



## PHARMACOLOGICAL REVIEW ON *FICUS RACEMOSALINN*



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### Abstract

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*Ficus racemosa* (Linn) is a moderate sized avenue plant, belongs to family- *Moraceae*. This is native to Australia, South-East Asia and the Indian subcontinent. It is cultivated throughout India. It is popular in Indigenous system of medicine such as Ayurveda, Siddha, Unani and also homeopathy system of medicine. The plant *Ficus racemosa* (Linn) in Marathi is called as 'Audumbara'. The plant can be grown by vegetative as well as sexual propagation (using seeds). The plant parts such as roots, leaves, figs (fruits), latex, and bark are used in various diseases such as dysentery, diarrhea, diabetes, stomachache, menorrhage, haemoptysis and piles.

## INTRODUCTION

There are several reasons why many people have been turning to herbal medication for simple cures. Herbal medicine has proven to be successful for regular illness and they are also cost effective. Most times they can be found in your own home and in the kitchen. A little knowledge and some fresh herbs can help you overcome your aches and pains. Herbal medicine has been around for centuries but over the years, they have become less popular, as pharmaceutical companies started to put out improved products. Herbal medicine, also known as alternative medicine, is used to prevent and treat various ailments. Herbal medicines can be effectively used for body's natural detoxification process, improve digestion and food absorption and boost your immune system.

The plant *Ficus racemosa* (Linn.) in Marathi is called as 'Audumbara'. The plant can be

grown by vegetative as well as sexual propagation (using seeds). The plant parts such as roots, leaves, figs (fruits), latex, and bark are used in various diseases such as dysentery, diarrhea, diabetes, stomachache, menorrhage, haemoptysis and piles. The aim of the present study is to provide complete information about the pharmacological importance of the *Ficus racemosa* (Linn).

## PLANT PROFILE

<b>Kingdom</b>	→	Plantae
<b>Division</b>	→	Magnoliophyta
<b>Class:</b>	→	Magnolipsida
<b>Order</b>	→	Urticales
<b>Family</b>	→	Moraceae
<b>Genus</b>	→	<i>Ficus</i>
<b>Species</b>	→	<i>F. Racemosa</i>
<b>Synonym</b>	→	<i>F. Glomerata</i> Roxb

## VERNACULAR NAMES

<b>Marathi</b>	→	Audumbara, Umbara
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<b>Sanskrit</b>	→	Udumbara	initially green in color and they become red
<b>Hindi</b>	→	Gular	when they ripe. They are in pyriform grow
<b>English</b>	→	Gular Fig, Cluster Fig	in clusters on a leafless, thin branch, which
<b>Bengali</b>	→	Jagadumur,	originates from the stem. The tree is

Gulangdumur, Yajnadumbar

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#### AYURVEDIC PROPERTIES

<b>Rasa</b>	→	Kashaya, Madhur
<b>Guna</b>	→	Guru, Ruksha
<b>Virya</b>	→	Sheet
<b>Vipak</b>	→	Katu
<b>Doshaghnata</b>	→	Kapha, Pitta Shama

#### DISTRIBUTION

This is native to Australia, South-East Asia and the Indian subcontinent.

#### DESCRIPTION

The plant *Ficus racemosa* grows generally up to 15 to 20 meters in height. The color of bark is whitish, and surface of the bark is somewhat rough. The leaves are dark green in color. The shape of a leaf is ovate, ovate-lanceolate or elliptical. The fruits are

**PARTSUSED:** Bark, Leaves, Fruits and Roots.

**USES:** General medicinal effects are: protective of glands, analgesic, antipyretic and useful in respiratory diseases and cough. Roots are used pectoral complaints, diarrhea, diabetes and mumps. Bark-Highly useful in threatened abortions. Leaves are used washing wound. Tender leaves used to improve complexion of skin. Tender fruits used as astringent, Stomachic and to improve voice<sup>1-2</sup>.

