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A REVIEW ON BIOLOGICAL POTENTIAL OF FICUS BENGALENSIS

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ABSTRACT

Ficus bengalensis, a genus of family moraceae is a tropical, deciduous, evergreen tree with more than 800 species and about 40 genera of the mulberry family. *Ficus bengalensis* is known as common name bargad and cultivated as a garden tree or spiritual tree. The leaves of *Ficus bengalensis* used as ulcer protective, leprosy and fever, inflammation (Ayurvedic). The milky juice is aphrodisiac, tonic, vulnerary, maturant also useful in piles, diseases of the nose, gonorrhea. In unani the aerial root is styptic, syphilis, biliousness, dysentery and inflammation of liver. A lot of pharmacological work has been scientifically carried out on various parts of *Ficus bengalensis* but some other traditionally important therapeutically uses are also remaining to prove till now scientifically as analgesic, antipyretic, anti-ulcerogenic, inflammatory bowel, antimicrobial, antidiabetic activity etc. The various chemical constituents present in *Ficus bengalensis* are bengalenosides, flavonoids and leucocyanidin glycoside.

KEYWORDS: *Ficus bengalensis*, Bargad, Bengalenosides, Flavonoids.

INTRODUCTION

Ficus bengalensis is an indigenous plant belonging to family moraceae. It is commonly known as banyan tree or bargad or bar.[1] It is reported to have antidiabetic activity.[2] There are more than 800 species and 2000 varieties of ficus genus, most of which are native to old world tropics. It is a large ever green tree distributed all over India from sub Himalayan region to the deciduous forest of Deccan and south India.[3] It grows up to 30 meters with spreading branches and many aerial roots.[4] The external features of the bark are 12-18 mm thick, grey, closely adhered ashy white, light bluish-green or grey patches, slightly curve,

thickness varies with the age of the tree. The surface of bark 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.[5]

Fig. *Ficus bengalensis.*

Taxonomic classification of *Ficus bengalensis*[6]

Kingdom: Plantea

Sub-kingdom: Tracheobionta

Super-civision: Spermatophyta

Division: Magnsliophyta

Class: Magnoliopsida

Subclass: Hamamelidae

Order: Urticales

Family: Moraceae

Genus: Ficus

Species: F.bengalensis

Phytochemical

Leaves yield quercetin-3-galactoside, rutin, friedelin, taraxosterol, lupeol, /3-amyrin along with psoralen, bergalen and 3-sisterol. The bark of ficus bengalensis presence of 5,7 Dimethyl ether of leucopelargonidin-3-O-o-L rhmnoside and 5,3 dimethyl ether of leucocynidin 3-0-o>D galactosyl cellobioside, glucoside, 20-tetratriaconthene-2-one, 6-heptatriacontene-10-one, pentatriacontan-5-one, beta sitosterol-alpha-Dglucose, and meso-inositol Earlier, glucoside, 20 tetratriaconthene-2-one,6- heptatriacontene-10-one,

pentatriacontan -5-one, /3sitosterol-alpha-Dglucose, and meso-inositol, Leucodelphinidinderivative, bengalenoside: Aglucoside, Leucopelargonin derivative, Leucocynidin derivative, glycoside of leucopelargonidin have been isolated from the bark of the ficus bengalensis.

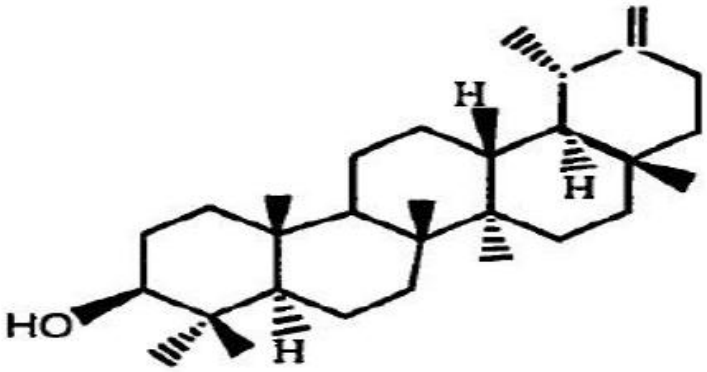

Fig. Structure of Friedelin.

