

Research Article

# A Comprehensive Review Of The Phytochemistry Pharmacology And Therapeutic Benefits Of *Ficus Racemosa* Linn.

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## ABSTRACT

*Ficus racemosa* Linn is an average-sized famous tree belonging to the Moraceae family, universally known as Cluster fig tree or Gular found in India. Gular is also known as goolar, dimur, jajayoga, udumbara, dumur, bodda, heibong, jantuphalam, yoggadumur, and significantly more names. *Ficus racemosa* can be found in various countries like Australia, Malaysia, Southeast Asia, Sri Lanka, Pakistan, China, New South Wales, and in Indian subcontinents where it grows or cultivated near the natural water bodies. All the parts of a plant's root, bark, fruits, leaves, latex, etc. are used in Indian ancestral medicines like homeopathy, ayurveda, Siddha, and Unani. *Ficus racemosa* Linn has different therapeutic actions including liver protective activity, anti-tussive, anti-HIV, chemopreventive, antidiabetic, anti-inflammatory, anti-ulcer, anti-fungal, anti-diuretic, hemorrhoids, anti-bacterial, antipyretic, respiratory and urinary diseases. This plant shows the presence of numerous chemical constituents in different parts of plants, the chief chemical constituents are  $\beta$ -Sitosterol, Glauanol acetate. Bark contains Kaempferol, Racemosic acid, Tannins etc. Leaves contains campesterol, Ficusin etc. Fruits contain Lupeol, Gallic acid, and Ellagic acid etc. despite having various pharmacological properties this plant remains underutilized because of its limited availability therefore this review's objective is to provide a detailed Morphology, Microscopy, Macroscopy, Phytochemical constituents and analysis along with the pharmacological activities of the plant with a perspective to enlighten its use.

**Key Words:** *Ficus racemosa*, Phytochemistry, Traditional Uses, Pharmacological activities, Cluster Fig.

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## INTRODUCTION

India has a large population that relies on traditional medicine. There is a wealth of information regarding traditional folkloric practices and traditional ingredients of naturally occurring substances that have therapeutic value in the Indian Materia Medica.<sup>1, 2</sup> Medicinal plants, animals, or their by-products, as well as other natural substances (some of which are inorganic), are the part of traditional medicine.<sup>3</sup>*Ficus. racemosa* Linn is one of the medicinal plants that belong to the Fig family. It is

found all over the world, including Australia, Malaysia, Myanmar, China, and Indonesia. It is native to India, where it is found in the Himalayan ranges from Punjab to Khasia mountain. It is also found in many other parts of the world, including America, Africa, and Australia. It is also known by various names.<sup>4,5</sup> The tree and its fruit are called 'atti' in the southern part of India, but 'gular' in the northern region.<sup>6,7</sup> *Ficus racemosa* Lin possesses numerous synonyms such as Udumbara, jajnanga, jajniya, ajnayoga, jajnyasara, gular,

Cluster Fig tree, and Country fig tree, among others. This species has been historically utilized in ceremonial sacrifices.<sup>8</sup> Maharishi Charka has classified udumbara as an anti-diuretic herb known as mutra sangrahaniya. Sushruta has provided a detailed account of the plant's properties, including its astringent nature, ability to promote callus healing in fractures (bhagnasandhaniya), effectiveness in alleviating Rakta pitta, burning sensation, and obesity, as well as its usefulness in treating vaginal disorders. This tree holds great significance for both Hindus and Buddhists, being considered sacred by both religions. The group known as "Nalpamaram" consists of four species within this genus, *F. racemosa*, *F. microcarpa*, *F. bengalensis*, and *F. religiosa*, known as Athi, Ithi, Peral, and Arayal respectively.<sup>9</sup> The Moraceae family comprises fifty genera and 1400 species. There are approximately 850 species of *Ficus* found worldwide. According to the World Health Organization (WHO), it is estimated that around 80% of the population relies on herbal medicines for primary healthcare.<sup>10</sup> The propagation of the plant is achieved through the utilization of stem and root sucker cuttings. Alternatively, seeds can also be employed for propagation. The pollination of the flowers is carried out by minuscule wasps. In the presence of a water source, the plant retains its evergreen leaves; however, if it lacks proximity to water, it undergoes leaf shedding in January.<sup>11,12</sup>

Many species thrive in humid woodland environments, although they can also be found in monsoon climates and teak forests, even in areas where the soil tends to dry up. The fertilization process of fig trees is unique, as each species relies on a specific type of wasp that is entirely dependent on that certain fig genus for reproduction.<sup>13</sup> The aerial components and roots are frequently employed for the treatment of illnesses. It produces a distinctive fruit that is a flower turned upside down.<sup>7</sup> *Ficus* species is abundant in polyphenolic compounds, specifically flavonoids, which possess potent antioxidant properties. These properties play a crucial role in the prevention and treatment of numerous oxidative stress-related ailments, including neurodegenerative and hepatic diseases.<sup>14</sup> The bark and leaves of the plant are utilized for their astringent, haemostatic, anti-inflammatory, and antiseptic properties. They are commonly prescribed for treating diarrhoea, dysentery, skin disease ulcers, vaginal disorders, leucorrhoea, menorrhagia, deficient lactation, and as a urinary astringent. Additionally, they aid in reducing sugar levels in diabetic conditions.<sup>15</sup> The indigenous systems of medicine utilize the stem bark of the tree for various purposes, such as treating coughs and colds.<sup>16</sup> This plant exhibits a variety of pharmacological effects, such as antidiabetic, antioxidant, antidiarrheal, anti-inflammatory, antipyretic, antifungal, antibacterial, hypolipidemic, anti-filarial, and hepatoprotective actions.<sup>17</sup>