#### PHARMACOLOGICAL STUDIES OF *FICUS RACEMOSALINN*

**1. Hypoglycemic:**-Several mechanisms have been proposed for the antidiabetic effect of medicinal plants such as inhibition

of carbohydrate-metabolizing enzymes, manipulation of glucose transporters, beta-cell regeneration and enhancing insulin-releasing activity. The present investigation evaluated the possible mechanism of action through which *Ficus racemosa* stem bark (Moraceae) exerts its hypoglycemic effect using suitable in vitro techniques. The experimental of diabetes was induced by intraperitoneal injection of 50mg/kg, streptozotocin sterile saline solution. Each group were subjected to overnight fasting then blood samples of each groups were collected from retro orbital plexus by means of sterilized glass capillary tubes under light ether anesthesia. Then the blood was cold centrifuged at 2800rpm for 2 min. The glucose oxidase/peroxidase method was used for the determination of blood glucose level in the rats by colorimetric estimation method (490-550 nm). After 5days of streptozotocin injection,

the hyperglycemic (glucose level>300mg/dl) rats were separated and used for the study. *Ficus racemosa* bark (FRB) exhibited significantly higher ( $P < \text{or} = 0.01$ ) glucose-binding capacity than wheat bran (WB) and acarbose (ACB) consequently showed significantly higher ( $P < \text{or} = 0.01$ ) retardation of glucose diffusion compared to WB and ACB. In case of amylolysis kinetics the liberation of glucose was greatly inhibited by FRB, as reflected by a significantly lower ( $P < \text{or} = 0.01$ ) glucose diffusion rate in the system containing FRB compared to the control and acarbose. Furthermore, FRB significantly increased ( $P < \text{or} = 0.01$ ) the rate of glucose transport across the yeast cell membrane and also in isolated rat hemi-diaphragm. The findings indicate *F. racemosa* bark to possess strong hypoglycemic effect and hence can be utilized as an adjunct in the management of diabetes mellitus<sup>3-4</sup>.

**2. Antioxidant:-**Ethanol extract (FRE) and water extract (FRW) of *Ficus racemosa* were subjected to free radical scavenging both by steady state and time resolved methods such as nanosecond pulse radiolysis and stopped-flow spectrophotometric analyses. FRE exhibited significantly higher steady state antioxidant activity than FRW. FRE exhibited concentration dependent DPPH, ABTS, hydroxyl radical and superoxide radical scavenging and inhibition of lipid peroxidation with  $IC_{50}$  comparable with tested standard compounds. *In vitro* radio protective potential of FRE was studied using micronucleus assay in irradiated Chinese hamster lung fibroblast cells (V79). Pretreatment with different doses of FRE 1h prior to 2 Gy  $\gamma$ -radiation resulted in a significant ( $P < 0.001$ ) decrease in the percentage of micro nucleated binuclear V79 cells. Maximum radioprotection was observed at 20  $\mu\text{g/ml}$  of FRE. The

radioprotection was found to be significant ( $P < 0.01$ ) when cells were treated with optimum dose of FRE (20  $\mu\text{g/ml}$ ) 1 h prior to 0.5, 1, 2, 3 and 4 Gy  $\gamma$ -irradiation compared to the respective radiation controls. The cytokinesis-block proliferative index indicated that FRE does not alter radiation induced cell cycle delay. Based on all these results we conclude that the ethanol extract of *F. racemosa* acts as a potent antioxidant & probable radio protector<sup>5</sup>.

**3. Antidiarrhoeal:-** People living in the area of Jalgaon District traditionally use various parts of the plant *Ficus racemosa*, for their antidiarrhoeal activity. Wistar albino rats weighing 180 to 200g of both sexes were used for the study. The antidiarrhoeal activity of ethanolic extract of leaves of the plant *Ficus racemosa* were evaluated by different experimental models viz. castor oil induced diarrhea, gastrointestinal motility test. Result shows that ethanolic extracts of

*Ficus racemosa* of concentration 400 and 600 mg/kg significantly inhibited diarrhea. The experiment showed dose dependent antidiarrhoeal activity<sup>6</sup>.

**4. 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 anti-inflammatory, 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<sup>7</sup>.

