



**BOTANICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL REVIEW OF
FLACOURTIA JANGOMAS (LOUR.) RAEUSCH**

Dibyoyoti Baruah and Bijoy Neog

Department of Life Sciences, Dibrugarh University, Dibrugarh, Assam, India

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ABSTRACT

Flacourtia jangomas is traditionally used in India, China, Malaya Peninsula, Brazil for the treatment against asthma, anemia, diarrhoea, diabetes. Considering its medicinal and economic values the plant is not attractive to the farmers because of its low yield and lack of awareness towards its potential. Aim of this review is to provide an up to date knowledge or overview about the vernacular names, distribution, botanical aspects, chemical constituent and phytochemical analysis. Further phytochemical and pharmacological potential of this species are suggested for future investigations.

INTRODUCTION

Flacourtia jangomas is a plant belongs to the family of Flacourtiaceae growing in various parts of the world. It has been used as a traditional medicine for the treatment of different diseases in India [1], Malay Peninsula [2], Bangladesh and Myanmar [3].

The plant is not only use for its medicinal properties but also cultivated for its edible fruits and lumber [4]. Considered as an indigenous plant in India, *Flacourtia jangomas* has been used in the treatment of asthma [5], bleeding gum, tooth ache, diabetes [6] and the leaves after decoction are used in the treatment of diarrhoea and dysentery [7].

To the best of our knowledge, no previous reviews are available regarding the traditional uses the phyto chemistry and the pharmacological studies of *Flacourtia jangomas*. The aim of this review is to provide an up-to-date and comprehensive overview of the botany, vernacular names, distribution, phytochemistry and pharmacological activities of *Flacourtia jangomas*, as it has been performed for many other plants. Additionally, we aim to discuss the studies providing an evidence for local and traditional uses of *Flacourtia jangomas* and to suggest the future research opportunities for this plant.

Vernacular Names, Distribution And Botanical Aspects

Vernacular names

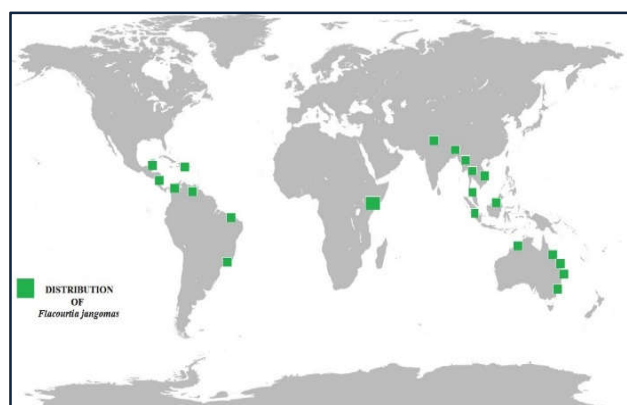
Flacourtia jangomas is commonly known as coffee plum, East Indian Plum, Indian Plum, Manila Cherry, Paniala, Puneala Plum, Rukam, Runeala- Plum, Spiked Flacourtia, Talisfir or Zarnabin Arabic, Cereja-De-Cameta in Brazil, Yun Nan Ci Li Mu in China, Prunier D' Inde or Prunier Malgache in France, Paniyal in Assamese, India, Talispatri in Hindi [8], Painnagola in Bangladesh [9]. More common names of *Flacourtia jangomas* called in different parts of the world is shown in table 1.

Distribution

Flacourtia jangomas is a tree from the lowland areas cultivated in Southeast and East Asia [10]. According to Sleumer 1954, *Flacourtia jangomas* is not familiar to the wild condition or we can say wild environment. The species is cultivated in villages and from there it got distributed to throughout tropical regions mainly in East Africa and tropical Asia. The species is also reported in the warmer coastal districts of eastern Australia. The present scenario about distribution of *Flacourtia jangomas* in different parts of the world is shown in fig 1.

