

Ficus racemosa Linn: Its Potentials Food Security and Rural Medicinal Management (Review Article)

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Abstract

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. Plants are one of the most important sources of medicines. This time widely used by the traditional medical practitioners for curing various diseases in their day to day practice. In traditional systems of medicine, different parts (leaves, stem, root, fruit, seeds, latex and even whole plant) of *Ficus Racemosa Linn* (commonly known in all over India as udumbara, gular have been recommended for the treatment of diarrhea, diabetes, hypertension, gastric ulcer, wound healing etc. *Ficus Racemosa Linn*. Showed a wide range of pharmacological actions like hypoglycemic, hypolipidemic, renal anti-carcinogenic, anti-diuretic, anti-tussive, hepatoprotective, radioprotective, anti-ulcer, anti-inflammatory, anti-diarrhoeal and anti-fungal. β -sitosterol, glauanol acetate, the active constituent present in *Ficus Racemosa L.*, has been found to be largely responsible for the therapeutic potentials of gular. Its great therapeutic potentials and wide occurrence in India the practitioners of traditional systems of medicine have been using *Ficus Racemosa L.* for curing various ailments, a rational approach to this traditional medical practice with modern system of medicine. Thereby, the objective of this review is an attempt to provide a detailed survey of literature on traditional uses and pharmacological properties of the plant as a boon for ailments of human kind.

Keyword: *Ficus racemosa* Linn, Medicinal plants, Traditional, Biological Activity

INTRODUCTION

Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of human kind. The Materia Medica of India provides a great deal of information on the folklore practices and traditional aspects of therapeutically important natural products. It has traditional medicine is based on various systems including Ayurveda, Siddha, Unani and Homoeopathy. Plants are one of the most important sources of medicines, because of its great therapeutic potentials and wide occurrence in India the practitioners of traditional systems of medicine have been using *Ficus Racemosa L.* for curing various ailments, a rational approach to this traditional medical practice with modern system of medicine is, however, not much more available. In order to establish the therapeutic uses of *Ficus Racemosa L.* in modern medicine, in last few decades several Indian scientists and researchers have studied the pharmacological effects of ethanolic, methanolic & aqueous extracts of various parts of gular plant. These pharmacological studies & their different formulation may have established a scientific basis for therapeutic uses of this plant. Thereby, the objective of this review is an attempt to provide a detailed survey of literature on traditional uses and pharmacological properties of the plant as a boon for ailments of human kind.

Common Name

Bengali: Dumur, Hpak-Lu, Jagyadumbar, Mayen, Taung
Tha Phan, Thapan, Ye Thapan.
Kannada: Alhi, Atthimara, Atti.
Malayalam: Athi (Kerala), Athiathial, Atthi.
Marathi: Audumbar, Umbar.
Nepalese: Dumrii.
Oriya: Dimri.
Sanskrit: Gular, Hemadugdhaka, Jantuphala, Sadaphalah,
Udumbar, Udumbara, Udumbarah,
Assamese : *Jagna Dimaru*
Oriya/Odiya : *Dimbiri*
Kannada: *atti*
Telugu: (*Medi Pandu* Telugu
Tamil : *Malaiyin munivan*
Malayalam : *Aththi*, Malayalam.
Marathi : *Umbar, Audumbar*
Nepal : *Dumri*
Thai : Ma-Duer Uthumphon, Ma-Duer Chumphon
Vietnamesesung: *Junj, sunj*
Chinese: Ju Guo Rong.

