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COMPREHENSIVE REVIEW ON FICUS RACEMOSA

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A B S T R A C T

With numerous medicinal benefits, the genus Ficus is a very important and useful group of trees. Often referred to as the cluster fig tree, Ficus racemosa Linn. is a medium-sized tree in the Moraceae family. In addition to these and many more names, Ficus racemosa is also known as Yajnayoga, Udumbara, Goolar, Dumar, Bodda, Heibong, Jantuphalam, Dimri, and Yogga Dumur. Australia, Malaysia, South-East Asia, Sri Lanka, Pakistan, China, New South Wales, and the Indian subcontinent are just a few of the nations where you can find ficus racemosa. While it can be grown artificially, it naturally develops around water sources. The plant Ficus racemosa is mentioned in ancient Ayurvedic, Siddha, Unani, and homeopathic traditions for its wide range of medicinal properties, including antidiuretic, antitussive, antiulcer or gastroprotective, anti-oxidant activity, anthelmintic, antibacterial, antipyretic, anticholinesterase, potential anticancer activity, antifilarial, wound healing, antidiarrheal, anti-inflammatory, antiulcer, The plant description, habitat, microscopical properties, and uses of Ficus racemosa were all thoroughly covered in this review.

INTRODUCTION

The healing abilities of plants were documented by the medical system known as Ayurveda [1,2]. By using Traditional Chinese medicine (TCM) therapies, diseases can be averted and even improved. Numerous chronic, geriatric, and terminal diseases are treatable [3]. Traditional Chinese Medicine is harmless, uncomplicated, and inexpensive. The genus Ficus is a very significant and significant group of trees that are found in many locations, including China, and that have a variety of medicinal properties and play a crucial part in a variety of therapeutic reasons [4]. The four species groupings that make up the ficus genus are Ficus rasamosa, Ficus microcarpa, Ficus benghalensis, and Ficus religiosa [5,6]. A medium-sized tree belonging to the Moraceae family is called Ficus racemosa (Fig. 1). the ficus racemose also known as Yajnayoga, Udumbara, Goolar, Dumar, Bodda, Heibong, Jantuphalam, Dimri, and Yoga. Near a decent body of water, such a pond or riverbank, this plant grows in the forest or on hillsides [7]. Fast-growing Ficus racemose Linn. can reach a height of 12 m and thrives in either full or partial shade and likes moist soil. The flowers are pollinated by wasps and this fruit-bearing tree. In order to treat diarrhea, Ficus racemose leaves are used [8]. The fruit and bark both have astringent properties and are used to treat hemoptysis, menorrhagia, and haematuria [9]. When the fruit is laden with sugar, it is remarkably cooling [10]. The sap can be utilized to treat gonorrhea, the mumps, and other inflammatory glandular enlargements [11]. To treat tonsillitis, the roots can be used [12–15].

❖ Geographical distribution

Africa, Asia, Australia, Bangladesh, Cambodia, China, East Africa, East Timor, Egypt, Ethiopia, Hawaii, Himalayas, India, Indochina, Indonesia, Laos, Malaysia, Myanmar, Nepal, North Africa, Northeastern India, Pacific, Pakistan, Papua New Guinea, PNG, Southeast Asia, Sikkim, Singapore, Sri Lanka, Taiwan, Thailand, Timor-Leste, USA, Vietnam [16].

❖ Plant profile

With a curved trunk and a spreading canopy, the lovely cluster fig tree Ficus racemosa is quite attractive. Banyan trees have aerial roots, but this tree is not one of them (Fig. 1). The most striking aspect of this tree is the clusters of little red, stubbly figs that sprout from the tree's stem right away. Ficus racemosa is a tree with hundreds of blossoms, thus those looking for it should be aware of this. Extremely tiny wasps that enter via the opening in search of an appropriate location for reproduction fertilize the flowers. Fig trees are incapable of seed reproduction without these pollinators [16,17]. The blossoms respond by giving the wasps' young a secure place to live and food. A common tree in the region is the Ficus racemosa..

Fig. 1. Ficus racemosa linn

❖ **Taxonomic classification**

The taxonomical classification has been represented in Fig. 2.

