

## *Flacourtia indica* (Burm. f.) Merr.-A Phytopharmacological

### Review

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#### ABSTRACT

The medicinal plants are widely used by the traditional medical practitioners for curing various diseases in their day to day practice. *Flacourtia indica* (*Flacourtiaceae*) is the most useful traditional medicinal plant in India. It is now considered as a valuable source of unique natural products for development of medicines and targeting against various diseases. Each part (leaves, bark, stem, fruits, root and even whole plant) of the *Flacourtia indica* has demonstrated several pharmacological activities including Anti-Inflammatory, Antimicrobial, Antioxidant, Hepatoprotective, Antimalarial, Anti-Diabetic, Anti asthmatic and Antibacterial Activity. The present review highlights a literature on botanical and pharmacological discussion of *Flacourtia indica*.

**Key Words:** *Flacourtia indica*, Phytoconstituents, Phytopharmacology, Indigenous medicinal plant.

#### INTRODUCTION

*Flacourtia indica* (Burm. f.) Merr. Synonymous to *Flacourtia ramontchi* L'Herit. (Family-*Flacourtiaceae*), commonly known as 'Baichi' or 'Katai'. It is an indigenous medicinal plant widely distributed in Bangladesh and India<sup>[1]</sup>. This plant has been reported as an answer for the treatment of a variety of diseases and functional disorder. Fruits are used as appetizing, diuretic, digestive, in jaundice and enlarged spleen. Barks are used for the treatment of intermittent fever. Roots are used in nephritic colic and gum is used in cholera<sup>1,2</sup>. Previous phytochemical investigation on this plant resulted in the isolation of  $\beta$ -sitosterol (a well-known phytosterol),  $\beta$ -sitosterol- $\beta$ -Dglucopyranoside, ramontoside, butyrolactone lignan disaccharide, flacourtin, coumarin such as scoparone and aesculetin<sup>2-4</sup>. Thin layer chromatographic screening and isolation of phytochemicals from *F. indica* showed the presence of flavonoids, poly phenols and other compounds<sup>2-5</sup>.

#### PLANT DESCRIPTION

(k.m.Nadkarni., Indian Meteria Medica)

*F. indica* is a species found from the Punjab eastward to Bihar, the Deccan and the southern Peninsula. Fruit is red or brown, dark pinky when ripe. Fruits are, appetizing and digestive. They are given in jaundice and enlarged spleen. After child birth among the poor the seeds are grind to powder with turmeric and rubbed all over the body to prevent rheumatic pains from exposure to damp

winds. Gum is administered along with other ingredients in cholera.<sup>(6)</sup>

#### Synonyms

(The Ayurvedic Pharmacopoeia Of India)

*Beng.* : Bincha, Bainchi, Bewich

*Eng.* : Governors Plum, Madaraskara Plum

*Guj.* : Kankata

*Hindi.* : Bilangra

*Kan.* : Llumanika, Dodda Gejjalakai

*Mal.* : Vavankataku , Vikamkath, Yaliya Nzerinigal, Loloikka

*Mar.* : Kaker

*Ori.* : Kantheikoli, Vaincha, Uincha

*Punj.* : Kakoa, Kukoya

*Sansk.* : Vikankata, Gopakanta

*Tam.* : Sottaikala, Kat Ukala

*Tel.* : Putregu, Kanvegu Chettu, Vikankata

#### a) Macroscopic

Leaves simple, sessile, 3 to 5 cm long and 1 to 3 cm wide, ovate to obovate, glabrous above, more or less pubescent beneath, serrate towards apex, and crenate in basal region, greenish-grey. (The Ayurvedic Pharmacopoeia Of India)

#### b) Microscopic

##### leaf

**Midrib:** Epidermis, single layered, covered externally with thin cuticle; followed by 1 or 2 layers of collenchyma and 3 to 5 layers of adjacent collenchymas and 2 to 3 layers of parenchyma; vascular bundle single, situated in the center, covered by fibre sheath on both sides; a few unicellular, hooked, trichomes present on lower

surface; a few rosette and prismatic crystals of calcium oxalate scattered in parenchyma cells.

#### Lamina

Epidermis single layered on both surfaces, covered with thin cuticle; a few simple, unicellular hair with blunt tips present on lower surface; 2 layers of palisade cells and 2 or 3 layers of spongy parenchyma cells present; rosette and a few prismatic crystals of calcium oxalate present in epidermis, palisade and spongy parenchyma cells; a few veinlets present in between palisade and spongy parenchyma; stomata anisocytic, present on lower surface; palisade ratio 2 or 3; vein islet number 8 to 10 per sq. mm; veinlet termination number 10 to 12 per sq.mm; stomatal index 24 to 26. (The Ayurvedic Pharmacopoeia Of India)

#### Powder

Greenish-grey, shows fragments of collenchymatous, and parenchymatous cells; elongated, thick-walled pointed fibres; sinuous walled epidermal cells in surface view, containing rosette and a few prismatic crystals of calcium oxalate; palisade cells, a few anisocytic stomata, and pieces of unicellular hair present. (The Ayurvedic Pharmacopoeia Of India)

#### THERAPEUTIC USES

Raktavikara, Sopha, Kamala<sup>7</sup>

#### PROPERTIES AND USES

The roots are sweet, refrigerant, depurative, alexipharmic and diuretic. They are useful in vitiated conditions of *pitta* and *vata* aphthae, poisonous bites, skin diseases, pruritus, erysipelas, strangury, nephropathy and psychopathy.

