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# *Ficus racemosa* Linn. : A Comprehensive Review

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## ABSTRACT

*Ficus racemosa Linn. syn. Ficus glomerata Roxb. (Family - Moraceae) is a large deciduous tree dispersed all over India which is generally known as Gular, Gular fig, Cluster fig or Country fig. It is a sacred tree of Hindus and Buddhists. All parts of this plant (leaves, fruits, bark, latex, and sap of the root) are medicinally significant in a variety of treatments such as diabetes, diarrohoea ulcers, stomachache, piles, skin diseases, dysentry and as carminative etc. Among various pharmacological properties, Ficus Racemosa Linn imparts vital role as anti-oxidant, anti cancer, antidiuretic, anti bacterial, anti-inflammatory, memory enhancing and gastro-protective agent etc. In this review, emphasis is lead upon research associated to therapeutic properties, phytochemistry and pharmacological profile of Ficus racemosa Linn.*

**Keywords:** *Ficus racemosa* Linn., Gular, antidiuretic, carminative, gastro-protective.

## INTRODUCTION

*Ficus racemosa* (Linn) is a moderate sized avenue plant, belongs to family- Moraceae which is usually known as the Cluster Fig Tree, Indian Fig Tree or Goolar (Gular) Fig. This plant is native to Australia, Malaysia, South-East Asia and the Indian Subcontinent [1]. *Ficus racemosa* grows all over India in several forests and hilly areas. It is frequently available around the water streams and is also cultivated. Found along the river banks and inland forests from plains to 1500 m most frequently in India, Sri Lanka, Pakistan, Queensland and South China to New Guinea. The plant can be grown by vegetative as well as sexual propagation (using seeds) [2].

It is unusual in that its figs grow on or close to the tree trunk, termed cauliflory [3]. In India the tree and its fruit are called 'gular' in the north and 'atti' in the south. The fruits are a favourite staple of the common Indian macaque. In Kerala it is consider as one among nalpamara. It serves as a food plant for the caterpillars of the butterfly the Two-brand Crow (*Euploea sylvester*) of northern Australia [4]. The Ovambo people call the fruit of the Cluster Fig 'eenghwiyu' and use it to distill 'Ombike', their traditional liquor [5].

*Ficus racemosa* Linn (Moraceae) is an evergreen, moderate to large sized spreading, lactiferous, deciduous tree, without much prominent aerial roots. Tree about 20 m tall often with aerial roots, bark whitish-brown, smooth, Leaves grooved minutely hairy, lamina ovate-lanceolate to elliptic-lanceolate, tri-ribbed, 8-10 pairs of lateral pairs from broad to narrowly cuneate, oblique base, margin entire, acuminate at apex, glabrous on both sides, stipules triangular-ovate, brown, sub-persistent, cystoliths present only on lower side. Hypanthodia on long peduncles, borne in large clusters from tubercles on the main trunk and main leafless branches, subpyriform-globose, green, subtended by, broadly triangular-ovate brownish brads, bracts, apical orifice sunken, closed by brown bracts without internal bristles. Male flowers are sessile, ostiolar in 2-3 whorls, united, lobes dentate and stamens. Gall flowers pedicellate, dispersed among female. Female flowers are sessile or subsessile, ovary substipitate, glabrous style, stigma simple. Figs depressed subglobose or pyriform, red when ripe usually streaked. Seeds are lenticular 1 mm. Syconus fruit [6, 7].

Udumbara is considered scared to god Dattaguru. All ficus species possess latex-like material within their vasculatatures that provide defense and self healing from physical assaults [8]. This plant is universally used in traditional system of medicine for the treatment of numerous disorders. It is one of the herbs mentioned in all ancient scriptures of Ayurveda, Siddha, Unani and Homeopathy. Various plant parts such as bark, root, leaf, fruits and latex are used as astringent, vermifuge, carminative and anti-dysentery. It is a good medication for excessive appetite. The extract of fruit is used in leucoderma, menorrhagia and diabetes. It is used locally to relieve inflammation of lymphadenitis, fibrositis, skin wounds and in sprains [9].