Scientific Classification

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Rosales
Family:	Moraceae
Genus:	<i>Ficus</i>
Species:	<i>F. racemosa</i>

Synonyms: *Ficus glomerata* Roxb

Common names: Udumbara, Gular fig, Cluster fig, Country fig, Cluster Fig Tree, Goolar Fig

DESCRIPTION

Goolar, to 30 m high; bole buttressed; bark 8-10 mm thick, surface reddish-brown or yellowish-brown smooth, coarsely flaky, fibrous; blaze creamy pink; latex milky; young shoots and twigs finely white hairy, soon glabrous; branchlets 1.5-3 mm thick, puberulous.[1] Leaves simple, alternate, stipules 12-18 mm long, lanceolate, linear-lanceolate, pubescent, often persistent on young shoots; petiole 10-50 mm long, slender, grooved above, becoming brown scurfy; lamina 6-15 x 3.5-6 cm, ovate, obovate, elliptic-oblong, elliptic-lanceolate, elliptic-ovate or oblong-ovate, base acute, obtuse or cuneate, apex narrowed, blunt or acute, margin entire, membranous, glabrous, blistered appearance on drying; 3-ribbed from base, 4-8 pairs, slender, pinnate, prominent beneath, intercostae reticulate, obscure. Flowers unisexual; inflorescence a syconia, on short leafless branches or warty tubercles of trunk or on larger branches, subglobose to pyriform, smooth, often lenticellate-verrucose; peduncle 3-12 mm long, stout, orifice plane or slightly sunken, closed by 5-6 apical bracts; internal bristles none; basal bracts 3, 1-2 m long, ovate-triangular, obtuse, persistent; flowers of unisexual, 4 kinds; male flowers near the mouth of receptacles, in 2-3 rings, sessile, much compressed; tepals 3-4, dentate-lacerate, lobes jointed below, red, glabrous; stamens 2, exserted; filaments 1 mm, connate below; anthers oblong, parallel; female flowers sessile or very shortly stalked among gall flowers; tepals 3-4, dentate-lacerate, lobes jointed below, red, glabrous, ovary superior, sessile or substipitate, red spotted; style 2-3 mm long, glabrous, simple; stigma clavate; gall flowers long stalked; ovary dark red, rough; style short. [2] Syconium 2.5 x 2 cm, orange, pink or dark crimson; achene granulate.

MACROSCOPICAL CHARACTERS

Goolar is an attractive fig tree with a crooked trunk and a spreading crown. Unlike the banyan, it has no aerial roots. The most distinctive aspect of this tree is the red, furry figs in short clusters, which grow directly out of the trunk of the tree.[5] Those looking for the flower of goolar should know that the fig is actually a compartment carrying hundreds of flowers

Leaves: The leaves are dark green, 6-10 cm long, glabrous; receptacles small subglobose or piriform, in large clusters from old nodes of main trunk.

Fruits: The fruits receptacles are 3-6 cm in diameter, pyriform, in large clusters, arising from main trunk or large branches. The fruits resemble the figs and are green when raw, turning orange, dull reddish or dark crimson on ripening. The fruit of

Ficus Racemosa Linn is 3/4inch to 2 inches long, circular and grows directly on the trunk [4].

Seeds: The seeds are tiny, innumerable and grain-like. Outer surface of the bark consists of easily removable translucent flakes grayish to rusty brown, uniformly hard and non-brittle [4]

Bark: Bark is reddish grey or grayish green, soft surface, uneven and often cracked, 0.5-1.8 cm thick, on rubbing white papery flakes come out from the outer surface, inner surface light brown, fracture fibrous, taste mucilaginous without any characteristic odour. Unlike the banyan, it has no aerial roots. Those looking for the flower of goolar should know that the fig is actually a compartment carrying hundreds of flowers [5, 6] .Texture is homogeneously leathery [8].

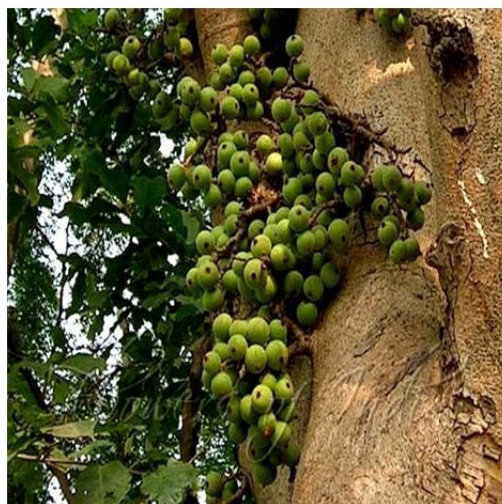


Figure 1 *F.racemosa* (goolr)

Roots: The roots of *F.racemosa* are long, brownish in colour. It's having characteristic odour and slightly bitter in taste Roots are irregular in shape [5].

