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Ficus benghalensis: The Banyan tree with medicinal and health-promoting properties

Aakrati Chauhan[1], Piyush Mittal[2], Kavina Ganapathy

[1]Department of Agriculture, Vivekananda Global University, Jaipur, India,
[2]College of Pharmacy, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India and [3]Department of Biotechnology, School of Sciences, JAIN (Deemed-to-be University), Karnataka, India

Abstract

The banyan tree, or Ficus bengalensis, is a perennial tree of the mulberry group (Moraceae). There are about 800 different Ficus species. This tree is indigenous to India and the tropical regions of the old world. It has been grown all over the world and has been used in traditional medicine and as an attractive plant for thousands of years. Flavonol, querecitin-3-glactoside, rutin, and sitosterol are all present. Depending on the species, cultivars, and parameters for growing it, such as the type of sand, the climate, and the soil's acidity, each chemical component can be present to different degrees. A banyan tree is crucial to several pharmaceutical industries. Uses for the roots of the banyan tree include intractable vomiting and infusion. The bark's properties include tonic and astringent. They were also used for diarrhea and dysentery. The bark is utilized in the Ayurvedic medical system to treat diabetes. To reveal the methods by which this traditional plant functions, it is imperative to research the Banyan, particularly its chemical makeup, and to carry out extensive molecular studies both in vitro and in vivo.

Keywords: Traditional medicine, Phytochemicals, Health-promoting properties, Banyan tree

Full length article **Corresponding Author, e-mail Id: aakriti.chauhan@vgu.ac.in*

1. Introduction

The vast plant known as a banyan, Ficus benghlensis belongs to the Moraceae family, including mulberries. It has been utilized for many centuries and is now a crucial plant in the medical industry. The shape, growth habits, flower color, leaves, stems, and chemical makeup of banyans vary [1]. It is accessible all year long in many parts of the planet. Except for a few dry regions where it briefly goes without leaves due to aridity and water scarcity, it flourishes in evergreen environments. Ficus Religiosa (Pipal tree), *Ficus benghalensis* (Banyan tree), and Anjir tree are some of the more popular varieties of the family Ficus, which belongs to the family Moracea. Depending on the location of the world in which it operates, Facebook goes by different names. In English, Facebook is frequently referred to as Banyan; its usual name is Bohr. It is known as Bargad among native Hindi speakers in India [2]. It goes by a variety of names throughout India, including Bera in Punjab, Bar in Bengali, Vatam in Malayalam, Vad in Gujarati, Ala in Kanarese, Vada in Marathi, Bahupada in Sanskrit, Alai in Tamil, and Peddamarri in Telugu [3]. Its lovely flavor is arguably Banyan's most well-known quality. There are numerous cultivars and kinds of *Ficus benghalensis*, each with a unique flavor and application. Three species are frequently used as examples: Ficus Religiosa (Pipal tree), Banyan tree, and Anjir tree are some of the more popular varieties of the family Ficus, which belongs to the family Moracea.

Central Canada, South Canada, Islands, and Northern Canada. However, the banyan tree is the most popular spice among these. Epiphytic in nature is the Banyan [5]. It can reach 20 to 30 meters and has a substantial spreading head. May through August are when flowers bloom. The leaves of the banyan tree are elliptical, very big, glossy green, and leathery. Young leaves have an appealing reddish hue, it seems. As the fruit ripens, its color changes from orange to crimson. In certain parts of the world, it is also grown as a decorative plant [6]. *Ficus benghalensis* also contains significant levels of ß flavonoids, phenols, tannins, sterols, and saponins. The leaf extract of this plant completely lacks some elements such as volatile oils, mucilage, aromatic acids, triterpenoids, carbohydrates, and gums [7].