**Table 1**: Taxonomic position of *Ficus racemosa* Linn.

| | |
|---|---|
| **Kingdom** | Plantae |
| **Division** | Magnoliophyta |
| **Class** | Magnolipsida |
| **Order** | Urticales |
| **Family** | Moraceae |
| **Genus** | *Ficus* |
| **Species** | *racemosa* |

**Table 2:** Vernacular names of *Ficus racemosa* Linn.

| | |
|---|---|
| **Sanskrit** | Yajnayoga, Sadaphalah, Brahanvrkisha, Shitavalkah, Sutah, Udumbara, Gular, Mashakin, Jantukaphalah, Jantuphalah, Krmiphalah, Vasudrumah, Saumya, Hemadugdhaka, Jantumati, Yagniyah, Audumbara |
| **Hindi** | Pushp-hina, Pani Bhuj, Dumar, Goolar, Umari, Yajnyadumbur, Udumbara, Jantu Phal, Dharma Patra, Goolar |
| **English** | Gular fig, Cluster Fig, Country Fig |
| **Bengali** | Udumbara |
| **Telugu** | Brahmamamidi, Atti, Bodda |
| **Gujrati** | Goolar, Umbaro |
| **Manipuri** | Heibong |
| **Malayalam** | Atthi, Atthi Al, Aththi, Atthi-al, Udumbaram, Jantuphalam |
| **Marathi** | Umbar, Udumbar |
| **Urdu** | Dumar |
| **Oriya** | Dimri |
| **Konkani** | Rhumbud |
| **Kannada** | Atti, Atti Mara |

| | |
|---|---|
| **Irula** | Athi |
| **Others** | Goolar, Atthi, Atteeka, Athi, Crattock, Country Fig, Dumrii, Cluster Fig, Vellaiatthi, Gular Fig, Indian Fig, Redwood Fig, Rumbodo |

**Table 3**: Ayurvedic properties of *Ficus racemosa* Linn.

| | |
|---|---|
| **Rasa** | Kashaya, Madhur |
| **Guna** | Guru, Ruksha |
| **Virya** | Sheet |
| **Vipak** | Katu |
| **Doshaghnata** | Kapha, Pitta Shama |

**Table 4**: Phytoconstituents of *Ficus racemosa* Linn.

| | |
|---|---|
| **Leaf** | Sterols, tannins and flavonoids, triterpenoids (Lanosterol) and alkaloids. A new tetracyclic triterpene glauanol acetate which is characterized as 13α, 14β, 17βH, 20αH-lanosta-8, 22-diene-3β-acetate and racemosic acid were isolated from the leaves [7]. |
| **Stem-Bark** | Tannin, wax, saponin gluanol acetate, β-sitosterol, leucocyanidin- 3 – O – β – D - glucopyrancoside, leucopelargonidin – 3 – O – β – D - glucopyranoside, leucopelargonidin – 3 – O – α – L - rhamnopyranoside, lupeol, ceryl behenate, lupeol acetate, α-amyrin acetate, leucoanthocyanidin, and leucoanthocyanin from trunk bark, lauanol acetate, lupeol, β-sitosterol and stigmasterol were isolated from stem bark[10]. |
| **Trunk-Bark** | Upenol, β-sistosterol and stigmasterol [10]. |
| **Fruit** | Glauanol, glauanol acetate, hentriacontane, β sitosterol, glauanolacetate, glucose, tiglic acid, esters of taraxasterol, lupeolacetate, friedelin, higherhydrocarbons and other phytosterol [11]. |
| **Root** | Cycloartenol, euphorbol and its hexacosanoate, taraxerone, tinyatoxin; bark euphorbol and its hexacosanate, ingenol and its triacetate, taraxerone [12]. |
| **Latex** | a-amyrin, β-sitosterol, cycloartenol, cycloeuphordenol, 4-deoxyphorbol and its esters, euphol, euphorbinol, isoeuphorbol, palmitic acid, taraxerol, tinyatoxin, tirucallol, trimethyl ellagic acid [13]. |