Table 1 Vernacular names of *Flacourtia jangomas*

Country Name/ Language	Vernacular Names of <i>Flacourtia jangomas</i>
Arabic	Talisfir, Zarnab
Brazil	Cereja-De-Cameta
Burmese	Kyetyo Po, Mak Kyen, Naywe, Sumbung
Chinese	Yun Nan Ci Li Mu
Dutch	Babydruiif, Babykers
French	Prunier D' Inde, Prunier Malgache
Germany	Paniaala
India	Paniyal, Phinel, Polian
Assamese	Bara Baichi, Paniaala, Tali
Bengali	Dorichik
Garo	Talispatri
Gujrati	Jamuna, Pachnala, Paniaala, Paniamla, Paniyala,
Hindi	Talisapatri, Talispatar, Talispatri
Kannada	Chanchali Mara, Chankali, Charichali, Goraji, Hulumanike, Kirinelli, Shamper, Tahsapatram,
Khasi	Talisapatr
Konkani	Dieng Sohmluh
Malayalam	Jagam
Manipuri	Thaliru, Vaiyyamkaitha, Vaiyyankata,
Marathi	Vayyankataku
Oriya	Heitroi
Sanskrit	Champeran, Jangam, Jangli-Jagam, Paanaamle,
Urdu	Thambat
Indonesia	Baincha
Malaysia	Paaniiyaamalaka, Paniaala, Praachinaamalaka,
Nepalese	Taala, Taali, Talisapatra;
Persian	Talispatar;
Portuguese	Rukam;
Spain	Akar Temberak, Daun Ekor Serangat, Bebuas Akar,
Taiwan	Kelekup, Kerkup, Kerkup, Kerkup Besar, Kerkup
Thai	Bakoh, Kerpup; Rokam, Rukam;
Vietnamese	Talispatri;
	Talispatar;
	Ameixa-Da-India;
	Ciruela De Madagascar, Ciruela Forastera,
	Jagomeira, Kerkup, Mamonga;
	Luo Dan Mei, Yin Du Li;
	Makwen Khwai (Northern Thailand), Ta Khop
	Khwai (Central Thailand), Khrop, Ta Khop Tai;
	Bo Quan, Hong Quan, Muon Quan.



Source: [11]

Botanical aspects

Flacourtia jangomas is a tropical deciduous tree grows to a height of 6- 10m [12]. The trunks and branches which are a bit older are not comprise of spikes but younger branches have sharp, simple or divaricate spines. Leaves are narrow-ovate to ovate-oblong and rarely ovate-lance like or long obtuse acuminate, base broadly wedge in shape. They are smooth and shining in upper side but mostly dull beneath, somewhat

toothed, 7-10 X 3-4 cm. Leaf stalk is 6-8 mm long. Flowers are fragrant and blooms on both male and female trees separately. Fruits are round in shapes with size of about 15-25mm. It's an edible fruit with juicy and fleshy in content.

Chemical Constituents

Flacourtia jangomas contains different chemical groups including tannins, carbohydrate, fats (palmitic, hexadecadienolic, stearic, oleic and linoleic acids), minerals, ascorbic acids, tartaric acids, proteins, amino acids and phenolic compounds [13]. Kermasha *et al.*[14] showed the presence of proteins, vitamin C, fructose, α , β glucose, sucrose, calcium, potassium, phosphorus, iron, magnesium based on the dry weight of *Flacourtia jangomas*. The concentration of the following constituent are shown in table 2. Ajay Kr Singh and Jyoti Singh [15] through phytochemical screening of *Flacourtia jangomas* reported the presence of carbohydrates, protein, lipids, alkaloids, glycosides, tannins, etc. Tanins can be found primarily in barks but leaves and young shoots are also rich in tanins.

Table 2 Chemical constituent present in *Flacourtia jangomas*

Component	Concentration (based on dry weight)
Protein	3.9%
Vitamin C	218mg/100g
Carbohydrate (fructose, α and β glucose, sucrose)	21%
Calcium	175mg/100g
Potassium	158mg/100g
Phosphorus	147mg/100g
Iron	118mg/100g
Magnesium	57mg/100g

Another important compound reported in *Flacourtia jangomas* was Limonoids. Ahmed *et al.* 1984 stated limonin and jangomolide were the two limonoids usually present in *Flacourtia jangomas*[1]. Limonin was first isolated from navel orange juice in the year 1938 by Higby *et al.* 1938 [16] but its structure was revealed in the year 1968 with the help of chemical and physical methods (X-ray crystallography). From the pharmacological point of view limonin is an important compound as it showed the inhibition of replication of HIV-I in a number of cellular system [17]. Suppression of intestinal carcinogen in APC- mutant mice by limonin is reported in Shimizu *et al.* 2015 [18]. According to them limonin might be use as a chemo preventive agent against intestinal carcinoma. In an independent study, Lam and Hesegeawa 1989, evaluate the potentiality of limonin and nomilin for inhibition of benzo[a]pyrene-induced forestomach neoplasia in mice. It is revealed that limonin is a weak enzyme inducer compared to nomilin and a weak inhibitor of BP-induced neoplasia [19].