Taxonomical Classification

Kingdom : Plantae Domain : Eukaryota Phylum : Spermatophyta

Subphylum : Angiospermae

Family : Moraceae Order : Urticales Genus : Ficus

Class : Dicotyledonae

Fig. 2. Taxonomical classification of Ficus racemosa

CULTIVATION DETAILS

Both the canopy and understory trees in lowland tropical rainforests use the Ficus racemosa linn. tree species. While many species can be found in monsoon climates and teak woods, including places where the soil dries up, the majority of species require per-humid woodland.[18] Each species of fig tree relies on a unique, highly specialized wasp species that is only capable of reproducing in that particular fig genus.This is how fig trees are fertilized. Male, long-styled female, and short-styled female, also referred to as gall flower, are the three flower types produced by the trees. All three types of flowers are a part of what is often referred to as the fruit structure. The long-styled female flowers are fertilized by the female fig wasp's eggs, which she lays on the short-styled female flowers once she enters the fig. [19–21].First, the wingless male fig wasps emerge, fertilize the emerging females, and then the winged females dig their escape tunnels. Females emerge, collect pollen from male flowers, and then fly out in search of figs with female flowers that are receptive. For a colony of the pollinator Ficus spp. to survive, individual plants must bloom at different times [22,23]. To ensure that at least some plants have overlapped in fig wasp emission and reception at any time of year, a population must exceed a critical size limit

MORPHOLOGICAL CHARACTERISTICS

The Ficus racemosa is a deciduous tree with a buttressed bole, consistent thickness, reddish- brown or yellowish-brown glossy, coarsely flaking, fibrous surface layer, milky pink blaze, and white-fuzzy young shoots and branches. Small, abundant, and grain-like are seeds. There are clear, removable flakes on the bark's exterior that range in color from rusty brown to grey. Stipules on new branches are 12–18 mm long, pubescent, lanceolate or linear-lanceolate, and frequently persistent. The petiole measures 10–50 mm in length, is thin, grooved above, and is brown scurfy. The lamina are ovate, obovate, elliptic–oblong, elliptic–lanceolate, elliptic– ovate, or oblong–ovate [24]. On the main stem or large tree branches, huge clusters of pyriform,2- to 5-cm-diameter fruit receptacles are seen. The spherical, 1.5 to 3 inch long fruit of the Ficus racemosa is. Flowers occur in a few rings close to the receptacle opening, sessile, heavily compressed, dentate-lacerate, with lobes joined below and scarlet, glabrous stamens [25]. The long, tan-colored roots of Ficus racemosa. It tastes a little bit harsh and has a unique odor. The form of roots varies [26].

❖ **Macroscopical characteristics**

Root **Bark** **Seeds** **Leaves &** **Fruits**

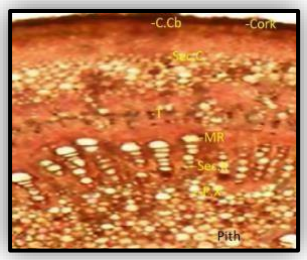
Fig.3. Macroscopy of Ficus racemosa

Numerous hillsides and woodlands are where Ficus racemosa first appeared. This plant can be planted artificially for shade and edible fruits in rural villages, but it also grows naturally in the forest or on slopes near a good water source, such a pond or riverside. From the main trunk, huge clusters of 7.5–10 cm long, ovate or elliptic, green leaves emerge. The fresh fruits start out green and ripen to orange, dull reddish, or dark crimson. There are 23 relatively small, abundant, and grain-like seeds in all. The roots are fairly lengthy and have a brownish hue. It smells strongly and tastes a little bitter [27,28,29].

The bark is 0.51 to 1.80 cm thick, greyish-green in color, soft, irregular, and commonly fractured [Fig. 3].When the outside surface is rubbed, white paper-like flakes appear, while the inner surface is light brown with a fibrous fracture and a mucilaginous flavor.[30]

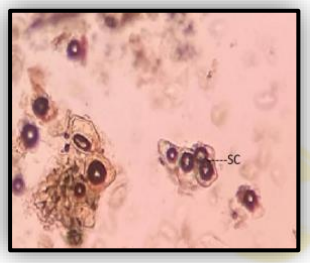
Cork

It is composed of cells that are polygonal or rectangular in shape. Both polygonal and rectangular cells make up cork. The phellogen is composed of 1-2 layers of cells with thin walls.