Two critical species from this genus, *Ficus benghalensis*, and Ficus religiosa, were the focus of this review, which sought to provide an overview of their medicinal applications, phytochemistry, and pharmacological effects. Most Asian nations, including Malaysia, are home to many of these species. According to the results of the chemical analysis, Ficus species contain a variety of phytoconstituents, such as phenols, flavonoids,

alkaloids, tannins, saponins, terpenoids, glycosides, sugar, protein, essential and volatile oils, and steroids [8]. The aldose reductase inhibitory effects of *Ficus benghalensis* alpha-glucosidase inhibitors can be seen after intestinal absorption. Additionally, these phytoconstituents control a variety of protein molecules and processes. Therefore, these compounds' anti-diabetic effectiveness results from their interactions with other protein molecules and synergistic effects, which should be proven by further research [9]. The anti-inflammatory effects of fatty acid glucoside (FAG), derived from *Ficus benghalensis*, on RAW 264.7 macrophages activated by lipopolysaccharide (LPS). Using an MTT assay, the FAG's cytotoxic effect on RAW 264.7 macrophages was assessed [10]. 240 Botryosphaeriaceae-like isolates were found in this investigation in the bodies of collected arthropods, pruning wood waste, and discolored wood tissues. It was determined that the isolates were Lasiodiplodiatheobromae and Neoscytalidium dimidiated based on morphological traits and DNA sequence data of the ITS and tef-1 gene regions [11]. *Ficus benghalensis* tree leaves extract has been used to synthesize metal oxides such as Fe3O4, CeO2, and ZnO. Powder X-ray emission and scanned electron microscopy methods were used to examine the framework and morphology of the metal oxide samples as prepared. The connectivity in the metal oxide particles was analyzed using a Fourier transform ultraviolet spectroscopy investigation [12].

The research and report in this paper show that *Ficus benghalensis* leaves powder is suitable for the adsorptive elimination of Cobalt (II) from water-based solutions. To comprehend how the variables—metal concentration of ions, the dosage of adsorbent, initial solution pH, and temperature—which are essential in the treatment interact, experiments depending on the response surface approach are carried out [13]—the phenolic components in the therapeutic plant species Ficus in the current investigation. The Folin-Ciocalteu test was used to determine the total phenolics content of the medicinal herbs FicusBenghalnesis, FicusRacemosa, and FicusCarica. *Ficus benghalensis* includes 3.18–1.499 mg/ml of total phenol and 0.84–0.395 g/ml of antioxidant activity [14]. The sociocultural of health related to reducing perinatal hazard in Bihar, India. Focus groups with younger and older mothers described the occurrences, goals, and clarification about health thoughts and actions during pregnancy and postpartum. First, we represent biological and traditional practices, including taboos, superstitions, and rituals employed to counter perceived physical and supernatural threats [15].

It is crucial to advance study on the Banyan, especially it is chemical composition, and to conduct thorough molecular research both in vitro and in vivo to shed light on how this traditional plant functions.

2. Origin / History

F. benghalensis was given its name in India. The word "banya" in Gujarati does not imply "tree" but rather "grocer or merchant." This name originated in Portuguese, where it was used to describe the Hindu traders. It was first used in English in 1599 and quickly gained currency. English authors first referred to the banyan plant as a tree in 1634. Hindu business people gathered and offered their products and services under the protection of this tree. Village meetings were also held in this tree's shelter. Later, the word "banyan" was used to refer to the tree itself. Additionally, banyans are often regional, and they are present in a variety of habitats, including the far north Queensland rainforest and rain trees. Some people feared banyan trees and referred to them as "the vat Vriksh," while others thought that Shiva, the Hindu god, constantly descended silently and stood beneath the trees on his feet [16].

3. Ecology, morphology, and botany

Benghalensis is a massive everlasting tree ranging between 25 and 35 meters. It has thick, softly branching leaves and broad, spreading branches supported by aerial roots. Later, it creates supplementary trunks that stretch across a vast region. Simple, alternating, 10–20 cm long leaves cover the *Ficus benghalensis* tree. The bases of the leaves are rounded, subcordate, or acute. The veins are reticulate and have 7-8 pairs of lateral and basal solid veins. Stipules measure 1.8 to 2.5 cm long, and petioles are 1.2 to 5 cm long.