**Table 5:** Ethnobotanical uses of *Ficus racemosa* Linn.

| PLANT PART | USE |
|---|---|
| **Fruits** | Used in leprosy, diarrhoea, circulatory and respiratory disorders and menorrhagia [14-16]. Tender fruits are used as astringent, stomachic, refrigerant, in 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, epitasis, carminative and intestinal worms. They are also useful in miscarriage, spermatorrhoea, epididymitis, cancer, myalgia, scabies, haemoptysis, intrinsic haemorrhage and extreme thirst [17, 18]. |
| **Roots** | Roots are used in dysentery, pectoral complaints, and diabetes, applied in mumps, other inflammatory glandular enlargements and hydrophobia [12, 18, 19]. |
| **Bark** | It is highly effective in threatened abortion and also recommended to treat Menorrhagia, leucorrhoea, gonorrhoea, urinary diseases, hemorrhage and skin diseases [20]. The bark is highly recommended in urological disorders, diabetes, hiccough, leprosy, dysentery and piles [7, 12, 18, 19]. |
| **Leaves** | The leaves are excellent wash for wounds and ulcers. They are useful in dysentery and diarrhea. The infusion of bark and leaves is also employed as mouth wash to spongy gums and internally in dysentery, menorrhagia, efficient remedy in glandular swelling, abscess, chronic wounds, cervical adenitis and haemoptysis [17-19]. |

| | |
|---|---|
| **Latex** | It is administered in haemorrhoids, boils, alleviates the edema in adenitis, parotitis, orchitis, traumatic swelling, toothache, vaginal disorders, diarrhoea particular in childrens and also aphrodisiac. Latex is applied externally on chronic infected wounds to alleviate edema, pain and to promote the healing [2]. The latex is reportedly used for treating piles [21]. |
| **Root Sap** | It is used for treating diabetes [20]. The sap of this plant is a popular remedy for mumps and other inflammatory enlargements [16, 19]. In Sri Lankan indigenous system of medicine, it is used in the treatment of skeletal fracture. The Australian aborigines use this plant in the treatment of mumps, smallpox, heamaturia, menorrhagia and inflammatory conditions. In Siddha the bark, fruits and latex are used to treat constipation, anaemia and dysentery [20, 22]. |

## APPLICATIONS

**Pharmacological Profile**

**Anti cancer activity:** *Ficus racemosa* extract at a dose of 200 and 400 mg $kg^{-1}$ when given orally a considerable decrease in lipid peroxidation, xanthine oxidase, γ-glutamyl transpeptidase and hydrogen peroxide ($H_2O_2$) generation with decrease in renal glutathione content and antioxidant enzymes generated by Potassium bromate ($KBrO_3$), a nephrotoxic agent that induces renal carcinoma in rats .There was considerable recovery of renal glutathione content and antioxidant enzymes. These results recommend that *Ficus racemosa* extract is a potent chemopreventive agent and suppresses $KBrO_3$ mediated nephrotoxicity in rats [23].

**Hypolipidemic:** Dietary fiber content of fruits when fed to rats in diet induced pronounced hypocholesterolemic effect, as it increased fecal excretion of cholesterol as well as bile acids. Hypolipidemic activities of ethanolic extract of bark were studied at the doses of 100-500 mg/kg b.w to alloxan-induced diabetic rats. Investigation showed that extract had potent anti-diabetic and hypolipidemic effects when compared to that of the standard reference drug, glibenclamide [24].