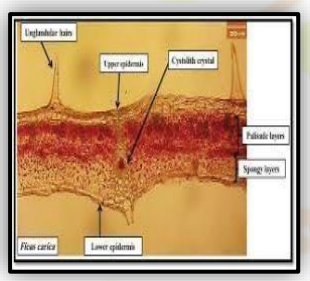
Stone Cells

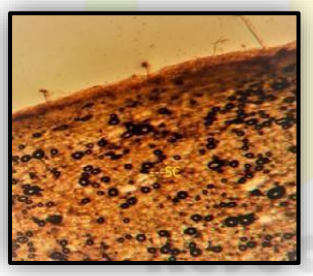
These polygonal cells have beaded walls, a large pitted lumen, and a spherical but squarish shape.



Epidermal

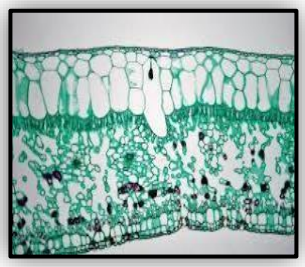
An inner layer that is mostly made of cellulosic material and an outer layer that is thick and pectinaceous with some cellulose microfibrils.





Phelloderm

Additionally lignified, it has small clusters of sclereids or dense tissue made of parenchyma cells. a number of parenchymatous cells with a single, reddish, calcium oxalate-containing prism.



Mesophyll

It comprises sclerenchymatous cells that cover the vascular bundle and is the middle layer of the leaf's epidermis between the lower and upper epidermis. Between the lower epidermis and the vascular bundles, in the mesophyll, are collenchymatous cells.

PHYTOCHEMISTRY

The active phytochemical constituents of Ficus racemosa have been described in Table 01. The structures with their stereochemistry have been noted in Fig. 5[31].

Table 01

Active phytochemical constituents of Ficus racemosa

Part of the Plant	Phytochemical constituents	Refs.
Leaf	sterols, triterpenoids (Lanosterol)	
Tetracyclic triterpene-glauanol acetate		[32] Alkaloids, tannins, and flavonoids.
Stem-Bark	gluanol acetate, sitosterol, leucocyanidin	
3-O-D-glucopyrancoside, leucopelargonidin		
3-O-D-glucopyranoside, leucopelargonidin-		[33]
3-O-L-rhamnopyranoside, lupeol,cerylbehenate, Lupeol acetate, and a – amy Lupenol, sistosterol, And stigmasterol.		
Trunk-Bark Fruit	Upenol, sistosterol and stigmasterol. Glauanol,	
glauanol acetate, hentriacontane, sistosterol,		[33] glauanol acetate, glucose, tiglic acid, taraxasterol
lupeolacetate, friedelin, higher hydrocarbons.		
Cycloartenol, euphorbol and its hexacosanoate,		[35] Taraxerone, and tinyatoxin.
Latex	a-amyrin, sitosterol, cycloartenol,	
Cycloeuphordenol, 4-deoxyphorbol euphol,		[36] Euphorbinol, isoeuphorbol, palmitic acid.