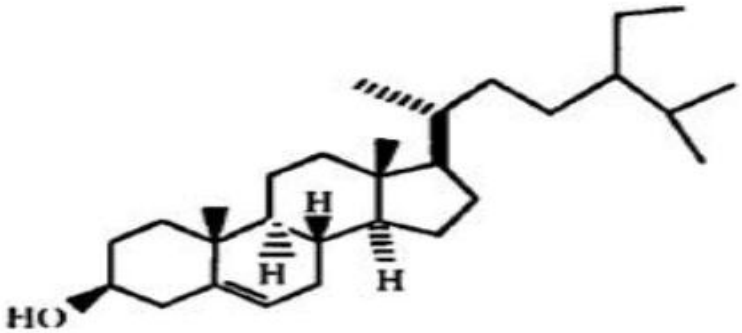

Fig. Structure of β-Sitosterol.

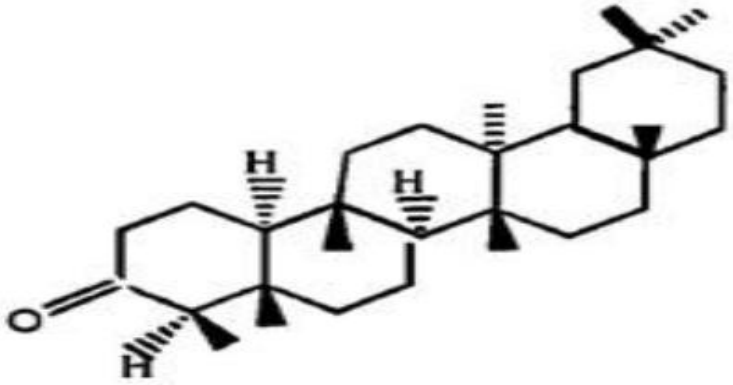

Fig. Structure of Quercetin-3-glactosidde.

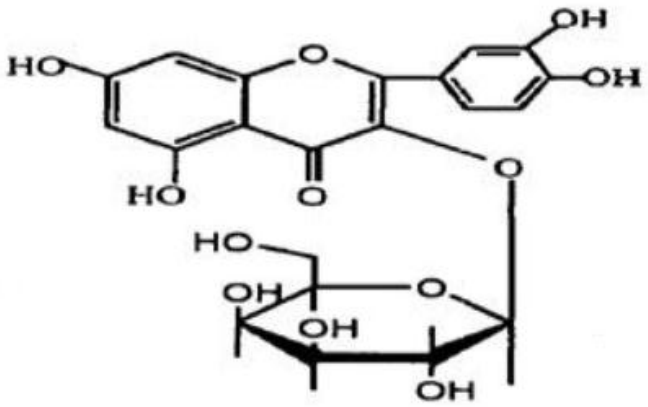

Fig. Structure of Taraxasterol.

Traditional Uses

The plants has been extensively used in Ayurvedic and unani medicine to treat various health problems. It is useful for treating ailments like dysentery, seminal weakness, menorrhagia, leucorrhoea, erysipelas, nervous disorders and burning sensation etc.[8]

Pharmacological Effects

Antihelmintic activity

The extract from *Ficus bengalensis* were found not only to paralyze but also to kill the earthworms. The aqueous and methanolic extract was found to be more effective to execyte the earthworm when compared to antihelmintic drugs.[9]

Immunomodulatory activity

The successive methanol and water extract exhibited a significant increase in the percentage phagocytosis versus the control. In *in vivo* studies, the successive methanol extract was found to exhibit a dose related increase in the hypersensitivity reaction, to the SRBC antigen, at concentration 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 200mg/kg in animal studies.[10]

Antioxidant (free radical scavenging) activity

Ficus bengalensis possesses antioxidant activity which is mostly due to phenolic compounds. Anti-oxidant and free radical scavenging activity of methanolic and acetone: water (70:30) extracts of *F. bengalensis* aerial roots was studied. Antioxidant potential of the methanol extract, estimated by using potassium ferric cyanide reduction method, was comparable to that of tannic acid. DPPH free radical scavenging activity (%) of the 70% acetone and

methanol extracts was about 50, nearer to each other, at concentrations of 46.79 µg and 39.3 µg respectively. The values of TAA determined by $ABTS^{\cdot+}$ radical cation scavenging activity of the 70% acetone and methanol extracts were 6182.7 and 6096.1 µmol/g respectively.[11]

