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Pharmacognostic, Phytochemical, Pharmacological Potential on Banyan Tree (*Ficus bengalensis* L.)



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ABSTRACT

Since the birth of humans on this planet, plants have been used for the diagnosis, and treatment of various ailments. *Ficus bengalensis* L., belonging to the family Moraceae, is commonly known as one of the most used plants. It is a very large tree with spreading branches bearing multi hanging downward. In traditional systems of medicines, various plant parts such as stem be vegetative buds, leaves, fruits, and latex are used in diabetes, dysentery, seminal weakness leucorrhoea, erysipelas, nervous disorders, burning sensation, hemorrhages, and applied topica abscesses, wounds, ulcers, sores, cracked soles of the feet and rheumatic inflammations. This is usually known as Indian banyan or Bat or Bargad is known to have medicinal properties, also even used as home medication in the rural and the farthest parts of India. The fruit of *Ficus benghalensis* used as astringent, hemostatic, anti-septic, anti-inflammatory, antioxidant, and anticancer agent and also in the treatment of diarrhea, dysentery, and the treatment of skin diseases, abscesses, vaginal disorders, leucorrhoea, menorrhagia, and deficient lactation; therefore an effort has been made to carried out the detailed quality control and assurance of the drug followed by HPTLC profiles, physiochemical analysis, phytochemical studies and fluorescence analysis of drug to get authentic therapeutic value



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INTRODUCTION:

Plants are the oldest and the most important source of medicines. At the end nine after the synthesis of aspirin, research on herbal products was halted and researchers started synthetic and semi-synthetic drugs. But in the last few decades, there is an upsurge in research on the natural origin, especially botanical drugs. About 25% of the prescribed drugs are higher plants and this value is increased to 50%, if animal and microbial products are also *Ficus bengalensis* L., belonging to the family Moraceae, which is commonly known as Banyan Darakht-e-Reesh and Bargad (Unani medicines) and Bohar (Urdu). It is native to the wild i.e. India, Burma, Southeast Asia, Southern China, Thailand, and Malaysia. The tree in botanical gardens and parks throughout the tropical regions of the world. Many activities and useful phytoconstituents of this plant have been reported.^[1]

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, one such plant is *Ficus bengalensis* Linn. syn. *Ficus banana* ken. (Family-Moraceae). The plant is a large evergreen tree distributed all over India from the sub-Himalayan region and in the deciduous forest of Deccan and south India. It is grown in gardens and roadsides for shade (Anonymous, 1999, Parrotta et al., 2001). 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 and grows in evergreen except in dry localities where it is leafless for a short time. It is hardy and drought-resistant; it withstands mild frost. It is epiphytic when young. Fruit of *Ficus* species (family- Moraceae) viz. *Ficus benghalensis* Linn. commonly known as 'Chinese banyan or the banyan tree or *Bargad*' respectively has been most widely used in the traditional medicinal system all over the world including India. *Ficus* species are native to India, Nepal, Sri Lanka, Southwest China, and Indochina also found throughout the plains of India up to 170 m altitudes in the Himalayan region (Anonymous, 2000, Sharma et al., 2001, Gupta, 2008, Sharma, 2009).^[12]

Different parts of the banyan tree are used as a traditional medicine to get remedies for several ailments. The bark is useful for burning sensations, hemorrhages, diarrhea, dysentery, diabetes, ulcer, and skin diseases. The leaves are good for ulcers, leprosy, skin allergies, etc. The buds are used in diarrhea and dysentery. Latex is useful in rheumatism, hemorrhoids, inflammation, and skin diseases.



Scientific Classification:

Kingdom: Planate

Subkingdom: Tracheobinote

Super division: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Hamamelidae

Order: Urticales

Family: Moraceae

Genus: Ficus

Species: *Benghalensis, indica*^[3]

Morphology:

- Plant *F. benghalensis* is a laticiferous tree, up to 30 m in height with widely spreading branches bearing many aerial prop roots.
- The bark is greenish white. Leaves are simple, alternate, and arranged often in clusters at the ends of branches.

- They are stipulate, 5-12 cm broad and 10-18 cm long, entire, broadly elliptic to ovate.
- Fruits are achenes, which are small, crustaceous, and enclosed in the common fleshy receptacles, having red outside color.
- The young bark is somewhat smooth having a transverse and longitudinal row of lenticels, while in the older bark, the lenticels are numerous and closely spaced.
- Outer bark flakes off easily.
- The fresh-cut surface of the bark is pink to flesh-colored and exudes plenty of latex. The innermost part of the bark adjoining the wood is nearly white and fibrous.^[1]

History:

Vata is known as a sacred tree frequently mentioned in Atharvaveda. The Atreya Bramha informed that it grew abundantly in the region of Kurukshetra.

