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FICUS RACEMOSA L.: A REVIEW OF ITS TRADITIONAL USES, PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES

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ABSTRACT

Ficus racemosa, also called the cluster fig or gular, is a milky-sap tree of the family Moraceae that is widely used in Ayurveda, Siddha, Unani and Homeopathy. Its bark, root, leaves, fruit and latex are traditionally used for diabetes, dysentery, diarrhoea, wounds and many other problems. Lupeol, gallic acid and β-sitosterol are the main active compounds found in the stem bark, leaves and fruit, and bergenin, bergapten, tannins and flavonoids add to the list. Laboratory studies show that its extracts have antidiabetic, cholesterol-lowering, antioxidant, antimicrobial, anti-inflammatory, wound-healing, liver-protective, anticholinesterase and cytotoxic effects. The effect on blood sugar and blood fats is the best studied and is linked mainly with β-sitosterol and related compounds. Newer studies use GC-MS, docking and animal tests to connect the fruit and leaf compounds with Alzheimer's disease. A single oral dose of 2000 mg/kg did not kill any rat, but good human trials are still lacking. This review explains the plant's botany, its main chemical compounds part by part, its pharmacology, traditional uses and safety, and it points out what research is still needed.

KEYWORDS: Ficus racemosa; Udumbara; lupeol; gallic acid; β-sitosterol; antidiabetic; antioxidant; antimicrobial.

INTRODUCTION

Plants are still a major source of medicine, and about 70–80% of people in developing regions depend mainly on herbal remedies for basic healthcare.[1] The genus *Ficus* is the biggest genus of the family Moraceae, with about 750 to 800 species, and many of them show antioxidant, antibacterial, anti-inflammatory, antidiabetic and liver-protective effects.[1,2]

Ficus racemosa (also named *Ficus glomerata*) is a tall shade tree with milky sap, known as the cluster fig, gular or Udumbara, and it grows wild or is planted across India and other parts of Asia and Australia.[1] It is described in Ayurveda, Siddha, Unani and Homeopathy and is used for dysentery, diarrhoea, diabetes, wounds and bile-related complaints.[3,4] Its extracts have shown antidiabetic, antioxidant, antidiarrhoeal, anti-inflammatory, antipyretic, antimicrobial, cholesterol-lowering, antifilarial and liver-protective effects in laboratory studies.[5]

Earlier reviews covered its pharmacognosy, chemistry and pharmacology, but new work on wound healing, brain disease models and safety has appeared since then.[4] An overview of its phytopharmacological properties was also published in 2010.[6] This review joins the older and newer findings and pays special attention to its main compounds: lupeol, gallic acid and β-sitosterol.[3,5]

AIM AND OBJECTIVE

Aim

The aim of this review is to give a clear, evidence-based account of the traditional uses, phytochemistry and pharmacological activities of *Ficus racemosa*.

Objective

- To describe the taxonomy, distribution and morphology of the plant.
- To explain the main constituents lupeol, gallic acid and β-sitosterol, and the plant parts in which they are found.
- To discuss the major pharmacological activities in detail and the other activities briefly.
- To record the traditional medicinal uses of the plant.
- To study the toxicity and safety data.
- To point out research gaps and future prospects.

BOTANICAL DESCRIPTION

Taxonomy

In the classification usually given for the genus, *Ficus racemosa* belongs to the kingdom Plantae, class Magnoliopsida, subclass Dilleniidae, order Urticales, family Moraceae and tribe Ficeae.[1] The same species is also listed as *Ficus glomerata*.[1] Some of its local names are Udumbara, Yajnayoga, Goolar (Gular) and Dumar, and in English it is called the cluster fig.[3]

Table 1: Taxonomic classification of *Ficus racemosa* L.[1]

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Urticales
Family	Moraceae
Tribe	Ficeae
Genus	*Ficus*
Species	*Ficus racemosa* L. (syn. *Ficus glomerata* Roxb.)

Distribution

The tree is native to Australia, South-East Asia and the Indian subcontinent and is found wild or planted all over India.[1] In India it grows from the lower Himalayan ranges and Punjab to Bihar, Orissa, West Bengal, Rajasthan, the

Deccan and South India.[1] It likes moist places, stream banks and evergreen or deciduous forests, and it can grow up to about 1800 m above sea level.[1,3] People often plant it near homes and temples, and it is counted among the four sacred Nalpamara trees.[1]

Morphology



Figure 1: *Ficus racemosa* L.: whole tree, leaves and fruits.[1] Habit and bark.