**Table 1: Taxonomical Classification<sup>18,19</sup>**

|                     |                       |
|---------------------|-----------------------|
| <b>Domain</b>       | Eukaryote             |
| <b>Kingdom</b>      | Plantae               |
| <b>Sub-kingdom</b>  | Viridiplantae         |
| <b>Phylum</b>       | Magnoliophyta         |
| <b>Sub-phylum</b>   | Euphyllophytina       |
| <b>Infra-phylum</b> | Radiatopses           |
| <b>Division</b>     | Tracheophyta          |
| <b>Class</b>        | Magnoliopsida         |
| <b>Subclass</b>     | Magnolidae            |
| <b>Order</b>        | Rosales               |
| <b>Family</b>       | Moraceae              |
| <b>Genus</b>        | <i>Ficus</i>          |
| <b>Species</b>      | <i>Ficus racemosa</i> |

**Table 2 : Vernacular Names<sup>6</sup>**

|                 |                                                                                                                                                                                                |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Kannada</b>  | Atti, Atti Mara                                                                                                                                                                                |
| <b>Hindi</b>    | Pushp-hina, Pani Bhuj, Dumar, Goolar, Umari, Yajnyadumbur, Udumbara, Jantu Phal, Dharma Patra, Goolar                                                                                          |
| <b>Sanskrit</b> | Yajnyayoga, Sadaphalah, Brahanvrkisha, Shitavalkah, Sutah, Udumbara, Gular, Mashakin, Jantukaphalah, Jantuphalah, Krmiphalah, Vasudrumah, Saumya, Hemadugdhaka, Jantumati, Yagniyah, Audumbara |
| <b>English</b>  | Gular Fig, Cluster Fig, Country Fig                                                                                                                                                            |
| <b>Bengali</b>  | Udumbara                                                                                                                                                                                       |
| <b>Telugu</b>   | Brahmamamidi, Atti, Bodda                                                                                                                                                                      |
| <b>Marathi</b>  | Umbar, Udumbar                                                                                                                                                                                 |
| <b>Urdu</b>     | Dumar                                                                                                                                                                                          |

**COMMON NAME: <sup>20</sup>**

Gular fig, Cluster fig, Country fig, redwood fig, Udumbara, Country fig tree.

**IDENTICAL NAME: <sup>21</sup>**

*Covellia glomerata* (Roxb.) Miq. *Ficus glomerata* Roxb.  
*Ficus vesca* F. Muell. Ex Miq. *Ficus semicostata*. F.M.Bailey  
*Ficus chittagonga*

## MORPHOLOGY

***Ficus racemosa*** is a highly cosmopolitan tree that grows all over India, especially in habitats like forests and hills. It is of medium height up to 10-16 meters with quite rich green foliage that provides good shade.<sup>22</sup>

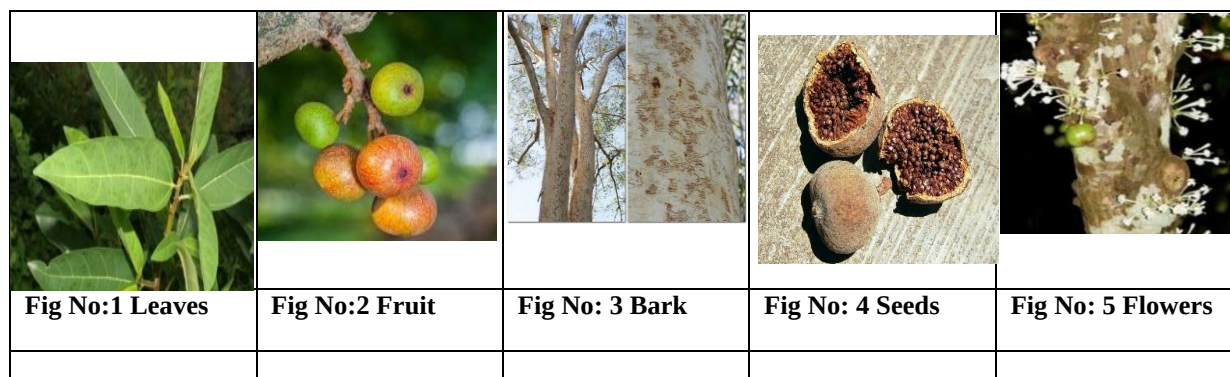
**Leaves** are dark green coloured, 7.5-15 by 3.2-6.3 cm, ovate-oblong, or elliptic-lanceolate, tapering to a bluntish point at the apex, with entire margins, glabrous on both surfaces when mature, base acute or rounded, 3-nerved lateral main nerves 4-6 pairs.

