

**A CRITICAL REVIEW OF *FLACOURTIA JANGOMAS* (LOUR.) RAEUSCH: A RARE  
FRUIT TREE OF GORAKHPUR DIVISION**

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**ABSTRACT**

The current investigation performed with the objective of finding the scientific reason for health benefits of *Flacourtia jangomas* (Lour.) Raeusch, simultaneously evaluating the antioxidant and antimicrobial activity of ethanol, methanol, and chloroform extracts. The aim of the review is to present an updated and comprehensive overview of ethnomedicinal significance, phytochemical and pharmacological aspects of *F. jangomas* to highlight its ethnopharmacological uses and to explore its therapeutic potentials thereby providing a basis for future research. The potent antioxidant, antimicrobial, and anti-inflammatory extracts can be used for producing a novel ointment formulation, functional food or nutraceutical, in combination. The qualitative analysis of antioxidant activity has been explained by reducing power assay and DPPH assay and antimicrobial activity is reported by agar diffusion method and minimum inhibitory concentration of crude extract. Further, the bioactive compounds present in different plant parts extracts have been detected by GS-MS analysis and their applications are explained. The result indicates that *Flacourtia jangomas* possesses significant free radical scavenging and anti-inflammatory activities. GS-MS analysis of the plant revealed the presence of several bioactive compounds. This article is an endeavor to review the ethno-pharmacological, antioxidant, antimicrobial and anti-inflammatory properties of *F. jangomas* in nutshell.

**KEYWORDS:** Ethnomedicine, Pharmacology, Phytochemistry, Anti-inflammatory.

**INTRODUCTION**

Plants have been used as a source of medicine from ancient to contemporary age. Initially, these were the main part of folk or ethnomedicine, practiced in India and other parts of the world like China, Middle East Africa and South America. Later, substantial part of such indigenous knowledge was organized, documented and eventually passed into the organized system of medicines such as Ayurveda, Chinese, Yunani, Sidha, Tibetan or other systems.<sup>[1]</sup> Despite significant development of rural health services, village people still use herbal folk medicines to a good extent for treatment of common ailments like cough, cold and fever, headache and body-ache, constipation and dysentery, burns, cuts and scalds, boils, ulcers, skin diseases and respiratory troubles and others.<sup>[2]</sup> Over the last decade, there has been a paradigm shift from synthetic drug molecules to the traditional and complementary system of medicine.<sup>[3]</sup> The revival of these medicines can be due to the irrational use of the chemical drugs leading to microbial resistance, lack of modern curative therapies for the treatment of chronic diseases and the awareness among people prevent themselves various diseases.<sup>[4]</sup> Furthermore, the technological advancement in the area of phytomedicine

and alternative therapies has made an impact on the scientific fraternity for future discoveries of potent bioactive molecules for curing various ailments.<sup>[5]</sup> It is estimated that 25% of the crude drugs used in recent years are derived from plants, of which 5-15% have been explored for bioactive compounds.<sup>[6]</sup> According to W.H.O, China, Africa, Indonesia, India, Japan, Singapore, The Republic of Korea etc. are some countries, where more than 50% of the population relies upon their traditional and complementary system of medicines. Therefore, directives and unified efforts in assuring their quality control, stability and standardization parameters are the need of the hour.<sup>[7]</sup> A traditionally known plant *Flacourtia jangomas* (Lour.) Raeusch. belonging to the genus *Flacourtia* is has diverse therapeutic value. The genus was formerly named in the honor of Étienne de Flacourt (1607–1660), a governor of Madagascar and was placed in the now defunct family Flacourtiaceae.<sup>[8]</sup> It is native to the African and Asian tropics and sub tropics. Several species of the genus are cultivated for their fruits and as ornamentals.

**Taxonomical classification** Kingdom: Plantae, Subkingdom: Tracheobionta, Infrakingdom: Superdivision: Spermatophyta. Division: Tracheophyta (Vascular plants) Subdivision: Spermatophytina (Spermatophytes) Class: Magnoliopsida, Superorder: Rosanae. Order: Malpighiales. Family: Salicaceae (Willows) Genus: *Flacourtia*, Species: *jangomas*.