Additionally, there are the malformed females (gall flowers), which are grouped with the bracteoles in the innermost walls of fleshy receptacles; *Ficus benghalensis* also features males and female flowers of three different varieties that are unisexual and small. Sessile, globose, and growing in axillary pairs, the fleshy receptacles are approximately 1.8 cm in diameter [17]. The tree is covered in large basal bracts. In addition to male flowers, the tree also has non-reproductive perianth and stamen filaments, which are close to the receptacles' openings. The bloom of female flowers is similar to that of male flowers, except it is shorter. The ovaries are better and eccentrically shaped, with one pendulous ovule that can be straight or oblique. The stigma is also relatively straightforward. *Ficus benghalensis* fruits feature a fleshy pericarp with embedded achenes. Depressed-globose figs grow to a size of 15–2.5 cm, and the fruit's color is dish-red. *Ficus benghalensis* grows well in moist environments with sandy loam soils that drain quickly. Although it can withstand drought, sandy soil is where it grows best [18].

4. Chemical composition

The powder of F.benghalensis is a greenish-white color, is fine and odorless, and has a taste that is somewhat bitter and sweet. Fibers and trichrome are seen in the tiny powder. The results of numerous qualitative chemical analysis studies on *Ficus benghalensis* show significant levels of “sterols, flavonoids, phenols, tannins, and saponins in the ethanolic extracts” [19].

4.1 Phytochemistry

“Quercetin-3-galactoside, rutin, friedelin, taraxosterol, lupeol, -amylin, psoralen, bergapten, and –sisterol” are all found in the leaves of the *F. benghalensis* plant (Figure 1). Albumin, cerin, sugar, malic acid, caoutchouc, resin, and albumin are all present in the latex. Facebook is a surprisingly abundant supply of oil carrying fatty acids that may be used industrially.” GC-MS analysis is typically used to determine the chemical composition of seed oil. Which included vitriolic acid (9.3%), malvalic acid (2.9%), and sterculic acid (2.1%) in addition to other standard fatty acids like linoleic acid (13.5%), lauric acid

(2.3%), myristic acid (2.2%), oleic acid (19.4%), palmitic acid (34.6%), stearic acid (5.1%), and linolenic acid" (9.7%).

4.2 Low levels of chemical composition

Ficus benghalensis contains little fat, as well as little magnesium and calcium. The leaves also contain small amounts of flavonols, quercetin3-galactoside, rutin, fibers, calcium oxalate, CaO, phosphorus, and stored crude protein. *Ficus benghalensis* produces latex that comprises malic acid, resin, albumin, caoutchouc sugar (3.5%), and cerin.

5. Extraction and harvesting

In January, it is advisable to harvest the aerial root and stem components. The separated stem bark is powdered after being air-dried in the shade for various uses. The plant material is first macerated at room temperature before being submerged in petroleum ether, chloroform, and methanol in that order to create the *Ficus benghalensis* leaf extract. Several sticky crude extractions are produced from the solvent using a rotatory evaporator, and these extractions can be employed for various purposes.

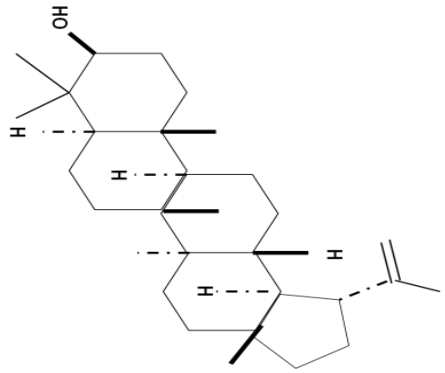

Figure1: Design of lupeol

6. Extra benefit

Ficus benghalensis trees are cultivated to preserve soil and prevent its evaporation. Strong curbing, furniture, and paper pulp are all made from tree wood, also employed in other construction projects. The fodder contains leaves. To prepare traditional sherbet, fruits are utilized. Additionally, conventional medicine uses bark as an antidiarrheal and anti-diabetic treatment.

7. Medicine and *Ficus benghalensis*

Different traditional treatments use banyan components as a medicinal herb. The plant can synthesize a wide range of chemical substances that are essential for several critical biological processes. It offers protection from attack by predators such as insects, fungi, and herbivorous animals. When consumed by humans, most banyan phytochemicals have a noticeable impact on long-term health and may be utilized to treat various human illnesses. The plant contains chemical components that affect the human body through procedures similar to those used to produce synthetic medications. Because herbal medicines have fewer adverse effects than contemporary treatments, many utilize them [20].