Vata is said to be very sacred to Hindus and the Shathpatha brahmana stated that Nyagrodha was named due to its downward growth bending its branches down to the ground and developing new secondary trunks. So that single tree in course of time from a large grove.

A very vast Vata tree near Narmada is famous in India and is called Kabir Vad. It is a very old one and large. Nearly 20,000 people can sit inside this.

The life span of the Vata tree is more than 100 years. Hence it is called Akshayvata. The great Sage Charaka has been categorized as mutrasangrahaniya (anti-diuretic). Acharya vagbhatta has mentioned the use of its twigs for brushing the teeth (dantdhavan). The decoction of its bark skin is useful in vaginal disease mentioned in astangasamghrha by Vagbhata.^[4]

Chemical Constituents:

Stem bark consists of several anthocyanidin derivatives (methyl ethers of leucodelphinidin-3-O-L-rhamnoside, leucopelargonidin-3-O-L-rhamnoside.

Lecocyanidin-3-O-D-galactosylcellobioside) and aliphatic long chain ketones (pentatriacontan-5-one, tetratriacont-20-en-2one, heptatriacont-6-en-10-one), besides betasitosterol glucoside and mesoinositol. Leucodelphinidin derivative, bengaleno side:

Aglycoside, Leucopelargonin derivative, leucocyanidin derivative, glycoside of leucopelargonidin have been isolated from the bark of the *Ficus benghalensis*.

The leaves contain 9.63% crude protein, 26.84% crude fibers, 2.53% calcium oxalate, and 0.4% phosphorous. Several qualitative chemical tests of ethanol extract and aqueous extract of leaves contain sterols, flavonoids, phenol, tannins, and saponins in large amounts whereas aromatic acids, carbohydrates, triterpenoids, gums, mucilage, and volatile oils were 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, taraxosterol, lupeol, β - amyryn along with psoralen, bergapten, and β -sisterol. [13]

S. No	Activity	Parts Used	Compounds Isolated
1	Anti-diabetic action and Insulin raising effect	Stem bark	3',5-dimethylether of leucocyanidin-3 -O-P-D ¹⁴
2	Insulin sparing action	Stem bark	3',5-dimethylether of leucocyanidin-3-O-P-D-galactosylcellobioside ²¹
3	Hypolipidemic effect	Stem bark	5,7-dimethylether of leucopelargonidin-3-O-a- L-rhamnoside ¹³
4	Antioxidant effect	Stem bark	5,7-dimethylether of leucopelargonidin-3-O-a- L-rhamnoside ²⁶
5	Effects on glucosesphosphate, Hexose kinase and HMGC α Areductase enzyme activity	Stem bark	3', 5 -dimethylether of leucocyanidin-3-O-P-D-galactosylcellobioside ¹⁴
6	Anti-tumour	fruits	Not isolated
7	Anti-microbial	fruits	Not isolated
8	Anti-diarrhoeal	Hanging roots	Not isolated

• **Isolation and Cultivation of Endophytes from Plant Roots:**

The most critical step for working with microbial endophytes is to isolate them. The procedure should be sensitive enough to recover a maximum number of endophytes and strong enough to eliminate the epiphytes present on the root surface.

A] Selection of Plant Material:

Around 30,000 plant species exist on the earth. Since each plant is a host to one or more endophytes, creative and imaginative strategies must be used to quickly narrow the search for the host plant for bio prospective endophytes. While selecting a plant for investigation of endophytes capable of producing novel bioactive molecules, the following criteria need to be considered:

1. Plants from a unique environmental niche, especially those with unusual biology and possessing novel strategies for survival are seriously considered for the study.

2. Plants that have an ethnobotanical history (use by indigenous peoples) that are related to some specific application of interest are selected for the study.
3. Endemic Plants, that have unusual longevity, or have occupied a certain ancient land mass, are appropriate for study.
4. Plants growing in areas of great biodiversity also have the potential for housing endophytes with great diversity.

B] Isolation of Endophytic Microorganisms:

The first step in the isolation of microorganisms residing in plant tissues is surface sterilization of explants. To achieve complete surface sterilization, various steps should be followed; the method varies according to the type of tissue as well as its location.

I] Pre-Washing and Cleaning

Thorough pre-washing of plant material is necessary to remove the adhering soil particles and dust on the root surfaces to reduce the load of surface flora. Pre-washing can increase the effectiveness of the surface-sterilizing agents. The root tissue selected for isolation should be disease-free and freshly collected. Immediately after collection, the sample should be processed for surface sterilization. Pre-washing can be carried out by vigorous washing with tap water, distilled water, or one of several dilute saline buffers of pH-7.2.

