

## PHARMACOLOGICAL PROPERTIES AND PHYTOCHEMICAL OF LIMONIA ACIDISSIMA: A REVIEW

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### ABSTRACT

Plants provide a major resource for a large number of traditional medicines that have been in existence for thousands of years in country like India. Ayurveda, one of the oldest medicinal systems in the world, provides leads for a vast number of therapeutically useful compounds. The combination of traditional and modern knowledge can produce better source of the active constituents for the treatment of diseases with fewer side effects. With the everincreasing interest of today's population towards natural plant bearing multiple medicinal properties, belonging to family. Following various claims for cure of plant through scientific biological screening. This review majorly deals with the traditional and recent pharmacological activities of different parts of *Limonia acidissima*. Wood apple botanically known

as *Limonia acidissima* is the only species in its genus belonging to family Rutaceae, found in the tropical and subtropical regions of the world. The plant is an angiosperm with multifaceted medicinal properties almost every part of it is used traditionally. *Limonia acidissima* has a high nutritional value the fruit.

**KEYWORDS:** *Limonia acidissima*, Rutaceae, Active constituents, Pharmacological activities.

### INTRODUCTION

*Limonia acidissima*, belonging to family Rutaceae synonymally known as *Feronia Limonia* Swinglel, *Feronia elephantum*, *Schinus Limonia* and commonly also called as wood apple

and elephant apple is native and common in the wild in dry plains of India and Ceylon and cultivated along roads and edges of fields and occasionally in orchards. It is also grown throughout Asia tropical, Asia temperate, Southern America and northern Malaysia. *Limonia acidissima* (L.) of family Rutaceae (Citrus family) belongs to the monotypic genus *Limonia*, confined to India, Pakistan, Sri Lanka and Southeast Asia.<sup>[1]</sup> It is also known as woodapple, elephant-apple, monkey fruit, curd fruit, kath bel and kaitha. This plant is given as a medicine for the treatment of various disorders.<sup>[2]</sup> *L. acidissima* is a deciduous, slow-growing, erect tree with a few upward-reaching branches bending outwards near the summit where they are subdivided into slender branchlets drooping at the tips. Wood-apple is useful in preventing and curing scurvy and in relieving flatulence. Mashed seedless pulp of the raw fruit is beneficial in the treatment of dysentery, diarrhoea and piles. *L. acidissima*, considered to be a hepatoprotectant, possess different biological activities namely adaptogenic activity against blood impurities, leucorrhoea, dyspepsia and jaundice. Traditionally, all parts of the plants are given as natural medicine as a cure for various ailments.<sup>[3]</sup>

#### **Habitat (Swarupa)**

Deciduous trees, to 20 m high, bark dark-grey or black, deeply cracked longitudinally; thorns straight, to 2.5 cm, axillary. Leaves imparipinnate, alternate, 1-3 in a cluster, estipulate; rachis 60-80 mm long, stout, glabrous, often narrowly winged; leaflets 4-7, opposite, sessile, estipellate; lamina 1.3-3.8 × 1.3 cm, obovate, base cuneate or acute, apex obtuse, margin entire, glabrous, pellucid-punctate, coriaceous; lateral nerves pinnate, obscure, intercostae obscure. Flowers polygamous, dull red, 1.3 cm across, in axillary cymes; calyx small, flat, 5-toothed, pubescent without, deciduous; petals 5, free, spreading; stamens 10-12, inserted round the disc; filaments dilated below, villous on face and margins; anthers linear-oblong; disc thick, annular, pubescent; pistillode short; ovary superior, oblong, 5-6-celled, at length 1-celled, ovules many; stigma oblong, fusiform. Fruit a berry, 5-7.6 cm across, globose, whitish-brown, rind hard and woody; seeds many.<sup>[4]</sup>

**Vernacular Names**

- English: - Wood Apple, Elephant Apple, Monkey Fruit or Curd Fruit  
Hindi: - Kaitha, Kath Bel or Kabeet  
Oriya: - Kaitha  
Sanskrit: - Kapittha or Dadhistha.  
Telugu: - Vellaga Pandu  
Tamil: - Vilam Palam  
Malayalam: - Vilam Kai  
Bengali: - Koth Bel  
Gujarati: - Kothu  
Malaysia: - Belingai