7.1 Common usages

The various polyphenolic components have been implicated as the source of several of *Ficus benghalensis*'s medicinal qualities. Antiviral and anticancer applications for bioactive peroxides, anti-malarial, anti-diabetic, and neuroprotective properties, along with cardioprotective, hepatoprotective, and effects. Fruits, aerial roots, and bark of *Ficus benghalensis* are utilized in the Ayurvedic medical system to treat diabetes. Flavonoids called leucopelargonin are effective hypoglycemic and antioxidant medications. The decoction of the *Ficus benghalensis* bark is used to treat many skin conditions, including ulcers, and has antipyretic, antiseptic, and vermicide effects. In inflammatory swellings, it serves as a plaster. It is beneficial in treating urinary diseases, piles, gonorrhea, dysentery, asthma, and ridges. Nyagrodha's leaf, bud, and aerial root infusion was combined with honey and utilized to alleviate thirst and nausea. The leaves treat abscesses, ulcers, leprosy, burning, and allergic skin conditions. In cases of dysentery and diarrhea, the buds are employed. Latex treats inflammations, hemorrhoids, gonorrhea, otorrhagia, bruising, rheumatism, ulitis, and nastiness. It is frequently used in only crack treatment for specific skin conditions [21].

7.2 Biological processes

In the traditional medical system, several parts of the *Ficus benghalensis* plant, including the stem bark, root bark, leaves, vegetative buds, fruits, and latex, are used to cure a variety of conditions, including dysentery, mental disorders, diarrhea, diabetes, leucorrhoea, menorrhagia, and acidic rashes. *Ficus benghalensis* is utilized in the Ayurvedic medical system to promote wound healing [22].

7.2.1 Antitumor

Fruit extracts from *Ficus benghalensis* showed anticancer activity in another investigation. The banyan plant is utilized as an anticancer agent in Aryuvedic medicine. The four recognized ficus species' extracts have potent antibacterial properties but little antifungal activity. These studies support the conventional application of these herbs as anticancer treatments in folk medicine [23].

7.2.2 Antioxidant

Due to the polyphenolic concentration of the Ficus compound, it exhibits strong antioxidant properties. The presence and activity of antioxidants were investigated using a variety of techniques, "including hydrogen peroxide activity, hydroxyl radical scavenging activity, 1,1-diphenyl and 2,2-picryl hydroxyl (DPPH) radicals scavenging movement, reducing power, and total phenolic content". The water extracts demonstrated the highest DPPH radical scavenging (96.07%) at the concentration of 250 g/ml. Compared to hydrogen peroxide, which had an activity of (69.23%) at a 1000 g/ml concentration, it has a more significant action. Compared to other common compounds like ascorbic acid, the banyan extract produced the best results [24].

7.2.3 Anti-inflammatory

Different animals were used to assess the anti-inflammatory impacts of ethanolic and petrol ether extracts of banyan bark. The dietary fiber content of foods such as

khejripeepalbanti, Banyan, gular, and tents (Capparis decidua), which range in scope from 39.6% to 54.9%, was administered orally to the animals in doses of 200 and 500 daily body weight in kilograms. Rats received 15% of their diets in the form of fibers from every one of these plant sources. Results indicated that banyan extract has strong anti-inflammatory properties [25].

7.2.4 Anthelmintic

When compared to commonly prescribed medications, it was observed that *Ficus benghalensis* root extracts in methanolic, chloroform, and ether exhibit potent anthelmintic properties [26]. It was comparable to a standard anthelmintic drug (Figure 2).

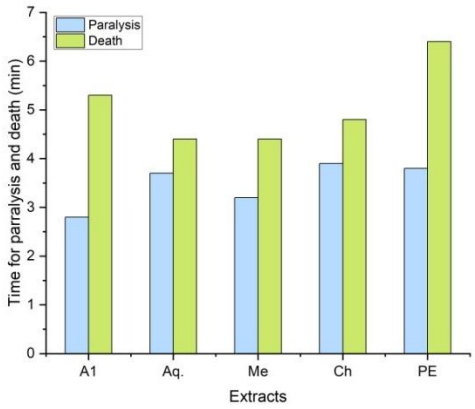

Figure2: *Ficus benghalensis* extracts with anthelmintic properties

7.2.5 wound healing

For a long time, the cause of the *Ficus benghalensis* plant's ability to heal wounds has been a mystery. In this instance, it was unclear which chemical elements contributed to the recovery of an injury. However, it was later discovered that *Ficus benghalensis* also includes those chemical ingredients and is an efficient injury recovery agent after the chemical elements involved in wound healing were identified [27].

