



RESEARCH ARTICLE

BIO-CHEMICAL ACTIVITIES OF FICUS BANGHALENSIS- A REVIEW ARTICLE

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ABSTRACT

Ayurveda and other literature mention the use of plants in treatment of the various human ailments. Ficus benghalensis is a large evergreen tree found throughout India. It is commonly called Banyan tree. It is used in traditional system of medicine like ayurveda and homoeopathy. Different parts of the tree have been found to possess medicinal properties: leaves are good for ulcer, aerial roots are useful in gonorrhoea, seeds and fruits are cooling and tonic. This paper reports on its traditional and pharmacognostic properties such as antioxidant, anticancer, analgesic, anti-inflammatory, antihelminthic, antidiabetic and antibacterial of Ficus benghalensis.

INTRODUCTION

Ficus benghalensis (Moraceae, Mulberry family) 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. It is used in Ayurveda for the treatment of diarrhea dysentery and piles; teeth disorders Rheumatism, skin disorders like sores to boost immune system as a hypoglycemic. The extracts of Ficus benghalensis were also reported to inhibit activity from liver and kidney fruit extracts exhibited anti-tumor activity in the potato disk bioassay (Aswar *et al.*, 2008). The English name Banyan is given by the Britishers to this tree because under the tree Banias that is the Hindu merchants used to assemble (Ahmad *et al.*, 2011). The seed of banyans are dispersed by fruits –eating birds. The seeds are small and most banyans grow in forests, so that a plant germinating from a seed that land on the ground is unlikely to survive. However many seeds land on branches and germinate they send roots down towards the ground and may envelop parts of the host tree or building structure giving banyans the casual name of "Strangler". The "Strangling" growth habit is found in a number of tropical forest species particularly of the genus, that complete for light.

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Any Ficus species showing that habit may be termed a stringier. The leaves of the banyan tree are large, leathery, glossy green and elliptical in shape, the leaf bud is covered by two large scales. Young leaves have an attractive reddish tinge (Wikipedia). Seed oil was found to contained vernolic acid (8.2%), Malvalic acid (3.7%) and Sterculic acid (1.65) along with the other normal fatty acids like lauric acid (1.5%), Myristic acid (1.3%), palmitic acid (35.2%), stearic acid (4.2%), oleic acid (20.3%), linoleic acid (15.4%) and linolenic acid (8.7%) (Adebayo *et al.*, 2015). Old Indian medicinal systems like Ayurveda are using plants for many symptoms such as for snake bites the ground root is given with water until the patient vomits and regains consciousness, fresh piece of root is used as tooth brush, on diarrhoe (Diwan *et al.*, 2014).

Ficus benghalensis

Ficus benghalensis belongs to the family Moraceae, which is commonly known as Banyan tree. F. benghalensis are fast growing, evergreen tree found in monsoon and rain forests. External features of the bark: Mature bark is 12-18 mm thick, gray, closely adhered ashy white, light bluish-green or gray patches, slightly curve, thickness varies with the age of the tree. Surface is deeply fissured and rough due to the presence of longitudinal and transverse row of lenticels, mostly circular and prominent, fracture short in outer 2/3 of bark while inner portion shows a fibrous fracture (Manimozhi *et al.*, 2012).

Fig.1 is showing whole Banyan tree & fig. 2 is showing leaves & fruits of banyan tree.



Fig. 1. Banyan Tree



Fig. 2. Leaves and Fruits of Banyan Tree

Taxonomical Classification

Kingdom – Plantae-Plants
 Subkingdom- Tracheobionta
 Superdivision- Spermatophyta
 Division- Magnoliophyta
 Class- Magnoliopsida
 Subclass- Hamamelidae
 Order- Urticales
 Family- Moraceae
 Genus- Ficus
 Species- *F. benghalensis* (Ogunlowo *et al.*, 2013)

Religious background

The banyan symbolizes lord Shiva and is even sacred to Hindu Gods like Vishnu, Brahma, Kali, Lakshmi and Kubera. It also depicts life and fertility in many Indian cultures. Vishnu is also compared to the seed of the Banyan tree (Gopukumar *et al.*, 2015).

Habitat

Monsoon and rain forests, often planted throughout the forest tract of India. Hardy, drought resistance and withstands mild frost (<http://hort.Purdue.edu/newcrop/cropfactsheet/ficus.html>).

Useful Parts

Bark, root-fibers, leaves, seeds and milky juice (<http://hort.Purdue.edu/new crop/ crop factsheet/ ficus.html>).

Distribution

Banyan found in all kind of forests from plains to 1000m. Common India, Sri Lanka, Pakistan, now widely planted in the tropics (eol.org/page/491535/details).