F. racemosa is a medium to large, spreading tree that can reach about 20 m, and it gives milky sap.[1] Unlike many other figs, it does not form many hanging aerial roots.[1] The outer bark is greyish to rusty brown and peels off in thin, loose flakes.[1]

Leaf

The leaves are egg-shaped to narrow-oval with three main veins, an uneven base, a smooth edge and a pointed tip.[1] Each leaf has eight to ten pairs of side veins, and both surfaces are smooth, while the small leaf-like stipules are triangular, brown and stay for a long time.[1] Tiny mineral bodies called cystoliths are present only on the lower surface of the leaf.[1] The tree drops its leaves around December and grows new ones in January and April, so it is bare for a short time.[1]

Flower

Like other figs, the flowers are very small, are either male or female, and sit inside a closed, fleshy cup called the syconium.[1] The syconium has a narrow opening at the top, and special fig wasps carry out pollination in this genus.[1,2]

Fruit

The fruits are pear-shaped syconia, 2–5 cm wide, that grow in big bunches straight from the trunk and thick branches.[1] They are green when raw and turn orange, dull red or dark red when ripe.[1] The ripe fruits are edible and are eaten by villagers, and the tree is also grown for shade and fruit.[1]

Seed and pharmacognostic features

The seeds are tiny, very many and grain-like.[1] Studies on the stem bark and root powder have recorded their outer and microscopic features, which helps in identifying the correct drug.[7,8]

PHYTOCHEMISTRY

Chemical studies of *Ficus racemosa* have used simple screening tests, isolation by chromatography, HPLC-DAD and GC-MS.[9,10] They report sterols, triterpenoids, flavonoids, tannins, phenolic acids, glycosides and alkaloids, and the amount of each depends on the plant part and the solvent used.[3,5] Three compounds appear again and again in studies that connect chemistry with activity, namely lupeol, gallic acid and β-sitosterol, so they are explained first, followed by bergenin and bergapten and then the other compounds part by part.[9,11]

Lupeol

Lupeol is a triterpene built from five rings, and it is found in many edible fruits, vegetables and medicinal plants.[12] In *Ficus racemosa*, it was separated from the stem bark together with its ester, lupeol acetate, by following the wound-healing activity step by step.[11] The stem bark is therefore the plant part where lupeol has been clearly isolated and linked with an effect.[11]

Lupeol is known to have anti-inflammatory, antioxidant, anticancer and antibacterial actions.[12] Its anticancer power and the use of nano-carriers to deliver it better have also been reviewed.[13] In the bark of this plant, lupeol and β-sitosterol were the compounds that helped skin cells to move and close a scratch wound, giving more than 80% migration, similar to the positive control.[11] The best doses were about 30 μM for lupeol and 35 μM for β-sitosterol, and lupeol acetate worked like a pro-drug that changes into lupeol near the cells.[11]

Gallic acid

Gallic acid is a simple phenolic acid that is present in many fruits and medicinal plants.[14] In *Ficus racemosa*, HPLC-DAD analysis of methanol extracts showed a good amount of gallic acid in both the leaves and the fruit, along with other phenolic compounds.[9] A GC-MS study of the methanol extract of the plant also talks about phenolic compounds such as gallic acid and ellagic acid.[15]

Gallic acid is known for antioxidant, anti-inflammatory and anticancer effects, though most proof comes from cell and animal studies.[14] It can stop some bacteria, such as *Pseudomonas aeruginosa* and *Staphylococcus aureus*, from moving, sticking and forming biofilm.[14] New reviews explain how it kills bacteria and cancer cells and describe its derivatives and nanoparticle forms.[16] The authors of the *Ficus racemosa* study believe that the large amount of gallic acid and other phenolics gives the leaf and fruit extracts their antioxidant, antibacterial and cytotoxic action.[9]

β-Sitosterol

β-Sitosterol is the commonest plant sterol in foods, and its structure looks like cholesterol.[17,18] In *Ficus racemosa*, it was reported from the bark along with stigmasterol, and also from the fruit.[9,19] It was found in the stem bark again as an active wound-healing compound.[11]

β-Sitosterol shows anti-inflammatory, fever-reducing, pain-relieving and antidiabetic effects, and it is studied most for its anticancer potential.[17] It acts on immunity, inflammation and drug resistance of cancer cells, as explained in a review of its cancer-preventing and cancer-treating actions.[17] Its antioxidant power has been tested in the laboratory with

DPPH-type tests, and it is also an accepted treatment for an enlarged prostate.[18] Another review studied its structure, effects in the body and treatment value, and called it an orphan sterol because its development is behind its promise.[20] Reviewers of *Ficus racemosa* give β-sitosterol the credit for the blood sugar-lowering action of the bark.[5,19]

Bergenin and bergapten

The acetone extract of the stem bark, which had the highest phenol content, was reported to contain bergenin and bergapten as its major components.[21] Bergenin has been reviewed for its pharmacological and chemical-analysis features.[22] The same bark extract protected rat kidney and testis from doxorubicin damage, and its LD50 was above 2 g/kg.[21]

Bergapten, also called 5-methoxypsoralen, is a furocoumarin that is mostly obtained from bergamot and other citrus oils.[23] It has antibacterial, anti-inflammatory, fat-lowering and anticancer effects, and it is used with ultraviolet light in skin diseases such as psoriasis and vitiligo.[23] Few human trials exist, and it is said to cause fewer side effects than its isomer 8-methoxypsoralen even though it is absorbed less.[23]

Other constituents part by part

Leaves

The leaves gave glauanol acetate, a four-ring triterpene, and a compound called racemosic acid.[9] Simple screening of leaf extracts shows alkaloids, tannins, sterols and flavonoids.[19] The methanol extract of the leaf had measurable phenols, flavonoids and tannins, and gallic acid was the main phenol found by HPLC-DAD.[9] GC-MS of the ethanol extracts identified 80 compounds in the leaf and 48 in the fruit.[10] Leaf galls have also been used to make silver nanoparticles by green synthesis.[24]