The leaves are useful in pruritus and scabies. The fruits are sweet, appetizer, digestive and diuretic, and are useful in strangury jaundice, gastropathy and splenomegaly (Indian medicinal plants)<sup>8</sup>.

#### PHARMACOLOGICAL ACTIVITIES

##### *In vitro* Antioxidant Activity

S.N. Tyagi et al (2010) conducted phytochemical tests and screening of *In vitro* antioxidant activity on *F.indica* leaves. The results of phytochemical tests showed that the presence of alkaloids, tannins, saponins, flavonoids, glycosides, phenolic compounds, terpenoids and steroids. The antioxidant activity was performed by using methanolic and aqueous extracts. The results indicated that *F. indica* exhibit potent free radical scavenging and antioxidant activity. Finally, the authors concluded that *F. indica* leaves could be a potential source of natural antioxidant that could have great importance as therapeutic agents in preventing or slowing the progress of aging and age associated oxidative stress related degenerative diseases<sup>9,10</sup>.

##### Hepatoprotective Activity (methotrexate induced hepatotoxicity)

The effect of *F. indica* leaves against methotrexate induced hepatotoxicity on rats were studied by Joyamma Varkey et al (2011). The acute toxicity study was performed in Pet. ether extract of aerial parts of *F. indica* and results indicated that dose of 1750 mg/ kg was tolerated in mice. The extract was further investigated for hepatoprotective activity. Methotrexate induced hepatotoxicity characterized by significant alterations in marker enzymes for liver function and oxidative stress were observed. *F. indica* treatment in a dose of 350mg/kg orally for 5 days significantly improved the level of marker enzymes for liver function and oxidative stress which was evident in histopathology also where a relative degree of reversal of methotrexate induced necrosis was observed<sup>11</sup>.

##### Antimalarial Activity

Ali Mohamed Kaou., (2010) was Conducted the phytochemical studies on the aerial parts of *F.indica* and he investigated three compounds pyrocatechol, homaloside D and poliothryoside by isolated from the decoction of this plant material. The *in vitro* antiplasmodial activity on the chloroquine-resistant strain (W2) of Plasmodium falciparum and the cytotoxicity on two complementary human cell lines (THP1, HepG2), of AcOEt extract obtained after liquid/liquid extraction of the decoction and pure compounds, were evaluated. The results elucidated as the poliothryoside isolated from the AcOEt extract had strong antiplasmodial activity (IC<sub>50</sub>)=7.4 microM) and a good selectivity index (>28) similar to chloroquine. This study reports that AcOEt extract of *Flacourtia indica* having antiplasmodial activity majorly by three important constituents<sup>12</sup>.

##### Antibacterial Activity

Gopal C. Sarker et al., (2011) results the *in vitro* antibacterial screening (by disc diffusion method) against two Gram positive and two Gram negative bacteria by chloroform soluble fraction of *Flacourtia jangomas* and *Flacourtia sepiaria*. Chloroform fraction of *Flacourtia jangomas* showed good activity against all the tested bacteria and among them *E. coli* was found. *Flacourtia sepiaria* had no activity against *E. coli* and *Bacillus cereus*. In respect of the zone of inhibition of both plant fractions, *Flacourtia jangomas* was better activity than *Flacourtia sepiaria*. Among all tested extract, only *F. jangomas* extract showed significant MIC value, ranges of (0.325 to 5 mg/ml). In toxicity study, the chloroform fraction of *Flacourtia jangomas* showed toxic effect using brine shrimp lethality bioassay with LC<sub>50</sub> values of 12.58 µg/ml<sup>13</sup>.

**Anti-Diabetic Activity**

Ajay kumar singh *et al.*, (2010) investigated the acute and subacute anti hyperglycaemic effect of the two different doses (200 and 400 mg/kg b.w.p.o) of *Flacourtia jangomas* (lour) extracts in streptozotocin induced diabetic rats. Fasting blood glucose level, body weight and serum lipid profiles were evaluated in normal and diabetic rats. Supplementation of this extract significantly reduces the fasting blood glucose level and increases the glycogen level as compared to diabetic control. In the extracts treated groups, serum lipid profile shows a significant improvement. For all the estimated parameters, the results of the extract treated groups were restored to the near normal level, there by indicating good antihyperglycemic activity of the methanol extract of *Flacourtia jangomas* (lour)<sup>14</sup>.