II] Surface Sterilization:

Sterilizing agents are chemicals used to kill the microflora on the surface of plant material. The most commonly employed surface-sterilizing agents are sodium hypochlorite, mercuric chloride, ethanol, hydrogen peroxide, and chlormine. Propylene oxide vapor and formaldehyde are less frequently used chemical sterilizing agents. More effective sterilization can be achieved using a combination of agents or combined chemical and physical agents. For example, root tissue of *Citrus jambhiri* was sterilized by dipping in 90% ethanol and flamed to remove surface microflora. To achieve effective surface sterilization, nonionic detergents like Tween 20, Triton X-100, and Tween-80 can sometimes be used along with surface-sterilizing agents, to improve penetration of surface sterilizers to niches and grooves beyond the epidermal cells. The concentration of sterilizing agents, combination treatment, and incubation period for sterilization may vary depending on the plant as well as tissue material.

C] Cultivation of Endophytes:

Surface-sterilized root tissue is subjected to an isolation procedure. The most commonly employed procedures are cutting off the surface-sterilized plant tissue and maceration. The root material is cut aseptically into small pieces (7–8 mm) and subjected to cultivation on nutrient media. Plant secretions such as latex and wax also contain microflora, so these secretions should be collected aseptically and streaked onto nutrient agar media to cultivate the endophytic bacteria. During cultivation, the organism can grow fast, and hence the limitation of nutrients can affect the isolation of slow-growing microflora. Maceration is the method by which the slow- and fast-growing cultures can be isolated. Maceration requires sterilized mortar and pestle, homogenizer, or blender. Sterile buffer or sterile saline is used during the homogenization of plant tissue to maintain the integrity of endophytic organisms. The whole procedure should be performed aseptically to avoid contamination. However, heat generation during the maceration may kill the endophytes, so care should be taken while processing to have minimum heat generation.

D] In Planta Visualization/Localization of Endophytes:

To study plant-interacting bacteria such as endophytes and their behavior in the plant system it is necessary to demonstrate their internal colonization ability and the establishment of endophytic strain in the plant. Isolation procedures are the simplest way to demonstrate the establishment of microflora in the internal tissue of a plant and give a rough estimate of the bacterial population density. However, isolation procedures do not allow an exact localization and often detect only minor naturally occurring microorganisms. In general, the two types of investigation of bacterial endophytic behavioral studies are those that are concerned with indigenous populations and those that monitor the colonization of an introduced endophyte.

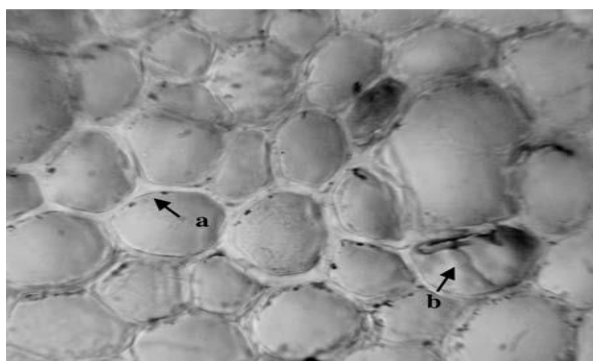


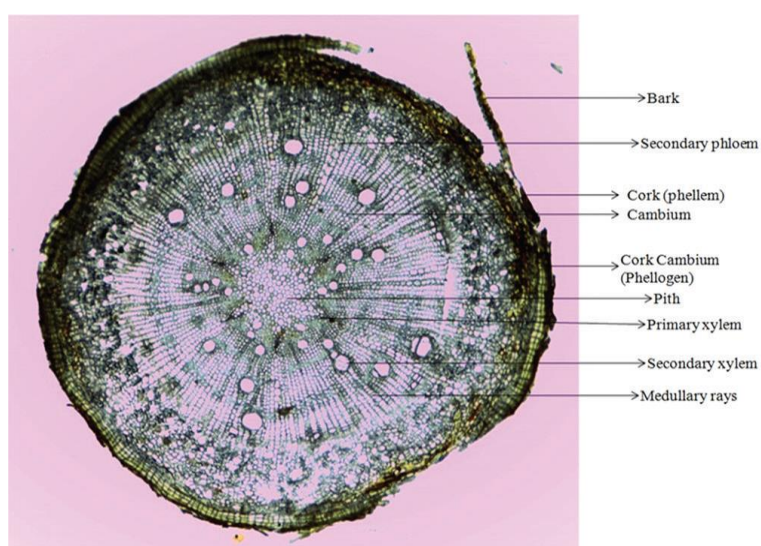
Figure no - Light micrograph of a transverse section of hanging roots of a Banyan tree

Macroscopic characteristics:

