts, consist of Nyagrodha (*Ficus bengalensis*), udumbara (*Ficus glomerata/Ficus racemosa*), Plaksha (*Ficus lacor/Ficus retusa*) and ashvattha (*Ficus religiosa*) the bark and leaves of this group are used as astringent, haemostatic, anti-inflammatory, anti-septic; prescribed in diarrhoea, dysentery, and in the treatment of skin diseases, ulcers, vaginal disorders, leucorrhoea, menorrhagia, deficient lactation¹².

A very large tree up to 30m in height leaves spirally arranged on branch lets, up to 10-30cm long and 7-20cm wide, coriaceous, elliptic to ovate, apex obtuse, base rounded, with 5-7 basal nerves; petioles 2.5-5 cm long; stipules stout. Fruits (figs) receptacles sessile, axillary in pairs 1.3-1.9 cm in diameter globose silky pubescent, scarlet or brick red when ripe; bracts 4-5, cupular, 6mm, shortly connate, obtuse persistent, tepals 3-5, shortly connate, glabrous. Male flowers dispersed with female, stamen 1, another oblong, parallel, unequal, shortly mucronate. Female sessile. Ovary-obovoid globose, 1.5×1mm, style erects or

curved, tapering, gall flowers similar to female, pedicellate, achenes globose-ellipsoid, 2×1.5mm dark brown.. Flowers during the summer and fruits the rainy season. Bark smooth, light grey-white, 1.27cm thick wood moderately hard, grey or grayish-white^{6, 10, 13, 14}.

In the traditional system of medicine, the plant is used for various health problems and diseases⁸⁻¹². Therefore, the aim of this paper is to present an overview of traditional, pharmacognostical, phytochemical and pharmacological investigations carried out on the plant.

PHARMACOGNOSTICAL CHARACTERISTICS

Macroscopical

A very large evergreen tree, extending laterally by sending down aerial roots. Large aerial roots many some developing in to accessory trunks and assisting the lateral spread of the tree indefinitely¹⁴. Leaves are green spirally arranged on branch lets, up to 10-30cm long and 7-20cm wide, coriaceous, elliptic to ovate, apex obtuse, base rounded, with 5-7 basal nerves; petioles 2.5-5 cm long; stipules stout opposite arrangement and reticularly pinnate venation. Fruits (figs) in red color receptacles sessile, axillary in pairs 1.3-1.9 cm in diameter globose. Bark smooth grey hard surface and uneven 0.5-1.9 cm thick, on rubbing white papery flakes come out from the outer surface inner surface light brown fracture fibrous taste mucilaginous without any characteristics odour^{6, 15, 16}.

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Fig 1. Fruits and leaves of *Ficus bengalensis*



Fig2. Bark of *Ficus bengalensis*

Microscopical

A transverse section of bark of *Ficus bengalensis* showed, The outermost zone viz. the cork tissue was composed of three to six rows of thick-walled rectangular cells nearly twice as long as broad. The cortex was fairly wide and composed of several rows of cells. A wide continuous band of sclereids was present at the periphery of the cortex. The stone cells were 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. Several of them are loaded with compound starch grains, while others contain calcium oxalate crystals or tannin. The inner bark was thin and consists of radial segments of phloem alternating with two to five seriate medullary rays. The wood is composed of vessels, wood fibers, and wood parenchyma and medullary rays. The wood parenchyma and medullary ray cells are pitted in the wood region. Vessels occur singly or in groups of two or three^{17, 18}.