Ruberto *et al.* 2002 investigated limonin as an antifeedent agent against an important pest *Spodoptera frugiperana* along with nomilin and obacunone and their derivatives. The antifeedent properties of the limonin was confirmed in their investigation [20]. Therefore further investigation are needed to explore the efficacy of limonoids from *Flacourtia jangomas*.

Pharmacological Reports

The literature survey reveals that *Flacourtia jangomas* was investigated in different pharmacological areas, including analgesia, anti-inflammatory, antibacterial, antifungal, anti-diarrheal, antiviral, and anti-oxidant activities.

Antibacterial activity

Parvin *et al.* (2011) investigated the activity of the ethanolic extracts of *Flacourtia jangomas* against both gram positive and gram negative bacteria. They had analysed Disc-diffusion method and Minimum Inhibitory Concentration (MIC) for antimicrobial screening. It was shown that the extract had significant inhibition activity against *Shigella shiga* and *Bacillus megaterium* and moderate activity against *Bacillus cerus* and poor activity against *Escherichia coli* [21].

In the same year, in vitro studies were reported regarding antibacterial activity by chloroform fraction of *Flacourtia jangomas* through disc diffusion method against two species each from gram positive and gram negative bacteria. Among the four species analysed, E.coli was found to be the most susceptible towards the extract with a zone of inhibition about 14 ± 0.59 mm. The MIC value was also significant with a range from 0.325 to 5 mg/ml [22].

Therefore antibacterial activity of *Flacourtia jangomas* was first mentioned in Parvin *et al.* (2011) and Sarkar *et al.* but different species of Flacourtiaceae family having antibacterial activity has been reported in Anago *et al.* (2011) where they had analysed antibacterial activity of six medicinal plants used in Benin [23]. The extract of *Boswellia dalzielii* (Flacourtiaceae family) shown least minimum inhibitory concentration (MIC) value of 0.313 mg/mL among the rest five species. In another study Khan *et al.* [24] analysed the antimicrobial activity of *Terminalia complanata* and *Flacourtia zippelli*. Further investigation are needed in a vast number of bacterial species to explore the efficacy of *Flacourtia jangomas* extract as an antibacterial agent.

Antifungal activity

The antifungal activity of *Flacourtia jangomas* has not yet been done but species belongs to flacourtiaceae family such as *Flacourtia inermis* which is a flowering plant native to Phillipines, they comprises antifungal activity which has been reported [25]. It was shown that the acetonic extract of *Flacourtia inermis* fruit contains agents that are active against human opportunistic pathogenic fungi. As antifungal activities of *Flacourtia jangomas* is not yet tested, so it's difficult to draw a conclusion of *Flacourtia jangomas* comprise of antifungal activities.

Antidiabetic activity

Singh *et al.* (2010) investigated the efficacy of methanolic extract of *Flacourtia jangomas* leaf and stem combination (1:1) in streptozotocin (STZ) - induced diabetic rats. Oral administration of methanolic extract of *Flacourtia jangomas* for 21 days shown impressive ($P < 0.01$) hypoglycemic activity and altered biochemical parameters are also corrected, specifically cholesterol and triglycerides significantly ($P < 0.05$). Analysis of urine on 21st day also revealed the absence of glucose and ketone traces in *methanolic extract of Flacourtia jangomas* treated mice [15].

Another study by surjit singh *et al.* (2010) indicated the potentiality of methanolic extract of *Flacourtia jangomas* in treating hyperglycemic rats. They had evaluated the blood glucose level, body weight and serum lipid profiles of normal and diabetic rats along with liver and muscle glycogen level in normal and diabetic rats. By administration of methanol extract of *Flacourtia jangomas* in a dose of 200mg/kg and 400mg/kg significantly reduces the glucose level [26].