Macroscopic characteristics identification of medicinal plant materials is based on the shape, size, surface, texture, fracture, color, and appearance of the cut surface. The collected cut pieces of aerial roots were 8–10 cm long and macroscopic characteristics were evaluated. [7]

Microscopic characteristics:

Fresh specimens of aerial roots of *F. benghalensis* were collected and washed thoroughly with distilled water. Then, the samples were fixed in 2.5% glutaraldehyde. Freehand semi-thin transverse sections were done with the help of a razor. The sections were allowed to dehydrate by passing it from various gradations of ethanol starting from 30% to 100%. After the dehydration, sections were mounted over a drop of DPX taken in a clean slide and directly observed under a light microscope (LEICA DM750) under low magnification. [7]



Pharmacognostic characters¹⁴

1. Stem bark:

Shade dried stem bark is of brownish grey color with dark patches from the outer surface and reddish brown to yellowish brown on the inner surface possessing stimulant odor, astringent taste, and rough texture due to the presence of lenticels. The thickness of bark varies with the age of the tree; normally 0.8 to 2.5 cm. Fracture is brittle in the outer bark and fibrous in the inner portion. Microscopically, stem bark is differentiated into outer and inner bark having a width of 288–576 and 2.9–3.5 mm respectively. Periderm consisting of phellem and phelloderm originates from the deeper portion of the secondary phloem. Phellem cells are thin-walled, homogeneous, rectangular, and suberized. Phelloderm is distinct and wide, its cells are turned into radially arranged cubical sclereids.^[1]



2. Leaf

Leaves are coraceous having a slightly bitter taste, green in color, opposite arrangement, ovate to elliptic in shape (lanceolate shape) with obtuse apex and reticulately pinnate venation. Length and width are 10-30 cm and 7-20 cm respectively with 2.5-5 cm long petiole. Powder of leaf is pale green colored and odorless possessing a slightly bitter taste. Trichomes, fibers, calcium oxalate crystals, spiral thickenings, and epidermal cells with anticlinal walls are visible under a microscope.^[1]



3. Leaf primordium

Fresh leaf primordium has a light green thick outer covering. Leaf primordia are arranged alternatively and occur in predictable positions. The length and width of primordium are 2-4 cm and 0.4-0.6 mm respectively. In dry form, these possess abundant trichomes on the outer surface. Primordia have an agreeable odor and a slightly bitter taste. In the transverse section, a different sequence of arrangements in concentric rings is visible. Abundant uniseriate trichomes are present on the epidermis. ^[1]

Vernacular names of Banyan Tree:

Names in different languages:

1. Hindi name – Bad, Bargad, Baragad
2. English name – Banyan tree
3. Kannada name – Alada mara, Aala, Vatavruksha
4. Assamese name – Vat, Ahat, Vatgach
5. Bengali name – Bat, Bat Briksh
6. Gujarati name – Vad
7. Kashmiri name – Bad
8. Malayalam name – Peroal
9. Marathi name – Vad
10. Oriya name – Bata, Bara.
11. Punjabi name – Bhod, Bhaur
12. Tamil name – Ala
13. Telugu name – Peddamari
14. Urdu name – Bad, Bargud^[4]

Physicochemical parameters:

Stem bark:

Physicochemical parameters of *F. bengalensis* stem bark are as follows; Foreign matter (1.53% w/w); Total ash (11% w/w); Acid insoluble ash (2.46% w/w); Water soluble ash (5.13% w/w); Loss on drying (10% w/w); Water soluble extractive (13% w/w); Alcohol soluble extractive (8.2% w/w) [11, 15].

Leaf:

Physicochemical parameters of *F. bengalensis* leaf are as follows;

Vein termination number (12.6/mm²); Vein islet number (10.7/mm²); Stomatal index (lower epidermis) (16/mm²); Stomatal index (upper epidermis) (7.5/mm²); Total ash (11.63% w/w); Acid insoluble ash (4.5% w/w); Water soluble ash (7.56% w/w); Water soluble extractive (6.4% w/w); Ethanol soluble extractive (4.8% w/w); Chloroform soluble extractive (1.2% w/w); Petroleum ether soluble extractive (1.8% w/w) [13].

Leaf primordium:

Physicochemical parameters of *F. bengalensis* leaf primordium are as follows; Foreign matter (0.65%); Moisture (10.75%); Total ash (10.95% w/w); Acid insoluble ash (0.75% w/w); Water in soluble ash (1% w/w); Water soluble extractive (0.63% w/w); Benzene soluble extractive (0.54% w/w); Chloroform soluble extractive (0.23% w/w).^[1]

Plant Specifications:

Distribution:

The banyan tree is found in all kinds of forests from plains to 1000 m of height from sea level. Commonly it is found in India, Sri Lanka, Pakistan, and Bangladesh. It is widely planted in the tropic regions. It is planted throughout the forest tract of India. It is Hardy, drought-resistant, and can withstand mild frost.