**5. 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  $\mu\text{g ml}^{-1}$ ). The IC<sub>50</sub> values

of 1813 and 1331  $\mu\text{g ml}^{-1}$  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  $\mu\text{g ml}^{-1}$ ) and hence IC<sub>50</sub> values were calculated by extrapolation using Boltzmann's dose response analysis<sup>8</sup>.

**6. Anti-inflammatory:-** Bioassay-guided fractionation of the ethanol extract of *Ficus racemosa* resulted in the identification of a

new compound 4,6-dihydroxy-5-[3-methyl-(E)-propenoicacid-3-yl]-7-beta-glucopyranosyl-[2alpha,3beta-dihydrobenzofuran]-(3,2:b)-[4alpha,5beta-dihydroxy-6alpha-hydroxymethyltetrahydropyran] (racemosic acid). Racemosic acid showed potent inhibitory activity against COX-1 and 5-LOX in vitro with IC<sub>50</sub> values of 90 and 18 microM, respectively. Racemosic acid also demonstrated a strong antioxidant activity to scavenge ABTS free radical cations with an IC<sub>50</sub> value of 19 microM. In addition, cytotoxic effects of the extracts of *F. racemosa* were investigated in vitro using the ATP-based luminescence assay and results showed no cytotoxicity on the cell lines skin fibroblasts (1BR3), human Caucasian hepatocyte carcinoma (Hep G2) and human Caucasian promyelocytic leukemia (HL-60). Bergenin was also isolated from the same active fraction<sup>9</sup>.

**7. Antibacterial:** - A coarse powder of the leaves of *Ficus Racemosa* Linn was prepared and dried at 50°C. The coarse powder extracted using hydroalcoholic (methanol: water) in Soxhlet apparatus. The extracts were then subjected to photochemical screening using standard procedure. The extract was screened against bacteria i.e. *Actinomyces Viscosus* (MTCC 7345). Agar Broth Dilution technique and Cup Plate Diffusion Method used to assay. Agar broth dilution technique shows that the lowest concentration that inhibited the growth of microorganism *Actinomyces viscosus* was 0.08 mg/ml. From this data Minimum Inhibitory Concentration of the extracts of *Ficus racemosa* leaves for microorganism *Actinomyces viscosus* was found to be 0.08 mg/ml. Cup Plate Diffusion Method the concentration of extract of *Ficus racemosa* leaves 0.08 mg/ml, 0.09 mg/ml; 0.1 mg/ml shown the zone of inhibition. The extract of

*Ficus racemosa* leaves of 0.08mg/ml to 0.1 mg/ml has better antibacterial activity<sup>10</sup>.

**8. Antidiuretic:**-The decoction (D) of the bark of *Ficus racemosa* Linn (Family: Moraceae) is claimed as an antidiuretic by some Sri Lankan traditional practitioners. However, the validity of this claim has not been scientifically proven or refuted. The aim of this study was to evaluate the antidiuretic potential of D of the bark of *F. racemosa* (made as specified in traditional use) in rats using three doses (250, 500 or 1000 mg/kg) following oral administration. The reference drug used was ADH. The results demonstrated both the low- and high-doses of D and ADH significantly impaired the total urine output. The D-induced antidiuresis had a rapid onset (within 1 h), peaked at 3 h and lasted throughout the study period (5 h). However, antidiuretic potential of D was about 50% lower than that of ADH. The D

was well tolerated even with sub-chronic administration. The D caused a reduction in urinary Na<sup>+</sup> level and Na<sup>+</sup>/K<sup>+</sup> ratio, and an increase in urinary osmolarity indicating multiple mechanisms of action. The results provide scientific support for its claimed antidiuretic action and deserve intensive scrutiny<sup>11</sup>.