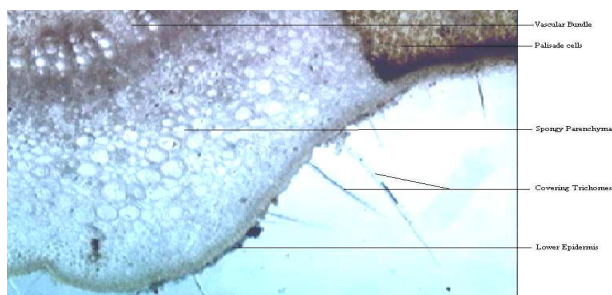


Fig 3. Transverse section of leaf of *F. bengalensis*



Fig 4. Transverse section of leaf of *F. bengalensis*



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Powder

Ficus bengalensis Linn is a pale green, fine, odorless powder with a slightly bitter taste. The powder microscopy revealed the presence of trichomes, fibres, epidermal cells with anticlinal walls, calcium oxalate crystals, and spiral thickenings. Similarly, the fluorescence characteristic of the powdered leaf when treated with various chemical reagents and its extracts has also been extensively studied. The various qualitative chemical tests of powder, and ethanol extract indicates the presence of sterols, flavonoids, phenols, tannins, and saponins in large amounts whereas aromatic acids, carbohydrates, triterpenoids, gums, mucilage, and volatile oils were totally absent in the leaf extract of this plant¹⁵.

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/w¹⁵.

Traditional uses

Charaka prescribed aqueous extract of leaf buds of Nyagrodha (*Ficus bengalensis*) mixed with sugar and honey for checking diarrhoea; milk processed with the aerial roots or leaf buds of Nyagrodha in hemorrhages and bleeding piles; a decoction of leaf buds and aerial roots of Nyagrodha, mixed with honey, was given for checking vomiting and thirst; also during fevers with burning sensation (Astaanga Hridaya, Vrindamaadhava, vaidyamanorama)¹². The aerial roots are useful in obstinate vomiting and leucorrhoea and are said to be used in osteomalacia of the limbs. The bark is useful in burning sensation, haemoptysis, haemorrhages, diarrhoea, dysentery, diabetes, enuresis, ulcers, skin diseases, gonorrhoea, leucorrhoea, and hyperpiesia. The leaves are good for

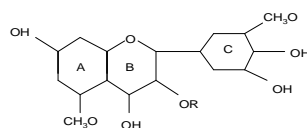
ulcers, leprosy, allergic conditions of skin, burning sensations and abscesses. The buds are useful in diarrhoea and dysentery. The fruits are refrigerant and tonic and are useful in vitiated condition of *pitta*. The latex is useful in neuralgia, rheumatism and lumbago bruises, nasitis, ulorrhagia, ulitis, odontopathy, hemorrhoids, gonorrhoea, inflammations, cracks of the sole and skin diseases¹⁹. Milky juice and seeds are beneficial as local application to sores and ulcers, soles of the feet when cracked or inflamed and in rheumatism. Leaves are heated and applied as a poultice to abscesses; tender leaves pasted with honey beneficial in *raktapitta*. Tender ends of the hanging (aerial roots) are antiemetic. Seeds are cooling and tonic^{5,6,14}.

Some important Ayurvedic Marketed formulations are: *Nyagrodhaadi churnam (Bhaishajya Ratnavali)*, *Saarivaadyaasava*, *Chandanaasava*, *Dineshavalyaadi Taila (Sahasrayoga)*.

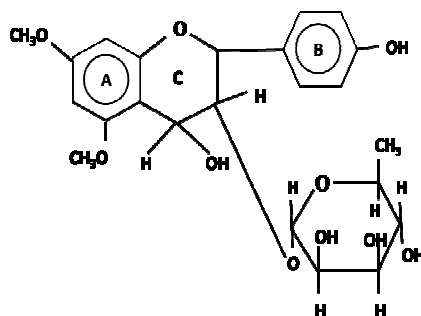
Phytochemical properties

Leaves yield quercetin-3-galactoside, rutin, friedelin, taraxosterol, lupeol, β -amyrin along with psoralen, bergapten and β -sisterol¹⁴. The bark of *Ficus bengalensis* presence of 5,7 Dimethyl ether of leucopelargonidin-3-0- α -L rhamnoside and 5,3 dimethyl ether of leucocynidin 3-0- α -D galactosyl cellobioside, glucoside, 20-tetratriacontene-2-one, 6-heptatriacontene-10-one, pentatriacontan-5-one, beta sitosterol-alpha-Dglucose, and meso-inositol Earlier, glucoside, 20 tetratriacontene-2-one, 6-heptatriacontene-10-one, pentatriacontan-5-one, β sitosterol-alpha-Dglucose, and meso-inositol²⁰⁻²⁵, Leucodelphinidinderivative²⁶, bengalenoside: Aglucoside²⁷, Leucopelargonin derivative^{28,29}, leucocynidin derivative³⁰, glycoside of leucopelargonidin³¹ have been isolated from the bark of the *Ficus bengalensis*