External features of the bark:

The bark of the Banyan tree is around 12 to 18 mm in thickness, grey colored has light bluish-green or grey patches, is slightly curved, and girth varies with the maturity of the tree. The surface is strongly fissured and rough due to the presence of a longitudinal and oblique

row of lenticels, mostly circular and raised, split shortly in the outer 2/3 of bark while the inner portion shows a fibroid fracture. The banyan tree is multipurpose in use and very attractive for its medicinal, socio-cultural, and ethnobotanical properties. The tree provides habitat for several animals and plants and hence it is considered one of the most important keystone species in the Gangetic flood plain and other ecosystems of Bangladesh. It is also considered the most suitable plant for community plantation as a shade tree. Thus, there are good demands for the transplant of a banyan tree for mass-scale plantation affairs in different countries of arid and semi-arid regions.

Propagation and Cultivation:

The seeds of the banyan tree are diffused through small birds that eat the figs and excrete out the undigested seeds. Initially, the Banyan tree is an epiphyte and often utilizes other mature trees as its hosts. The banyan tree is propagated primarily by root tip cutting or eye cuttings. Initially, they demand moisture content, but once established, these trees are drought resistant. The plant may be grown indoors on a much smaller scale by a special method known as the Bonsai.^[3]

Root System Of Banyan Tree:

1. The root system is a descending portion of the plant axis. When a seed germinates, the radicle is the first organ to come out. It elongates to form a primary tap root that gives off lateral branches and thus forms the root system. It branches through large and deep areas in the soil and anchors the plant very firmly.
2. The banyan tree is mainly composed of aerial roots that provide support to the big heavy plant.
3. A single type of root system under the soil is not enough to provide support to the big and heavy-standing banyan tree.
4. Prop roots come out from the aerial parts of branches that touch the ground and later become thicker and stronger.
5. The banyan tree is a dicot tree and the underground roots of the banyan tree are Tap Roots.^[3]



Root Growth:

The roots develop throughout the life of the plant. They grow longer from the tip, adding cells to the meristematic part of the roots and they grow fatter as they add cells around their tube-like bodies. At the tip of each root, there is a small group of tough, dead, hard cells called the root cap. The root cap is the strongest part of the root tip and its job is to push the root further into the dirt road in the search for the moisture and nutrients for the plant. Therefore the root cap helps in the geotropic movement of the roots and accepts the pressure of gravity.^[3]

Sanskrit Synonyms

Sanskrit Synonyms of Vatavruksha:

Bahupada- The tree has multiple roots like many feet

Shipharuha, Padarohini, Pada rohi – roots look as if they climb or latch on to the stem

Raktaphala- The fruit is red colored like blood

Ksheeri- The tree has a milky latex

Shrungi- Has horn-like shoots

Vanaspathi- Flowers are not visible

Neela, Jataala – plenty of roots

Mahachaya – the tree grows big and wide and gives a huge area of shadow

Yakshavasaka, Yakshataru – Yaksha (Divine character) lives in this tree Skandhajana,

SkandhajaNyagrodh, Avarohi, Rohini Daanta, Kanchana, DhruvaVaishravana Vasa, Vitapi, Mandali, Vanabhu^[4]

Medicinal Uses Of Banyan Tree:

A) Banyan Leaves Remedies:

- 1) **Abscess (a painful collection of pus due to bacterial infection), Boils:** Take fresh Banyan leaves. Coat them with Til or sesame oil. Warm coated leaves and apply the form of poultice to affected areas.
- 2) **Painful joints, swelling:** Apply sesame oil on fresh leaves of Banyan. Warm this and apply it to the affected areas.
- 3) **Rashes:** Apply leaves paste on the affected area.
- 4) **Freckles:** Make a paste of tender leaves of Banyan and coconut pulp. Apply on freckles. Similarly, the leaf bud of Banyan and Masur ki dal paste removes freckles and gives a glow.
- 5) **Intrinsic hemorrhage:** Tender leaves of durva grass and Banyan mixed with honey should be taken.^[9]

B) Banyan Milky Latex Remedies:

- 1) **Bad breath, Gum infections, loose teeth:** Break leaves or branches of a Banyan tree. Collect the milky exude. Mix this with honey and apply it to the gums. Keep this for ten minutes then rinse the mouth.
- 2) **Bleeding piles:** Take a few drops of sap and add in a glass of milk. Drink this regularly.
- 3) **Corneal opacity:** Finely powder Camphor/Kapoor. Mix this in Banyan latex. Apply this mixture as an eye ointment.
- 4) **Conjunctivitis, ophthalmic:** Make a fine paste of one clove and Banyan latex. Apply this to the eye.
- 5) **Haemorrhoids, bruises, inflammation:** Apply the latex externally to the affected area.
- 6) **Cracked heels:** Fill the cracks with the latex of the Banyan tree.