Synonyms

English- Banyan tree
 Sanskrit- Nyagrodhah
 Hindi- Bat, Bargad
 Bengali- Bar, Bot
 Marathi- Vada
 Tamil- Alamaram, Peral
 Telugu- Peddamarri
 Malayalam- Peral, Vatavriksham
 Gujrati-Vad (Kaur *et al.*, 2015)

Description

A large, evergreen to deciduous, up to 20 m tall, with wide leafy crown and branches spreading up to 100 m or more with pillar – like prop roots and accessory trunks massive, fluted, bark grey, smooth, young softly white puberulous. Leaves with stout, 2-6cm long, dorsally compressed hairy petiole; lamina coriaceous, ovate or orb ovate to elliptic, 10-20 cm long, 8- 15 cm broad, glabrous above, finely pubescent beneath, base subcordate or rounded, margins apically obtuse, lateral nerves 4-7 pairs, intercostals distinct, ± bulging stipules coriaceous, stout, 1.5-2.5 cm long, acute; cystoliths abundant on site, few or absent below. Hypanthodia sessile, in axillary pairs on young depressed-globose, 1.5-2 cm in diameter, green, hairy, subtended by 3, reniform 3-4 mm long, 6-7 mm wide, minutely hairy basal bracts, apical orifice by 3, flat or ± umbonate bracts, internal bristles absent. Male flowers: numerous ostiolar, shortly pedicellate; sepals 2-3; stamen solitary, with shortly mucronate anther. Female flowers: sessile, mixed with gall flowers; sepals 3-4, small; ovary with an elongated style. Gall flowers numerous, pedicellate; sepal as in female ovary with a short style. Figs globose to depressed- globose, 1.5-2.5 cm in diam, pinkish-red hairy (eol.org/page/491535/details).

Cultivation

F. benghalensis is widely cultivated in the tropics. It is cultivated in India and has not had its associated wasp introduced and therefore has not yet spread from initial plantings. *F. benghalensis* is the world's largest tree in terms of its spread with some old trees covering over an acre of ground. One of the most popular banyan trees, *F. benghalensis*, on Maui, located on Front St. in Lahaina, is a meeting place for tourists, artists, children, and folks selling their goods. In addition to the large spreading growth form, trees also have attractive red fruits and aerial roots which hang from limbs (Mandal *et al.*, 2010).

Pests and diseases

The pests associated with Ficus species: mealybugs, scale insects, spider mites, root knot nematodes, and thrips occur under most environmental conditions, fungal and bacterial leaf spot, crown gall, twig dieback etc. (Mandal *et al.*, 2010).

Traditional uses

Different parts of the tree have been found to possess medicinal properties: leaves are good for ulcers. Aerial root are useful in gonorrhoea, seed and fruit are cooling, tonic and astringent and is also used in diarrhoea, dysentery and diabetes. The bark of the plant is used in ayurvedic medicine for the treatment of diabetes (Mandal *et al.*, 2010).

Chemical constituents

Stem bark consists of number of anthocyanidin derivatives (methyl ethers of leucodelphinidin-3-O-L-rhamnoside, leucopelargonidin-3-O-L-rhamnoside, leucocyanidin-3-O-D-galactosylcellobioside) and aliphatic long chain ketones (pentatriacontan-5-one, tetratriacont-20-en-2-one, heptatriacont-6-en-10-one), besides-beta-sitosterol glucoside and mesoinositol. Leucodelphinidin derivative, bengaleno side: Aglucoside, Leucopelargonin derivative, leucocyanidin derivative, glycoside of leucopelargonidin have been isolated from the bark of the *Ficus benghalensis*. The leaves contain 9.63% crude portion, 26.84% crude fibers, 2.53% calcium oxalate and 0.4% phosphorous. Number of qualitative chemical tests of ethanol extract and aqueous extract of leaves contain sterols, flavanoids, phenol, tannins, and saponins in large amount whereas aromatic acids, carbohydrates, triterpenoids, gums, mucilage, and volatile oils were totally absent in this plant. The flavonols of the leaves have been identified as quercetin-3-galactoside and rutin. Leaves yield quercetin-3-galactoside, rutin, friedelin, taraxasterol, lupeol, β -amyrin along with psoralen, bergapten and β -sitosterol (Gopukumar *et al.*, 2015).

Pharmacological Activity

Anti-inflammatory Activity

The ethanolic (300 mg) and petroleum ether extracts (600 mg/kg/day) of *Ficus benghalensis*, significantly reduced ($p < 0.05$) carrageenan-induced paw edema in rats. The result indicated the ethanolic extract of *Ficus benghalensis* exhibited significant anti-inflammatory activity (Joseph *et al.*, 2011).

Anthelmintic Activity

The methanolic aqueous, chloroform, Petroleum ether extracts of FB used studied for paralysis and death of earthworm. All the extracts were found not only to paralyze (vermifuge) but also to kill the earthworms (vermicidal). The aqueous and methanolic extract were found to be more effective to execute the earthworm (Bhalerao *et al.*, 2015).