### Botanical description

*F. jangomas* (Lour.) Raeusch commonly known as Paniala or Indian plum or Coffee plum belongs to the family Flacourtiaceae (now placed in Salicaceae).<sup>[9,10]</sup> It is a small deciduous tree growing up to 6-10 m but occasionally reach up to 14 m in height. Trunk and branches of old trees are thorn less whereas woody thorns are present when young. Leaves are alternate, deciduous, pale pink when young, spirally arranged; rarely ovate-lanceolate, long point toothed, very thin, both surfaces glossy, blade elliptic, serrate. Inflorescence is axillary racemes, sub-corymbose, glabrous. Flowers are dioecious, white to greenish in colour comprising 4 or 5 ovate triangular petals bearing fragrance of honey before or with the young foliage. Male flowers are filaments, glabrous and solitary or in clusters while female flowers are solitary. Male and female flowers are on separate trees. Flowers appear from December to April together with new leaves with very beautiful fresh green colour. Fruits are ellipsoid berries, subglobose, dull brownish red or purple, then blackish, with greenish-yellow pulp ripening from March to July, enclosing 4-5(-10) flat seeds. The tree is propagated through seeds. However, seeds are slow to germinate; therefore, propagation is usually by in arching or budding onto self-seedlings. Ripe fruits are eaten by birds and widely dispersed thus facilitating very wide distribution of the species.<sup>[11]</sup>

### Origin and distribution

*F. jangomas* is lowland semi-cultivated fruit tree with uncertain wild confinement. Its wild organ is unknown however it is said to have originated from India and distributed throughout tropical regions of East Africa and tropical Asia, but now it has escaped cultivation in a number of places. It is indigenous to North-Eastern Terai region of Uttar Pradesh especially in the Gorakhpur division. In Gorakhpur it is a rare fruit tree. The area from which data were studied lies between the 26°5'-27°29' parallels north latitude, and 83°4'-84°26' east longitude and occupy a part of northeastern corner of the state of Uttar Pradesh. The specific tribal settlements visited include Chowk, Doma, Lachhmipur, Madhaulia, Nichlol, Rajhain, Ramgarh and Tedighat. An ethnopharmacological survey of the Gorakhpur forests was conducted and found that the wild plant species of *Flacourtia* is now almost rare in this region.<sup>[12]</sup> It needs urgent conservation strategies.

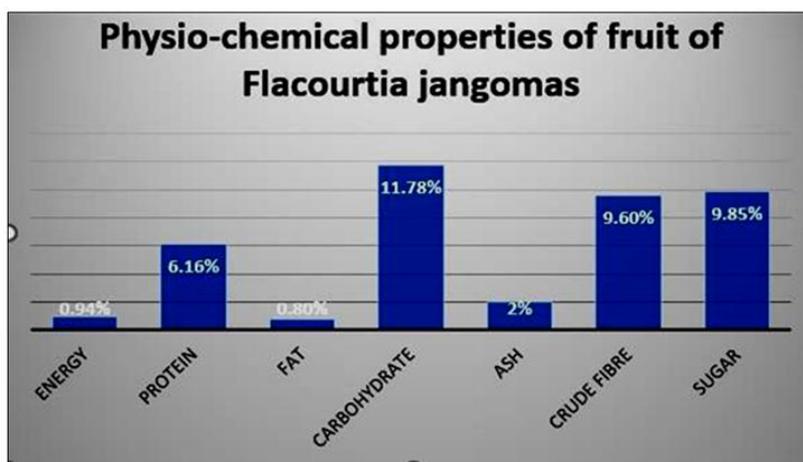
### Ethnopharmacology

*F. jangomas* is an important fruit tree having immense nutritional and medicinal significance. In the Indian

system of medicine, fruits are regarded as alleviator of doshas and toxic conditions. The fruits are used in bilious conditions and in diarrhoea. It is also used in the treatment of bleeding gum, toothache, to overcome digestive disorders, acidity, fevers and nausea. Fruits are also known to be given in jaundice and enlarged spleen.<sup>[13,14,15]</sup> The leaves after decoction are used in the treatment of bleeding dysentery and piles.<sup>[16]</sup> Different parts of the plant are pharmaceutically used for the treatment of asthma, pre-and post-natal blood purification and many other ailments. Barks are used for the treatment of intermittent fever.<sup>[17,18]</sup> The roots are sweet, refrigerant, depurative alexipharmic and diuretic. The leaves and young shoots, which taste like rhubarb are astringent and stomachic. Ground bark paste is also used for curing many common ailments in the Tribal settlements of Western Ghats.<sup>[16]</sup> The plant is also used for diabetes in south Indian traditional medicine.<sup>[19]</sup>

