

Ficus racemosa Linn.—An overview

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Abstract

Ficus racemosa Linn. is a moderate-sized avenue tree found throughout India either wild or cultivated for its fruits eaten by villagers. It is popular in Indigenous System of Medicine like Ayurveda, Siddha, Unani and Homoeopathy. In the Traditional System of Medicine, various plant parts such as bark, root, leaves, fruits and latex are used in dysentery, diarrhoea, diabetes, bilious affections, stomachache, menorrhage, haemoptysis, piles and as carminative and astringent. The present review is therefore, an effort to give a detailed survey of the literature on its pharmacognosy, phytochemistry, traditional and pharmacological uses.

Keywords: *Ficus racemosa*, Cluster Fig, Gular Fig, Pharmacognosy, Phytochemistry, Pharmacology, Traditional medicine.

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ovate, ovate-lanceolate or elliptic, sub acute, entire and petiolate. Leaves are shed by December and replenished by January and April, when the tree becomes bare for a short period. Figs subglobose or pyriform, red when ripe, borne in large clusters, on short, leafless branches emerging from the trunk and the main branches^{1,9}. The tree is without aerial roots unlike its many family members. It naturally comes up in wasteland and forests in subtropical climate. It is seen dwelling in areas up to 1200m altitude on hilltop. This requires well-drained medium to heavy soils for its successful cultivation and comes up in all kinds of soil except in water logged and clay soil⁸. The plant is propagated by using cuttings of stem and root suckers. Hardwood cutting 0.5 to 1.5cm in diam and about 30 cm long are taken from straight, healthy 1-2 year old shoots and planted in December to February. Seeds can also used for propagation. Natural regeneration is very good from seeds dispersed by animals and birds. Four months old seedlings are transplanted to polythene bags and then planted in field after one month⁸.

In the traditional system of medicine, the plant is used for various health problems and diseases²⁻⁴. Therefore, the aim of this paper is to present an overview of

Introduction

India has an ancient heritage of traditional medicine. The Materia Medica of India provides a great deal of information on the folklore practices and traditional aspects of therapeutically important natural products. Indian traditional medicine is based on various systems including Ayurveda, Siddha, Unani and Homoeopathy. The evaluation of these drugs is primarily based on phytochemical, pharmacological and allied approaches including various instrumental techniques such as chromatography, microscopy and others. 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 racemosa* Linn. syn. *Ficus glomerata* Roxb. (Family — Moraceae). The plant is a large deciduous tree distributed all over India from outer Himalayan ranges, Punjab, Khasia mountain, Chota Nagpur, Bihar, Orissa, West Bengal, Rajasthan, Deccan and common in South India¹. It is the member of the four sacred trees *Nalpamara* (*Ksirivrsas*) meant to be planted around the home and temples. It is found throughout the year, grows in evergreen forests, moist localities and bank of streams, deciduous forests, to the elevation of 1800m above sea level, often cultivated in villages for shade and its edible fruits²⁻⁵. It is commonly known as Gular fig, Cluster fig in English, *Gular* in Hindi and as *Udumbara* in Sanskrit⁶⁻⁸.

The tree is up to 18m high, leaves

pharmacognostical, traditional, phytochemical and pharmacological investigations carried out on the plant.

Pharmacognostical characteristics

Macroscopical

A moderate to large sized spreading laticiferous tree without much prominent aerial roots. Leaves dark green, ovate or elliptical; fruits receptacles 2-5cm in diam, subglobose or pyriform, smooth or rarely covered with minute soft hairs, when ripe; they are orange, dull reddish or dark crimson and have pleasant smell resembling that of cidar apples. Bark grayish green, soft surface and uneven, 0.5-1.8cm thick, on rubbing white papery flakes come out from the outer surface, inner surface light brown, fracture fibrous, taste mucilaginous without any characteristics odour⁹⁻¹¹.

Microscopical

The cork is made up of polygonal or rectangular cells. The phellogen is made up of 1-2 layers of thin walled cells. Phelloderm is well marked compact tissue consisting of mainly parenchymatous cells with isolated or small groups of sclereids, particularly in inner region. Sclereids are lignified with simple pits. Several parenchymatous cells contain single prism of calcium oxalate or some brownish content. The cortex is wide with numerous sclereids and some cortical cells contain resinous mass. Prismatic crystals of calcium oxalate are present in some of the cells. Sclereids are rectangular or isodiametric and pitted thick walled. Phloem composed of sieve tubes, companion cells, phloem parenchyma, sclereids, phloem fibres and medullary

rays. Sclereids have lignified walls with simple pits like those of cortex. Phloem fibres are non-lignified, having narrow lumen without any septa. Prismatic crystals of calcium oxalate and few clustered crystals are also present. Starch grains are ovoid to spherical. Laticiferous vessels with a light brown granular material are present in the phloem region. Cambium when present 2-3 layered of tangentially elongated thin walled cells^{12, 13}.