Microscopically Cork: The cork is made up of polygonal or rectangular cells. The phellogen is made up of 1-2 layers of thin walled cells.

Phelloderm: Phelloderm is well marked compact tissue consisting mainly of 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.

Cortex: 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 [7].

Phloem: Phloem consists of sieve tubes, companion cells, phloem parenchyma, sclereids, phloem fibres and medullary rays. Starch grains are ovoid to spherical. Laticiferous vessels with a light brown granular material are present in the phloem region. Cambium is present in 2-3 layered of tangentially elongated thin walled cells. Figs are smooth or rarely covered with minute soft Hair [6, 8].

Table 1: Identity, Purity and Strength *Ficus Racemosa* Linn. [12]

Foreign matter	Not more than 2 %
Total Ash	Not more than 14 %
Acid-insoluble ash	Not more than 1 %
Alcohol-soluble extractive	Not less than 7 %
Water-soluble extractive	Not less than 9 %

Chemical constituents

Racemosa Linnaeus species contain flavanoid glycosides, alkaloids, phenolic acids, steroids, saponins, coumarins, tannins, triterpenoids – oleanolic acid, ursolic acid, α -hydroxy ursolic acid, protocatechuic acid, maslinic acid. The nonenzymatic constituents include phenolic compounds, flavonoids, vitamin C. The enzymatic constituents present are ascorbate oxidase, ascorbate peroxidase, catalase, peroxidase. The phenolic compounds present are gallic acid and ellagic acid. Furanocoumarins that are reported are psoralen, bergapten. [3] β -sitosterol and a new tetracyclic triterpene – gaulon acetate are reported from the leaves, bark and heartwood of *F. palmata*. Besides, ceryl behenate, lupeol, α -amyirin acetate are reported from the stem bark of *F. palmata*. Taraxasterol tiglate in heartwood, quercetin-3-glucoside, rutin from leaves and three new methyl ethers of leucoanthocyanins (delphinidin-3-O- α -L-rhamnoside, pelargonidin-3-O- α -L-rhamnoside, leucocyanidin-3-O- β -D-galactosylcellobioside), methyl ether of leucoanthocyanidin, 20-tetra triaconten-2-one, pentatriacontan-5-one, 6-heptatriaconten-10-one, β -sitosterol- α -D-glucoside, meso-inositol were reported from the stem bark of *F. benghalensis* [4]. Triterpenoid constituents rhoiptelenol, 3- α -hydroxy-isohop-22(29)-en-24-oic acid were isolated from the methanolic extracts of fresh leaves and stems of *Ficus thumbergii*. This species also contains lupenyl acetate, β -amyirin acetate, α -amyirin acetate, lupeol, β -amyirin, α -amyirin, glutinol, ursolic acid, betulinic acid in its leaves and stems [6]. Besides the leaves, bark and fruits of *F. benjamina* contains cinnamic acid, lactose, naringenin, quercetin, caffeic acid, stigmasterol [5]. Two new pentacyclic triterpenes 8,26-cyclo-urs-21-en-3 β , 20 β -diol and 3- β -acetoxy-8,26-cyclo-ursan-20 β -ol and also 3-friedelanone, oleanolic acid, betulinic acid, lupeol acetate, α and β amyirine, 3,5,7,4'-tetra hydroxyl flavones, 3,5,7,3',4' pentahydroxy flavanate are reported from the stem bark of *Ficus cordata* [8]. 4, 4, 24-trimethyl-cholesta-8-en-3 β -ol,

mixture of campesterol, stigmasterol and sitosterol, stigmasterol 3-B-O-glucoside and 4, 5, 7-trihydroxy flavan-3-ol. In addition to xanthoxin, β -amyirin and α -amyirin from n-hexane and ethyl acetate fractions of ethanol extract of *Ficus capensis* (Thunb) leaves [7].