### Phytochemistry

*F. jangomas* is among those plants which have not been adequately explored scientifically. Studies so far have shown that the Flacourtiaceae elaborates a diverse array of compound classes; which include terpenoids, alkaloids, flavonoids and tannins, lignans and flavanolignans, glucosides, coumarins and isocoumarins. The plant contains tannin and a fixed oil whereas the bark principally contains tannins; leaves and young shoots are rich in tannins.<sup>[15]</sup> There have also been reports of xanthenes, quinones, limonoids and phenazines. Two limonoids, namely limolin and jangomolide were reported from the stem and bark of *F. Jangomas*.<sup>[20]</sup> The bioactive compounds including corymbulosine, tremulacin, hydnocarpic acid, chaulmoogric acid have been reported in *F. jangomas*. The fruit and stem bark yielded a coumarin named ostruthin.<sup>[21]</sup> The phenolic glucoside ester, flacourtin was reported in bark whereas, a butyrolactone lignan disaccharide named ramontoside and steroids including  $\beta$ -sitosterol and its  $\beta$ -D-glucopyranoside were reported in the heartwood.<sup>[22]</sup> Fruits were reported to be rich in nutrients, protein, fat, sugars (fructose,  $\alpha$ - and  $\beta$ -glucose and sucrose), amino acids, vitamin C and minerals including calcium, potassium, phosphorous, iron, magnesium, sodium, manganese, copper, and zinc.<sup>[23]</sup> Analysis of fatty acids in fats revealed the presence of palmitic, hexadecadienoic, stearic, oleic, linoleic, alpha-linolenic and a few minor unidentified acids. Further, amino acids from extract of dried ripe fruits showed the presence of proline, hydroxyproline, methionine, alanine, glycine, and valine. Paper chromatography studies on simple reducing sugars and their alditol acetates indicated the presence of arabinose, glucose, fructose and galactose.<sup>[24]</sup> The ripe fruits of *F. jangomas* contains good amount of potassium, having high bioavailability and thus, may serve as a good source for sufficient potassium intake.<sup>[25]</sup>



**Table 1: *Flacourtia jangomas*-physio-chemical properties of fruit.**



**Fig:(a) *Flacourtia jangomas* tree at Gorakhpur with the researcher.**

**Fig: (b) *Flacourtia jangomas* fruits.**

**Fig: (c) *Flacourtia jangomas* flower.**

**Fig: (d) *Flacourtia jangomas* a branch bearing fruits.**

#### **Therapeutic values**

This is a unique fruit tree with great nutritional value and also very good for our over-all health. The ripe fruits have high fiber content together with good protein content, low fat and higher amount of monounsaturated fatty acids as compared to polyunsaturated fatty acids. It contains a significant amount of beta-carotene followed by lutein and zeaxanthin, retinol and phylloquinone (vitamin K) which are important in the regulation of

hemoglobin and fibrinogen in the human body. The plant and some of its active chemical constituents have been investigated for various pharmacological properties including anti-inflammatory, antibacterial, anti-diarrheal, antiviral, antioxidant, and anti-amylase activity.<sup>[26]</sup> Pharmacological studies of various parts of the plant as summarized here.

### Antibacterial activity

Antibacterial activity of the crude extract of *F. jangomas* has been studied against both gram- positive and gram-negative bacteria, which showed good antibacterial activity against *Shigella flexneri* and *Bacillus megaterium* and moderate activity against *Bacillus cereus* and poor activity against *Escherichia coli*. Further, there is also report about the chloroform fraction of the root extract showing strong antimicrobial activity against pathogenic bacteria.<sup>[27]</sup> Fruit extract of the plant has reported to exhibit good antimicrobial activity against *Pseudomonas aeruginosa*, *Klebsiella pneumonia* and *E. coli*.<sup>[28]</sup> In another study, bacterial endophytes isolated from roots showed broad spectrum antimicrobial activity against clinical pathogens gram positive (*Staphylococcus aureus*) and gram negative (*E. coli*, *Pseudomonas* sp., *Proteus vulgaris*, *Klebsiella* sp.,) bacteria thus indicating promising antimicrobial activity of the bacterial endophyte isolates against human pathogenic bacteria.<sup>[29]</sup>

### Antifungal activity

Fungal infections have been in the rise destroying the peace of the healthy world for the past few decades. Methanol extracts of different parts of *F. jangomas* including leaf, flower, bark and root were evaluated for antifungal efficacy against *Candida tropicalis*, a resistant strain that ranks second or third causative agent of many candidal infections and several oral diseases such as dental caries, endodontic infections, periodontal diseases and oral candidiasis.<sup>[30]</sup>