Stem bark

Lupeol, lupeol acetate and β-sitosterol are the best known compounds of the stem bark.[11] Stigmasterol, bergenin and bergapten are also reported from the bark.[19,21] The bark is rich in phenolic compounds, which explains most of its antioxidant action.[21,25] Standard identity and quality tests have been prepared for the stem bark.[7] Minerals such as calcium, potassium, magnesium, phosphorus and iron have been found in different parts of the tree.[4]

Root and root bark

The root and root bark have been tested for basic phytochemicals and antioxidant power.[8] Root extracts showed saponins, tannins, alkaloids and flavonoids, while amino acids and carbohydrates were absent.[26] Studies on root powder describe its colour, smell, taste and microscopic features, which help in quality control.[8]

Fruit

The fruit contains glauanol, hentriacontane, β-sitosterol, tiglic acid, cycloartenol, cycloeuphordenol, euphol, euphorbinol, isoeuphorbol and palmitic acid.[9] Anthocyanins were taken from the red fruit with acidified methanol, studied by HPLC at 520 nm and protected small blood vessels better than the standard drug proxerutin.[27] A hydroalcoholic fruit extract was tested for carbohydrates, proteins and secondary metabolites, and it contained flavonoids, phenols and alkaloids.[28] Fruit extracts of *Ficus glomerata*, the other name of this species, also showed several kinds of compounds along with antimicrobial action.[29]

Latex, seeds and galls

Latex, seeds and galls are not well studied, and in the whole genus seeds and resin are among the least studied parts.[1]

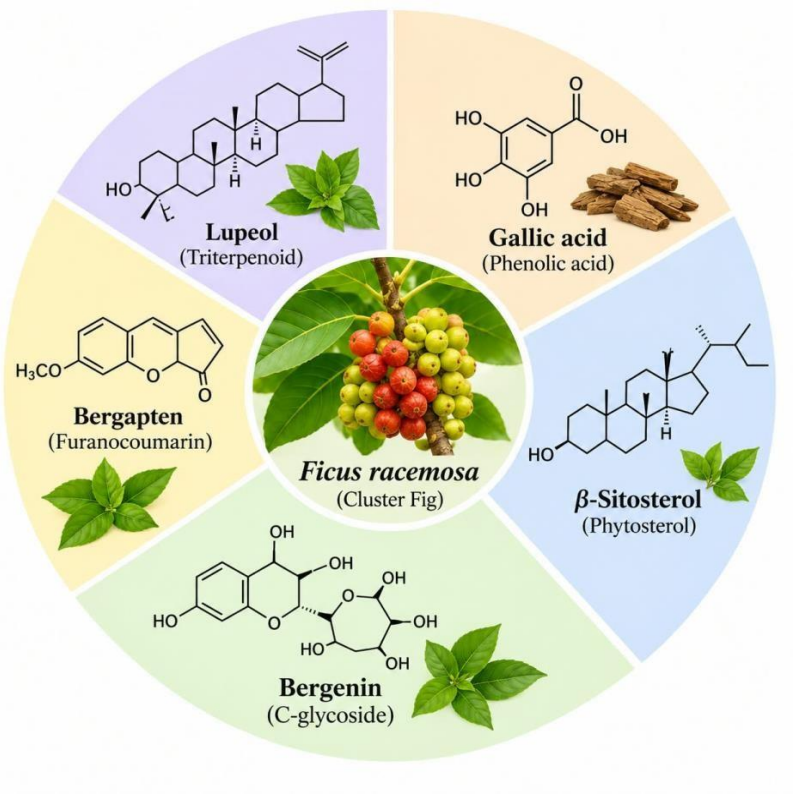

Figure 2: Chemical structures of Lupeol, Gallic acid, Bergenin and Bergapten.[9,11,21]

PHARMACOLOGICAL ACTIVITIES

Studies on *Ficus racemosa* include enzyme tests, cell-based tests and animal experiments, and reviews list more than twelve activities.[3,5] The four activities with the most evidence are explained in detail, and the others are described briefly.[3]

Antidiabetic and hypolipidemic activity

Diabetes is a long-term disease with high blood sugar, and it can later damage nerves, kidneys and the heart.[30] *Ficus racemosa* is a well-known home remedy for diabetes in the Indian subcontinent, and this is why so many studies focus on it.[5,31] A survey in rural and urban Dhaka found it among the plants most often named for diabetes, but it said that the scientific data were not yet enough to recommend such plants.[31]

Stem bark extract lowered blood sugar, protected the liver and improved blood fats in diabetic rats made diabetic with streptozotocin.[32] The cholesterol-lowering effect of the bark was tested even earlier in rats made diabetic with alloxan.[33] A short clinical report also described a blood sugar-lowering effect of bark extract in people with type 2 diabetes.[5]