**Classification**

- Family: - Rutaceae  
Kingdom: - Plantae  
Sub-kingdom: - Tracheobionta  
Super division: - Spermatophyta  
Division: - Magnoliophyta  
Class: - Magnoliopsida  
Subclass: - Rosidae  
Order: - Sapindales  
Genus: - Limonia L.  
Species: - L. acidissima

**Synonyms**

*Feroniaele phantum* Correa,

*Feronia limonia* (L.) Swingle,

*Schinus limonia* L.<sup>[5]</sup>

Kapittha, Dadhittha, Dadhiphala, Surabhichhada, dfiRFk] dSFk] iq"iQy] dfifiz;] nUr'kB

Ayurvedic Properties and Action of Kapitha

Rasa (taste on the tongue): Kashaya (Astringent), Madhura (Sweet), Amla (Sour); Unripe Pulp: Amla (Sour), Kashaya (Astringent)

Guna (Pharmacological Action): Laghu (Light), Unripe Pulp: Guru (Heavy)

Virya: Sita (Cooling); Unripe Pulp: Ushna (Hot)

Vipaka (transformed state after digestion): Madhura (Sweet); Unripe Pulp: Amla (Sour)

Action

Vata-pitta-har; Rakta - pitta-har

**Medicinal Properties**

The fruit contains fruit acids, vitamins and minerals.<sup>[6]</sup> It is used mainly as a liver tonic to stimulate the digestive system.<sup>[6]</sup> The fruit is also astringent, especially when unripe, and a cardiac tonic.<sup>[8]</sup> The pulp of the fruit, especially when unripe, is used in the treatment of diarrhoea and dysentery.<sup>[6]</sup> The fruit is also seen as an effective treatment for hiccough, sore throat and diseases of the gums.<sup>[7]</sup>

Both the fruit pulp and the powdered rind can be poulticed onto bites and stings of venomous insects.<sup>[7]</sup>

The fruit is part of a formula that is applied as a paste to the breasts in order to tone them.<sup>[6]</sup>

The leaves contain tannins and an essential oil.<sup>[6]</sup> They are astringent and are used internally, often combined with milk and sugar, in the treatment of indigestion, flatulence, diarrhoea, dysentery (especially in children) and haemorrhoids.<sup>[6]</sup>

An oil derived from the crushed leaves is applied on itchy skins.<sup>[7]</sup>

The powdered gum, mixed with honey, is given to overcome dysentery and diarrhoea in children.<sup>[7]</sup>

The spines are crushed with those of other trees and an infusion taken as a remedy for menorrhagia.<sup>[7]</sup>

The bark is chewed with that of *Barringtonia* and applied on venomous wounds.

### Phytochemicals

The preliminary phytochemical analysis of *Limonia acidissima* plant parts showed the presence of alkaloids, flavonoids, phenols, terpenoids, tannins, fats steroids, saponins, glycosides, gum, mucilage and fixed oils<sup>15-18</sup>. The unripe fruits contain stigmasterol. Fruit pulp contains large quantity of citric acid and other fruit acids, mucilage and minerals. Alkaloids, coumarins, fatty acids and sterols have been detected in the pericarp. It also contains umbelliferone, dictamnine, xanthoxol, scoparone, xanthotoxin, isopimpinellin, isoimperatorin and marmin.<sup>[8]</sup> Leaves contain stigmasterol, psoralen, bergapten, orientin, vitedin, saponarin, tannins and an essential oil.<sup>[9]</sup> Marmesin, feronolide and feronone have been isolated from the bark.<sup>[10]</sup> Seeds contain fixed oil, carbohydrates, proteins and amino acids. Roots contain feronia lactone, geranylum belliferone, bargapten, osthol, isopimpinellin, marmesin and marmin.

## PHARMACOLOGICAL ACTIVITY

### Anti-Diarrhoeal activity

Plants have various useful chemical constituents which are used in the treatment of diarrhoea.<sup>[11]</sup>

The antidiarrheal activity and gastrointestinal motility reducing activity of alcoholic and aqueous extract of bark of *Limonia acidissima* Linn, was evaluated.