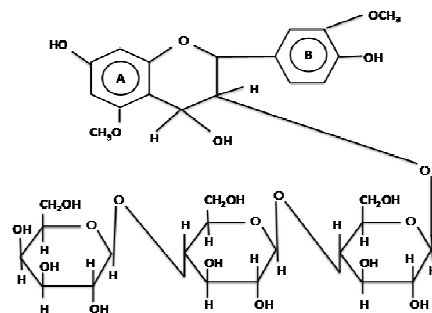
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Lecucodelphenidin



5,7 Dimethyl ether of leucopelargonidin, 3-O-α-L rhamnoside



5,7 dimethyl leucocyanidin, 3-O-β-galactosyl cellobioside

PHARMACOLOGICAL ACTIVITIES

Antioxidant

Ficus compound showed significant antioxidant effects which may be attributed to their polyphenolic nature. The antioxidant effect of aqueous extract of the bark of *Ficus bengalensis* has been evaluated in hypercholesterolemia rabbits. Rabbits were divided into three groups, Group I served as healthy control;

groups II and III were made hypercholesterolemia by feeding cholesterol suspended in groundnut oil (100 mg/kg body weight per day) for 6 weeks. Rabbits of Group III received water extract of the bark of *Ficus bengalensis* at a dose of 50 mg/kg body weight per day in addition to cholesterol suspended in oil. Feeding cholesterol increased serum cholesterol, triacylglycerol and LDL + VLDL-cholesterol



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significantly in Group II as compared to Group I ($P = 0.001$). Treatment with water extract decreased the serum cholesterol level by 59%, triacylglycerol by 54% and LDL + VLDL-cholesterol by 60% in Group III as compared to Group II. In addition, treatment with this extract led to a decrease in lipid peroxidation as evidenced by fall in thiobarbituric acid reactive substances with a corresponding increase in blood glutathione content ($P = 0.001$). Further, there was significant increase in the activities of antioxidant enzymes; superoxide dismutase ($P < 0.001$), catalase ($P < 0.03$), glutathione peroxidase ($P = 0.03$) and glutathione reductase ($P < 0.01$); which were depressed in Group II rabbits after cholesterol feeding. Thus, our results show that the water extract of the bark of *Ficus bengalensis* has significant antioxidant effect³²,

Two flavonoids compounds viz. 5,7 Dimethyl ether of leucopelargonidin-3-0- α -L rhamnoside and 5,3 dimethyl ether of leucocynidin 3-0- α -D galactosyl cellobioside, obtained from the bark of *Ficus bengalensis* were evaluated for their antioxidant action in hyperlipidemic rats³³.

The stem bark and fruits of *Ficus bengalensis* L. and *Ficus racemosa* L. are used in India for the treatment of diabetes and a number of other diseases. Since these effects may be correlated with the presence of antioxidant compounds, methanol and 70% acetone (acetone: water, 70:30) extracts of *Ficus bengalensis* (aerial root) and *Ficus racemosa* (stem bark) were evaluated for their antioxidant activity and radical scavenging capacity in comparison with *Camellia sinensis* (L.) O. Kuntz (green tea)³⁴.

Antiatherogenic

One month treatment of alloxan diabetic dogs with glycoside, viz. leucopelargonin derivative (100mg/kg/day) isolated from the bark of *Ficus bengalensis* decreased fasting blood sugar and

glycosylated haemoglobin by 34% and 28% respectively. Body weight was maintained in both the treated groups while the same was decreased significantly by 10% in the control group. In cholesterol diet fed rats, as the atherogenic index and the hepatic bile acid level and the faecal excretion of bile acids and neutral sterols increased, the HMGCOA reductase and lipogenic enzyme activities in liver and lipoprotein lipase activity in heart and adipose tissue and plasma LCAT activity and the incorporation of labeled acetate in to free and ester cholesterol in liver decreased significantly³⁵.

