



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

FERONIA LIMONIA LINN: AN ETHOBOTANY AND PHYTOPHARMACOLOGICAL

REVIEW

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Received 26th Dec. 2021; Revised 24th Jan. 2022; Accepted 14th Feb. 2022; Available online 1st Nov. 2022

<https://doi.org/10.31032/IJBPAS/2022/11.11.6551>

ABSTRACT

Background: This review emphasize on the pharmacognostic, phytochemical and pharmacological profile of "*Feronia limonia linn swingle*". **Method:** All the available information on *Feronia limonia linn* were collected from published articles. Report: According to this article reports related to scientific evidence, *Feronia limonia linn* is used for various treatment. Crude extract of wood apple are reported to contain feronolide, feronone, marmesin, vitedin, psoralen, bergapten, xanthotoxin, stigmasterol, fatty acids, mucilage, sugars, citric acid, essential amino acid and some minerals, ect. Which are broadly used for therapeutic purpose. **Conclusion:** This article summarizes that wood apple is pharmacologically active and it is used for treatment of various ailments.

Keywords: *Feronia limonia linn*, wood apple, elephant apple, Anti-histaminic, Hepatoprotective

INTRODUCTION

Feronia limonia Linn. The elephant apple is local & normal in dry fields. It favours a stormy environment with particularly dry

conditions. Trees in the western- Himalayas can reach heights of 450 meters [1]. It is clearly a dry spell-open-minded and best

adjusted to light soils. Wood apple is viewed as in all through the India, likewise grown in Bangladesh- Pakistan & Srilanka [2]. Proliferation is finished by seeds & vegetatives strategy. However, high speed of seedling mortality and outbreeding nature of this plant address helpless recuperation and unsatisfactory germplasm [3]. To vanquish this, *in-vitro* inducing through axillary bud duplication has been made. Because of the expanding mindfulness among individuals towards regular items, normal medication is drawing in more consideration than allopathic framework [4]. Additionally this arrangement of medication is without contamination and less poisonous without incidental effects. Ayurveda, Siddha, Unani, Amchi, and other Indian healing systems employ a wide range of plants for the treatment of human and animal illnesses [5]. Limonia then, at that point, being invalid, the following most established conventional name must be taken up. This is *Feronia*, distributed by Corrêa in 1800, the name currently regularly utilized. Since the wood-apple was first distributed as *Schinus Limonia* by Linnaeus in 1753, the most seasoned substantial name of the wood-apple is *Feronia limonia* (L).

Botanical features [6, 7]

F. Limonia Linn is an evergreen, sluggish tree belongs to the Rutaceae family. The fruit, round to oblong, obovate, enormous, 2 to 5 inch wide, with a hard, woody skin, which is grayish-white, scurfy skin around six millimeter-thick, possesses supporting features. The crush is shabby brown, sweet-smelling foul, resinous, astringent, destructive or sweetish, with different little, white seeds scattered through it. The seeds are round to oval, 5-12.5 cm wide, with a hard, woody, grayish-white, 6 millimeters thick, pound brown, smelly, resinous, astringent, destructive or sweetish, with different little, white seeds scattered through it. In India, the *Feronia limonia* is used as a liver and heart tonic, as well as an astringent approach for stopping free insides and looseness of the bowels when unripe, and is useful for the treatment of cough, sore throat, and gum disease. The pound is an excellent antidote to venomous bites down. Physically, blooms are normally open. Things in nature mature in India from starting October to March. Seedlings won't be fruitful until they're about 15 years old.



Figure 1: Botanical features of *Feronia limonia* Linn

Vernacular names [8]

1. English- wood apple, elephant apple
2. Hindi - kaitha
3. Tamil- vilamaram, vilangai
4. Telugu- velaga
5. Kanadam- Bekalu.

Taxonomical system [9]

- Kingdom-Plantae
- Division-Magnoliophyta
- Class-Magnoliopsida
- Order-Sapnadales

- Family-Rutaceae

- Genus-Limonia

- Species-*Feronia limonia*

Synonym: *Limonia elephatum* (cirrea) panigrahi, *Limonia acidissium* Linn, *Schhinus limonia* Linn [10].

Conventional medicinal uses (elephant apple): Different parts of *Feronia limonia* have been used against many illness and issues in Folkmedicine.

Table 1: Folkmedicinal values of *Feronia limonia*

S. No	Plant parts	Folks uses	Ref
1.	Leaves	Antiemetics, Carminative, Cardiotonic, Expectorant, Calculus, Diarrhea, Hiccups, Gastric problems.	[11]
2.	Barks	Relives pitta and Hepatoprotective.	[12]
3.	Gum	To treat - diarrhea, dysentery, diabetes.	[13]
4.	Ripen fruits	Cough, Cardio protective, Anti-vomiting, Tumours, lung tonic, liver tonic, Antidote for venomous bites, Earache, leukorrhea..	[14]
5.	Unriped fruits	Aromatics, Astringent, antivenom, to treat-pharynx pain.	[15]

Therapeutic utilization:

Feronia limonia Linn was a supporter of a local medical strategy for the treatment of various diseases. Laves and bark extracts are

used to treat vata and pitta imbalances. The leaves are astringent and carminative, making them useful for regurgitation, indigestion, hiccups, and entrail separation.