ELEMENTAL COMPOSITION

The mineral composition of the bark is shown in Table. It is observed that potassium was the most abundant mineral present in the bark followed by chloride and calcium. The bark was a good source of iron, magnesium, phosphorous as well as trace elements such as manganese, nickel, chromium, and zinc and copper. However, the bark contained significantly less ($p \leq 0.01$) sodium in proportion to potassium. The trace elements such as cadmium, aluminum, cobalt, mercury and arsenic were not detected [11].

Table 2: Concentration of mineral elements (\pm SD) in the bark of *Ficus Racemosa* Linn.

Sr. No	Mineral elements	Concentration (ppm)
1	Calcium	1729.3 \pm 13.02
2	Iron	159.2 \pm 2.03
3	Magnesium	196.2 \pm 4.63
4	Phosphorous	443 \pm 8.98
5	Zinc	0.49
6	Manganese	1.9 \pm 0.14
7	Nickel	1.9 \pm 0.14
8	Cadmium	ND
9	Chromium	0.38
10	Copper	5.2 \pm 0.15
11	Lead	0.017 \pm 0.003
12	Sodium	255 \pm 42.03
13	Potassium	11975 \pm 537.74
14	Chloride	7475 \pm 263
15	Aluminum	ND
16	Cobalt	ND
17	Arsenic	ND

PHARMACOLOGICAL PROPERTIES

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). 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 osmolality indicating multiple mechanisms of action [16].

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 (p.o.) 90 min after administration [18].

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].

Antibacterial: The hydro alcoholic extract of leaves was found effective against *Actinomyces viscosus*. The minimum inhibitory concentration was found to be 0.08mg/ml [42].

Antipyretic: 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 body wt. p.o. It showed significant dose - dependent reduction in normal body temperature and yeast - provoked elevated temperature which extended up to 5 h after drug administration. The anti - pyretic effect was comparable to that of paracetamol [16]

Wound healing:

Ethanol extract of stem bark showed wound healing in excised and incised wound model in rats [22].

Antifilarial: 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 microfilariae in vitro LC50 and LC90 were 21 and 35 ng/ml, respectively for alcoholic, which were 27 and 42 ng/ml for aqueous extracts [28].

Antidiarrhoeal: Ethanol extract of stem bark was evaluated for anti - diarrhoeal activity against different experimental models of diarrhoea in rats. It showed significant inhibitory activity against castor oil induced diarrhoea and PGE2 induced enteropooling in rats. These extracts also showed a significant reduction in gastrointestinal motility in charcoal meal tests in rats. The results obtained established its efficacy as anti - diarrhoeal agent [24].

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) exhibited maximum anti-inflammatory effect of 30.4, 32.2, 33.9 and 32.0% with carrageenin, serotonin, histamine, and dextran -induced rat paw oedema, respectively. In a chronic test, the extract (400 /kg) showed 41.5% reduction in granuloma weight, which was comparable to that of phenylbutazone [25]. Bioassay - guided fractionation of the ethanol extract of leaves isolated racemoseic acid. It showed potent inhibitory activity against COX - 1 and 5 - LOX in vitro with IC50 values of 90 and 18 μ M, respectively. Ethanol extract of stem bark also inhibited COX -1 with IC50 value of 100 ng/ml proves that the drug is used in the treatment of inflammatory conditions [26].

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 ulcer [29].

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 [30].

Hepatoprotective: An ethanolic extract of the leaves was evaluated for hepatoprotective activity in rats by inducing chronic liver damage by subcutaneous injection of 50% v/v carbon tetrachloride in liquid paraffin at a dose of 3 mL/kg on alternate days for a period of 4 weeks. The biochemical parameters SGOT, SGPT, serum and alkaline phosphates were estimated to assess the liver function [52]. 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 kidney [31].