A petroleum ether extract was given for seven days at 100, 200 and 300 mg/kg to diabetic rats, and the highest dose brought the average blood sugar down from about 290 to 205 mg/dL.[19] The same extract reduced cholesterol, triglycerides, LDL and VLDL, raised HDL and reduced fat damage and protein damage in the liver.[19]

In a study on diabetic nerve damage, water extract (250 and 500 mg/kg) and ethanol extract (200 and 400 mg/kg) of the bark were given for 28 days, and both lowered blood sugar and HbA1c.[30] HbA1c came down from about 8.1% in untreated diabetic rats to roughly 5.4–6.4% in treated rats.[30] The treated rats also had more SOD and catalase, less nitrite, CRP and fat damage, and better pain response.[30]

Reviewers give most of the credit for the sugar-lowering action to the β-sitosterol of the bark.[5,19] In diabetic rats, a mixed extract of *Syzygium cumini* and *Ficus racemosa* was tested at three doses, and the middle dose gave the best fat-lowering effect.[34] Since the fall in sugar comes together with antioxidant protection and better blood fats, the plant probably works in more than one way.[19,30] Still, most proof comes from short animal studies using crude extracts, so the right human dose, quality control and long-term safety are not yet known.[1,5]

Antioxidant activity

Oxidative stress is linked with inflammation, infection, diabetes and cancer, so antioxidant plants are of great interest.[9] Methanol extracts of the leaves and fruits of *Ficus racemosa* removed DPPH radicals, showed good reducing power and cleared superoxide, hydroxyl and hydrogen peroxide radicals.[9] They contained good amounts of phenols, flavonoids and tannins, and the high gallic acid found by HPLC-DAD probably adds to the effect.[9] Using many tests together gives a more reliable picture of antioxidant power than one test alone.[9]

A standardised stem bark extract was described as a strong antioxidant and a possible natural protector against radiation.[35] The bark has shown antioxidant action in the test tube, in tissues and in diabetic rats.[21] In rats given doxorubicin, an acetone extract of the bark (250 and 500 mg/kg) reduced fat damage by removing free radicals and protected the kidney and testis.[21]

In diabetic rats, bark extracts raised SOD and catalase and lowered fat damage, nitrite and CRP.[30] That study concluded that the extract reduces oxidative-nitrosative stress and early inflammation, which links antioxidant action with tissue protection.[30] A petroleum ether extract also lowered TBARS and protein damage in the liver.[19]

An extract of *Ficus glomerata*, another name for this species, was tested by the DPPH method and the activity was expressed as gallic acid equivalent.[36] Methanol and water extracts of *Ficus racemosa* were compared with other medicinal plants for antioxidant and anti-inflammatory action, and the link between the two was studied.[37] Gallic acid and β-sitosterol are both antioxidants, which fits the action of these extracts.[14,18] It is hard to compare studies because the plant part, solvent and test are different in each one.[3,5]

Antimicrobial activity

Leaf, fruit, bark and root preparations of *Ficus racemosa* are reported to act against bacteria and fungi.[3,5] A hydroalcoholic leaf extract stopped *Actinomyces viscosus* at an MIC of 0.08 mg/mL.[1] Step-wise extracts of the stem bark were also tested for antibacterial action.[38]

Fruit extracts made with water, chloroform, ethyl acetate, hexane and ethanol acted against bacteria and fungi, and MIC was found by the broth dilution method.[39] Methanol extract of the fruit acted against disease-causing bacteria and fungi in a disc diffusion test.[9] Fruit extracts of *Ficus glomerata* have also been screened for antimicrobial action.[29]

Methanol extract of the leaf was tested against *Staphylococcus aureus* by disc diffusion and broth microdilution, and its compounds were suggested as an alternative to common antibiotics.[40] Ethyl acetate and methanol extracts of the stem bark stopped *Staphylococcus* and *Bacillus* bacteria and the fungus *Candida albicans*.[11] Methanol extracts of the leaf and fruit also showed antibacterial action in the disc diffusion method.[9]

Lupeol is reported to be antibacterial, and gallic acid can block biofilm formation, so both may add to the action of whole extracts.[12,14] Silver nanoparticles made from leaf gall extract showed antibacterial and anticancer action, which points to a nano-medicine route.[24]

Neuroprotective and anticholinesterase activity

Low acetylcholine is a key problem in Alzheimer's disease, so stopping the enzyme AChE is a common aim of drug search.[41] Cold and hot water extracts of the stem bark moderately blocked rat brain AChE in the test tube, and the authors linked this with the high phenol content of the bark.[25] The authors noted that no earlier report existed on this activity, so their work gave the first evidence.[25] In diabetic rats with nerve damage, bark extracts improved pain response, body balance and movement.[30]

Ethanol extracts of the fruit and leaf were studied by GC-MS and gave 48 and 80 compounds.[10] Some of these compounds showed good docking with AChE, β-secretase and γ-secretase, and blood compatibility, oxidative markers and organ tissue were also checked.[10]

A later study tested ethanol extracts of the leaf and fruit in rats with memory loss caused by scopolamine and measured acetylcholine, AChE and amyloid beta.[41] It built on earlier findings that the plant affects acetylcholine, AChE and amyloid beta.[41] Docking only predicts binding and does not prove action, and how well the extracts reach the brain, the right dose and long-term effects are still unknown.[10,41]