The **Fruit** receptacles are 2-5 cm in diameter, pyriform, in large clusters, arising from the main trunk or large branches. The fruits resemble the figs and are green when raw, turning orange, dull reddish, or dark crimson on ripening.<sup>12</sup>

**The Bark** is greyish green, soft surface, and is uneven 0.5-1.8 cm thick. On rubbing, white papery flakes come out from the outer surface, inner surface is light brown fracture fibrous, and tastes mucilaginous without any characteristic odour.<sup>23</sup>

**Seeds** - The seeds are tiny, innumerable, grain-like structures, the outer surface of the bark consists of easily removable translucent flakes greyish to rusty brown, uniformly hard, and non-brittle.<sup>24</sup>

**Flowers:** They have a stigma clavate and a long-stalked style lateral. Unisexual their clusters are brief. Grow directly on the trunk of the tree. Flowering time is – January – to April, Male flowers with sessile, three to four membrane-covered sepals form a layer close to the receptacle walls, while gall flowers form a more internal layer.<sup>25</sup>



## MACROSCOPIC STUDY

***Ficus racemosa* L.** Large tree, often epiphytic, reaching a height of 20 m; stem aerial erect, solid, hairy (glabrous, pubescent, or scaberulous), grey, reddish brown, rough; leaves simple, alternate, 4.5-15 cm long and 3.5-7 cm broad; petiole glabrous, 1-3 cm, stout; stipules ovate, lanceolate, pubescent, 2-3 cm long, ovate-oblong elliptic lanceolate, entire margins blunt pointed; surface pubescent hairy (when mature both side glabrous). Reticulate, unicostate venation with a rounded or sharp base and three fibres. hypanthodium-type inflorescence. Fruit a syconium, sub-globose, orange-red coloured when ripe.<sup>26</sup>

## MICROSCOPIC STUDY OF LEAF

Leaf stomata are anomocytic. The transverse section's lamina reveals the hypodermis beneath the upper epidermis. The hypodermis is covered in a bi-layer mesophyll that is made up of three to four layers of loosely packed parenchymatous cells and sporadic cluster crystals of calcium oxalate. Vascular bundles are bicollateral, with three to four secondary vascular bundles located above the major vascular bundle and patches of peri-medullary phloem. A sheath of cluster crystals of calcium oxalate is found beneath the main vascular bundle. Starch grains are scattered throughout the ground tissue. Trichomes are long, unicellular coverings, with a few having a hooked top.<sup>27</sup>

## MICROSCOPY STUDY OF FRUIT

The fruit has a single layer of epidermis covered in a thick cuticle with many unicellular hooked hairs and a reddish-

brown content. It has subsequently 5-8 layers of oval to polygonal, collenchyma Tous cells and oval to polygonal, thin-walled parenchymatous cells, respectively; the collenchyma Tous cells have a few rosette crystals of calcium oxalate and a reddish content; there are also vascular traces, lactiferous cavities, and pitted, round to oval lignified stone cells with a wide lumen. These are present in the parenchymatous zone.<sup>27</sup>

## MICROSCOPIC STUDY OF BARK

**Mature bark:** Mature bark is brittle and contains large amounts of secondary dead cells.

**Young stem comprising of bark:** The young stem's transverse section (T.S.), which is made up of bark, was selected because the mature bark was fragile and had a lot of dead secondary cells in it. The T.S. showed a periderm consisting of the following three layers.

1. The outer **phellem**, or cork, was made up of two layers of densely packed cells.

2. The **cork cambium**, or **middle phellogen**, is a continuous layer of thin-walled, tangentially elongated cells.

3. The inner **phelloderm**, also known as the secondary cortex, was made up of a few layers of parenchymatous cells. Some of these cells have thick-walled fibers, while others have several chloroplasts. Rhomboidal and prismatic calcium oxalate crystals as well as cells packed with tannin were visible in the cortical region. Secondary phloem and secondary xylem were found adjacent to the cortex. A few layers of conjunctive tissues were visible in between. There is primary xylem and central pith visible next to the secondary xylem.<sup>27,6</sup>