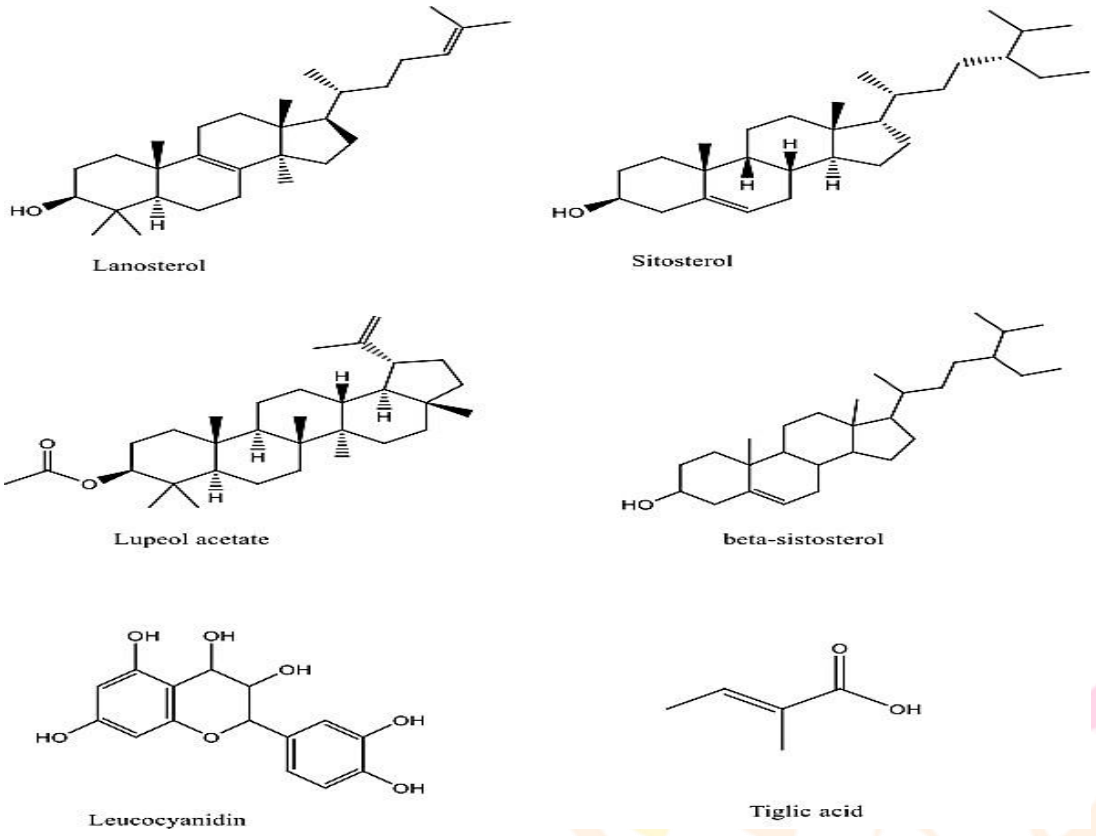


Fig.5. Phytoconstituents present in Ficus racemose

TRADITIONAL USES

In order to treat a variety of disorders, Ficus racemosa linn. has also been widely used in traditional medicine (Table:2). Its bark, fruits, leaves, roots, latex, seeds, and other parts of the plant are all utilized medicinally in some way [37–43].

Traditional Utilization of F.racemosa.

Plant Part	Traditional Disease Curring Application
Leaves	• Bilious infection is treated with a mixture of leaves and honey. • Dysmenorrhea is treated with a leaf decoction. • Boils, blisters, and measles are prevented by leaf latex. • Hair is rubbed with leaf juice to prevent splitting. • Cervical adenities, abscesses, persistent wounds, dysentery and diarrhea, glandular swelling, and hemoptysis
Fruits	• Serve as a stimulating tonic for the stomach's healthy operation.

• Hemoptysis and menorrhagia are treated with fruit juice.
• Treat diarrhea, constipation, and visceral blockage.
• Diabetes and leprosy treatments.
• Leucorrhoea, loss of voice, renal and spleen problems, astringent to the colon, stomachic, refrigerant dry cough,

Bark

- Mouthwash infused with bark is used to treat dysentery, menorrhagia, and spongy gums.
- Bark decoction is used to wash wounds, burns, asthma, piles, and edema.
- It is crucial to prevent numerous urinary tract illnesses in uropathy.
- Probable abortion, menorrhagia, lecorrhoea, gonorrhea, urinary infections, bleeding, and skin conditions
- Impending abortion, menorrhagia, lecorrhoea, gonorrhoea, urinary illnesses, bleeding, & skin problems

Latex

- It is used to make aphrodisiac medications that increase fertility.
- It functions as a remedy for cholera, mumps, and stomach ailments.
- It is employed in the management of bone fractures.
- It also serves as an adhesive for a variety of uses.
- Boils, traumatic pain and swelling, toothaches, inflammatory enlargements, hemorrhoids, diarrhea, diabetes, and so forth.

Sap of Root

- Diabetes and gonorrhea are both treated with sap of root.
- Muscle soreness, headaches, heat stroke, chronic wounds, and cattle malaria are among conditions that are treated with root sap.
- Diabetes, inflammatory diseases, menorrhagia, heamaturia, smallpox, and the mumps.