7) **Rheumatism, Lumbago, joint pain:** Massage joints with latex of tree.^[9]

C) Banyan Aerial roots remedies:

1) **Diarrhea:** Take aerial roots of the tree and pound them. Take this with buttermilk. Soak tender leaf buds in water at night. The next morning drink the infusion.

2) **Gum problems, Pyorrhoea:** Use aerial roots for mouth cleaning.

3) **Pimple:** Apply a paste of aerial roots.

4) **Hair problems:** Make Powder of equal quantities of the aerial roots of banyan and the lemon peel. Boil this powder in coconut oil and apply. In the case of baldness, powder the aerial roots of the banyan tree and lotus roots and use them the same way.

5) **Tooth care:** Chew Tender aerial roots and use them as toothbrushes.^[9]

D) Banyan Bark Remedies:

1) **Moth ulcers, Bad breath:** Boil bark (1 inch) of a Banyan tree in one cup of water. Gargle with this water frequently.

2) **Excessive urination:** Boil 2 teaspoon bark powder in a glass of water till volume reduces to 1/2 glass. Drink this prepared decoction throughout the day.

3) **Skin diseases, Venereal diseases:** Boil 5 grams of bark powder in 2 glasses of water and cook till water reduces to 1/4 in. Drink this 2-3 times a week.^[9]

Other Uses of a Banyan tree:

1. Banyan tree for the digestive system:

The use of the banyan tree to treat infections of the gastrointestinal tract is very common. Banyan tree leaves have powerful healing and anti-microbial properties and can be used for treating disorders like dysentery and chronic diarrhea. A study concluded that the use of *Ficus benghalensis* as a dietary supplement can result in numerous health benefits. The fiber content of banyan tree extract (in the form of latex) is quite high, which makes its use in the treatment of constipation.

2. Banyan tree for oral health:

The root extract of the banyan tree shows prominent antibacterial activity against many bacterial species responsible for tooth decay and gum disorders. The two main strains of bacteria responsible for this are *Lactobacillus* and *Streptococcus mutans*. A study demonstrated that the banyan tree root extract, when mixed in toothpaste, showed significant germicidal (potential to destroy or kill germs) activity when tested on animal models. The use of the banyan tree may thus be beneficial for oral health and hygiene.

3. Banyan tree for inflammation and pain:

Banyan tree has been traditionally used for its anti-inflammatory (effective against inflammation, that is, swelling, pain, and redness) and analgesic (pain relieving) properties. The use of banyan tree leaf extract against inflammation caused by diseases such as arthritis has been demonstrated. Studies found that the aqueous extract of banyan tree leaves has pain-relieving properties similar to that of morphine. Further in vivo studies are, however, required to acknowledge the full potential of banyan tree extract in this regard.

4. Banyan tree for the immune system:

Ficus benghalensis has been popularly used in the folk medicine of India. The extract from the bark of the banyan tree is a good agent for boosting the immune system. Studies found that this extract contained several bioactive compounds. These bioactive compounds have antioxidant properties and the capacity to neutralize free radicals (that cause damage to the internal organs of the body). They help in boosting the immune system and prevent diseases.

5. Banyan tree for vaginal infection treatment:

The use of leaves and extract of the banyan tree has been found in the treatment of vaginal infection, particularly leucorrhoea. Vaginal infection is usually caused due to the microbial flora of the vagina. Banyan tree extract is antimicrobial and thus can be used for the treatment of vaginal infections. The bark or the leaves are crushed to make a powder, which is then mixed with water to prepare a vaginal wash for the treatment of the infection.

6. Banyan tree for skin care:

The extract of the banyan tree leaves and barks has been found to have skin protective properties. It can block the toxic effects of several allergens (allergy-causing agents) and provide a soothing feeling. It is also used to prevent skin damage.

The leaf extract of the banyan tree can be used along with warm milk to prepare a herbal drink to treat conditions like acne and rashes. Dermatologists prescribe concoctions (mixtures) prepared from banyan tree leaves and aloe vera to treat skin allergies and improve skin health. The aqueous extracts of *Ficus benghalensis* have been found to possess the capacity to heal wounds and are often used in their treatment.

7. Banyan tree for diabetes:

Diabetes is a major health concern gripping the modern world. The use of banyan tree extracts for the treatment of diabetes has been prevalent since early times. The bioactive compounds present in banyan tree extracts have been used in several preparations to treat diabetes and other related chronic disorders.