**Table 3: Ethnobotanical Uses of *Ficus Racemosa* Linn.**

| Plant Part      | USES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fruits</b>   | Used in leprosy, diarrhoea, circulatory and respiratory disorders, and menorrhagia <sup>29</sup><br>Tender fruits are used as astringent, stomachic, refrigerant, in dry cough, loss of voice, diseases of kidney and spleen, astringent to bowel, styptic, tonic, useful in the treatment of leucorrhoea, blood disorder, burning sensation, fatigue, urinary discharges, leprosy, epistaxis, carminative and intestinal worms. They are also useful in miscarriage, spermatorrhoea, epididymitis, cancer, myalgia, scabies, haemoptysis, intrinsic hemorrhage, and extreme thirst. <sup>8</sup><br>Fresh fruits are used as a source of dietary fiber. Ripe fruits are alexipharmic (an antidote or defensive remedy against poison, venom, or infection), and are good for foul taste, and heart disease. The powdered fruit is taken for asthma. <sup>30</sup> |
| <b>Roots</b>    | Roots are used in dysentery, pectoral complaints, and diabetes, applied in mumps, and other inflammatory glandular enlargements. They act as a powerful tonic. According to Ayurveda, roots are useful in hydrophobia. <sup>27</sup> The roots are even chewed to prevent gum diseases. The root is chewed as a treatment for tonsillitis. <sup>31</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Bark</b>     | The bark is an acrid, cooling, galactagogue, and is good for gynecological disorders. The stem bark is used to treat menorrhagia, leucorrhoea, gonorrhea, urinary diseases, hemorrhage, and skin diseases. The bark is also used for the treatment of dysentery. The bark is highly efficacious in threatened abortion and recommended for urological disorders, diabetes, hiccoughs, leprosy, asthma, and piles. <sup>27</sup> The decoction of the bark is used in the treatment of various skin diseases, ulcers, inflammation, swellings of the neck, scabies, and mouthwash for toothache and for strengthening gums. <sup>27,31</sup>                                                                                                                                                                                                                        |
| <b>Leaves</b>   | According to the Unani system of medicine, leaves show astringent properties to the bowels and a good effect on bronchitis. The leaves are excellent for wounds and ulcers. The infusion of bark and leaves is also employed as a mouth wash for spongy gums and internally for dysentery and menorrhagia. It also acts as an efficient remedy for glandular swelling, abscess, chronic wounds, cervical adenitis, and haemoptysis. The tender leaf buds are applied to the skin as a paste to improve the complexion. <sup>8,32</sup>                                                                                                                                                                                                                                                                                                                             |
| <b>Latex</b>    | The latex (milky juice) is administered in haemorrhoids and boils. It is also used to alleviate the edema in adenitis, parotitis, orchitis, traumatic swelling, toothache, vaginal disorders, diarrhea particularly in children, and aphrodisiac. Externally applied on wounds to alleviate edema, and pain for its anti-inflammatory activities. It is also effective for dysentery, haemorrhoids, stomach ache, cholera, mumps pain, boils, blisters, and measles. Latex is most importantly used as an adhesive. The latex is reportedly used for treating piles. <sup>29,8,33</sup>                                                                                                                                                                                                                                                                            |
| <b>Root Sap</b> | It is used for treating diabetes. The sap is a popular remedy in Bombay, that is applied locally to mumps and other inflammatory glandular enlargements and is also used in the treatment of gonorrhea. <sup>34</sup><br>In the Sri Lankan indigenous system of medicine, it is used in the treatment of skeletal fracture. The Australian aborigines use this plant in the treatment of mumps, smallpox, haematuria, menorrhagia, and inflammatory conditions.<br>In Siddha, the bark, fruits, and latex are used to treat constipation, anemia, and dysentery. <sup>31,35</sup>                                                                                                                                                                                                                                                                                  |

**PHYTOCHEMICALS**

The *Ficus racemosa* Linn. species contains primary and secondary metabolites like carbohydrates, mucilage, alkaloids, flavonoids, steroids, tannins, terpenoids, phenolic substances, glycosides, saponins, coumarins, triterpenoids,  $\alpha$  phenolics, bergapten, bergaptol, lanosterol, stigmasterol, lupen-3-one,  $\beta$ -sitosterol-d-glucoside and vitamin K<sub>1</sub>,  $\alpha$  hydroxyl ursolic acid, protocatechuic acid, oleanolic acid, ursolic acid, maslinic acid also used for treating many diseases. The non-enzymatic constituents like phenolic components flavonoids, vitamin C, and the enzymatic constituents like ascorbate oxidase, ascorbate peroxidase, catalase-peroxidase, quercetin-3-glucoside, rutin and methyl esters of leucoanthocyanins are obtained from leaves.<sup>36</sup>

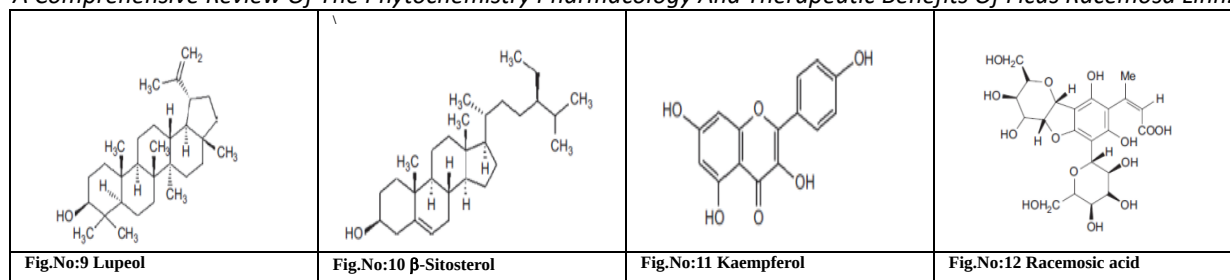
**Bark** – Tannin, wax, saponin,  $\beta$ -sitosterol, steroids, alkaloids, glauanol acetate, leucopelargonidin-3-O- $\alpha$ -L-rhamnopyranoside, leucopelargonidin-3-O- $\beta$ -D-glucopyranoside, leucocyanidin-3-O- $\beta$ -D-glucopyranoside, lupeol, ceryl behenate, lupeol acetate,  $\alpha$ -amyirin acetate,

leucocyanidin and leucoanthocyanin, kaempferol, coumarin, ellagic acid,  $\alpha$ -amyirin, stigmasterol, quercetin, bergenin, and racemosic acid.<sup>37</sup>