Antifungal activity

Antifungal activity of aqueous extracts of the stem bark, leaf and root was evaluated by agar diffusion technique at dose level of 30 mg/ml using nystatin (30µg/ml) as reference standard. Among the three extracts, stem bark extract showed antifungal activity against *Trichophyton rubrum* and *Candida albicans* comparable to that of nystatin. *T. rubrum* was resistant to the leaf extract and *K. pneumonia* was resistant to both leaf and root extracts.[12]

Wound healing activity

Wound healing capacity of aqueous and ethanolic extract of the root was studied by incision model, excision model and dead space wound model in rats. Increased breaking strength, decreased period of epithelialization and percentage wound contraction and increased hydroxyproline content were observed in incision, excision and dead space model respectively. Results were comparable to that of standard drug povidone iodine. In another study, using excision and incision wound models, wound healing ability of aqueous and ethanolic extracts of the stem bark was evaluated in excision and incision wound models. Significant wound healing activity was shown by increase in the skin breaking strength and the rate of wound contraction and a decrease in the period of epithelialization, compared with placebo.[13,14]

Cytotoxic activity

Fruits of *F. bengalensis* have cytotoxic activity demonstrated by brine *shrimp* bioassay with LC50 value of 900 and by potato disc bioassay with 48% tumor inhibition.[15]

Analgesic activity

Analgesic activity of methanolic extract of the leaf and the stem bark in Acetic acid induced writhing and Eddy's hot plate method in rats, was comparable to that of potent drugs i.e. diclofenac sodium and aspirin.[16]

Antidiabetic activity

Ficus.bengalensis has shown antidiabetic activity, the oral administration of aqueous extract of bark and leaves produced a hypoglycemic activity at all the doses. But bark 300mg/kg and 150mg/kg has shown reduction in the blood glucose levels (p value<0.0001) and also with leaf extract 150mg/kg from day 14 (highly significant, p<0.0001). Bark has produced a dose dependent increase in the hypoglycemic activity. However decreased hypoglycemic activity was observed with leaf 300mg/kg as the days progressed as compared to leaf extract 150mg/kg.[17,18]

Anti-inflammatory activity

Anti-inflammatory activity of bark of young plant of *F. bengalensis* was compared with that of mature plant using carrageenan induced hind paw edema for acute inflammation and cotton pellet induced granuloma for chronic inflammation, in rats. Ethanolic, chloroform and petroleum ether extracts at dose level of 300 and 600 mg/kg/day p.o. were studied using indomethacin at dose level of 10 mg/kg/day p.o. as standard drug. Ethanolic extract of younger plant at dose level of 300 and 600 mg/kg/day p.o. caused 37.64% and 69.04% reduction in paw volume after 3 h, while mature plant caused 55.03% and 65.54% reduction respectively, in carrageenan induced paw edema model. In cotton pellet granuloma model, ethanolic extract of younger plant at dose level of 300 and 600 mg/kg/day p.o. caused 19.27% and 39.03% reduction in paw volume after 3 h, while mature plant caused 14.12% and 34.25% reduction respectively. So, younger plant possesses relatively more anti-inflammatory activity than mature plant. Chloroform and petroleum ether extracts did not possess significant anti-inflammatory activity.[19,20]

Anti-diarrhoeal activity

Anti-diarrhoeal effect of ethanolic extract of *F. bengalensis* hanging roots (EEFB) was evaluated at dose level of 400 mg/kg p.o. against castor oil induced diarrhea, PGE2 induced enter pooling and GI motility in charcoal meal test in rats using diphenoxylate (5 mg/kg p.o) and atropine (0.1 mg/kg i.p) as reference standards. In castor oil induced diarrhea, mean defecations per animal in 4 hours, treated with diphenoxylate and EEFB were1.37 and 2.21 respectively and mean number of wet faeces per animal were 0.0 and 1.96 respectively. In PGE2 induced enteropooling, volume of intestinal fluid in PGE2 and PGE2+EEFB was 2.97 and 1.25 ml respectively. Movement of charcoal meal with atropine and EEFB was 34.2 and 50.2 respectively.[21]