**9. Antipyretic:**-A study was carried out to evaluate the anti-pyretic effect of a methanol extract of stem bark of *Ficus racemosa* Linn. (MEFR) on normal body temperature and yeast-induced pyrexia in albino rats. A yeast suspension (10 ml/kg body wt.) increased rectal temperature 19 h after subcutaneous injection. The MEFR, at doses of 100, 200 and 300 mg/kg body wt. p.o., showed significant dose-dependent reduction in normal body temperature and yeast-provoked elevated temperature. The effect extended up to 5 h after drug administration. The anti-pyretic effect of

MEFR was comparable to that of paracetamol (150 mg/kg body wt., p.o.), a standard anti-pyretic agent<sup>12</sup>.

**10. Hypolipidemic:**-Hypercholesterolemia and hyper-triglyceridemia have been reported to occur in alloxan-induced diabetic rats. Accumulation of cholesterol and phospholipids in liver due to elevated plasma free fatty acids has been reported in diabetic rats. The higher concentration of plasma total cholesterol observed in diabetic rats is probably due to mobilization of free fatty acids from the peripheral fat depots. Alterations in the erythrocyte membranes lipid composition may be a reflection of alterations in the plasma lipid profile. HDL removes cholesterol from non-hepatic tissues to liver through the process known as reverse cholesterol transport. Several studies have documented reduction in plasma HDL cholesterol in diabetic rats and diabetic patients due to defect in

reverse cholesterol. Our results support these observations. Liver plays an important role in the catabolism and excretion of cholesterol. Profound increases in plasma and tissue lipids (cholesterol, phospholipids, triglycerides and free fatty acids) were reported in diabetic animals. Triglycerides accumulation in the liver of diabetic rats is due to enhanced synthesis or decreased output from liver as VLDL or combination of both. Oral administration of FrEBet restored the levels of lipids and lipoproteins in diabetic rats. The hypolipidemic effect of the *F. racemosa* bark extract is due to inhibition of endogenous synthesis of lipids probably by potentiating the secretion of insulin. The hypolipidemic effect of FrEBet may also be due to the presence of several bioactive hypolipidemic principles and their synergistic properties<sup>12</sup>.

**11. Antifilarial:**-Effect of alcoholic and aqueous extracts of the fruits of

*F. racemosa* Linn, on the spontaneous movements of both the whole worm and nerve muscle preparation of *Setaria cervi* and on the survival of microfilariae in vitro was studied. 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. Initial stimulatory effect was not observed with aqueous extract on whole worm preparation, while effect of alcoholic extract on whole worm and nerve muscle preparation was characterized by an increase in amplitude and tone of contractions followed by paralysis. The concentrations required to inhibit the movement of the whole worm and nerve muscle preparation for alcoholic extract of fruits of *F. racemosa* were 250 and 50 microg/ml, respectively, whereas aqueous extract caused inhibition of the whole

worm and nerve muscle preparation at 350 and 150 microg/ml, respectively, suggesting a cuticular barrier. Both alcoholic and aqueous extracts caused death of microfilariae in vitro. LC50 and LC90 were 21 and 35 ng/ml, respectively for alcoholic, which were 27 and 42ng/ml for aqueous<sup>14</sup>.

**12. Hepatoprotective:-**In the present study, the hepatoprotective effects of petroleum ether (FRPE) and methanol (FRME) extract of *Ficus racemosa* Linn. (Moraceae) stem bark was studied using the model of hepatotoxicity induced by carbon tetrachloride (CCl<sub>4</sub>) in rats. CCl<sub>4</sub> administration induced a significant decrease in serum total protein, albumin, urea and a significant increase ( $P \leq 0.01$ ) in total bilirubin associated with a marked elevation in the activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) as compared to control

rats. Further, CCl<sub>4</sub> intoxication caused significant increase in the TBARS and decrease in glutathione (GSH) levels in serum, liver and kidney. Pretreatment with FRPE and FRME restored total protein and albumin to near normal levels. Both the extracts resulted in significant decreases in the activities of AST, ALT and ALP, compared to CCl<sub>4</sub>-treated rats. However, a greater degree of reduction was observed in FRME pretreated group (FRPE 43%, 38%, and 33%; FRME 55%, 73%, and 38%). Total bilirubin content decreased from 2.1 mg/dL in CCl<sub>4</sub>-treated rats to 0.8 and 0.3 mg/dL in FRPE and FRME pretreated rats, respectively. The extracts improved the antioxidant status considerably as reflected by low TBARS and high GSH values. FRME exhibited higher hepatoprotective activity than a standard liver tonic (Liv52), while the protective effect of FRPE was similar to that of Liv52. The protective effect of *F.*

*racemosa* was confirmed by histopathological profiles of the liver. The results indicate that *F. racemosa* possesses potent hepatoprotective effects against CCl<sub>4</sub>-induced hepatic damage in rats<sup>15</sup>.