Powder

Powder is light pink to light brown in colour, faint odour and astringent in taste. Microscopically it shows presence of abundant prismatic crystals of calcium oxalate, either free or in detached parenchymatous cells. Sclereids are separated or more or less in small intact groups. Portions of broken unligified fibres with narrow lumen are at times associated with sclereids and or with cells containing calcium oxalate crystals. Medullary ray cells have a wavy outline and contain minute starch grains which are spherical or ovoid, simple or 2 to 4 compound. Occasionally parenchymatous cells with brownish contents are seen. Cork cells are polygonal in surface view¹⁴.

Physical constants

Foreign matter about 2, total ash 14, acid soluble ash 1, alcohol soluble extractive 7 and water soluble extractive 9%¹⁵.

Traditional uses

Root is used in dysentery, pectoral complaints, diabetes, applied in mumps, other inflammatory glandular enlargements and hydrophobia. The bark is highly efficacious in threatened abortion

and also recommended in urological disorders, diabetes, hiccough, leprosy, dysentery, sashma and piles. The leaves are good wash for wounds and ulcers. They are useful in dysentery and diarrhoea. The infusion of bark and leaves is also employed as mouth wash to spongy gums and internally in dysentery, menorrhagia, effective remedy in glandular swelling, abscess, chronic wounds, cervical adenitis and haemoptysis. Tender leaves are used in bilious affection and also to improve skin complexion. Tender fruits are astringent, stomachic, refrigerant, dry cough, loss of voice, diseases of kidney and spleen, astringent to bowel, styptic, tonic, useful in the treatment of leucorrhoea, blood disorder, burning sensation, fatigue, urinary discharges, leprosy, menorrhagic, epitis, intestinal worms and carminative. They are useful in miscarriage, menorrhagia, spermatorrhoea, epididymitis, cancer, myalgia, scabies, haemoptysis, intrinsic haemorrhage, excessive thirst, visceral obstructions. Latex is aphrodisiac and administered in hemorrhoids, diarrhoea, diabetes, boils, alleviates the edema in adenitis, parotitis, orchitis, traumatic swelling, toothache and vaginal disorders^{2, 3, 7, 16-19}.

Some important Ayurvedic marketed formulations are: *Asamgrahaniya kasaya churna*, *Udumbarasara*, *Udumbaravaleha*, *Udumbramtra*.

Phytochemical properties

Very little phytochemical work has been carried out on this plant *F. racemosa*. The stem bark showed the presence of two leucoanthocyanins: leucocyanidin-3-O- β -glucopyranoside,



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leucopelarogonidin-3-O- α -L-rhamnopyranoside, β -sitosterol, unidentified long chain ketone, ceryl behenate, lupeol, its acetate, α -amyrin acetate. From trunk bark, lupeol, β -sitosterol and stigmasterol were isolated. Fruit contains glauanol, hentriacontane, β -sitosterol, glauanol acetate, glucose, tiglic acid, esters of taraxasterol, lupeol acetate, friedelin, higher hydrocarbons and other phytosterol. A new tetracyclic triterpene glauanol acetate which is characterized as 13α , 14β , 17β H, 20α H-lanosta-8, 22-diene-3 β -acetate and racemosic acid were isolated from the leaves. An unusual thermostable aspartic protease was isolated from latex of the plant. The stem bark and fruit showed presence of glauanol acetate²⁰⁻³².

Pharmacological activities

Hypoglycemic

The relationship of the post absorptive state to the hypoglycemic studies on *F. racemosa* showed that the absorption of the drug leads to a better

hypoglycemic activity³³. The ethanol extract (250mg/kg/day, p.o.) lowered blood glucose level within 2 weeks in the alloxan diabetic albino rats confirming its hypoglycemic activity³⁴. In another study, the glucose lowering effect of methanol extract of stem bark was studied at the doses of 200 and 400mg/kg, p.o., both in normal and alloxan induced diabetic rats. The activity was comparable to that of a standard antidiabetic agent Glibenclamide (10mg/kg) proving its folklore claim as antidiabetic agent^{35, 36}. β -sitosterol isolated from the stem bark was found to possess potent hypoglycemic activity when compared to other isolated compound³⁶.