**Leaves** - Campesterol, arabinose, bergapten, psoralenes, fucosin, stigmasterol, isofucosterol,  $\alpha$ -amyirin, lupeol, tannic, arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tyrosine, methionine, valine, isoleucine, leucine, n-nonacosane, n-hentricontane, hexa-cosanol, n-octacosanguanol acetate, racemosic acid, quercetin-3-glucoside, rutin and methyl esters of leucoanthocyanins.<sup>38</sup>

**Fruits** - The phenolic compounds like gallic acid and ellagic acid. Furanocoumarins like psoralen, bergapten,  $\beta$ -sitosterol tetracyclic triterpene, glauanol acetate, Glucanol, tiglic acid, taraxasterol, lupeol acetate, friedelin, hydrocarbons, sterols, glycosides, carbohydrates, hentriacontane and  $\alpha$ -amyirin.<sup>12</sup>

**Latex** - Euphol, isoeuphorbol,  $\beta$ -sitosterol, 4-deoxyphorbol, cycloartenol and cycloeuphordenol.<sup>39</sup>



Structures of identified and isolated phytochemicals from various parts of *Ficus racemosa* Linn.<sup>40</sup>

## PHYTOCHEMICAL TESTS

**Table 4: The analysis of phytochemicals in the different organic extracts of *Ficus racemosa* bark.**<sup>41,42</sup>

| Phytochemicals      | Benzene | Chloroform | Ethanol | Ethyl acetate | Methanol | Petroleum Ether |
|---------------------|---------|------------|---------|---------------|----------|-----------------|
| Amino acids         | -       | -          | -       | -             | -        | -               |
| Anthraquinones      | -       | -          | -       | -             | -        | -               |
| Alkaloids           | +       | +          | -       | +             | -        | +               |
| Carbohydrates       | -       | +          | -       | -             | +        | -               |
| Flavonoids          | +       | +          | +       | +             | +        | +               |
| Glycosides          | +       | +          | +       | +             | +        | +               |
| Saponins            | -       | -          | -       | -             | +        | +               |
| Steroids            | -       | -          | +       | +             | -        | +               |
| Tannins             | -       | -          | +       | -             | +        | -               |
| Triterpenoids       | +       | -          | +       | +             | +        | +               |
| Phenols             | +       | +          | +       | +             | +        | +               |
| Fixed oils and fats | -       | -          | +       | -             | -        | +               |

(+) Presence of constituents, (-) Absence of constituents,

**Table 5 : The analysis of phytochemicals in the different organic extracts of *Ficus racemosa* leaf**<sup>43,44</sup>.

| Phytochemicals | CE | AqE | EAE | EE | ME | PEE | AcE |
|----------------|----|-----|-----|----|----|-----|-----|
| Alkaloids      | ++ | +   | ++  | +  | -  | -   | +   |
| Glycosides     | +  | +   | -   | +  | +  | -   | --  |
| Carbohydrates  | ++ | ++  | ++  | -  |    | -   |     |
| Phenols        | +  | +   | -   | +  | +  |     | +   |
| Steroids       | +  |     | ++  | -  | +  |     | ++  |
| Saponins       | +  | -   | +   |    | -  | +   | --  |
| Proteins       | +  | +   | -   |    | +  | +   | +   |
| Amino acids    | -  | -   | -   |    |    | -   |     |
| Flavonoids     | +  | -   | ++  | +  | +  | +   | ++  |
| Tannins        | +  | +   | +   |    | +  |     | --  |
| Terpenoids     | +  | +   |     |    | +  | -   | -   |

CE-Chloroform extract; AqE-Aqueous extract; EAE-Ethyl acetate extract; EE-Ethanol extract; ME-Methanol extract; PEE-Petroleum ether extract; AcE-Acetone extract of *Ficus racemosa* leaf. (+) -presence of compound; (-) - absence of compound

**Table 6 : The analysis of phytochemicals in the different organic extracts of *Ficus racemosa* Fruit**<sup>45</sup>

| Phytochemicals     | Aqueous | Chloroform | Ethyl acetate | Methanol | Hexane |
|--------------------|---------|------------|---------------|----------|--------|
| Acids              | +       | -          | ++            | ++       | +      |
| Alkaloids          | -       | +++        | +             | +++      | -      |
| Anthocyanin        | ++      | +          | +++           | ++       | ++     |
| Carbohydrate       | +++     | +++        | +++           | +++      | +++    |
| Cardiac glycosides | ++      | +          | +             | ++       | -      |
| Coumarins          | -       | +          | -             | -        | -      |
| Flavonoids         | ++      | +++        | +             | +++      | ++     |
| Glycosides         | ++      | -          | --            | -        | -      |