**Anti-ulcer/Gastro-protective:** Gastro-protective effect of 50% ethanolic extract of *Ficus Racemosa Linn* known as *F. glomerata* fruit (FGE) was studied in different gastric ulcer models in rats. FGE prevents the oxidative damage of gastric mucosa by blocking lipid peroxidation and by considerable decrease in superoxide dismutase, H+K+ATPase and increase in catalase activity. The H+K+ATPase are the dimeric enzyme responsible for H+ secretion by the gastric parietal cells. H+K+ATPase are selectively blocked by the action of ranitidine, an acid blocker used to treat gastric ulcers [25, 26].

**Anti-oxidant activity:** Ethanol extract and water extract were subjected to free radical scavenging both by steady state and time resolved methods. The ethanol extract exhibited significantly higher steady state antioxidant activity. It also exhibited concentration dependent DPPH, ABTS, hydroxyl radical and superoxide radical scavenging and inhibition of lipid peroxidation when tested with standard compounds [27-29].

**Antidiuretic:** The decoction of the bark of *F. racemosa* is claimed as an antidiuretic and its potential is evaluated in rats using three doses (250, 500 or 1000 mg $kg^{-1}$). It had a rapid onset (within 1 h), peaked at 3 h and lasted throughout the study period (5 h). It also caused a reduction in urinary Na+ level and Na+/K+ ratio, and an increase in urinary osmolarity indicating multiple mechanisms of action [30].

**Hepato protective activity:** Methanol extract of *Ficus racemosa* stem bark were studied using the model of hepatotoxicity induced by carbon tetrachloride ($CCl_4$) in rats. Pretreatment with methanol extract

resulted in significant decreases in the activities of AST, ALT and ALP, compared to $CCl_4$-treated rats. The results indicate that *F. racemosa* possesses potent hepatoprotective effects against $CCl_4$- induced hepatic damage in rats [31].

**Antitussive:** The methanol extract of stem bark was tested for its antitussive potential against a cough induced model by sulphur dioxide gas in mice. The extract exhibited maximum inhibition of 56.9% at a dose of 200 mg $kg^{-1}$ (p.o.) 90 min after administration [32].

**Hypoglycemic:** There is more than one type of hypoglycemic principles, both organic and inorganic, in *Ficus racemosa* Linn. fruits which produce a significant fall in blood glucose levels in normal and alloxan-diabetic rabbits by producing an organotropic effect on the B-cells which results in an increased release of insulin from the pancreatic beta cells. *Ficus racemosa* Linn. fruits pulp may, in the long run after more detailed studies, prove to be a more valuable anti-diabetic agent as in addition to its insulin releasing and insulin-like activities. Methanol extract of powered fruits at the dose 1, 2, 3, and 4 g $kg^{-1}$ reduced the blood glucose level in normal and alloxan induced diabetic rabbits. On the other hand the glucose-lowering efficacy of methanol extract of the stem bark was evaluated both in normal and alloxan-induced diabetic rats at the doses of 200 and 400 mg $kg^{-1}$ p.o. The activity was also comparable to that of the effect produced by a standard antidiabetic agent, glibenclamide (10 mg $kg^{-1}$) proving its folklore claim as anti-diabetic agent. The ethanol extract (250 mg $kg^{-1}$ $day^{-1}$, p.o.) lowered blood glucose level within 2 weeks in the alloxan diabetic albino rats confirming its hypoglycemic activity. β-sitosterol isolated from the stem bark was found to possess potent hypoglycemic activity when compared to other isolated compounds. Ethanolic extract of leaves lowered the blood glucose levels by 18.4 and 17.0% at 5 and 24 h, respectively, in sucrose challenged streptozotocin induced diabetic rat model at the dose of 100 mg $kg^{-1}$ body weight [33, 34].

**Anthelmintic:** The crude extracts of bark were evaluated for anthelmintic activity using adult earthworms; they exhibited a dose-dependent inhibition of spontaneous motility (paralysis) and evoked responses to pin-prick, which was comparable with that of 3% piperazine citrate. However, there was no final recovery in the case of worms treated with aqueous extract suggesting wormicidal activity [19].