### Antidiabetic activity

Study on the effect of methanolic extract of *F. jangomas* leaves and stem (1:1) in alloxan- induced diabetic rats using glibenclamide as standard antidiabetic agent. Antidiabetic potency of the extract was assessed by fasting blood glucose (FBG) level. The result demonstrated that methanolic extract induces significant decrease of blood glucose level in diabetic rats and this effect was more potent after repeated dose (200 mg/kg and 400 mg/kg) administration, a marked reduction of blood glucose level in these rats was achieved after 14 days of treatment.<sup>[31]</sup>

### Antidiarrheal activity

*In vivo* antidiarrheal test of ethanolic extract of *F. jangomas* leaves by castor oil induced diarrhoeal model showed significant ( $P < 0.001$ ) increase in onset of diarrhoea and reduction in frequency of defecation as compared with control in dose dependent manner. The extract exhibited 74.05 and 85.50% inhibition of defecation at the doses of 250 and 500 mg/kg, respectively while standard loperamide showed 88.00% inhibition of defecation at the dose of 3mg/kg thus clearly indicating promising antidiarrheal activity as substantiated by the prolongation of latent period as compared with control and standard.<sup>[32]</sup>

### Antioxidant activity

Ethanol extract of leaves of *F. jangomas* exhibited a significant DPPH radical scavenging activity in concentration dependent manner with IC<sub>50</sub> value of 11 µg/ml whereas the IC<sub>50</sub> value for the standard ascorbic acid was 5 µg/ml. A comparative study of total phenol, total flavonoid contents and antioxidant potential of different extracts including chloroform, petroleum ether and methanol extract of *F. jangomas* using DPPH radical scavenging assay, reducing power method, total antioxidant capacity showed moderate to good antioxidant activity of extracts as compared to ascorbic acid. The IC<sub>50</sub> value of the chloroform, methanol and petroleum ether extracts were 523.15, 1623.87 and 5811.35 µg/ml respectively while, the IC<sub>50</sub> value of well-known antioxidant Ascorbic Acid was 13.37µg/ml.<sup>[33]</sup> Different studies indicate that different types of polyphenolic compounds (flavonoids, phenolic acids) found in plants have multiple biological effects, including antioxidant activity of *F. jangomas*.<sup>[34,35]</sup> Chloroform extract of *F. jangomas* showed good DPPH scavenging activity where ascorbic acid was chosen as the reference antioxidant. The flower extract of *F. jangomas* showed significant antioxidant potential with IC<sub>50</sub> values of 11.16±0.54 µg/ml and 12.34±0.37 µg/ml for DPPH and ABTS assays.<sup>[36,37]</sup>

**Table 2: *F. jangomas* plant parts extract and its activity.**

Plant extract	Activity exhibited
Root (Chloroform)	Antibacterial
Leaf, bark, root (Methanolic)	Antifungal
Leaves (Ethanolic)	Antidiarrheal
Leaves and Stem (Methanolic)	Antidiabetic
Flower extract (methanolic)	Antioxidant

### CONCLUSION

Medicinal plants have been used for centuries as remedies for human ailments, because they contain components of therapeutic value. The curative properties of medicinal plants are attributed to the presence of various bioactive phytochemicals which may explain their traditional uses against various diseases. In this review article, effort has been taken to collect and compile the details regarding ethnomedicinal, phytochemical and therapeutic facets of *F. jangomas*, a less explored plant, however, it has received interest owing to its diverse ethnomedicinal significance and presence of many biofunctional phytochemicals. Literature study has shown that the plant has immense medicinal uses in different systems of medicine in India as well as throughout the world. Bioactive chemical constituents isolated and characterized so far from the plant and a variety of pharmacological activities, including antibacterial, antifungal, antidiabetic, antidiarrheal and anti-oxidant are presented in this review. *Flacourtia jangomas* is having restricted distribution and is underutilized. The wild flora of this species is diminishing in the Gorakhpur area of Eastern U.P and is now threatened in the forest area. Hence

special emphasis should be given, for the sustainable utilization, extensive cultivation and conservation of *Flacourtia* for its nutraceutical properties and bioprospection through proper agro techniques. Thus a rare tree species could be conserved for the health, economy, environment and food security of the country.

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