



A WILD EDIBLE FRUIT- FICUS PALMATA

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ABSTRACT

Plants are used in various ailments since the ancient times. Ficus palmata is a huge tropical deciduous and evergreen tree belonging to the family moraceae. Ficus palmata is a herbaceous plant with more than 800 species. Root, bark, leaves and latex of Ficus palmata are used for the treatment of various diseases. Ficus palmata commonly known as bedu. Ficus palmata mucilage used as a dietary item to treat constipation, lungs diseases and bladder diseases. The phytochemical analysis of Ficus palmata shows the presence of alkaloids, tannins, flavonoids, terpenoids and cardiac glycosides. The aerial part of Ficus palmata shows the presence of trans-soralenoside, germanicol acetate, psoralene, bergapten, vanillic acid and rutin by using liquid-liquid fractionation and various chromatographic techniques. Ficus palmata plant is used in various ailments such as gastrointestinal disorder, tumour, ulcer, hypoglycaemia, diabetes, hyperlipidaemia, hypercholesterolemia, fungal infection, lung diseases, bladder diseases and warts. Ficus produces a unique fruit which is an inverted flower in actual. Ficus palmata total plant extracts exhibit hepatoprotective, nephroprotective antiulcer activity. Ficus palmata mucilage can serve as a binding agent in formulation of sustain release matrix tablets and had to give better drug release effect even after long term storage. Ficus palmata mucilage showed its compatibility with diclofenac sodium and pharmaceutical excipients.

KEYWORD: Ficus palmata, antioxidant, polyphenols, flavonoids.

INTRODUCTION

Herbs are used as medicine since the ancient times.^[1] Uttarakhand is a huge source of herbs including wild edible fruits because of its geographical and climatic conditions.^[2] Ficus palmata is commonly known as bedu and also called as wild Himalayan fig because it wildy grows in the Himalayan region.

Other common name of Ficus palmata are pheru (Dehradun), khemri, pepri Gujrat), phegra, khasra, daghla, anjir (Himachal Pradesh), manmjedi (Andhra Pradesh), pheru (Jaunsar), abjiri, phegwara, phagoru, beru, bedu. Ficus palmata is herbaceous evergreen tree which belongs to the family moraceae.

Description and distribution

It is deciduous tree having height of 6 to 10 m or 30 feet approx. It is found in Uttarakhand Punjab and Kashmir

in India, Nepal, Pakistan, Afghanistan, Iran, Somalia, Sudan, Ethiopia, South Egypt and Arabian Peninsula. Flowering of Ficus palmata plants starts from March and remains until the end of April. Fruiting starts from June and continues till the first half of July. Leaves of Ficus palmata are alternate, broad, and ovate, size range from 12.92 cm long and 14.16cm broad. Flowers are unisexual, Monoecious, greenish white coloured and small in size. Fruits of Ficus palmata are unique because they are actually inverted flowers, colour varying from deep violet to black; average diameter is 2.5 cm and weight 6gm, syconoid in shape. Ficus palmata can grow in nutritionally poor soil and can tolerate drought.^[3,4,5] The fruit of Ficus palmata used as a dry vegetable .It is very tasty and juicy fruit which is also used in making of jam squash and jelly.^[6]



Figure 1: Ficus palmata leaves



Figure 2: Ficus palmata ripe fruits



Figure 3: Ficus palmata unripen fruits



Figure 4: Ficus palmata whole tree

Scientific Classification of Ficus palmata^[7]

Domain	Eukaryota
Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphylllophytina
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Urticales
Family	Moraceae
Genus	Ficus
Species	palmata

Ficus is the genus which comprises of about 800 species. Ficus palmata is one of them.^[8] Various species of Ficus used in folk medicine and it cures various disease.^[9-18] Ficus palmata is very popular wild edible fruit in Uttarakhand. This fruit is having great nutritional value^[19,20, 21]

Chemical constituents

Phytochemical analysis of Ficus palmata showed presence of alkaloids, tannins, flavonoids, terpenoids and cardiac glycosides.^[22] Leaves, bark and heartwood of Ficus palmata contain gallic acid, ellagic acid, sigmasterol, beta-sitosterol and a new triterpene–glaunol acetate. Stem bark of Ficus palmata contain cerylbehenate, lupeol, alpha-amyrin and beta-amyrin acetate.^[23,24,25] Aerial parts of Ficus palmata contain

germanicol acetate, psoralene, bergapten vanillic acid and a flavone glycoside rutin.^[26]