Roots

• Diarrhea, hyperglycemia, pectoral issues, mumps, and different inflammatory glandular enlargements, in addition to hydrophobia.

Tab:2 Traditional uses of Ficus racemose

5.PHARMACOLOGICAL ACTIVITIES

❖ Antidiuretic

It has been shown that a decoction of the bark of Ficus racemosa, taken at doses of 250, 500, or 1000 mg/kg body weight, has an antidiuretic effect. Furthermore, it increased urinary osmolarity while decreasing urine Na+ levels and the Na+/K+ ratio, demonstrating several mechanisms of action [44].

❖ Antitussive

A cough-induced paradigm utilizing sulphur dioxide gas is used to test the antitussive efficacy of a methanolic stem bark extract in mice. The extract was most inhibited at a dose of 200 mg/kg 90 minutes after delivery [45].

❖ Anti-ulcer/gastro-protective

In rat stomach ulcer models, the gastrointestinal protective effects of 50% methanol extracts of the Ficus racemosa linn. fruit, also known as Ficus glomerata, were examined. Ficus racemosa guards against oxidative damage to the stomach mucosa by preventing lipid peroxidation, drastically lowering superoxide dismutase, enhancing catalase activity, and decreasing H+K+ATPase. H+ secretion by gastric parietal cells is mediated by the dimeric enzyme H+K+ATPase [46,47].

❖ Anti-oxidant activity

Using steady-state and time-resolved approaches, the ability of ethanol and water extracts of Ficus racemosa to scavenge free radicals was examined. In the steady-state, Ficus racemosa ethanol extract had significantly higher antioxidant activity [48,49].

❖ Antihelmintic

In tests for antihelmintic activity on adult earthworms, the crude extracts of Ficus racemosa bark reduced spontaneous movement and induced pin-prick reactions. This had an impact comparable to that of 3% piperazine citrate [50].

❖ Antibacteria

A hydroethanolic extract of Ficus racemosa leaves was used to successfully treat Actinomyces viscous. 0.08 mg/ml was found to be the lowest inhibitory dose [51].

❖ Antipyrectic

Methanol extract of Ficus racemosa stem bark effectively decreased normal body temperature and yeast-induced pyrexia in albino rats up to 5 hours after drug administration at dosages of 100, 200, and 300 mg/kg body weight. The antipyretic effect was comparable to paracetamol [52].

❖ Anticholinesterase

In this study, hot and cold aqueous extracts of Ficus racemosa stem bark were investigated in vitro for anticholinesterase activity against rat brain acetylcholinesterase. Both cold aqueous extract (FRC) and hot aqueous extract (FRH) inhibited rat brain acetylcholinesterase in a dose-dependent manner. The proportion of anticholinesterase activity was calculated. FRC and FRH extracts both inhibited rat brain acetylcholinesterase in a dose-dependent manner. Their inhibitory effects were, however, significantly lower than those of neostigmine bromide, a common acetylcholinesterase inhibitor. FRH had significantly higher cholinesterase inhibitory activity than FRC; however, neither extract demonstrated 50% inhibition of AChE at the dosages tested (200-1000 g/ml), hence IC50 values were calculated using Boltzmann's dose-response analysis [53].

❖ **Anti-cancer activity**

Oral administration of Ficus racemosa extract at doses of 200 and 400 mg kg1 significantly reduced lipid peroxidation, xanthine oxidase, glutamyl transpeptidase, topoisomerase-II, and hydrogen peroxide (H2O2) generation, as well as renal glutathione content and antioxidant enzymes produced by potassium bromate (KBrO3) .In rats, this nephrotoxic substance causes kidney cancer. Renal glutathione levels and antioxidant enzymes improved noticeably. These findings indicate that Ficus racemosa extract is a potent chemopreventive agent that inhibits KBrO3-mediated nephrotoxicity in rats [54].The ability of lupeol present in ficus to alter signaling pathways such as nuclear factor kappa B (NF-B) and the phosphatidylinositol 3-kinase [PI3K]/Akt (protein kinase B pathway), both of which are known to play important roles in carcinogenesis, was found to be linked to the drug's anti-tumor promoting actions.

❖ **Wound healing**

In excision and incision wound models in rats, ethanolic extracts of Ficus racemosa stem bark improved wound healing [55].