|                      |     |     |     |     |    |
|----------------------|-----|-----|-----|-----|----|
| <b>Phenols</b>       | +++ | +   | ++  | ++  | ++ |
| <b>Protein</b>       | -   | -   | -   | -   | -  |
| <b>Quinones</b>      | +   | -   | -   | -   | +  |
| <b>Saponins</b>      | +++ | +++ | +++ | +++ | +  |
| <b>Steroids</b>      | ++  | +   | +++ | +++ | ++ |
| <b>Tannins</b>       | ++  | -   | +++ | ++  | -  |
| <b>Terpenoids</b>    | ++  | -   | +++ | ++  | -  |
| <b>Triterpenoids</b> | ++  | +   | ++  | +++ | +  |

+++ : Highly present; ++ : Moderately present; + : Trace; - : Absence

**Table 7: The analysis of phytochemicals in the different organic extracts of *ficus racemosa* root<sup>46</sup>**

| <b>Phytonutrients</b> | <b><i>F. racemosa</i></b> |
|-----------------------|---------------------------|
| Moisture Content (gm) | 80.2                      |
| Crude Fibre (gm)      | 0.5                       |
| Crude Fibre (gm)      | 28.12                     |
| Fat (gm)              | 1.0                       |
| Mineral (gm)          | 2.0                       |
| Carbohydrate (gm)     | 15.84                     |
| Carotene (µg)         | 200                       |
| Ascorbic acid (mg)    | 5.3                       |
| Calcium (mg)          | 30.5                      |
| Phosphorus (mg)       | 103                       |
| Iron (mg)             | 250                       |

**Table 8 : Nutrient Content of *Ficus Racemosa*<sup>47</sup>**

| <b>Plants Constituents</b> | <b>Ethanol Extract</b> |
|----------------------------|------------------------|
| <b>Carbohydrates</b>       | +                      |
| <b>Alkaloids</b>           | +                      |
| <b>Tannins</b>             | +                      |
| <b>Flavonoids</b>          | +                      |
| <b>Saponins</b>            | -                      |
| <b>Proteins</b>            | +                      |
| <b>Fats</b>                | +                      |
| <b>Steroids</b>            | +                      |
| <b>Triterpenoids</b>       | +                      |

(+) indicates positive (-) indicates negative

**Table 9 : Pharmacological Activities Reported In *Ficusracemosa* Linn.**

| <b>Sl. No</b> | <b>Part of plant</b> | <b>Pharmacological activity</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.            | <b>Leaves</b>        | Anti-Hyperglycaemic activity <sup>45</sup> Anti-inflammatory activity <sup>46</sup> Antihyperglycemic and hypoglycemic <sup>15</sup> Anti-fungal activity <sup>47</sup> Hepatoprotective Activity <sup>48</sup> Wound healing activity Antioxidant activity <sup>49</sup> Anti-microbial activity <sup>50</sup> Anti-diarrheal <sup>51</sup> Analgesic activity <sup>52</sup> Anti-obesity and Anti-cancer <sup>53</sup> Anti-ulcer activity <sup>54</sup> |
| 2.            | <b>Bark</b>          | Wound healing <sup>55</sup> Antidiuretic activity <sup>56</sup> Anthelmintic activity <sup>57</sup> anti-pyretic <sup>58</sup> Antithyroid activity <sup>59</sup> Hypolipidemic activity <sup>60</sup> Anti-inflammatory <sup>61</sup> larvicidal activity <sup>62</sup> Antioxidant activity <sup>63</sup> anti-obesity <sup>64</sup> Anti-ulcer activity <sup>54</sup> Antifertility <sup>65</sup>                                                       |
| 3.            | <b>Stem bark</b>     | Cardioprotective activity <sup>66</sup> Antioxidant activity <sup>67</sup> Antibacterial activity <sup>68</sup> Antidiabetic activity <sup>69</sup> Hepatoprotective activity <sup>70</sup> Antimicrobial and Anti-inflammatory <sup>71</sup> Analgesic <sup>72</sup> Antihyperglycemic <sup>73</sup> Nephroprotective <sup>74</sup>                                                                                                                       |
| 4.            | <b>Fruit</b>         | Hypoglycaemic and antioxidant activity <sup>75</sup> Antibacterial and antifungal <sup>76</sup> CNS activity <sup>77</sup> Anti-filarial activity <sup>78</sup> Antinociceptive activity <sup>79</sup> Analgesic activity <sup>80</sup> Anthelmintic activity <sup>57</sup> Antiulcerogenic effects <sup>81</sup>                                                                                                                                          |
| 5.            | <b>Roots</b>         | Antioxidant activity <sup>82</sup> wound healing activity <sup>83</sup> Antipyretic activity <sup>84</sup> Hypoglycaemic activity <sup>85</sup>                                                                                                                                                                                                                                                                                                            |