Anti-inflammatory, analgesic and antipyretic activity

Recent reviews list anti-inflammatory and pain-relieving actions of the plant.[3] Cold and hot water extracts of the bark stopped egg albumin from denaturing as the dose increased, with the best effect at 1000 µg/mL and a stronger action than the reference drugs.[42] Methanol and water extracts were also checked by albumin denaturation and anti-lipoxygenase tests along with other plants.[37] A bark extract reduced inflammation in albino rats, and the same study showed wound healing.[43] A chloroform extract of the leaf relieved pain in the hot plate test in mice and was compared with pentazocine.[44] The ethanol extract of the root was reported to reduce fever in rats.[45] In diabetic rats, CRP fell after bark extract, which shows lower body inflammation.[30] Lupeol and β-sitosterol are both anti-inflammatory compounds, which agrees with these results.[12,17]

Hepatoprotective and organ-protective activity

Stem bark extract protected the liver of diabetic rats along with lowering their blood sugar.[32] Methanol extract of the bark was tested for ten weeks in rats with fatty liver caused by a high-fat, high-fructose diet, and liver enzymes, serum leptin and liver tissue were examined.[46] A mix of *Syzygium cumini* and *Ficus racemosa* extracts improved fat and liver markers in diabetic rats, and the middle dose worked best.[34] The earlier work of the Ahmed group showed protection against liver damage by CCl4 and heart damage by doxorubicin.[21] An acetone extract of the bark protected the kidney and testis from doxorubicin at 250 and 500 mg/kg.[21]

Wound-healing activity

Latex and other parts of the tree are used for wound healing in Ayurveda and in the traditional medicine of Sri Lanka.[11] In a scratch wound test on BHK 21 and MDCK cells, dichloromethane and hexane extracts of the bark helped cells to move and close the wound.[11] Lupeol and β-sitosterol were the active compounds, and lupeol acetate acted as a pro-drug.[11] Water and ethanol extracts of the root were tested in incision and excision wound models in rats, and the water extract healed wounds better than the ethanol one.[26] Bark extract also showed wound healing and anti-inflammatory action in albino rats.[43]

Cytotoxic and anticancer activity

Methanol extracts of the leaf and fruit killed brine shrimp, which shows some cell-killing power.[9] Silver nanoparticles made with leaf gall extract showed anticancer action in the trypan blue test.[24] Lupeol, gallic acid and β-sitosterol are each reported to have anticancer action in other studies, but this is not yet proven for *Ficus racemosa* extracts.[13,17] Anticancer potential is listed among the plant's activities, but proof from pure compounds and animals is limited.[3,5]

Other activities

Stem bark relieved cough, with a highest effect of about 56.9% at 200 mg/kg.[1] Extracts have also killed larvae of the mosquitoes *Culex quinquefasciatus* and *Culex gelidus*.[1] Urine-increasing, worm-killing, anti-ulcer, radiation-protective and antifilarial effects complete the list of reported activities.[3,5]

TRADITIONAL MEDICINAL USES

Ficus racemosa is described in Ayurveda, Siddha, Unani and Homeopathy and is used in several Asian traditional systems.[3,28] The bark, root, leaves, fruit and latex are used for diabetes, dysentery, diarrhoea, bile disorders, wounds and other problems.[4,5] The bark is astringent and is used as a mouthwash for spongy gums, and it is taken by mouth for dysentery, heavy periods and coughing of blood.[8] The fruit is also astringent and is used in kidney and spleen disorders.[9] Home use for diabetes is common, and in Bangladesh the plant is among those most often named for it.[31] Because of its sacred value, the tree is planted around temples and homes.[1]

Table 2: Plant parts of *Ficus racemosa* and their reported traditional uses.

Plant part	Traditional use
Bark	Astringent mouthwash for spongy gums; dysentery, menorrhagia, haemoptysis.[8]
Bark / stem bark	Diabetes, diarrhoea and dysentery.[4]
Fruit	Astringent; kidney and spleen disorders.[9]
Latex and bark	Wound healing in Ayurveda and Sri Lankan indigenous medicine.[11]
Whole plant (folk use)	Diabetes management in Bangladesh and the Indian subcontinent.[31]
Tree (cultural use)	Planted around homes and temples; one of the sacred Nalpamara trees.[1]

Animal studies have partly supported many of these uses, mainly for diabetes, wound healing, diarrhoea and inflammation.[3,5] Some uses, such as the fruit for spleen disorders, seem to lack direct experimental proof in the papers reviewed.[4]

TOXICITY AND SAFETY

Acute toxicity was tested in Wistar rats by giving a single oral dose of 2000 mg/kg of extract and watching them for 14 days for changes in behaviour, body weight and other signs.[28] No death occurred up to 2000 mg/kg, and the authors said that this supports the traditional use of the plant.[28] In the diabetic nerve study, doses were chosen using the 2000

mg/kg safety level, and no rat died during the experiment.[30] Acetone bark extract had an LD50 above 2 g/kg in earlier work.[21]