Anti-arthritic activity

Anti-arthritic activity of methanolic extract of the stem bark (MESB) at dose level of 400 mg/kg/day p.o was studied in formalin and Complete Freund's adjuvant (CFA) induced arthritis in rats by using arthritis score, oxidative stress, radiographic pattern of hind legs and biomarkers viz. lipid peroxidation, antioxidants (non-enzymatic and enzymatic), nitricoxide, serum lysosomal enzymes (ALT, AST, and LDH), connective tissue biomarkers (sialic acid, hydroxyproline and glucosamine) and pro-inflammatory mediators (IL-6 and TNF-α). Diclofenac sodium, dexamethasone and methotrexate at dose level of 10, 0.03 and 0.007 mg/kg/day p.o. respectively were used as reference standards. Anti-arthritic activity of MESB was slightly better than that of diclofenac sodium and less effective than that of dexamethasone and methotrexate.[22]

Antimutagenic and antioxidant activity

Aqueous extract of heat treated stem bark was used to determine antimutagenic and antioxidant activity by using Ames test (standard plate incorporation assay) and *ex-vivo* inhibition of lipid peroxidation in liver microsomes of rats respectively. Extract concentration of 500 µg inhibited mutagenic activity of sodium azide (NaN3) in Salmonella typhimurium with IC50 value of 70.24 µg/ml and inhibited microsomal lipid peroxidation with IC50 value of 80.24 µg/ml.[23]

Antibacterial activity

Catechin and genistein, isolated from methanol extracts of the leaves of Sudanese varieties F. bengalensis were testified for their antimicrobial activity by using disc diffusion method at dose level of 100 µg/ml. Streptomycin sulphate and nystatin at dose level of 25 µg/discs and 50µg/discs respectively, were used as reference standard. Both compounds showed antibacterial activity, comparable to that of streptomycin and nystatin, against Bacillus cereus and Pseudomonas aeruginosa. No antifungal activity was found against Aspergillus ochraceus, Sacchromyces cereviseae, Candida lipolytica and Sacchromyces lipolytica.[24]

Antibacterial activity of aqueous extracts of the stem bark, leaf and root was evaluated by agar diffusion technique. Among the three extracts, stem bark extract showed maximum antibacterial activity against *Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumonia, Staphylococcus aureus and Escherichia coli*.[25]

Antibacterial activity of hydroalcoholic (70% methanol) extract of the stem bark at concentration of 0.01-0.10 mg/ml was testified against Actinomyces viscosus using cup plate diffusion method and broth dilution technique. MIC was found to be 0.08 mg/ml and zone of inhibition at this concentration was 9.4 mm. No zone of inhibition was found at concentration of 0.01-0.07 mg/ml.[26] Antibacterial activity of methanolic extract of the stem bark determined by disc diffusion method at the dose of 200 mg/ml against enterotoxigenic E. coli was comparable to that of standard drug amikacin at the dose of 10µg/disc.[27] Antibacterial activity varies with a change in environmental conditions and geography.[28]

Toxicity study

Acute and chronic toxicity studies were conducted to assess toxicity of a partially purified preparation from the water extract of the bark of Ficus bengalensis, which was demonstrated in our earlier studies to have significant hypoglycemic and hypocholesteroiemic effect on alloxan induced, mild and severe diabetes in rabbits. LDs0 of this preparation was found to be -1 gnYkg in rats when given orally. For chronic toxicity studies 3 doses of aqueous preparation were given to 3 groups of rats. First group received 5 times EDso (50 mg/kg), second group 10 times EDs0 (100 mg/kg) and the third group 15 times EDs0 (150 mg/kg) for 3 months. Fourth group which served as control was given water. After three months, blood was collected for studying biochemical and hematological parameters. Blood glucose, serum cholesterol, liver and kidney function tests, haemoglobin, total and differential leukocyte count were determined. Animals were sacrificed and histopathological examination of liver, heart and kidneys was carried out. Results of the study showed that partially purified preparation from Ficus bengalensis is not toxic by all the above mentioned parameters.[29]

CONCLUSION

Plants have been serving the humanity for centuries by providing a good source of medicines. Active constituents from plants are isolated and being used for diagnosis, treatment, mitigation, and prevention 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 abscesses. Because of its importance in traditional medicines, its quality control parameters are established by pharmacognostic studies and various phytochemicals have also been isolated and identified. Pharmacological studies on various parts of the plant have verified its use in traditional medicines. Many aspects of this plant are to be uncovered,

for example, toxicity studies, proper dose for a particular disease when the plant is used in crude form, isolation of further phytoconstituents, synergistic studies, drug-drug interactions and drug food interactions.

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