Radio protective/antioxidant: 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. 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 γ - radiation resulted in a significant decrease in the percentage of micronucleated binuclear V79 cells suggesting its role as radio protector. The methanol extract of stem bark has shown potent in vitro antioxidant activity when compared to the methanol extract of its roots [30]. The fruit ethanol extract exhibited significant antioxidant activity in DPPH free radical scavenging assay. 3-O-(E)-Caffeoyl quinate showed significant antioxidant activity [27]

Antifungal: The plant possesses potent inhibitory activity against six species of fungi, viz. *Trichophyton mentagrophytas*, *Trichophyton rubrum*, *Trichophyton soundanense*, *Candida albicans*, *Candida krusei* and *Torulopsis glabrata* [24, 30]

Hypoglycemic: 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 p.o. The activity was also comparable to that of the effect produced by a standard antidiabetic agent, glibenclamide (10 mg/kg) proving its folklore claim as antidiabetic agent. 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 activity [23]. The ethanol extract (250 mg/kg/day, p.o.) lowered blood glucose level within 2 weeks in the alloxan diabetic albino rats confirming its hypoglycemic activity β sitosterol (1) isolated from the stem bark was found to possess potent hypoglycemic activity when compared to other isolated compounds Methanol extract of powered fruits at the dose 1, 2, 3, and 4 g/kg reduced the blood glucose level in normal and alloxan induced diabetic rabbits. 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 body weight [30].

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 acids [32] Hypolipidemic activities of ethanolic extract of bark were studied at the doses of 100 - 500 mg/kg bw to alloxan - induced diabetic rats. Investigation showed that extract had potent antidiabetic and hypolipidemic effects when compared to that of the standard referencedrug, glibenclamide [36].

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) [32].

Renal anticarcinogenic: *F. racemosa* extract (200 mg/kg body weight and 400 mg/kg 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 [28]. Similar results were obtained when Ferric nitrilotriacetate (Fe - NTA) was used as renal carcinogen [32]. Both the results proved that the extract is a very potent chemopreventive agent.

Clinical evaluation: A clinical trial was taken off in 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 a

helped in quicker epithelialization. The burns were completely healed in 8 to 26 days of treatment Efficacy of a proprietary herbal preparation consisting of *F. racemosa*, *Syzygium cumini*, *Tinospora cardifolia*, *Pteracarpus marsupium*, *Momordica charantia* and *Ocimum sanctum* 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 recorded [32]

Antihelmintic activity:

Methanolic, aqueous, chloroform, petroleum ether extracts of the roots were studied for paralysis and death of earthworm. All the extracts were found not only to paralyze but also to kill the earthworms. The aqueous and methanolic extract was found to be more effective to execute the earthworm when compared to standard anti helminthic drugs [35].

Anti-inflammatory and Analgesic activity: Treatment with methanol extract during inflammatory condition both acute (carrageenan induced hind paw edema and acetic acid induced vascular permeability) and subchronic (cotton pellet induced granuloma) prevented increase in malondialdehyde formation and myeloperoxidase activity in edematous as well as granulomatous tissue. Further serum marker enzymes (AST, ALT and ALP) increased in inflammatory conditions were also inhibited with methanol extract treatment .In addition the extract also showed significant analgesic activity in acetic acid induced writhing[34]

Antifertility activity: Extract reduced fertility to 70% within 60 d. Suppression of cauda epididymis sperm count, motility, viability and abnormal morphology was observed. Marked reduction was noted in the weight of reproductive organs and the level of sialic acid in epididymis and fructose in seminal vesicle. Vaginal application of bark extract exhibited 80% vaginal contraceptive efficacy. [38]

CONCLUSION

From these findings it is evident that the ethanolic extract of ficus species showed a greater effect against microbes, worms and renal carcinoma in rat compared with the standard drugs *Ficus Racemosa* Linn (Family-Moraceace) is very important in various diseases. *Ficus Racemosa* Linn have the many pharmacological activities such as anti-diuretic, anti-tussive, gastroprotective, anti-ulcer antifertility etc. The use of *Ficus Racemosa* Linn is very ancient. It is strongly believed that detailed information as presented in this review on various therapeutic actions of the constituents might provide detailed evidence for the use of this plant in different medicines. Further investigations should be conducted to isolate and characterize the active components of these ficus species.

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