Methanol extract of powdered fruits at the dose 1, 2, 3 and 4g/kg reduced the blood glucose level in normal and alloxan induced diabetic rabbits³⁷.

Hypolipidemic

Dietary fibre content of fruits when fed to rats in diet induced pronounced hypocholesterolemic effect, as it increased fecal excretion of cholesterol as well as bile acids³⁸.

Renal anticarcinogenic

F. racemosa extract at a dose of 200 and 400mg/kg when given orally resulted in a significant decrease in xanthine oxidase, lipid peroxidation, gamma glutamyl transpeptidase and hydrogen peroxide generated by potassium bromate mediated nephrotoxicity in rats. There was significant recovery of renal glutathione content, antioxidant enzyme, decrease in the enhanced renal ornithine decarboxylase activity, DNA synthesis, blood urea nitrogen and serum creatinine³⁹. Similar results were obtained when ferric nitrilotriacetate was used as

renal carcinogen⁴⁰. Both the result proves that the extract is a very potent chemo preventive agent.

Antidiuretic

The decoction of stem bark was investigated for antidiuretic potential in rats at a dose of 250, 500 and 1000mg/kg, p.o. It had a rapid onset (within 1h), peaked at 3h and lasted throughout the study period of 5h and it also caused reduction in urinary Na^+ level, Na^+/K^+ ratio and an increase in urinary osmolarity indicating multiple mechanism of action for its antidiuretic activity⁴¹.

Antitussive

The methanol extract of stem bark exhibited maximum inhibition of 56.9% at a dose of 200 mg/kg p.o., 90 min after administration of sulphur dioxide gas in mice proving its antitussive potential against a cough induced model⁴².

Hepatoprotective

An ethanol extract of leaves was evaluated for its hepatoprotective activity in rats against carbon tetrachloride induced liver damage. The biochemical parameters, viz. SGOT, SGPT, serum bilirubin and alkaline phosphatase level were significantly reverted back to normal levels⁴³.

In other study, the methanol extract of stem bark at the doses of 250 and 500 mg/kg was evaluated for its hepatoprotective activity in rats against carbon tetrachloride induced liver damage with silymarin as standard. It showed significant reversal of all biochemical parameter towards normal when compared to carbon tetrachloride treated control rats in serum, liver and kidney⁴⁴.

Radio protective/antioxidant

In vitro radio protective potential of the ethanol extract of *F. racemosa* (FRE) was studied using micronucleus assay in irradiated Chinese hamster lung fibroblast cells (V79). Pretreatment with 20µg/ml FRE 1h prior to 0.5, 1, 2,3 and 4 Gy γ -radiation resulted in a significant decrease in the percentage of micro nucleated binuclear V79 cells suggesting its role as radioprotector⁴⁵. It also ethanol extract exhibited potent antioxidant activity against DPPH, ABTS, hydroxyl radical, super oxide radical scavenging and inhibited lipid peroxidation in concentration dependent doses⁴⁵. The methanol extract of stem bark has shown potent *in vitro* antioxidant activity when compared to the methanol extract of its roots⁴⁴.

Antiulcer

The 50% ethanol extract of fruits was studied in different gastric ulcer models, viz. pylorus ligation, ethanol and cold restraint stress induced ulcers in rats at a dose of 50,100 and 200 mg/kg body weight p.o. for 5 days twice daily. The extract showed dose dependent inhibition of ulcer index in all three models of ulcers^{46,47}.

Wound healing

Ethanol extract of stem bark showed a potent wound healing in excised and incised wound model in rat⁴⁸.

Anti-inflammatory

Ethanol extract of leaves at a dose of 400 mg/kg exhibited maximum anti-inflammatory effects with 30.4, 32.2, 33.9 and 32% with carrageenin, serotonin, histamine and dextran induced rat paw

edema models, respectively. In chronic model of cotton granuloma weight method, it showed 41.5% reduction in the granuloma weight. The results were comparable with that of Phenylbutazone^{49, 50}. Racemosic acid isolated from ethanol extract of leaves by bioassay guided fractionation showed potent inhibitory activity against COX-1 and 5-LOX *in vitro* with IC₅₀ value of 90 and 18mM, respectively³¹. Ethanol extract of stem bark also inhibited COX-1 with IC₅₀ value of 100ng/ml proving the drug use in the treatment of inflammatory condition⁵¹.