Ethanol extracts of the fruit and leaf were checked for blood compatibility, oxidative markers and vital organ tissue, and the results pointed to good safety.[10] An earlier review gathered toxicology and clinical trial data, but the number of human studies is small.[5] Most *Ficus* species, including this one, lack well-controlled, double-blind human studies.[1] The brine shrimp deaths seen with leaf and fruit extracts show biological activity and should not be taken as proof of toxicity in humans.[9] Bergapten can make skin sensitive to ultraviolet light, which matters when furocoumarin-containing preparations are used.[23] Since the extracts lower blood sugar, using them with diabetes medicines could in theory cause too low a sugar level, but no interaction studies were found in the sources reviewed.[5,19] Long-term and reproductive toxicity, safety in pregnancy and contamination checks of the raw drug still need to be studied.[1,5]

DISCUSSION

Ficus racemosa shows a very wide range of biological actions, and many traditional uses have received some experimental support. The strongest evidence is for control of blood sugar and blood fats, where bark and leaf extracts worked in several animal models. Lower HbA1c together with better fat and antioxidant markers shows that the effect is more than just a fall in sugar.

The chemistry gives reasonable explanations for many actions: lupeol from the stem bark links with wound healing, anti-inflammatory and antibacterial effects, gallic acid links with antioxidant, antimicrobial and cell-killing action, and β-sitosterol links with sugar and fat control. However, most proof for these three compounds comes from other plants or from pure-compound studies, and only the wound-healing work has directly connected lupeol and β-sitosterol from this plant with a measured effect.

The plant part and solvent change the result, since petroleum ether, water and ethanol extracts of the bark all lowered sugar, while for wound healing the water extract of the root worked better than the ethanol extract. Effective doses in rats were mostly between 100 and 500 mg/kg, far below the 2000 mg/kg level at which no death was seen, but this does not prove safety in humans. Many experiments also use crude extracts without marker-based quality control, which makes comparison and repetition difficult.

Newer research on brain disease, based on GC-MS, docking and scopolamine studies, is promising but mostly computer-based or early. Only one short clinical report was found, so the evidence supports the traditional use of *Ficus racemosa* but is not yet enough for a clinical recommendation.

FUTURE PROSPECTS

The raw drug and its extracts should be standardised using marker compounds such as lupeol, gallic acid and β-sitosterol with validated HPLC methods. Compounds should also be isolated from the fruit and root, where such work is limited, to find more active principles. Since nano-carriers are being used to deliver lupeol and gallic acid better, they can also be tried with lupeol-rich bark fractions.

Studies on glucose uptake, enzyme blocking and fat metabolism are needed to confirm how the plant lowers sugar. Creams made from lupeol-rich fractions can be developed and tested for wound healing because they help cell movement and also fight microbes. For brain protection, studies on absorption, brain entry and long-term effect should

follow the docking and scopolamine work.

Long-term, reproductive and gene toxicity studies are needed before human use is considered. Well-designed randomised human trials using standardised preparations are the most important missing step. The tree should also be grown and protected in a sustainable way because it has cultural as well as medicinal value.

CONCLUSION

Ficus racemosa is a culturally important and medicinally versatile tree whose parts have long been used for diabetes, wounds and stomach disorders. Its bark, leaves, fruit and root contain lupeol, gallic acid, β-sitosterol, bergenin and other phenolic and triterpene compounds that give a reasonable basis for the reported activities. Antidiabetic, cholesterol-lowering, antioxidant, antimicrobial and brain-protective effects are the best supported, and the acute safety data are encouraging. Standardised extracts, studies on pure compounds and controlled human trials are needed to turn this promise into dependable treatment.

LIST OF ABBREVIATIONS

Abbreviation	Full form
AChE	Acetylcholinesterase
CCl4	Carbon tetrachloride
CRP	C-reactive protein
DPPH	2,2-Diphenyl-1-picrylhydrazyl
GC-MS	Gas chromatography–mass spectrometry
HbA1c	Glycosylated haemoglobin
HDL	High-density lipoprotein
HPLC-DAD	High-performance liquid chromatography with diode-array detection
LDL	Low-density lipoprotein
LD50	Median lethal dose
MIC	Minimum inhibitory concentration
SOD	Superoxide dismutase
STZ	Streptozotocin
TBARS	Thiobarbituric acid reactive substances
VLDL	Very-low-density lipoprotein

REFERENCES

1. Hasnat H, Alam S, Shompa SA, Saha T, Richi FT, Hossain MH, et al. Phyto-pharmacological wonders of genus *Ficus*: ethnopharmacological insights and phytochemical treasures from natural products. Saudi Pharm J., 2024; 32(12): 102211.
2. Dogara AM, Hama HA, Ozdemir D. Taxonomy, traditional uses and biological activity of *Ficus carica* L. (Moraceae): a review. Plant Sci Today, 2024; 11(2): 385-400.
3. Pahari N, Majumdar S, Karati D, Mazumder R. Exploring the pharmacognostic properties and pharmacological activities of phytocompounds present in *Ficus racemosa* Linn.: a concise review. Pharmacol Res Mod Chin Med, 2022; 4: 100137.
4. Ahmed F, Urooj A. Traditional uses, medicinal properties, and phytopharmacology of *Ficus racemosa*: a review. Pharm Biol, 2010; 48(6): 672-81.
5. Yadav RK, Nandy BC, Maity S, Sarkar S, Saha S. Phytochemistry, pharmacology, toxicology, and clinical trial of *Ficus racemosa*. Pharmacogn Rev, 2015; 9(17): 73-80.
6. Joseph B, Justin RS. Phytopharmacological properties of *Ficus racemosa* Linn - an overview. Int J Pharm Sci Rev

Res, 2010; 3(2): 134-8.