### Antidiabetic activity

Plants have various useful chemical constituents such Phenols, flavonoids which are used in the treatment of diabetes. The anti-diabetic activity was performed by using Methanolic extract, Aqueous extract of stem bark, fruit.<sup>[12]</sup>

### Anticancer activity

The fruit extract of *L. acidissima* Linn. shows anticancer effect.<sup>[13]</sup> Fruit extracts from fractions 1 to 4 and also the crude extract (ethanolic extract) were used to determine the ED50 value (50% inhibition of cancer cell growth) in two different breast cancer cell lines, SKBR3 and MDAMB-435. The bio-assays of extracts from *L. acidissima* Linn. showed that a

fraction (fraction 3) from an ethanolic extract had an anticancer effect on SKBR3 and MDA-MB-435 human breast cancer cells. After 48 h of exposure, this fraction at a concentration of 100µg/ml, significantly reduced cell proliferation in both cancer cells. In MDAMB-435 cells, cell cycle analysis showed that the fruit extract fraction 3 induced the accumulation of cells in G2/M phase, whereas no significant change in cell cycle was detected in SKBR3 cells.<sup>[14]</sup>

### **Antioxidative property**

The crude methanol extract of the stem bark of *Limonia acidissima* L. and its different organic soluble partitionates were screened for antioxidant activities.<sup>[15]</sup> The antioxidant (free radical scavenging) activity of the partitionates on the stable radical 1,1-diphenyl-2-picrylhydrazyl (DPPH) was determined. The chloroform soluble fraction (CL) of crude methanolic extract showed the highest free radical scavenging activity. At the same time the pet ether soluble fraction (PE) also exhibited strong antioxidant potential. The methanolic extract of *Limonia* fruit was also screened for their free radical scavenging properties by Ferric reducing antioxidant power (FRAP) assay and DPPH radical scavenging assay.<sup>[15]</sup> In vitro antioxidant activity of different extracts from leaves of *Limonia acidissima* has been well documented.<sup>[16,17]</sup>

### **Hepatoprotective**

Hepatoprotective activity of them ethanolic extract of fruit pulp of *L. acidissima* (MELA) was investigated against carbon tetra chloride (CCl<sub>4</sub>) induced hepatic injury in rats.

MELA exhibited significant dose dependant protective effect against CCl<sub>4</sub> induced liver damage which can be mainly attributed to the antioxidant property of the extract.<sup>[18]</sup>

### **Biosorbent**

The waste fruit shell of *Limonia acidissima* is used as a biosorbent. The powdered raw material and treated material (raw material treated with acid) of specific micron size were used for the removal of the methylene blue from aqueous solution. The results showed that the removal of dye by chemically treated material is effective than raw material at higher temperature. Temperature rise affects the solubility and chemical potential of the adsorption, the latter being a controlling factor for adsorption. The percentage removal of dye is maximum at 350C for treated material and at 250C for raw material.<sup>[19]</sup>

### Antibacterial activity

It was found that ethanolic extract of *Limonia acidissima*. leaves possess abroad spectrum of activity against Gram-positive and Gram-negative bacterial strains responsible for the most common bacterial diseases 36,18,15. The antibacterial activity was evaluated against Gram-negative and Gram-positive bacteria by agar well diffusion method. Methanol extract showed good antibacterial activity with the high inhibition zones while chloroform extract exhibited mild to moderate activity and hexane extract was found to be less active.<sup>[20]</sup>

### Antifungal Activity

The different extracts (petroleum ether, chloroform, methanol and aqueous) of *Feronia limonia* Linn fruit pulp exhibited antifungal activity against some pathogenic fungus. The essential oil from the leaves of the plant exhibited antifungal activity against eight tested fungi.<sup>[21]</sup>

### CONCLUSION

It is quite evident from this review that *Limonia acidissima* L. is an important medicinal plant. It contains a number of phytoconstituents, which are the key factors in the medicinal value of this plant. Almost all parts of this plant such as leaf, fruit, seed, bark and root are used to cure a variety of diseases. The present review summarizes some important pharmacological studies on *Limonia acidissima* and phytochemical investigations and isolated principles from them. Thorough screening of literature available on *L. acidissima* depicted the fact that it is a popular remedy among the various ethnic groups, Vaidya's, Hakims and ayurvedic practitioners for cure of variety of ailments. A systemic research and development work should be undertaken for the development of products for their better economic and therapeutic utilization.