Medicinal uses

Different species of Ficus are used in the treatment of various diseases such as inflammations^[27], vomiting^[20], ulcer^[28], biliousness^[29], leucoderma^[30], leprosy^[31], hepatoprotective^[32], diuretic.^[28]

Ficus palmata is used as demulcent, emollient. It has laxative property too. It is used as dietary item in constipation. Ficus palmata is also used in lungs and bladder diseases. The fruit of Ficus palmata is used in the treatment of diarrhoea and dysentery. The sap of the plant is used in the treatments of warts. The plant is used as gastrointestinal, antitumour, hypoglycemic, antiulcer, lipid lowering and antifungal.^[3,4,3]

Reported activity of Fruit, Leaves and bark of Ficus palmate^[22,23,24,25,26]

PART	REPORTED ACTIVITY	CHEMICAL CONSTITUENTS
FRUIT	Antioxidant Nephroprotective Hepatoprotective Antiulcer Anticoagulant Laxative ,demulcent In lung disease/bladder disease	Alkaloids ,Steroids Flavonoids ,Tannins, Proteins, Carbohydrate β - sitosterol, Polyphenols Psoralene, Bergapten
LEAVES	Antioxidant Nephroprotective Hepatoprotective Antidiabetic Antilipidperoxidative Antihyperlipidaemic Anticalcinogenic	β -sitosterol, Triterpene glaunol acteate, Gallic acid, Ellagic acid, Sigmasterol, Rutin Vanillic acid
BARK	Antioxidant Antimicrobial Antifungal Astringent Antiproliferative cardioprotective	Ceryl behenate, Lupeol α -amyrin acetate β -amyrin, β -sitosterol alkaloids ,Steroids Flavonoids, Tannins

(A)Pharmacological activity
1. Antioxidant property

Ficus palmata is a rich source of antioxidant property. Antioxidant property can be assessed through free radical scavenging activity. It is assessed by 2,2 -diphenyl -1-picryl hydrazyl (DPPH) and 2,2'- azinobis-3- ethyl benzo thiazoline -6-sulphonic acid (ABTS) cation radical scavenging assays. In the methanol extract of Ficus palmata fruit the DPPH scavenging activity was measured 104.29 mg CE (Catechin Equivalents)/100 g Fruit weight .While in the acetone extract it was found to be 146.9 mg CE/100g Fruit weight.

In the ABTS assay the cationic radical ABTS+ scavenging activity is measured. ABTS+ is formed due to the oxidation of ABTS. In the methanol extract of Ficus palmata fruit extract ABTS cation scavenging activity is found to be 557.09 mg BHAE (Butylated hydroxyanisole)/100 g Fruit weight and in the acetone extract it was 729.95 mg BHAE/100 g Fruit weight. This shows that highest antioxidant activity found in Ficus palmata acetone extract .therefore it can be used in various oxidative stress related diseases.^[35,26]

2. Antiproliferative activity

Antiproliferative activity of Ficus palmata fruit was highest in the acetone extract (63%) while the methanol extract measured as (22%). Antiproliferative activity is analysed against cervical cancer cell lines namely C33A, HeLa and one normal peripheral blood mononuclear (PBM) cells by colorimetric 3-(4,5- dimethyl thiazol-2-yl)-2,5- Diphenyl tetra zolium Bromide (MTT) assays. A cell culture was prepared using C33A and HeLa cells with an extract of Ficus palmata fruit. The extract concentration was equivalent to 0.667, 1.66, 3.33, 5.0 and 6.67 mg/ml of fruit. Primary culture of peripheral blood mononuclear cells (PBMCs) was incubated with

an extract concentration equivalent to 5.0 and 6.67 mg/ml of fruit. These all the extracts exhibits potent antiproliferative activity against C33A cells but in case of HeLa cells the antiproliferative activity was not seen.^[35]

3. Hepatoprotective activity

Hepatic toxicity can be measured by increase in biochemical parameter levels by CCl₄ administration. Biochemical parameter such as aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Gamma glutamyl transpeptidase (GGT), alkaline phosphatase (ALP) and total bilirubin level modified when there is any hepatotoxicity.