7. Ahmed F, Urooj A. Pharmacognostical studies on *Ficus racemosa* stem bark. Pharmacogn J., 2011; 3(19): 19-24.
8. Murti K, Kumar U, Panchal M, Shah M. Exploration of preliminary phytochemical studies of roots of *Ficus racemosa*. Marmara Pharm J., 2011; 15(2): 80-3.
9. Sumi SA, Siraj MA, Hossain A, Mia MS, Afrin S, Rahman MM. Investigation of the key pharmacological activities of *Ficus racemosa* and analysis of its major bioactive polyphenols by HPLC-DAD. Evid Based Complement Alternat Med, 2016; 2016: 3874516.
10. Rani A, Sharma PB, Bhatia S, Sharma AK. Comprehensive study on pharmacognostic, pharmacological, and toxicological features of *Ficus racemosa* in Alzheimer's disease using GC-MS and molecular docking analyses. Toxicol Res (Camb), 2024; 13(4): tfae098.
11. Bopage NS, Gunaherath GMKB, Jayawardena KH, Wijeyaratne SC, Abeysekera AM, Somaratne S. Dual function of active constituents from bark of *Ficus racemosa* L in wound healing. BMC Complement Altern Med, 2018; 18: 29.
12. Dalimunthe A, Gunawan MC, Utari ZD, Dinata MR, Halim P, Pakpahan NES, et al. In-depth analysis of lupeol: delving into the diverse pharmacological profile. Front Pharmacol, 2024; 15: 1461478.
13. AlMousa LA, Pandey P, Lakhanpal S, Kyada AK, Malathi H, Nayak PP, et al. An updated review deciphering the anticancer potential of pentacyclic triterpene lupeol and its nanoformulations. Front Pharmacol, 2025; 16: 1594901.
14. Kahkeshani N, Farzaei F, Fotouhi M, Alavi SS, Bahramsoltani R, Naseri R, et al. Pharmacological effects of gallic acid in health and diseases: a mechanistic review. Iran J Basic Med Sci., 2019; 22(3): 225-37.
15. Prasad KS, Ankanna S, Reddy TUK, Yaswanthi MS, Bhavani G, Bhanuprakash N, et al. Phytochemical screening and GC-MS analysis of methanolic extract of *Ficus racemosa*. J Pharmacogn Phytochem, 2024; 13(1): 404-11.
16. Keyvani-Ghamsari S, Rahimi M, Khorsandi K. An update on the potential mechanism of gallic acid as an antibacterial and anticancer agent. Food Sci Nutr, 2023; 11(10): 5856-72.
17. Wang H, Wang Z, Zhang Z, Liu J, Hong L. β-Sitosterol as a promising anticancer agent for chemoprevention and chemotherapy: mechanisms of action and future prospects. Adv Nutr, 2023; 14: 1085-110.
18. Arivarasu L. In-vitro antioxidant potential of beta-sitosterol: a preface. Cureus, 2023; 15(9): e45617.
19. Yadav RK, Keshari AK, Singh AK, Saha S. Antidiabetic and hypolipidemic effect of *Ficus racemosa* petroleum ether extract in streptozotocin induced diabetic albino rats. Int J Pharm Pharm Sci, 2015; 7(4): 283-7.
20. Bin Sayeed MS, Karim SMR, Sharmin T, Morshed MM. Critical analysis on characterization, systemic effect, and therapeutic potential of beta-sitosterol: a plant-derived orphan phytosterol. Medicines (Basel), 2016; 3(4): 29.
21. Ahmed F, Urooj A, Karim AA. Protective effects of *Ficus racemosa* stem bark against doxorubicin-induced renal and testicular toxicity. Pharmacogn Mag, 2013; 9(34): 130-4.
22. Patel DK, Patel K, Kumar R, Gadewar M, Tahilyani V. Pharmacological and analytical aspects of bergenin: a concise report. Asian Pac J Trop Dis, 2012; 2(2): 163-7.
23. Quetglas-Llabrés MM, Quispe C, Herrera-Bravo J, Catarino MD, Pereira OR, Cardoso SM, et al. Pharmacological properties of bergapten: mechanistic and therapeutic aspects. Oxid Med Cell Longev, 2022; 2022: 8615242.
24. Sabira O, Drisya N, Ajaykumar AP, Mathew A, et al. From *Ficus* recemosa leaf galls to therapeutic silver nanoparticles: antibacterial and anticancer applications. Pharmaceutics, 2024; 16(8): 1025.
25. Ahmed F, Urooj A. Anticholinesterase activities of cold and hot aqueous extracts of *F. racemosa* stem bark. Pharmacogn Mag, 2010; 6(22): 142-4.