❖ **Antifilarial**

Both alcoholic and aqueous extracts restricted the spontaneous motility of whole worms and nerve-muscle preparations of Setaria cervi, causing contractions to become more intense and toned. Microfilaria were destroyed in vitro by both Ficus racemosa preparations [56].

❖ **Anti-inflammatory**

Ficus racemosa was investigated for anti-inflammatory activity in rat hind paw edema models caused by carrageenin, serotonin, histamine, and dextran. Euphol has a variety of biological actions, including antiviral and anti-inflammatory properties. The extract (400 mg/kg) demonstrated peak anti-inflammatory effects of 30.4, 32.2, 33.9, and 32.0% in carrageenan, serotonin, histamine, and dextran-induced rat paw oedema. The extracts (400 mg/kg) reduced granuloma weight by 41.5% in a chronic test, which is equal to phenylbutazone [57]. Because ethanolic extracts of stem bark reduced COX-1 with an IC50 value of 100 mg/ml, the drug is utilized to treat inflammatory illnesses [58,59].

❖ **Antiulcer**

The 50% ethanol extract of Ficus racemosa fruits was examined in rats at doses of 50, 100, and 200 mg/kg weight for 5 days twice daily in various stomach ulcer models, including pylorus ligation, ethanol, and cold restraint stress. The extract decreased ulcer index in all three ulcer models [60,61] in a dose-dependent manner.

❖ **Analgesic**

When tested for analgesic action using an analgesiometer at 100, 300, and 500 mg/kg, the ethanolic extract of Ficus racemosa bark and leaves demonstrated a dose-dependent analgesic effect and was shown to contain [62].

❖ **Hepatoprotective**

After inflicting chronic liver injury on rats with a subcutaneous injection of 50% v/v carbon tetrachloride in liquid paraffin at a dosage of 3 ml/kg on alternate days for four weeks, an ethanolic extract of Ficus racemosa leaves showed hepatoprotective effect. The biochemical indicators SGOT, SGPT, serum bilirubin, and alkaline phosphates were computed to assess liver function [63]. Another study looked at the hepatoprotective activity of methanolic extracts of Ficus racemosa stem bark at dosages of 250 and 500 mg/kg against carbon tetrachloride-induced liver damage in rats, using silymarin as a control. It revealed a dramatic reversal of all biochemical indicators toward normal in serum, liver, and kidney compared to carbon tetrachloride-treated control rats [64].

❖ **Radio protective**

The ability of Ficus racemosa ethanol and water extracts to scavenge free radicals is investigated utilizing both stable state and time-resolved approaches. When tested with standard chemicals, it also displayed concentration-dependent DPPH, ABTS, hydroxyl radical, and superoxide radical scavenging, as well as lipid peroxidation prevention. The radioprotective ability of irradiated Chinese hamster lung fibroblast cells was examined in vitro utilizing the micronucleus assay (V79). Pre-treatment with varied doses 1 hour before 2 Gy-radiation resulted in a significant decrease in the proportion of micro-nucleated binuclear V79 cells, indicating a role as radioprotector [64]. In vitro antioxidant activity of stem bark methanolic extracts was substantially higher than that of its roots [65].Fruit ethanolic extracts revealed significant antioxidant activity in the DPPH free radical experiment. 3-O-(E)-Caffeoyl quinate has significant antioxidant activity [66].

❖ **Antifungal**

Trichophyton mentagrophytas, Trichophyton rubrum, Trichophyton soundanense, Candida albicans, Candida krusei, and Torulopsis glabrata were all suppressed by Ficus racemosa [67,68].

❖ **Hypoglycemic activity**

Methanolic extract of Ficus racemosa stem bark at doses of 200 and 400 mg/kg lowered glucose levels in normal and perhaps alloxan-induced diabetic rats. The activity was comparable to that of the standard antidiabetic medicine, glibenclamide (10 mg/kg), validating its folklore claim as an antidiabetic treatment [69-71]. The relationship between the post-absorptive state and hypoglycemia tests in Ficus racemosa demonstrated that drug absorption results in improved hypoglycemic action [72]. The ethanolic extract (250 mg/kg/day) lowered blood glucose levels in alloxan diabetic albino rats after two weeks, demonstrating hypoglycemic activity [73]. In normal and alloxan-induced diabetic rabbits, methanol extract of powdered Ficus racemosa fruits at doses of 1, 2, 3, and 4 g/kg lowered blood glucose levels [74]. An ethanolic extract of Ficus racemosa leaves at 100 mg/kg body weight lowered blood glucose levels by 18.4 and 17.0% after 5 and 24 hours, respectively, in a sucrose-challenged streptozotocin-induced diabetic rat model [75].