Hepatoprotective effects of the leaf extract Gum is a demulcent and a deterrent that can help with the runs, loose bowels, gastropathy, haemorrhoids, and diabetes. Unripe natural items are astringent, whilst seeds are useful for treating cardiac conditions. Bael in the runs and detachment of the insides are substituted with fruits. The fruits and leaves are violent, stomachic, energizers, diuretics, cardioprotective, hepatoprotective, and lung tonics, and are useful for asthma, use, development, ophthalmia, and leukorrhoea. The elephant apple can be eaten raw or processed into a number of desserts and pastries, or preserved as jam. In Thailand, leaves are consumed in different forms [16, 17].

Pharmacognostic profile:

1. Macroscopical review:

The organoleptic highlights of *Feronia limonia* Linn's leaf and the macroscopic review show that leaf is substitute, odd-pinnate (compounded) with the entire edge, the petioles are long, the pinnacle heartless and the base decurrent, with a glabrous surface. The inflorescence was equal and ended in panicles. Aspect 2.5-8×5.5 cm [18].

2. Microscopic review:

The microscopic characteristics of *Feronia limonia* leaf type-dorsiventral. The lower and upper epidermis contain tiny polygonal parenchyma cells, which seem to have a wave layout, and following chlorenchymatous cells. Chlorenchymatous cells are additionally considered in the upper palisade and lower light tissue. Palisades with two layers of customary, long, columnar cells, underneath which three to four layers of light tissues were available. The cortex is comprised of midribs, which consist of six to eight layers of parenchymatous cells. The vascular group was ovoid in shape around the vascular group layer of sclerenchyma cells. Multicellular trichomes were available at a superficial level. Actinocytic stomata are presented [19, 20].

Phyto-constituents profiles:

1. Qualitative reports:

As reports of phytochemical screening of *feronia*, *Limonia*, and other parts of plants have been reviewed, they show that terpenoids, terpenoids, glycosides, saponins, alkaloids, phenols, steroids, tannins, fats, gum, and fixed oils are observed [21] from various sources and the chemical components are tabulated below.

Table 2: Phytochemicals-*Feronia limonia* Linn

S. No.	Parts	Chemical classification	Phyto-constituents	Ref
1	Unripe Fruit	Sterols	Stigmasterol	[22]
2	Fruit pulp	Nutritional compound	Citric acid, mucilage and minerals	[23]
3	Pericarp	Alkaloid, coumarins and fatty acid	stearic acid, plamiti, oleic, lanolenic acids	[24]
4	Pericarp	-	Umbelliferone, dictamine, xanthatoxol, isopimpinellin, xanthotoxin and marmin	[25]
6	Leave	Sterols and essential oils	Stigmasterol, psoralen, bergapten, vitedin, saponarin.	[26]
7	Seeds and root	Sugar and essential component	Fixed oil, carbohydrate, proteins, amino acid, <i>Feronia</i> lactose.	[27]
9	Bark	Minerals	Marmesin, feronolide and feronone	[28]

2. Quantitative reports:

i) Fluorescence investigation [29]

Feronia limonia leaf and stem powder were prepared according to detailed standard strategies. A small amount of powdered sample was put on an oil-free, clean minuscule slide and one to two drops of freshly prepared solutions were added and blended using a delicate shifting slide. Then, the slide is set inside the UV chamber and seen for visible light, short wavelength of 254 nanometers, and long wavelength of 365 nanometers, UV rays. A few components show fluorescent reactions in the apparent light. UV rays create fluorescent in numerous regular items, but they don't appear to be fluorescent in light. Assuming the substances themselves are not fluorescent, they may frequently be changed into fluorescent aids.

ii) Physicochemical investigation [19]

Physio-chemical portrayal leaf of *Feronia* Furthermore, stems were dampened with a content of 9.00% and 6.50%, respectively. debris esteem was controlled by 3 unique structures: absolute debris, aqueous solvent debris, and corrosive insoluble debris. The total amount of debris on the leaf was 9.33 percent, with aqueous solvent debris accounting for 1.83 percent and corrosive insoluble debris accounting for 1.16 percent, respectively. All the debris on the stem is 3.16 percent, while both aqueous solvent debris and corrosive insoluble debris are 0.66 percent. The greatest extracts' worth was found in methanol dissolvable, and at least in pet ether, which dissolved the sample leaf and stem of *L. acidissima*.