Anthelmintic

The aqueous extract of bark was evaluated for anthelmintic activity using adult earthworm *Pheretima posthuma*. It exhibited a dose dependent inhibition of spontaneous motility which was comparable with that of 3 % Piperazine citrate. There was no recovery in the case of worms treated with the extract suggesting wormicidal activity⁵².

Antifilarial

Alcoholic as well as aqueous extracts of fruits caused inhibition of spontaneous motility of whole worm and nerve muscle preparation of *Setaria cervi* characterized by increase in amplitude and tone of contraction. Both extracts caused death of microfilarial *in vitro* activity at LC₅₀ and LC₉₀ as 21 & 35 ng/ml for alcohol extract and 27 & 42 ng/ml for aqueous extract, respectively⁵³.

Antidiarrhoeal

Ethanol extract of stem bark has shown significant inhibitory activity

against castor oil induced diarrhoea and PEG2 induced enteropooling in rats and also showed a significant reduction in gastrointestinal motility in charcoal meal test in rats which proves its efficacy as antidiarrhoeal agent⁵⁴.

Analgesic

The ethanol extract of bark and leaves evaluated for analgesic activity by analgesiometer at 100, 300 and 500 mg/kg was found to possess dose dependent analgesic activity⁵⁵.

Antipyretic

The methanol extract of stem bark was evaluated on normal body temperature and yeast induced pyrexia in albino rats at doses of 100, 200 and 300mg/kg p.o. The extract showed significant dose dependent reduction in normal body temperature and yeast provoked elevated temperature which extended up to 5h after drug administration⁵⁶.

Antifungal

The plant possess potent inhibitory activity against six species of fungi, viz. *Trichophyton mentagrophytas*, *Trichophyton rubrum*, *Trichophyton soundanense*, *Candida albicans*, *Candida krusei* and *Torulopsis glabrata*^{57,58}.

Antibacterial

Different extracts of leaves were tested for antibacterial potential against *Escherichia coli*, *Bacillus pumitis*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Out of all extracts tested, petroleum ether extract was the most

effective extract against the tested microorganism⁵⁹.

Larvicidal

The larvicidal activity of crude hexane, ethyl acetate, petroleum ether, acetone and methanol extracts of the leaf and bark were assayed for their toxicity against the early fourth-instar larvae of *Culex quinquefasciatus*. The larval mortality was observed after 24h exposure. All extracts showed moderate larvicidal effects however, the highest larval mortality was found in acetone extract of bark. The bioassay guided fractionation of acetone extract led to the separation and identification of gluanol acetate which was identified as new mosquito larvicidal compound. Gluanol acetate was quite potent against fourth-instar larvae of *Aedes aegypti* (LC₅₀ 14.55 and LC₉₀ 64.99 ppm), *Anopheles stephensi* (LC₅₀ 28.50 and LC₉₀ 106.50 ppm) and *C. quinquefasciatus* (LC₅₀ 41.42 and LC₉₀ 192.77 ppm)⁶⁰.

Clinical evaluation

A clinical trial was taken on 15 patients of burn with a composite ointment of which *F. racemosa* was one of the constituents. It proved highly efficacious in controlling *Candida albicans* infections and helped in quicker epithelialization. The burns were completely healed in 8 to 26 days of treatment⁶¹.

Efficacy of a proprietary herbal preparation consisting of *F. racemosa*, *Syzygium cumini* (Linn.) Skeels, *Tinospora cordifolia* (Willd.) Miers. ex Hook.f. & Thoms., *Pterocarpus marsupium* Roxb., *Momordica charantia* Linn. and *Ocimum*

sanctum Linn. was evaluated on 28 cases of persistent post prandial hyperglycemia. After 12 weeks of treatment a persistent fall in fasting and post prandial blood glucose levels was recorded⁶².

Conclusion

There are over 400 different tribal and other ethnic groups in India which constitute about 7.5% of India's population. Tribal, rural and primitive societies have discovered solution for treatment of disease to almost all their needs and problems from the natural resources around them⁶³. Hence, in recent years, ethnomedicinal studies received much attention as this brings to light the numerous little known and unknown medicinal virtues especially of plant origin which needs evaluation on modern scientific lines such as phytochemical analysis, pharmacological screening and clinical trials⁶⁴⁻⁶⁶. *F. racemosa* possesses various pharmacological activities as discussed in present paper. However, it is imperative that more clinical and pharmacological studies should be conducted to investigate the unexploited potential of this plant.

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