**Anti bacterial activity:** Different extracts of leaves were tested for antibacterial potential against *Escherichia coli, Bacilus pumitis, Bacillus subtilis and Pseudomonas aureus*. Out of all extracts tested, petroleum ether extract was the most effective extract against the tested microorganism [31].

**Anti-diarrhoeal:** Ethanol extract of stem bark has shown significant inhibitory activity against castor oil induced diarrhea and PEG2 induced enter pooling in rats and also showed a significant reduction in gastro intestinal motility in charcoal meal test in rats which proves its efficacy as anti-diarrheal agent [35].

**Anti-inflammatory:** The anti-inflammatory activity of *F. racemosa* extract was evaluated on carrageenin, serotonin, histamine and dextran-induced rat hind paw edema models. The extract (400 mg $kg^{-1}$) exhibited maximum anti-inflammatory effect of 30.4, 32.2, 33.9 and 32.0% with carrageenin, serotonin, histamine, dextran-induced rat paw oedema, respectively. In a chronic test, the extract (400 mg $kg^{-1}$) showed 41.5% reduction in granuloma weight, which was comparable to that of phenylbutazone [31]. Bioassay-guided fractionation of the ethanol extract of leaves isolated racemosic acid. It showed potent inhibitory activity against COX-1 and 5-LOX in vitro with IC50 values of 90 and 18 μM, respectively [36]. International Journal of Recent Advances in Pharmaceutical Research October 2011; 4: 6-15 with IC50 value of 100 ng $ml^{-1}$ proves that the drug is used in the treatment of inflammatory conditions [37].

**Antifungal:** The 50% methylene chloride in hexane flash column fraction of the extract of the leaves of *Ficus racemosa* Linn. was found to have antifungal activity. The extract inhibited the growth of several plant pathogens (*Curvularia sp, Colletotrichum gloeosporioides, Alternaria sp, Corynespora cassiicola and Fusarium sp*). Psoralen was identified as the active compound and was shown to be biodegradable,

having the potential to be developed as a fungicide against pathogens causing diseases on crops of economic importance [38].

**Anti-filarial:** Alcoholic as well as aqueous extracts caused inhibition of spontaneous motility of whole worm and nerve muscle preparation of Setaria cervi characterized by increase in amplitude and tone of contractions. Both extracts caused death of microfilaria in vitro. LC50 and LC90 were 21 and 35 ng/ml respectively for alcoholic, which were 27 and 42 ng $ml^{-1}$ for aqueous extracts [39].

**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* (Diptera: Culicidae). The larval mortality was observed after 24-h 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 a tetracyclic triterpenes derivative. Gluanol acetate was isolated and identified as new mosquito larvicidal compound. Gluanol acetate was quite potent against fourth-instar larvae of *Aedes aegypti* L. (LC (50) 14.55 and LC (90) 64.99 ppm), *Anopheles stephensi* Liston (LC (50) 28.50 and LC (90) 106.50 ppm) and *C. quinquefasciatus* Say (LC (50) 41.42 and LC (90) 192.77 ppm) [40].

**Renal anticarcinogenic:** *F. racemosa* extract (200 mg $kg^{-1}$ body weight and 400 mg $kg^{-1}$ body weight) resulted in a significant decrease in xanthine oxidase, lipid peroxidation, γ- glutamyl transpeptidase and hydrogen peroxide. There was significant recovery of renal glutathione content and antioxidant enzymes, decrease in the enhancement of renal ornithine decarboxylase activity, DNA synthesis, blood urea nitrogen and serum creatinine [41].