Dose dependent reduction is observed in the levels of all the measured parameters when treated with Ficus palmata total extract which indicate hepatoprotective activity of Ficus palmata total extract. Ficus palmata 400 mg/kg body weight significantly reduce the level of AST, ALT, ALP and Bilirubin (27.36, 39.85, 29.72, 20.69 and 51.61%) and protect against hepatic damage induced by CCl₄.^[26]

4. Nephroprotective activity

Nephrotoxicity can be measured by increased levels of serum electrolyte (sodium, potassium, calcium, magnesium, chloride) urea and creatinine. These parameters are used to investigate drug induced nephrotoxicity in animal and human.^[36] CCl₄ administration shows a significant increase in the biochemical parameters of kidney functions like serum urea, serum creatinine sodium and potassium levels. Treatment with Ficus palmata total extract shows dose dependent significant reduction in the elevated parameters. Animals are treated with Ficus palmata (400 mg/kg body weight) showed significant reduction in the

level of serum urea, serum creatinine, sodium and potassium levels (50.56, 34.28, 28.94 and 45.19%). This shows protective activity of *Ficus palmata* total extract against CCl_4 induced nephrotoxicity.^[26]

5. Antiulcer activity

When there is damage in mucus membrane gastric acid and pepsin can harm oesophagus, stomach and duodenum. Thus cause peptic ulcer. Mucus membrane protects oesophagus, stomach, duodenum from gastric acid secretion and pepsin.^[37] Antiulcer activity is measured by observing stomach lesions after ethanol treatment. The antiulcer effect of *Ficus palmata* total extract was tested at 200 and 400 mg/kg body weight against lesion induced by 80% ethanol. At two doses of 100 and 200 mg/kg body weight all the fractions were tested. Antiulcer activity of *Ficus palmata* was statistically significant and dose dependent.^[26]

6. Anti-diabetic activity

Hydro alcoholic extract of *Ficus palmata* leaves extract showed significant anti diabetic activity. *Ficus palmata* at doses of 50,100,200 mg/kg significantly reduce blood glucose level in STZ induced diabetic rats, which depend on dose and duration of treatment. Highest reduction value obtained on day 21 with inhibition values of 30.56%,51.65% and 50.58% respectively. Glibenclamide reduce blood glucose level to 63.66% in comparison to diabetic control.

Ficus palmata leaves extract also showed significant improvement in body weight of animal when compared to diabetic control. *Ficus palmata* leaves extract caused a significant increase in serum insulin level compared to diabetic control group. 100 mg/kg showed maximum elevation which was comparable to standard drug glibenclamide. Antidiabetic effect of *Ficus palmata* may be due to potentiating the pancreatic secretions of insulin from beta cells of islets of Langerhans of pancreas, hence the insulin level significantly increased in extract treated animals. Antidiabetic property of *Ficus palmata* may be due to presence of beta- sitosterol, stigmasterol, alpha-amyrin, beta-amyrin and lupeol acetate. Stigmasterol is an potent antioxidant and possess hypoglycemic properties. Alpha and beta amyirin have antihyperglycemic effect.^[38]

7. Anti-hypercholesterolemia and anti-hypertriglyceridemia property

Hypercholesterolemia and hypertriglyceridemia cause development of atherosclerosis and coronary heart disease. Hypercholesterolemia induced oxidative stress is one of the major cause of development of atherosclerosis.^[39] These are also secondary complications of diabetes.^[40] Cholesterol synthesis is regulated by the enzyme beta-hydroxy-beta-methyl glutaryl CoA reductase (HMG-CoA reductase) which is the rate limiting enzyme of cholesterol pathway.^[41] This enzyme catalyzes the formation of mevalonic acid from HMG-Co A. Currently cholesterol lowering drugs act by

inhibiting enzymatic activity of HMG-CoA reductase.^[42,43] *Ficus palmata* bark aqueous extract showed significant inhibition of HMG-CoA reductive activity which suggests its role in various oxidative stress related diseases such as atherosclerosis.^[44] Hydro alcoholic extract of *Ficus palmata* leaves exhibits decreased level of serum triglycerides and cholesterol in STZ induced diabetic rats. These result showed blood lipid abnormalities modulating activity of the extract. The extract showed a dose dependent significant reduction in triglycerides level with inhibition values of 15.91%, 24.62%, and 27.11% for 50, 100 and 200 mg/kg respectively. At the dose of 100 and 200 mg/kg maximum reduction in cholesterol level is observed. Lipid lowering property of *Ficus palmata* is due to beta-sitosterol, alpha amyirin and beta amyirin.^[38]

8. Anti-lipid per oxidative activity

Tissue damage takes place by free radicals which attack membranes through peroxidation of lipid or unsaturated fatty acid present in membranes.^[45] Lipid peroxidation leads to membrane damage and dysfunction.^[46] Improved antioxidant level may contribute to decreased lipid peroxidation.^[47]