Antitumor

Fruit extracts exhibited anti-tumor activity in the potato disc bioassay. None of the tested extracts showed any marked inhibition on the uptake of calcium in to rat pituitary cells GH4C1. The extracts of the four tested *Ficus* species had significant antibacterial activity, but no antifungal activity. The results of this preliminary investigation support the traditional use of these plants in folk medicine for respiratory disorders and certain skin diseases³⁶.

Anthelmintic

The methanolic, chloroform, and pet ether extracts of the roots of *Ficus bengalensis* have potent Anthelmintic activity when compared with conventionally used drug and is equipotent to standard Anthelmintic drug³⁷.

Anti-inflammatory

The anti-inflammatory effect of ethanolic and petroleum ether extracts of the bark of *Ficus bengalensis* were evaluated in experimental animals. We have determined the anti-inflammatory activity of ethanolic and petroleum ether extracts of the bark of



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Ficus bengalensis by oral administration of doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were studied for their anti-inflammatory activity in carrageenan-induced hind paw edema in rats and the paw volume was measured plethysmometrically at 0 to 3h after injection. The present results indicated the ethanolic extract of *Ficus bengalensis* exhibited more significant activity than petroleum ether in the treatment of inflammation compared with the standard drug Indomethacin¹⁵.

Analgesic and Antipyretic

Analgesic activity using hot-plate and tail-immersion method and Antipyretic, Brewer's yeast-induced pyrexia in rats will be carried out by the bark of *Ficus bengalensis* in our laboratory.

Antis tress and ant allergic

Various extracts of *Ficus bengalensis* bark was screened for its ant allergic and antis tress potential in asthma by milk-induced leucocytosis and milk-induced eosinophilia. Aqueous, ethanol, and ethyl acetate extracts showed significant decrease in leucocytes and eosinophils in the order given while petroleum ether and chloroform extracts were inactive. This shows the application of polar constituents of *F. bengalensis* bark as antis tress and ant allergic agents in asthma³⁸.

Antidiarrhoeal

Ethanol extract of four different plants of the Khatra region of the Bankura district of West Bengal, India were evaluated for anti-diarrhoeal activity against different experimental models of diarrhoea in rats. The extracts of *Ficus bengalensis* Linn. (hanging roots), *Eugenia jambolana* Lam. (bark), *Ficus*

racemosa Linn. (bark) and *Leucas lavandulaefolia* Rees (aerial parts) showed significant inhibitory activity against castor oil induced diarrhoea and PGE2 induced enter pooling in rats. These extracts also showed a significant reduction in gastrointestinal motility in charcoal meal tests in rats. The results obtained establish the efficacy of all these plant materials as anti-diarrhoeal agents³⁹.

Antidiabetic and Ameliorative

The aqueous extract of *Ficus bengalensis* at a dose of 500mg/kg/day exhibits significant antidiabetic and ameliorative activity as evidenced by histological studies in normal and *Ficus bengalensis* treated streptozotocin induced diabetic rats. On the basis of our findings, it could be used as an Antidiabetic and Ameliorative agent for better management of diabetes mellitus⁴⁰.

Hypoglycemic

According to Ayurvedic system of medicine *Ficus bengalensis* Linn (Banyan tree) is well known to be useful in diabetes. This attracted the attention of many earlier workers who studied the hypoglycemic effect of extracts from the bark of *Ficus bengalensis* and tried to isolate active compounds. Bark of this plant has antidiabetic properties. The hypoglycemic effect of extract of bark was demonstrated in alloxan diabetic rabbits, rats and in humans. Potent hypoglycemic water insoluble principle was isolated (Patent applied) from the bark in our lab by Babu et. al.. A water soluble hypoglycemic principle was also isolated from the bark (patent applied) in our lab by Shukla et. al. which was effective at a low dose of 10 mg/kg, bw/day. Both the banyan bark principles were effective in mild as well severe alloxan induced diabetes in rabbits, and improved lipid profile.