Antidiabetic Activity

Ficus benghalensis may be a beneficial hypoglycemic pharmaceutical agent for controlling blood glucose level of diabetic patients. The studies are needed to confirm the exact mechanism by which *Ficus benghalensis* extract decreases the blood sugar level (Lakshmi *et al.*, 2013). The bark and root of *Ficus benghalensis* had been reported to possess antidiabetic activity. The variable doses of aqueous extract of banyan tree roots on blood glucose level of normal sub- and mild-diabetic

have been studied and the results were compared with the reference drug Glipizide and Mg and Ca intake as glycemic element. Singh *et al.* explained that dose of 300 mg kg⁻¹ showed the maximum fall of 43.8 and 40.7% in BGL during FBG and glucose tolerance test (GTT) studies of normal rats, respectively. The same dose showed a marked reduction in BGL of 54.3% in sub- and 51.7% in mild-diabetic rats during GTT. The concentration of Mg (1.02%) and Ca (0.85%) identified through laser induced breakdown spectroscopy (LIBS) in the most effective dose could be responsible for this high percentage fall in BGL as they take part in glucose metabolism. The hypoglycemic effect in normoglycemic and antidiabetic effects in sub- and mild-diabetic models of aqueous extract of aerial root of *Ficus benghalensis* are due to the presence of these glycemic elements in high concentration with respect to other elements (Singh *et al.*, 2009). Shukla *et al.* have done an experiment in which hot water extract of banyan tree was given orally to normal rabbits with alloxan induced and alloxan recovered, mildly diabetic and severely diabetic state at a single dose of 50 mg/kg/day for three days then water extract was re-administered for three days at the same dose level no significant change in fasting blood glucose. In mildly diabetic rabbits there was 55.8% fall in fasting blood glucose values and an improvement in glucose tolerance (Shukla *et al.*, 1994).

Antibacterial Activity

The flavonoid extract of the banyan plant has good activity against the entire gram positive and gram negative bacteria, the methanolic extract of flavonoid found to be significantly low for all the five bacterial strains (Manimozhi *et al.*, 2012). The hydroalcoholic extract of banyan tree was found effective against *Antinomies viscosus* (MTCC 7345). The minimum inhibitory concentration (MIC) was determined using both dilution technique and found to be 0.08 mg/ml. The zone of inhibition was measured using cup plate diffusion technique (Bhangale *et al.*, 2010). The antibacterial activity against 5 important bacterial strains, namely *Bacillus subtilis* ATCC6633, *Staphylococcus epidermidis* ATCC12228, *Pseudomonas pseudoalcaligenes* ATCC17440, *Proteus vulgaris* NCTC8313 and *Salmonella typhimurium* ATCC23564. The antibacterial activity of aqueous and methanolic extracts was determined by agar disk diffusion and agar well diffusion method. The methanol extracts were more active than the aqueous extract of all 12 studied plants. The plant extracts were more active against Gram-positive bacteria than against Gram-negative bacteria. The most susceptible bacteria were *B. subtilis*, followed by *S. epidermidis*, while the most resistant bacteria were *P. vulgaris*, followed by *S. typhimurium* (Parekh *et al.*, 2005).

Antioxidant Activity

The methanolic extracts of leaves and branches of *Ficus benghalensis* Linn. showed DPPH scavenging activity (ED₅₀ 49.7 and ED₅₀ 47.3) in comparison with Vitamin C using different concentrations (EL-Hawary *et al.*, 2012). The extract was studied for its antioxidant activity by 1,1-diphenyl, 2-picrylhydrazyl (DPPH) radical scavenging activity, hydroxyl radical scavenging activity, reducing capacity, hydrogen peroxide activity, total phenolic content using Folin-

Ciocalteu's phenolic reagent. The extract showed maximum scavenging of DPPH radical (96.07%) at 250 µg ml⁻¹ concentration and hydrogen peroxide (69.23%) at 1000 µg ml⁻¹ concentration. The extract shows better results when compared with other compounds (Gupta *et al.*, 2010).

Analgesic Activity

The analgesic activity of stem bark extraction of *Ficus benghalensis* tested using acetic acid induced writhing model on rats, showed significant analgesic activity (Kothapalli *et al.*, 2014).

Anticancer Activity

The fruit extract of *Ficus benghalensis* has been documented for its anti-cancer activity in the potato disc bioassay, but none of the tested extracts showed any marked inhibition on the uptake of calcium in to rat pituitary cell-line GH4CL (Kothapalli *et al.*, 2014).

Conclusion

According to the results from various studies about *Ficus benghalensis* tree, we can conclude that it possess antidiabetic, antibacterial, anthelmintic, analgesic and anticancer, antioxidant, anti-inflammatory promoting properties. Studies suggest the presence of flavonoids in banyan tree. Flavonoids might be responsible for its anti-inflammatory activity. Reports also suggest that it can decrease blood glucose level.

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