#### PHARMACOLOGICAL ACTIVITIES:

**Analgesic activity:** Ethanolic bark and leaves extracts of *Ficus racemosa* Lin shows Analgesic activity. Forestieri AM

et.al, used hot plate and tail immersion techniques for analysing analgesic activity. *Ficus racemosa* Lin. leaf extract greatly lengthened the latency time at 300 mg/kg i.p.,

providing approximately 40.1% protection; the bark extract significantly lengthened the reaction time, providing 35% protection. They concluded that the presence of bergenin, friedelin, behenate, lupeol, and lupeol acetate was responsible for the analgesic effect they saw.<sup>86</sup>

A comparable outcome was obtained in the hot-plate test, wherein a significant analgesic effect persisted for three hours following the administration of the decoction in mice. In mice with paw edema caused by carrageenan, the petroleum ether extract demonstrated a significant anti-epidemic action.<sup>87,88</sup>

**Anti-tussive activity:** Biswas TK et.al, used cough-inducing sulfur dioxide gas model in mice for examine the antitussive properties of the methanol extract of *Ficus racemosa* Lin. stem bark. At a dosage of 200 mg/kg, the extract showed minimal inhibition of 56.9% after 90 minutes of administration.<sup>89</sup>

**Cardioprotective Activity:** The stem bark standardized extract of *Ficus racemosa* Lin. can protect the heart from doxorubicin-induced damage. The extract raised glutathione levels in cardiac tissue and serum while drastically decreasing thiobarbituric acid reactive substances (TBARS).<sup>66</sup>

**Wound Healing Activity:** Ethanol extract of *Ficus racemosa* Lin. stem bark shows wound healing in excised and incised wound models in rats.<sup>90</sup>

**Antibacterial activity:** The methanol extract of the flowers of the plant has been screened for their antibacterial activity. Broad-spectrum antibacterial activity against both gram-positive and gram-negative bacteria was demonstrated by the extract (7.5 mg/disc). The outcomes were juxtaposed against the conventional medication, streptomycin (10 µg/disc). It was discovered that the zone inhibition increased as the extract's concentration increased, demonstrating concentration-dependent action.<sup>87</sup>

**Hypoglycaemic/antihyperglycemic activity:** In rats and rabbits with diabetes produced by streptozotocin or alloxan, the antidiabetic potential of many *Ficus racemosa* parts has been assessed. Aqueous extract equivalent to 15g of *Ficus racemosa* bark powder decreased blood glucose to an extent of 13.3%; 18.8% at 18h and 48h fasting intervals in normoglycemic rabbits and 6%; 17% in diabetic rabbits.<sup>91</sup>

**Antifungal activity:** *Ficus racemosa* leaf extract with 50% methylene chloride in hexane flash column fraction was reported to have antifungal activity. Several plant diseases, including *Fusarium* sp., *Corynesporacassiicola*, *Alternaria* sp., *Curvularia* sp., and *Colletotrichum gloeosporioides*, were reduced in their growth by the extract. The molecule that showed the most promise for development as a fungicide against pathogens causing diseases on economically significant crops was found to be psoralen, which was also demonstrated to be biodegradable.<sup>92</sup>

**Anti-inflammatory:** Using carrageenan, serotonin, histamine, and dextran-induced rat paw edema models, ethanol extract of leaves at a dose of 400 mg/kg showed the most anti-inflammatory activity with 30.4, 32.2, 33.9, and 32%, respectively. Stem bark ethanol extract also showed COX-1 and an IC<sub>50</sub> value of 100mg/ml, indicating the drug's potential for application in the management of inflammatory conditions.<sup>93</sup>

**Antidiarrheal activity:** In rats with PGE<sub>2</sub>-induced enteropooling and castor oil-induced diarrhea, methanol

extract of the bark exhibited a strong antidiarrheal action. Rats' gastrointestinal motility was likewise significantly reduced by the extract in the charcoal meal test.<sup>94</sup>

comparable findings using a petroleum ether preparation of the leaves of *Ficus racemosa* in rats. When rats were given latex, it significantly inhibited the effects of castor oil-induced diarrhea and enteropooling. It also decreased the motility of the rats' gastrointestinal tract after a meal of charcoal.<sup>94,95</sup>

**Antipyretic activity:** In albino rats with both normal and yeast-induced pyrexia, the bark's

methanol extract administered at doses of 200 and 300 mg/kg bw significantly lowered body temperature in a dose-dependent manner. The extract's antipyretic properties were like those of the common antipyretic medication paracetamol (150 mg/kg b.w.). Rats with yeast-induced pyrexia showed a strong antipyretic effect from the leaf decoction and petroleum ether extract, like that of indomethacin.<sup>96</sup>

**Anti-filarial activity:** Alcoholic and aqueous extracts of *Ficus racemosa* fruits inhibited the spontaneous movement of the whole worm and increased the amplitude and tone of contractions in the nerve-muscle preparation of *Setariacervi*. For the alcohol extract, the concentrations needed to stop the entire worm and nerve-muscle preparation movement were 250 and 50 µg/mL, respectively, whereas for the aqueous extract, the amounts needed were 350 and 150 µg/mL. In *Invitro* analysis, alcohol and aqueous extracts both killed microfilariae. For alcohol and aqueous extracts, the LC<sub>50</sub> and LC<sub>90</sub> varied between 21 and 27 ng/mL and 35 and 42 ng/mL.<sup>97</sup>