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Mechanism of action of water soluble and insoluble hypoglycemic compounds was investigated⁴¹⁻⁴⁶.

Hypolipidemic

Hypolipidemic effect of the water extract of the bark of *Ficus bengalensis* was investigated in alloxan induced diabetes mellitus in rabbits showing a good glycemic control also corrects the abnormalities in serum lipid profile associated with diabetes mellitus. In view of the ability of the water extract of *Ficus bengalensis* to improve carbohydrate and lipid metabolism⁴⁷. Dietary fibre content of foods namely, khejri (prunopsis cinceria), peepalbanti (*Ficus religiosa*), barbanti (*Ficus bengalensis*) gullar (*Ficus glomerata*) and teent (*Capparis decidua*) varied from 38.5%, to 55.7%. fibre from all these plant foods, fed at the 10% dietary level to rats, induced a greater resistance to hyperlipidemia than cellulose. The dietary fibre influenced total lipids, cholesterol, triglycerides and phospholipids of the liver to varying extents⁴⁸.

Immunomodulatory

To evaluate the Immunomodulatory activity of the aerial roots of *Ficus bengalensis* (Family Moraceae). The successive methanol and water extracts exhibited a significant increase in the percentage phagocytosis versus the control. In the in vivo studies, the successive methanol extract was found to exhibit a dose related increase in the hypersensitivity reaction, to the SRBC antigen, at concentrations of 100 and 200 mg/kg. It also resulted in a significant increase in the antibody titer value, to SRBC, at doses of 100 and 200 mg/kg in animal studies⁴⁹.

Wound healing

Some of these plants have been screened scientifically for the evaluation of their wound healing activity in

different pharmacological models and patients, but the potential of most remains unexplored. In a few cases, active chemical constituents were identified. Some Ayurvedic medicinal plants, namely *Ficus bengalensis*, *Cynodon dactylon*, *Symplocos racemosa*, *Rubia cordifolia*, *Pterocarpus santalinus*, *Ficus racemosa*, *Glycyrrhiza glabra*, *Berberis aristata*, *Curcuma longa*, *Centella asiatica*, *Euphorbia nerifolia*, and *Aloe vera*, were found to be effective in experimental models. This paper presents a limited review of plants used in Ayurvedic medicine⁵⁰.

CLINICAL EVALUATION

From these clinical studies it is clear that Liv.52 by its hepatic stimulant, tonic, choleric and diuretic actions can increase the cure rate in the cases of cirrhosis of liver from 1% to 21%. It causes definite clinical as well as histological improvement. The response is particularly good in the early and intermediate stages of liver cirrhosis. Liv.52 has a definite but non-specific protective action on the liver. The experimental work of Surg. Capt. Jal R. Patel et al., carried out on rats and mice revealed that Liv.52 has clear-cut protective action on liver parenchyma against the toxic effects of carbon tetrachloride and *Ficus bengalensis*. It prevented fatty infiltration and lessened congestion. The investigative study carried out by G.V. Joglekar et al., on mice to compare the protective action of Liv.52, promethazine and chlorpromazine has shown that only Liv.52 could prevent the liver damage induced by carbon tetrachloride⁵¹.

CONCLUSION

There are 400 different tribal and other ethnic groups in India which constitute about 7.5% of India's population. Tribal, rural and primitive societies have discovered solution for treatment of disease to almost

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all their needs and their problems from the natural resources around them⁵². Hence in recent years, ethno medicinal studies received much attention as this brings to light the numerous little known and unknown medicinal virtues especially of plant origin which needs evaluation on modern scientific lines such as phytochemical analysis, pharmacological screening and clinical trials⁵³⁻⁵⁵.

Ficus bengalensis possesses various pharmacological activities as discussed in present paper. However, it is imperative that more clinical and pharmacological studies should be conducted to investigate the unexploited potential of this plant.

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