### 13. Cardio-protective:-*Ficus racemosa* Linn.

(Moraceae) bark is a rich source of phenolic compounds having diverse biological properties including antioxidant activity. The present study evaluated the cardio protective activity of sequential acetone extract of *Ficus racemosa* bark against doxorubicin-induced cardio-toxicity in rats. The extract was standardized by high-performance liquid chromatography (HPLC) and subjected to acute toxicological evaluation in mice. Cardiotoxicity was induced by administration of doxorubicin (10 mg kg<sup>-1</sup> i.v.) to the extract pretreated rats (250 and 500 mg kg<sup>-1</sup>) and compared with that of Arjuna, a standard cardiotoxic. Biochemical parameters included CK-MB,

LDH, AST, ALT, troponin I, thiobarbituric acid reactive substances (TBARS), and glutathione. The HPLC fingerprinting of the extract indicated the presence of bergenin (0.89%) and bergapten (0.07%). In an acute toxicity study, the extract at a dose of 2 g kg<sup>-1</sup> did not cause any adverse changes and no mortality was observed. Administration of doxorubicin significantly increased ( $p \leq 0.05$ ) serum levels of creatine kinase, lactate dehydrogenase, aspartate aminotransferase, and alanine aminotransferase, which were decreased to an extent of 68, 63, 41, and 65%, respectively, in extract pretreated group (500 mg kg<sup>-1</sup>). Troponin I was undetected in control group, while it was found in serum of all the experimental groups. The extract pretreatment significantly decreased ( $p \leq 0.05$ ) TBARS and increased glutathione levels in serum and cardiac tissue. These observations were further

substantiated by the histopathological studies. The acetone extract of *F. racemosa* bark possesses potential cardio protective activity against doxorubicin-induced Cardiotoxicity in rats by scavenging free radicals generated by the administration of the drug<sup>16</sup>.

**14. Mosquito larvicidal:-**The larvicidal activity of crude hexane, ethyl acetate, petroleum ether, acetone, and methanol extracts of the leaf and bark of *Ficus racemosa*(Moraceae) was 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 bark acetone extract of *F. racemosa*. In the present study, 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). The structure was elucidated from infrared, ultraviolet, (1) H-nuclear magnetic resonance (NMR), (13) C-NMR, and mass spectral data. This is the first report on the mosquito larvicidal activity of the reported compound from *F. racemosa*<sup>17</sup>.

**15. Gastroprotective:-** Gastroprotective effect of 50% ethanolic extract of *F. racemosa* fruit (FRE) was studied in different gastric ulcer models in rats.ods: FRE (50, 100 and 200 mg/kg body weight) was administered orally, twice daily for 5 days for prevention from pylorus ligation

(PL), ethanol (EtOH) and cold restraint stress (CRS) – induced ulcers. Estimation of  $H^+K^+$ ATPase activity and gastric wall mucous were performed in EtOH-induced ulcer and antioxidant enzyme activities in supernatant mitochondrial fraction of CRS-induced ulcers. FRE showed dose dependent inhibition of ulcer index in pylorus ligation, ethanol and cold restraint stress – induced ulcers. FRE prevents the oxidative damage of gastric mucosa by blocking lipid peroxidation and by significant decrease in superoxide dismutase,  $H^+K^+$ ATPase and increase in catalase activity. High performance thin layer chromatography (HPTLC) analysis showed the presence of 0.57% and 0.36% w/w of gallic acid and ellagic acid in FGE<sup>18</sup>.

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