Ficus palmata extract significantly reduce lipid peroxidation. This may be due to antioxidant effect of flavonoids and triterpenoids present in the *Ficus palmata* leaves extract. Flavonoids have free radicals scavenging activity and act as antioxidants thus may be helpful in oxidative stress induced diseases.^[48] Lipid peroxidation eventually leads to increased level of thiobarbituric acid reactive substances and hyper oxides. These are the end products of lipid peroxidation. Antioxidants like flavonoids reduce thiobarbituric acid reactive substance and hydro peroxides levels.^[49]

9. Antimicrobial activity

Antimicrobial activity of aqueous extract of *Ficus palmata* was evaluated by the agar well diffusion method. *Ficus palmata* aqueous extract possess antibacterial activity within the range of 17-22mm against *E.coli*, staphylococcus, and pseudomonas. The polarity of the solvent also having important role in showing potential antibacterial activity.^[22] The ethanolic bark extract of *Ficus palmata* showed significant antibacterial activity (18mm) against staphylococcus and (15 mm) against *E.coli*.^[50]

10. Coagulation effect of *Ficus palmata* in yoghurt production

Normally (at natural condition) milk needs one day to be coagulated but there are some plants which can coagulate milk with a short period of time. At room temperature one drop of *Ficus palmata* latex changed 10 ml of raw milk into yoghurt in 49 minutes while 3 drops takes 37 minutes to change 10 ml of raw milk into yoghurt.

At 30⁰ C two drop of *Ficus palmata* latex changed 10 ml of raw milk into yoghurt in 14 minutes but 3 drops takes

less time (9 minutes). At 35⁰C two drops of *Ficus palmata* latex takes 7 minutes to change 10 ml of raw milk into yoghurt while 3 drops takes only 5 minutes. At 40⁰ C two drops of latex takes 3 minute to change into yoghurt from 10 ml raw milk, and 3 drops takes only 2 minutes.

These result showed that as the concentration of the latex of *Ficus palmata* increases in raw milk, the time needed for the coagulation effect decreases. The result also showed that as the temperature increases the coagulation time decreases because bacteria found in milk are activated or initiated for coagulation within the temperature increase. The effect of yoghurt coagulated by the plant latex on health of human being is not known so further study should be conducted.^[51]

(B)Pharmaceutical property

1. Compatibility property of *Ficus palmata* mucilage with diclofenac sodium and some other pharmaceutical excipients

Physicochemical compatibility study of the pure drug (diclofenac sodium), isolated *Ficus palmata* mucilage and other excipients (microcrystalline cellulose, magnesium stearate and talc) was carried out by observing any physical/chemical changes in two different combinations mixtures. First mixture contain diclofenac sodium and *Ficus palmata* mucilage and the second mixture contain diclofenac sodium, *Ficus palmata* mucilage and other excipients which are stored at 4⁰C room temperature and 40⁰ C under observation. Fourier transform infra-red (FTIR) spectral study of all these were recorded using a Shimadzu spectrometer (FTIR-8700) over wave number range 4000 to 400 cm¹ using KBr (potassium bromide) disc which is prepared from powdered samples mixed with dry KBr.

Results showed no characteristic changes by any of the mixture after every week intervals in different storage conditions. FTIR spectrum data of the entire ingredients individually and in mixture form were obtained and no incompatibility between diclofenac sodium, *Ficus palmata* mucilage and other excipients were found after FTIR analysis.

Thus isolated *Ficus palmata* mucilage and other pharmaceutical excipients were found to be compatible with diclofenac sodium .Therefore such combinations can be used in formation of any kind of pharmaceutical dosage form^[52].

2. *Ficus palmata* mucilage as binding agent

Mucilage isolated from the leaves and stem of *Ficus palmata* can serve as a good binding agent in formulation of sustained release matrix tablets and had to give better drug release effect even after long term storage. *Ficus palmata* mucilage showed a slow and complete drug release of 96.12%, 95.89%, 92.11%, 89.26% over a period of 10-12 hr. after 3,6,9 and 12 months of storage respectively.

By observing the drug release pattern and swelling index, it was revealed that among all the formulations *Ficus palmata* mucilage might be used as eco-friendly and cost effective binding agent for industrial aspects.^[53]

CONCLUSION

Ficus palmata is a rich source of nutrition and can be used as a dietary item. It also contain polyphenolic compound and flavonoids which are strong antioxidants hence its potential in medicinal use is wide ranging. *Ficus palmata* used in various diseases and it should be explored for further pharmacological or pharmaceutical properties. This plant may be beneficial and can contribute to human healthcare.

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