### REFERENCES

1. Allen BM. Malayan Fruits. An introduction to cultivated species. Donald Moore Press Ltd. Singapore, 1967.
2. Khare CP. Indian Medicinal Plants: An Illustrated Dictionary, Springer Science, Springer Verlag.
3. Morton JF. Wood-Apple. In: Fruits of warm climates, Flare Books, Miami, Florida, 1987; 19019.
4. Dr. N Sasidharan (Dr. B P Pal Fellow), Kerala Forest Research Institute, Peechi.
5. Bhandari MM. Flora of the Indian desert, Scientifi Publishers, Jodhpur, 1978; 92.

6. The Encyclopedia of Medicinal Plants.
7. World Agroforestry Centre.
8. Chakroborty DP. Chemical examination of *Feroniaele phantom* Corr. *J Sci. Industr. Res.*, 1959; 18B: 90-91.
9. Patra A, Misra SK, Chaudhury SK. Constituents of *Limonia acidissima* application of two-dimensional NMR spectroscopy in structure elucidation. *J. Indian. Chem. So*, 1988; 65: 205-208.
10. Rahman Mohd. Mukhlesur, Gray Alexander I. Antimicrobial constituents from the stem bark of *Feronia limonia*. *Phytochem*, 2002; 59: 73.
11. Pokale S, Kushwaha R. A Review on Antidiarrhoeal Activity of Herbals. *Int J Res Pharm Biomed Sci.*, 2011; 2: 1357-1362
12. Priya E.Mohana, Gothandam K.M and Karthikeyan. S. Antidiabetic activity of *Llimonia acidissima* and *Artocarpus heterophyllus* in streptozotocin induced diabetic rats. *Journal of food technology*, 2012; 7(1): 43-49.
13. Dhanamani M, Lakshmi Devi S, Kannan S. Ethnomedicinal plants for cancer therapy – a review. *Hygeia j drugs med*, 2011; 3: 1-10.
14. Pradhan D, Tripathy G, Patnaik S. Screening of antiproliferative effect of *Limonia acidissima* Linn. Fruit extracts on human breast cancer cell lines. *Afri J Pharm Pharmacol*, 2012; 6: 468-473.
15. Nanasombat S, Khanha K, Phan-im J, Jitaied J, Wannasomboon S, Patradisakorn S, Wongsil A. Antimicrobial and antioxidant activities of thai local fruit extracts: application of a selected fruit extract, *Phyllanthus emblicalinn*. as a natural preservative in raw ground pork during refrigerated storage. *The Online J Sci Tech.*, 2012; 2.
16. Attarde DL, Chaudhari BJ, Bhambar RS. Phytochemical investigation and in vitro antioxidant activity of extracts from leaves of *Limonia acidissima* linn. (Rutaceae). *J pharmres*, 2011; 4: 766.
17. Merinal S, Viji Stella Boi G. In vitro antioxidant activity and total phenolic content of leaf extracts of *Limonia crenulate* (Roxb.) *J. Nat. Prod. Plant Resour*, 2012; 2: 209-214.
18. Ilango K, Chitra V Wound Healing and Anti-oxidant Activities of the Fruit Pulp of *Limonia Acidissima* Linn (Rutaceae) in Rats. *Trop J Pharm Res.*, 2010; 9: 223-230.
19. Torane RC, Mundhe KS, Bhave AA, Kamble GS, Kashalkar RV, Deshpande NR. Removal of Methylene Blue from Aqueous Solution Using Biosorbent. *Der Pharma Chemical*.

20. Naidu GK, Sujatha B, Naidu KCS. In vitro Antibacterial Activity Analysis of Leaves of *Limonia acidissima*. *Notulae scientia biologicae*, 2014; 6: 155-157.
21. Gupta C, Singh VP. In-vitro antifungal effect of essential oil of some medicinal plants. *Sci. Cult*, 1982; 48: 441-443.