7.2.6 Immunomodulatory

It was discovered that *Ficus benghalensis*'s aerial components have immunomodulatory properties. Both specific and not particular immunity are impacted by the aerial roots' immunomodulatory function. The fraction of phagocytosis was observed to increase significantly in a methanolic root extraction. In a different investigation, it was established that the extract significantly increased the proportion of human neutrophils that underwent phagocytosis. The section was observed to increase hypersensitive responses subject to dosage way, and it also caused an increase in the antibody titer value [28].

7.2.7 Hypoglycemia

The hypoglycemic impact of bark that is separate from *Ficus benghalensis* has been examined in numerous types of research. Bark was discovered to have anti-diabetic effects. For the first time, alloxan diabetic rabbits were used to demonstrate the bark's hypoglycemia effect before being applied to humans [29].

7.2.8 Anti-allergic and anti-stress

Various *Ficus benghalensis* bark preparations have been used as anti-allergic and anti-stress treatments. Asthma patients who received the extracts in milk experienced leucocytosis and eosinophilia. Leucocytes and eosinophils were significantly reduced in both aqueous and ethanolic extracts [30]. Extracts made from petroleum ether and chloroform, however, were shown to be inert. As a result, the bark is an effective anti-stress and anti-allergic treatment for asthma (Figure 3).

7.2.9 Antidiabetic

Banyan's antidiabetic properties are among its most important medical uses. Different aerial *Ficus benghalensis* components were compared for their effects on blood glucose downregulation. Fruits have a more significant positive impact than roots or bark in lowering blood glucose levels. The aqueous extract of the aerial roots of *Ficus benghalensis* has anti-diabetic properties since it contains significant quantities of certain glycemic elements (calcium and magnesium) [31].

7.2.10 Antipyretic activity

Rats that had been given Brewer's yeast-induced pyrexia were used to study the antipyretic effects of banyan bark. The flavonoids and phenolic chemicals may be responsible for the analgesic actions of specific banyan bark preparations. We concluded that the various *Ficus benghalensis* bark extracts exhibit analgesic and antipyretic properties, possibly due to the extract's bioactive components. Additionally, it was examined in certain studies employing a model of rat twisting produced by acetic acid, and it showed a substantial analgesic effect [32].

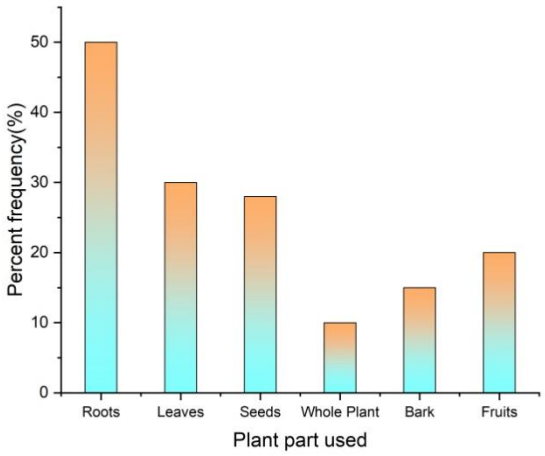

Figure 3: Frequency of plant components used in various illness treatments

8. Conclusions

The mulberry family (Moraceae) includes the perennial plant known as the banyan tree. For thousands of years, it has been grown worldwide and utilized as a decorative plant and in ancient medicine. “Flavonol, quercitin-3-galactoside, -sitosterol, and rutin are the main components of banyan”. The amount of each of these chemical components changes based on the species or

cultivar, as well as the growing environment's soil type, weather, and pH level. In addition to having cardio-protective, hepato-protective, and neuroprotective properties, bioactive peroxides are employed as anticancer, antiviral, diabetic, and malarial treatments. The bark of trees was used in the Ayurvedic medical system as a diabetes therapy.

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