Studies have found that these compounds have promising medicinal properties and can be used to develop drugs for the management of diabetes. Further scientific research is, however, required for the extraction of these compounds and to establish their safety as a potential drug.

8. Banyan tree for the brain:

Different parts of the banyan tree are used to treat several neurological conditions. The fruits of the banyan tree have been found to possess the compound serotonin which can act against anxiety and depression. Further studies have also found that banyan tree extract can aid in the relaxation of muscle cells. The bioactive compounds also can enhance memory and moderate the levels of seizures in case of a panic attack.

9. Banyan tree for cholesterol:

Leaf extract of banyan tree has been found to lower low-density lipoprotein or LDL (bad cholesterol) and increase the percentage of the high-density lipoprotein or HDL (good cholesterol). Studies have found that lipid levels in the blood have significantly been lowered by the use of medicine containing leaf extracts of *Ficus benghalensis*.

10. Banyan tree against mosquito-borne diseases:

The leaf extract of the banyan tree has larvicidal properties (killing the larvae) against the *Culex tritaeniorhynchus* and *Anopheles subpictus* species of mosquito. These mosquitoes act as vectors of diseases such as encephalitis and malaria respectively. The methanolic extract of banyan tree leaves is effective for the control of mosquito species, which can help to prevent and control mosquito-borne diseases.

11. Banyan tree as anti-bacterial and anti-fungal:

The extract obtained from the aerial roots also called prop roots of the banyan tree, have been found to possess anti-bacterial and anti-fungal properties. The aerial roots contain several bioactive compounds that are effective against several species of fungi and bacteria. This property of the aerial roots has immense potential for their use as biocontrol agents against the spread of many diseases and in food preservation.

12. Banyan tree for pollution control:

Banyan trees can also be used as agents for pollution control. Studies have found that the banyan tree has the potential to act against the agents causing air pollution. This property of the banyan tree makes it a good agent for maintaining the quality of air in areas with high levels of air pollution. This may help in the prevention of respiratory disorders and ailments in that community or area.^[5]

MATERIALS AND METHODS:

1. Plant materials:

Ficus benghalensis (Indian banyan) fruit are collected from Arogyadham campus garden, Chitrakoot, Satna, Madhya Pradesh. They were washed with tap water, rinsed with distilled water, and shade dried until the fracture is uniform and smooth. Then the dried fruit material was powdered. Then the final uniform powder was used for the extraction of active constituents of the fruit.

2. Preliminary Phytochemical Screening:

Phytochemical analysis of the extract was conducted following the procedure of Indian Pharmacopeia (Anonymous, 1996). By this analysis, the presence of several phytochemicals like alkaloid, flavonoid, tannin, saponin, resin, protein, and carbohydrate were tested.

3. Physico-chemical analysis:

Air dried fruit material was used for the quantitative determination of loss on drying, total ash, acid insoluble ash, alcohol, and water-soluble extractive values according to standard procedure of Indian Pharmacopoeia and WHO/QCMMPM (Anonymous, 1996, Harbone, 1984).

4. Fluorescence analysis:

Fluorescence analysis of the fruit powder was treated with different chemicals and seen under the normal light and UV radiations at 254 and 365 nm wavelengths as per the standard procedure. The color development under daylight was also observed in the presence of various phytochemical compounds (Anonymous, 1998).

5. High-Performance Thin Layer Chromatography (HPTLC):

For HPTLC, 5 g of coarse fruit was powdered in a 250 ml stoppered conical flask & extracted with 100 ml ethanol for 24 hours by maceration technique with occasional shaking. The extract was extracted and the volume was raised to 100 ml in a volumetric flask. 25 ml of the extract was taken from the above stock solution and concentrated on a water bath to similarly, ethanol extracts were prepared for one sample of *F. benghalensis* L. as reference. TLC of extracts of all the samples and the reference ingredients was carried out on Silica Gel 60 F254 precoated plates (0.2 mm thickness; from Merck India Limited). Camag Linomat 5 applicator was used for band application and Desaga Video documentation Unit 3 was used for documentation of fingerprinting. The mobile phase used was Toluene: Ethyl acetate (7:3). The plate was developed over a distance of 10 cm in a saturated development chamber (Twin trough chamber (10×10 cm with SS lid) and visualized under visible light, 254nm and 366nm. After spraying with 5% methanolic-sulphuric acid followed by heating at 1100C for 5-10 min (Kokate, 1994, Lohar, 2007, Anonymous, 2008).

Pharmaceutical Potency:

In the traditional system of medicine, different parts of the FB plant, such as stem bark, root bark, leaves, vegetative buds, fruits, and latex are used to treat dysentery, nervous disorders, diarrhea, diabetes, leucorrhoea, menorrhagia, and acerbic. In the Ayurvedic system of medicine, FB is used in wound healing.