.❖ **Hypolipidemic activity**

Ficus racemosa fruit fiber induced a clear hypocholesterolemic effect in rats by increasing faecal excretion of cholesterol and bile acids [76]. An ethanolic extract of Ficus racemosa barks was tested for hypolipidemic characteristics in alloxan-induced diabetic rats at doses ranging from 100 to 500 mg/kg. When compared to the standard reference medicine, glibenclamide, the extract demonstrated significant anti-diabetic and hypolipidemic benefits. By reducing the amount of cholesterol in the body, beta-sitosterol helps to lower cholesterol levels. The presence of beta-sitosterol in bark and latex might then be attributed to the hypolipidemic effect of ficus extract.

❖ **Larvicidal**

The toxicity of crude hexane, ethyl acetate, petroleum ether, acetone, and methanol extracts of Ficus racemosa leaf and bark against Culex quinque fasciatus early fourth-instar larvae was investigated [77]. Larval mortality was discovered after a 24-hour exposure. The larvicidal efficacy of all extracts was low; however, the acetone extract of bark had the maximum larval mortality.

❖ **Renal anticarcinogenic**

Ficus racemosa extracts at 200 mg/kg body weight and 400 mg/kg body weight lowered xanthine oxidase, lipid peroxidation, and hydrogen peroxide levels considerably. Renal glutathione concentration and antioxidant enzymes significantly improved, while renal ornithine decarboxylase activity, DNA synthesis, blood urea, and serum creatinine decreased [78,79]. When ferric nitrilotriacetate (FeNTA) was used as a kidney carcinogen, similar results were obtained [80]. Both data revealed that this extract is an extremely effective chemopreventive agent.

❖ **Memory enhancing agent**

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that causes dementia, and one of the most important approaches to treat AD is to employ acetylcholinesterase inhibitors to boost acetylcholine (Ach) levels in the brain. Aqueous extract of the bark of this tree with anti-inflammatory, antioxidant, and sometimes anticholinesterase activity was examined in rats for its ability to enhance Ach levels and antidementia activity. Ficus racemosa extract may have a number of therapeutic effects in the treatment of Alzheimer's disease, including neuroprotection due to antioxidant and anti-inflammatory characteristics. It may increase Ach levels, as previously observed for Ficus hispida extract [81,82]

CONCLUSION

This review was built on the traditional applications, phytochemicals, and pharmacological activities of Ficus rasemosa linn. Traditional Chinese Medicine (TCM), which is an important component of most healthcare systems, is based on natural components and has been used for thousands of years to protect people's health and prevent sickness. TCM therapeutic efficacy has aided in the development of formulations, which increase effectiveness by treating a variety of objectives that are usually linked to the synergistic nature of numerous herbs and substances. Numerous pharmacologically active chemicals have been discovered in the ficus plant, including -sitosterol, gluanol acetate, flavonoids, lupeol, stigmasterol, and tetracyclic triterpene glauanol, according to various phytochemical research. Its ethanolic, methanolic, and aqueous extracts have shown antifungal, hypoglycemic, hypolipidemic, larvicidal, renal anticarcinogenic, and memory-enhancing properties. It is strongly believed that the comprehensive information offered in this review on the different therapeutic effects of the constituents may provide comprehensive evidence for the usage of this plant in various medicines. However, animal models should be used to isolate and characterize the active ingredients of a distinct section of Ficus rasemosa as well as its pharmacological properties. Because of the lack of research on these compounds' biological activity and possible medical applications, further research is needed before their therapeutic potential can be completely explored. Because the aqueous extract has been marketed, scientists are adequately encouraged to study more about this medicinal plant in order to capitalize on its commercial potential. For more significant results, F. racemosa should be the topic of extensive research and development.

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