Antioxidant activity

In a recent study, Talukdar *et al.* (2012) reported that ethanolic extract from the leaves of *Flacourtia jangomas* (1mg/ml) exhibited higher scavenging activity ($IC_{50} = 11 \mu\text{g/ml}$) than ascorbic acid ($IC_{50} = 5 \mu\text{g/ml}$). Aklima *et al.* (2013) investigated the antioxidant activity of five fruits from Bangladesh. Among the five fruits one of them is *Flacourtia jangomas*. The DPPH free radical scavenging activity of *Flacourtia jangomas* showed 54.45 ± 0.75 at a concentration of 1.25 mg/ml. It's showed third highest activity after *P. sylvestris* and *A. lacucha* [27]. In another study, Dubey *et al.* (2013) evaluated the free radical scavenging activity and total antioxidant activity from unripe fruits of *Flacourtia jangomas* [28]. The extract showed DPPH radical scavenging activity from 44.1% to 98.2% and total antioxidant activity from 0.043% to 0.144%. The antioxidant could be a potential therapeutic measure in preventing oxidative stress. The antioxidant activity could be of the therapeutic potential in preventing oxidative stress involved in the development of many diseases such as cardiovascular and neurological disorders.

Analgesic activity

Talukdar *et al.* 2012 investigated the analgesic activity of ethanol extract from leaves of *Flacourtia jangomas* by following two widely used methods. By acetic acid writhing test the extract exhibited 45.45 and 67.05% inhibition of writhing at the doses of 250 and 500 mg/kg, respectively. This showed ethanol extract of *Flacourtia jangomas* has analgesic potential. In hotplate test also leaves extract of *Flacourtia jangomas* significantly exhibited increase pain threshold level [10].

CONCLUSION

The review shows that *Flacourtia jangomas* has been used as a medicinal plants in various parts of the world for the treatment of asthma, diarrhoea, diabetes, toothache and bronchitis. *Flacourtia jangomas* contains limonoids specifically limonin and jangomolide, tannins, ascorbic acid, tartaric acid, fats, carbohydrate, proteins and iron. The limonoids are reported to be capable for the treatment of cancer and therefore it can be used as an anticancer component. In this regard the extraction of limonoids from *Flacourtia jangomas* on commercial scale is of high demand and that's how the economic value of the plant can be enhance. Till now the plant is cultivated in some parts of the world but its actual value is not yet known by the farmers. Therefore through this review we tried to compile the information on traditionally used potential medicinal values of the plant.

The pharmacological studies performed on *Flacourtia jangomas* revealed the therapeutic potential in the treatment of inflammation, prevention of oxidative stress, infectious diseases and treatment for diabetes. Further investigations are needed to provide more evidence bases for traditional uses of this species against pain, anaemia etc. In addition there is a need for further investigation to provide an evidence base for traditional uses of this species against asthma, diabetes, bleeding gum, toothache, diarrhoea and reveal the compounds which is responsible for the therapeutic properties.