1. Antioxidant:

Ficus compound shows significant antioxidant effects which may be due to their Polyphenolic content. Antioxidant content and activity were studied by different methods; hydrogen peroxide activity, hydroxyl radical scavenging activity, 1,1 diphenyl and 2 picryl hydroxyl (DPPH) radical scavenging activity, reducing power and total phenolic content. The aqueous extracts showed maximum scavenging of DPPH radical (96.07%) at the concentration of 250µg/ml. Its activity is higher than hydrogen peroxide which was (69.23%) at the concentration of 1000µg/ml. The extract of banyan showed the best outcomes when compared with another standard compound such as ascorbic acid.

2. Antitumor:

In another study, FB fruit extracts exhibited antitumor action. In the Ayurvedic system of medicine, the banyan plant is used as an antitumor agent. The extracts of the four confirmed ficus species (*Ficus thonningii*, *F. saussureana*, *F. exasperata*, and *F. sur*) have important antibacterial activity, but with no significant antifungal effect. These experiments support the traditional use of these plants in folk medicines as antitumor remedies.

3. Anti-inflammatory:

Anti-inflammatory effects of ethanolic and petroleum ether extracts of the bark of banyan were measured in different animals. The animals were given oral doses of 300 and 600 mg/kg/day of body weight to the dietary fiber content of foods namely, khejri (prorsopiscinercia), peepalbanti (*Ficus religiosa*), banyan (*Ficus bengalensis*), gullar (*Ficus glomerata*) and tents (*Capparis decidua*) mottled from 38.5% to 55.7%. Fiber from all these plant foods is fed at the 10% dietary level to rats. Results showed that banyan extract was of high potential anti-inflammatory activity.

4. Immunomodulatory:

The aerial parts of FB showed to have immunomodulatory activity. The immunomodulatory action of the aerial roots has effects on both specific and non-specific immunity. Methanolic extract of the root was found to exhibit a prominent increase in the fraction of phagocytosis. In another study, it was proven that the extract exhibited a significant increase in the percentage of phagocytosis in human neutrophils. It was found that the extract can elevate

hypersensitivity reactions in a dose-dependent manner, it also resulted in a connotation elevation in the antibody titer value.

5. Wound healing:

The reason for the efficacy of the FB plant to heal wounds remains unknown for a long time. In this case, the chemical components responsible for wound healing were unknown. But later on, after the identification of chemical components responsible for wound healing, it was found that FB also contains chemical constituents and is an effective wound healing agent.

6. Antistress and antiallergic:

Different extracts of FB bark were used as an antiallergic and antistress therapy. The extracts were given to patients with asthma in milk resulting in leucocytosis and eosinophilia. Aqueous and ethanolic extracts revealed that there is a prominent decrease in the number of leucocytes and eosinophils. While petroleum ether and chloroform extracts were proved to be inactive. Hence, bark work as an anti-stress and anti-allergic agent in asthma.

7. Hypoglycemia:

In many studies, the hypoglycemic effect of bark which is isolated from FB was evaluated. It was found that bark has anti-diabetic properties. The hypoglycemic consequence of the bark was demonstrated in alloxan diabetic rabbits for the first time and then in human beings.

8. Antipyretic Activity:

The antipyretic action of bark from banyan was studied in Brewer's yeast-induced pyrexia in rats. The analgesic effects of different bark extracts of banyan might be due to the flavonoids and phenolic compounds. It was concluded that the various extracts of the bark of FB show analgesic and antipyretic effects which may due to the presence of bioactive components in the extract. Furthermore, it was also tested by some research by using the acetic acid-induced twisting model on rats, it showed significant analgesic activity.

9. Antidiabetic:

One of the most important medicinal applications of banyan is its antidiabetic activity. Different aerial parts of FB were comparatively used for their activity on blood glucose down-regulation. Fruits lowered the blood glucose concentration more beneficial than the

root or bark. The antidiabetic effects of aqueous extract of aerial roots of FB are due to the presence of specific glycemc elements (calcium and magnesium) in high concentrations.^[8]

CONCLUSION:

Plant life has been serving humankind for centuries by providing a good source of medicines. Active constituents from plants are isolated and used for analysis, treatment, mitigation, and inhibition of various diseases, but many crude drugs are also in use. *Ficus bengalensis* L. is one of the most important plants of traditional medicines and is still in use, to treat various diseases, particularly diabetes, reproductive system disorders, inflammatory conditions, and swellings. Because of its importance in traditional medicines, its quality control factors are established by pharmacognostic studies and various phytochemicals have also been isolated and recognized. Pharmacological studies on various parts of the plant have confirmed its use in traditional medicines.

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