**Anti-Inflammatory and Antimicrobial Activity**

Sulbha Lalsarea *et al.*, (2011) observed that the *Flacourtia ramontchi* is very useful plant in treating inflammation and infectious diseases. Successive screening of chloroform, methanol and hydromethanolic extracts of leaves with solvents of increasing polarity for anti-inflammatory (by Carrageenan induced rat paw model) and antimicrobial activity (by Cup and plate method) and thin layer chromatographic studies using mobile phase i.e. chloroform and methanol. The results clearly indicate that all three extracts i.e. chloroform, methanol and hydromethanolic, of the leaves having anti-inflammatory activity. But the chloroform and methanol extract showed promising results and even chloroform extract at the dose 150mg/kg exhibits equipotent anti-inflammatory activity as that of the standard Indomethacin. Methanol extract possess broad-spectrum antimicrobial activity at concentration 10000  $\mu$ g/ml whereas hydromethanolic and chloroform extracts having more or less antimicrobial activity<sup>15-17</sup>.

**Hepato Protective Activity (paracetamol-induced hepatotoxicity).**

Marina Nazneen *et al.*, (2009) were studied the hepato-protective properties of the aerial parts of *F.indica* (Burm. f.) Merr., by petroleum ether, ethyl acetate and methanol extracts. All extracts were found to reduce serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT) and serum alkaline phosphatase (SAP) in paracetamol-induced hepatic necrosis in rat models. The most significant reduction of the serum level of SGOT and SGPT were exhibited by petroleum ether and ethyl acetate extracts at a single oral dose of 1.5 g/kg of body weight with a reduction of 29.0% SGOT & 24.0% SGPT level by petroleum ether extract, and 10.57% SGOT & 6.7% SGPT level by ethyl acetate extract

compared to paracetamol (3 g/kg of body weight) treated animals. Petroleum ether and ethyl acetate extracts indicated good recovery of paracetamol-induced necrosis in histopathological examination. On the other hand, the methanol extract obtained by successive cold extraction did not show any remarkable effect on paracetamol-induced hepatic necrosis. The hepatoprotective effects exhibited by petroleum ether and ethyl acetate extract might be mediated through the inhibition of microsomal drug metabolizing enzymes<sup>2,18</sup>.

**Hepatoprotective Activity (Carbon Tetrachloride Induced Hepatotoxicity)**

Gnanaprakash K *et al.*, (2010) investigates that Carbon tetrachloride (CCl<sub>4</sub>) is a well-known hepatotoxin and exposure to this chemical is known to induce oxidative stress and causes liver injury by the formation of free radicals. The objective of this study was to investigate the hepatoprotective activity of aqueous extract of leaves of *F.indica* against CCl<sub>4</sub> induced hepatotoxicity. Animals were pretreated with the aqueous extract of *F.indica* (250 & 500 mg/kg body weight) for one week and then challenged with CCl<sub>4</sub> (1.5 ml/kg bw) in olive oil (1:1, v/v) on 7th day. Serum marker enzymes (ALP, AST, ALT, Total Protein & Total Bilirubin) and TBARS level (Marker for oxidative stress) were estimated in all the study groups. Alteration in the levels of biochemical markers of hepatic damage like AST, ALT, ALP, Total Protein, Total Bilirubin and lipid peroxides (TBARS) were tested in both CCl<sub>4</sub> treated and extract<sup>19</sup>.

**Anti-Asthmatic Potential of *F.indica* Merr**

Satyanand Tyagi *et al.*, (2011) were evaluated the antihistaminic activity by using ethanolic extract of leaves of *F.indica* (EEFI) on experimental models. Phytochemical screening of the ethanolic extract showed the presence of alkaloids, tannins, saponins, flavonoids, glycosides, phenolic compounds, terpenoids and steroids. When the guinea pigs were exposed to histamine Significant increase in preconvulsion time was observed due to pretreatment with *F.indica*. This bronchodilating effect of *F.indica* was comparable to ketotifen fumarate. Thus, the present study revealed EEFI has significant antiasthmatic (H<sub>1</sub> receptor antagonist) activity. Thus, the antiasthmatic effect produced by ethanolic extract of *F.indica* suggested that anti-asthmatic activity could be due to its bronchodilator and cell stabilising property. The possible mechanism of action may be blockade of H<sub>1</sub> and Ach receptors leading to inhibitory of smooth muscle to respond histamine and Ach induced spasm leading to inhibition of bronchoconstriction. It was conclude that apart from the folkore use of *F.indica* as antioxidant

agents, the ethanolic extract of leaves of the plant *F.indica* also possess anti-asthmatic activity<sup>20</sup>.

### CONCLUSION

The pharmacological studies conformed the traditional uses of the *Flacourtia indica* as antioxidant, antimicrobial, anti asthmatic, anti diabetic, anti bacterial, anti inflammatory, anti malarial, hepatoprotective agent. Most of therapeutic effects explained due to the presence of glycosides, tannins, Sugar, flacourtin,  $\beta$ -sitosterol,  $\beta$ -sitosterol- $\beta$ -D-glucopyranoside, ramontoside, butyrolactone lignan disaccharide, coumarin such as scoparone and aesculetin etc. Their quantification of the individual phytoconstituents as well as pharmacological profile based on *in vitro*, *in vivo* studies and on clinical trials should be further investigated.

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