**Wound healing:** Ethanol extract of stem bark showed wound healing in excised and incised wound model in rats [42].

**Anticholinesterase:** The present study evaluated the anticholinesterase activity of cold and hot aqueous extracts of *Ficus racemosa* stem bark against rat brain acetyl cholinesterase *in vitro*. Both the cold aqueous extract (FRC) and the hot aqueous extract (FRH) exhibited a dose dependent inhibition of rat brain acetyl cholinesterase. FRH showed significantly higher ($P \leq 0.001$) cholinesterase inhibitory activity compared to FRC; however, both the extracts did not show 50% inhibition of AChE at the doses tested (200-1000 µg $ml^{-1}$). The IC50 values of 1813 and 1331 µg $ml^{-1}$ were deduced for FRC and FRH, respectively (calculated by extrapolation using Boltzmann's dose response analysis). The percentage of anticholinesterase activity was calculated. Both the extracts (FRC and FRH) exhibited a dose dependent inhibition of rat brain acetyl cholinesterase. However, their inhibitory activities were significantly lower ($P \leq 0.001$) than that of neostigmine bromide, a standard acetyl cholinesterase inhibitor. Among FRC and FRH, FRH showed significantly higher ($P \leq 0.001$) cholinesterase inhibitory activity compared to FRC; however, both the extracts did not show 50% inhibition of AChE at the doses tested (200-1000 µg $ml^{-1}$) and hence IC50 values were calculated by extrapolation using Boltzmann's dose response analysis **[**43].

**Anti-pyretic:** Methanol extract of stem bark was evaluated on normal body temperature and yeast-induced pyrexia in albino rats, at doses of 100, 200 and 300 mg $kg^{-1}$ b.w p.o. It showed significant dose dependent reduction in normal body temperature and yeast-provoked elevated temperature which extended up to 5 hr after drug administration. The anti-pyretic effect was comparable to that of paracetamol [42].

**Memory Enhancing:** Alzheimer's disease (AD) is a progressive neurodegenerative disorder resulting in dementia and enhancement of acetylcholine (Ach) levels in brain using acetyl cholinesterase inhibitors is one of the most important approaches for the treatment of AD. Aqueous extract of Ficus racemosa Linn (Moraceae) bark having antiinflammatory, antioxidant, and Anticholinesterase activity was evaluated for its ability to enhance Ach levels, and to ascertain its antidementia activity in rats. This work was carried

out under the assumption that the *F. racemosa* extract may show combination of actions which could be beneficial in the treatment of AD, such as neuro protection, attributed to antioxidant and anti-inflammatory property and may elevate levels of Ach like Ficus hispida extract reported earlier. The plant extract selected for investigation elevated Ach levels and improved memory in rats. The collective pharmacological actions attributed by *F. racemosa* extract may serve as beneficial and supporting agent in the treatment of AD [44].

**Analgesic:** The ethanol extract of bark and leaves was evaluated for analgesic activity by analgesiometer at 100, 300 and 500 mg/kg and was found to possess dose dependent analgesic activity [45].

## CONCLUSIONS

The genus *Ficus* constitutes an important group of trees with immense medicinal value. The medicinal plants are widely used by the traditional medical practitioners for curing various diseases in their day to day practice. In traditional system of medicine, different parts such as root, fruit, leaves, stem, seeds, latex and even whole plant of *Ficus racemosa* (Linn) have been recommended for the treatment of gastric ulcer, diarrhea, wound healing, diabetes, hyper tension etc. It is one of the popular plant in Indigenous system of medicine such as Ayurveda, Siddha, Unani and also homeopathy system of medicine. *Ficus Racemosa Linn.* showed a wide range of pharmacological actions like hypoglycemic, hypolipidemic, anti-carcinogenic, anti-diuretic, hepatoprotective, anti-ulcer, anti-inflammatory, anti-fungal etc. Bio active constituents like β-sitosterol, glauanol acetate in *Ficus Racemosa L.*, has been found to be largely responsible for the therapeutic potentials as a boon for ailments of human kind. Hence, the present study shows the therapeutic potential, pharmacological and phytochemical properties of various bioactive compounds present in the *Ficus racemosa* (Linn). However, more Clinical and Pathological studies should be conducted to investigate the active potentials of bioactive compounds present in this plant which can help in proving it to be a promising source in neutraceutical as well as pharmaceutical industry.

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