**Antidiuretic Activity:** The decoction of *Ficus racemosa* Lin. Bark. At doses of 250, 500, or 1000 mg/kg body weight, has been demonstrated to have antidiuretic properties. It began quickly (within an hour), peaked at three hours, and persisted for the whole five-hour study time. Multiple modes of action are indicated by the reduction in urine Na<sup>+</sup> level and Na<sup>+</sup>/K<sup>+</sup> ratio as well as the increase in urinary osmolarity.<sup>98</sup>

**Hepatoprotective Activity:** When *Ficus racemosa* Lin. stem bark was extracted with petroleum ether and methanol and administered with CCl<sub>4</sub>, and the hepatoprotective effects were observed. These included a marked elevation in the activities of aspartate, aminotransferase, alanine, aminotransferase, and alkaline phosphatase, as well as a significant decrease in serum total protein, albumin, and urea. Pre-treatment with *Ficus racemosa* Lin. methanolic extract and petroleum ether extract, the total protein and albumin levels in the rats were significantly restored to levels close to normal. alkaline phosphatase.<sup>70</sup>

**Gastroprotective activity:** In pylorus ligation, ethanol and cold-resistant stress-induced ulcers, ethanol extract (50%) of the fruits demonstrated dose-dependent reduction of ulcer index. By preventing lipid peroxidation, superoxide dismutase, H<sup>+</sup> K<sup>+</sup> ATPase, and increasing catalase activity, the extract also protected the stomach mucosa.<sup>99</sup>

The ethanol extracts of *Ficus racemosa* bark and leaves reduced the gastric lesion caused by the HCl-ethanol mixture, demonstrated protection against water immersion stress-induced ulcer, and attenuated the gastric volume free acidity total acidity ulcer index in rats with gastric ulcers induced by aspirin plus pylorus ligation.<sup>100</sup>

**Hypotensive activity:** When *Ficus racemosa* leaves were extracted using different solvents, the glycoside-rich fraction showed a strong vasodilator and hypotensive impact on sedated dogs, as well as a direct cardiac depressing effect on isolated frog and rabbit hearts. In rats, the extract did not affect behaviour and showed no symptoms of acute poisoning.<sup>101</sup>

**Chemopreventive activity:** Rats treated with ferric nitrilotriacetate (Fe-NTA)-induced chemotoxicity showed a significant decrease in blood urea nitrogen, serum creatinine, lipid peroxidation,  $\gamma$ -glutamyl transpeptidase,  $H_2O_2$ , DNA synthesis (Pb 0.001), and tumor incidence when *Ficus racemosa* extract (200 and 400 mg/kg b.w.) was given orally to them. *Ficus racemosa* extract restored the glutathione content and the glutathione metabolizing and antioxidant enzymes in the kidneys, suggesting that it could be a potent chemo-preventive agent.<sup>102</sup>

**Larvicidal/Wormicidal activity:** When *Ficus racemosa* bark crude extracts (petroleum ether, chloroform, ethanol, and water) were tested for anthelmintic action on adult earthworms, the results revealed a dose-dependent suppression of spontaneous movement (paralysis) and elicited responses to pin-prick. At higher concentrations of the aqueous extract (50 mg/mL), irreversible paralysis was induced, indicating the wormicidal properties of the extract.<sup>57</sup>

**Memory Enhancing Activity:** Rat hippocampi treated with 250 and 500 mg/kg of extract from *Ficus racemosa* Lin. exhibited significantly greater Ach levels compared to the group under treatment. It was found that there had been a 22% and 38% percentage increase in Ach levels, respectively. Furthermore, the elevated plus-maze, an exteroceptive behavioural model used to evaluate rats' memory, showed a substantial reduction in transfer latency due to the extract. At both dosage levels, this impact was observed. It is found that treating Alzheimer's disease may benefit from the application of *Ficus racemosa* Linn.<sup>103</sup>

## CONCLUSION

*Ficus racemosa* Linn has been used for a very long time. It is widely believed that the extensive data, as presented in this review, on the various therapeutic activities of the constituents, can provide strong support for the use of this plant in a wide range of medical applications.<sup>104</sup> The *Ficus racemosa* Lin. having various important pharmacological activities which are discussed in the current review. This signifies that it is the most vital plant for human civilization and requires more concentration for formulation development.<sup>105</sup> Bioactive constituents like  $\beta$ -sitosterol, and glauanol acetate in *Ficus racemosa* L., are largely responsible for the therapeutic potentials.<sup>104</sup> It has been demonstrated that the phytoconstituents and extracts obtained from this plant elicit a variety of pharmacological reactions, including analgesic, hypoglycaemic, hypolipidemic, hypoglycaemic, analgesic, and renal anticarcinogenic effects. Because of its many advantages, *Ficus racemosa* is a real miracle of nature.<sup>106</sup> Numerous research has been done on various components of *Ficus racemosa*, however, the pharmaceutical industry has not yet established this plant as a medication. Given the characteristics of the plant, further human study can

be conducted to produce a medication with a variety of uses in the future.

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