26. Murti K, Kumar U. Enhancement of wound healing with roots of *Ficus racemosa* L. in albino rats. Asian Pac J Trop Biomed, 2012; 2(4): 276-80.
27. Sarpate RV, Tupkari SV, Deore TK, Chandak BG, Nalle SC. Isolation, characterization and microvascular activity of anthocyanins from *Ficus racemosa* fruits. Pharmacogn Mag, 2009; 5(19s): 78-82.
28. Pavani ANT, Sheela D, Venepally S. Quantitative phytochemical analysis and acute toxicity study of *Ficus racemosa*. Bioscan, 2024; 19(Suppl 2): 312-7.
29. Kirankumar S, Umesh MK, Ramesh L. Phytochemical screening and antimicrobial activities of *Ficus glomerata* Roxb fruit extracts. Int J Pharm Pharm Sci., 2013; 5: 372-5.
30. Solanki ND, Bhavsar SK. An evaluation of the protective role of *Ficus racemosa* Linn. in streptozotocin-induced diabetic neuropathy with neurodegeneration. Indian J Pharmacol, 2015; 47(6): 610-5.
31. Ocvirk S, Kistler M, Khan S, Talukder SH, Hauner H. Traditional medicinal plants used for the treatment of diabetes in rural and urban areas of Dhaka, Bangladesh - an ethnobotanical survey. J Ethnobiol Ethnomed, 2013; 9: 43.
32. Ahmed F, Urooj A. Glucose-lowering, hepatoprotective and hypolipidemic activities of stem bark of *Ficus racemosa* in streptozotocin-induced diabetic rats. J Young Pharm, 2010; 2(2): 160-4.
33. Sophia D, Manoharan S. Hypolipidemic activities of *Ficus racemosa* Linn. bark in alloxan induced diabetic rats. Afr J Tradit Complement Altern Med, 2007; 4(3): 279-88.
34. Amin MM, Mahmud MAA. Biochemical and histomorphometrical analysis of hepatoprotective and hypolipidemic potential of combined herbal extract in diabetic rats. Ann Bangladesh Agric, 2021; 25(2): 27-36.
35. Veerapur VP, Prabhakar KR, Parihar VK, Kandadi MR, Ramakrishana S, Mishra B, et al. *Ficus racemosa* stem bark extract: a potent antioxidant and a probable natural radioprotector. Evid Based Complement Alternat Med, 2009; 6(3): 317-24.
36. Prakash A, Sarangdevot YS, Vyas B, Roy S. Extraction and characterization of *Ficus glomerata* for antioxidant activity. Asian J Pharm Clin Res, 2022; 15(6): 46-50.
37. Rastogi S, Iqbal MS, Ohri D. *In vitro* study of anti-inflammatory and antioxidant activity of some medicinal plants and their interrelationship. Asian J Pharm Clin Res, 2018; 11(4): 195-202.
38. Ahmed F, Sharanappa P, Urooj A. Antibacterial activities of various sequential extracts of *Ficus racemosa* stem bark. Pharmacogn J., 2010; 2: 203-6.
39. Pingale T, Duse P, Ogale S. Antibacterial and antifungal approaches of *Ficus racemosa*. Pharmacogn J., 2019; 11(2): 355-7.
40. Pantarak N, Thanaputthiphat T, Niyomdecha N. Inhibitory effect of *Ficus racemosa* leaf extract on *Staphylococcus aureus*. Ramkhamhaeng Int J Sci Technol, 2023; 6(3): 16-21.
41. Rani A, Sharma PB, Bhatia S, Sharma AK. Neuroprotective effects of *Ficus racemosa* extracts on acetylcholinesterase and amyloid beta in a scopolamine-induced memory impairment. J Res Pharm, 2025; 29(6): 2587-601.
42. Dharmadeva S, Galgamuwa LS, Prasadinie C, Kumarasinghe N. *In vitro* anti-inflammatory activity of *Ficus racemosa* L. bark using albumin denaturation method. Ayu, 2018; 39(4): 239-42.
43. Dimple SM, Bhaven C, Kataria B, Sunita BC. Wound healing and anti-inflammatory activity of extract of *Ficus racemosa* Linn. bark in albino rats. Int J Basic Clin Pharmacol, 2012; 1(2): 111-5.
44. Rai N, Vyas S, Phadnis P. To evaluate the analgesic activity of *Ficus racemosa* leaf extract in albino mice using

Eddy's hot plate method. Asian J Pharm Clin Res, 2013; 6(Suppl 5): 19-21.

45. Chomchuen S, Singharachai C, Ruangrungsi N, Towiwat P. Antipyretic effect of the ethanolic extract of *Ficus racemosa* root in rats. J Health Res, 2010; 24(1): 23-8.
46. Solanki ND, Vadi K, Patel S. Alleviating effect of *Ficus racemosa* in high-fat-high-fructose diet-induced non-alcoholic fatty liver disease. Indian J Physiol Pharmacol, 2021; 65(1): 12-20.