References

- Ahmed J, Wizarat K, Shamsuddin KM, Zaman A, Connolly JD. Jangomolide, a novel limonoid from *Flacourtia jangomas*. *Phytochemistry* 1984; (23)6: 1269-1270
- Burkill IH. A Dictionary of the Economic Plants of the Malay Peninsula. Ministry of Agriculture and Cooperatives, Kuala Lumpur 1966: 2444.
- Mitra RL. Flacourtiaceae, in: Sharma, B.D., Balakrishnan (Eds.) *Flora of India*. BSI, Kolkata 1933; 2: 403-405.
- Anonymous. *Flacourtia comm.* (Flacourtiaceae). In the *Wealth of India: Raw Materials*, 1956, CSIR, New Delhi; 4: 42-44.
- Jain SK. *Dictionary of Indian Folk Medicine and Ethnobotany*. Deep Publication, New Delhi; 91: 1991.
- Khumbongmayum AO, Khan ML, Tripathi RS. Ethnomedicinal plants in the sacred groves of Manipur. *Indian Journal of Traditional Knowledge* 2005; 4(1): 21-32.
- Kirtikar KR, Basu BD. *Indian Medicinal Plants*, 2nd ed. Lalit Mohan Basu, Allahabad; 1935.
- Lim TK. *Edible Medicinal and Non-Medicinal Plants*. Vol 5. Springer Netherland; 2013.
- Web 1. Coffee Plum. *Flowers of India*. URL:<http://www.flowersofindia.net/catalog/slides/Coffee%20Plum.html>
- Talukdar C, Saha S, Adhikari S, Mondal HK, Islam MdK, Anisuzzman Md. Evaluation of antioxidant, analgesic, and anti-diarrhoeal activity of *Flacourtia jangomas* (Lour.) Raeusch. leaves. *Pharmacologyonline* 2012; 3: 20-28.
- Web 1. *Flacourtia jangomas* (Lour.) Raeusch. Species in GBIF backbone taxonomy. URL: <http://www.gbif.org/species/5331164>.
- Quiner Y, Zmarzty S. *Flora of China*. Available from <http://www.EFloras.org>. St. Louis, MO & Harvard University Herbaria, Cambridge, MA: Missouri Botanical Garden Press 2007; 118-21.
- Ghani A. *Medicinal plants of Bangladesh: chemical constituents and uses*. Dhaka: The Asiatic Society of Bangladesh 2003; 2, 315.
- Kermasha S, Barthakur NN, Mohan NK, Mohan NP. Chemical composition and proposed use of two semi-wild tropical fruits. *Food Chemistry* 1987; 26(4), 253-259.
- Singh AK, Singh J. Evaluation of anti-diabetic potential of leaves and stem of *Flacourtia jangomas* in streptozotocin-induced diabetic rats. *Indian Journal of Pharmacology* 2010; 45 (5), 301-305.
- Higby RH. The bitter constituents of navel and Valencia oranges. *J. Am. Chem. Soc* 1938; 60, 3013-3018.
- Battinelli L, Mengoni F, Lichtner M, Mazzanti G, Saija A, Mastroianni CM, Vullo V. Effect of limonin and nomilin on HIV-1 replication on infected human mononuclear cells. *Planta Med* 2003; 69, 910-913.
- Shimizu S, Miyamoto S, Fujii G, Nakanishi R, Onuma W, Ozaki Y, Fujimoto K, Yano T, Mutoh M. Suppression of intestinal carcinogenesis in Apc-mutant mice by limonin. *J Clin Biochem Nutr* 2015; 57(1), 39-43.
- Lam LK, Hasegawa S. Inhibition of benzo[a]pyrene-induced forestomach neoplasia in mice by citrus limonoids. *Nutr Cancer* 1989; 12(1):43-7.
- Ruberto G, Renda A, Tringali C, Napoli EM, Simmonds MS. Citrus limonoids and their semisynthetic derivatives as antifeedant agents against *Spodoptera frugiperda* larvae. A structure-activity relationship study. *J Agric Food Chem* 2002; 6, 50 (23), 6766-74.
- Parvin S, Kader A, Sarkar GC, Hosain SB. In-Vitro studies of antibacterial and cytotoxic properties of *Flacourtia jangomas*. *International Journal of Pharmaceutical Sciences and Research* 2011; 2, 2786-2790.
- Sarker GC, Zahan R, Alam MB, Islam S, Mosaddik MA, Haque MEK. Antibacterial activity of *Flacourtia jangomas* and *Flacourtia sepiaria*. *International Journal of Pharmacy and Life Sciences* 2011; 2 (7), 878-883.
- Anago E, Lagnika L, Gbenou J, Loko F, Moudachirou M, Sanni A. Antibacterial activity and phytochemical study of six medicinal plants used in Benin. *Pakistan Journal of Biological Sciences* 2011; 14(7), 449-455.
- Khan MR, Kihara M, Omoloso AD. Antimicrobial activity of *Terminalia complanata* and *Flacourtia zippelii*. *Fitoterapia* 2002; 73(7-8), 737-740.
- Benny PJ, Shibumon G, Sunny K, Cincy G. 2, 3-Dihydroxybenzoic Acid: An Effective Antifungal Agent Isolated from *Flacourtia inermis* Fruit. *International Journal of Pharmaceutical and Clinical Research* 2010; 2(3): 101-105.
- Singh NS, Geetha M, Amudha P, Chakraborty. Evaluation of anti-diabetic activity of methanol extract of *Flacourtia jangomas* (lour) in streptozotocin induced diabetic rats. *International Journal of Pharma and Biosciences* 2010; 1 (3), 1-11.
- Aklima J, Mojumder S, Sikdar D. Total phenolic content, reducing power, antioxidative and anti-amylase activities of five Bangladeshi fruits. *International Food Research Journal* 2014; 21(1), 119-124.
- Dubey N, Pandey VN, Tewari SK. Antioxidant potential and phytochemical composition of unripe fruits of *Flacourtia jangomas* (Lour.) *Raeusch*. *International Journal of Phytomedicines and Related Industries* 2013; 5(3), 164-167.