Pharmacological profile:

Table 3: Pharmacological activity -*Feronia limonia* Linn swingle

S. No	Activity	Reports	Ref
1	Anti- bacterial property	Methanolol extract is the most effective form of insecticide, while chloroform extract has gentle to direct effect, and hexane extracat is considered less active. Gram-(+)ve and Gram(-)ve bacterial strains that cause the most well-known infections move freely in <i>Limonia acidissima</i> leaves.	30,31
2	Anti-fungal	Petether, methanol, chloroform & fluid extraction of plant (<i>F.limonia</i> Linn) organic product mash shown antifungal movement against some pathogenic growth.(invitro method)	32
3	Wound healing properties	Methanol concentrate of organic product mash plant material. When the extraction wound model (albino rat) is treated with the concentrate, the injury contracted logically. When treated with inducer, the incision wound model shows better injury healing capability and a slightly shorter epithelization period.	33
4	Anti-oxidant activity	The Ferric reducing anti-oxidant power (FRAP) examiner and the DPPH extreme rummaging measure were also used to evaluate the methanolic concentrate of <i>Limonia</i> organic products for their free revolutionary searching properties.	34
5	Anti-tumor properties	<i>Limonia</i> ethanolic extract has anti-proliferative properties. Cell cycle analysis revealed that the organic product removal component three triggered cell collections at the G ₂ /M stage in MDA-MB-435 cells, while no significant changes in cell cycle were observed in SK-BR-3 cells.	35
6	Diuretics	Methanolic extracate of <i>L.acidissima</i> is examine to created a huge increment (P<0.001) in pee yield at a similar portion. Urinary extraction was too impacted by concentrate increment the urinary discharge electrolytes Na ⁺ , K ⁺ & Cl ⁻ shows diuretic effect.	36
7	Hepatoprotective properties	Ethanolic concentrate of pulp-fruit of <i>L. acidissima</i> was examined in comparison to CCl ₄ -induced liver injury in test animals. The dosages of inducer drugs are determined in order to influence the social events of animals. Inducer drug displayed huge portion dependant defensive impact verses CCl ₄ actuated hepatic damage can be chiefly ascribed as anti-tumor activity of extract.	37
8	Hypoglycemic activity	Extricate showed dose subordinate impact, 200miligram/kg, 400 miligram/kg portion observe that decrease in sugar level. Further more <i>L.acidissima</i> extracate showed critical decrease the plasma creatinine and urea level in treated animal. however through and through extended total protein level . A tremendous portion subordinate antidiabetic effect of methanolic normal item concentrate and aqueous leaf extract of sample in streptozotocin started diabetic pale skinned person rodents have been generally announced.	38,39
9	Anti diarrheal activity	Ethanolic extricate showed a huge	40

		antidiarrhoeal action and essentially diminished the drive of charcoal dinner through the gastro digestive system.	
10	Anti-larvicidal propertie	With LC50-129.24 ppm, 79.58 ppm, and 57.23 ppm, respectively, acetone extract-dried sample was found to be effective in stopping hatchlings of <i>C. fasciatus</i> and <i>A. stephensi</i> .	⁴¹
11	Anthelmintic	Aqueous extract of plant leaves, <i>F. Limonia</i> linn, has a strong anthelmintic action, but it takes a long time to kill the worms at a concentration of 50 milligrams/mililiter. Outcomes are contrasted with those of the STD drug piperazine citrate.	⁴²
12	Anti-histaminic activity	Ethanollic extracts of <i>F. elephantum</i> bark essentially suppressed clonidines (Cld) and induced reverie. Cld discharges Histamine from pole-cells, which is responsible for assorted asthma conditions. Catalepsy conveyed by Cld is mediated by histamine through the H1 receptor. Subsequently, it's assumed that ethanollic extracts of the bark of <i>F. elephantum</i> have antihistaminic activity.	⁴³
13	Anti-spermatogenic activity	Ethanollic extract of the pulp-fruit of <i>F. limonia</i> The administration of this concentrate to male rodents achieved a critical weight reduction of the conceptive parts of the rats, changes in locomotion, suitability, and structure of spermatozoa. It is presumed that the concentrate might have reversible antispermatogenic action.	⁴⁴

CONCLUSION

This article comprises few available information about pharmacognostic, phytochemicals and pharmacological studies of *Feronia limonia* Linn swingle. According to this article report related to scientific evidence, *Limonia species* is used for various treatment. Crude extract of *Feronia limonia* are reported to contain feronolide, feronone, marmesin, vitedin, psoralen, bergapten, xanthotoxin, stigmasterol, fatty acids, mucilage, sugars, citric acid, essential amino acid and some minerals, ect. Which are broadly used for therapeutic purposes. This article outlines that *Feronia limonia*

Linn swingle is pharmacologically active like anti-diabetic, anti-tumor, anti-histaminic, Hepatoprotective, anti-oxidant, antifungal and it is used for treatment of various ailments.

Acknowledgement

The authors would express their thanks to Prof. V. Chitra, M.Pharm., Ph.D, Dean and Department of pharmacology, SRMIST university, kattankulathur-603203, Tamil nadu, india for giving the support offices to finish this work.

Conflict of interest

The authors proclaim that NO irreconcilable situation among us.

REFERENCE

- [1] Vaidyaratnam Varier PS, Arya Vaidya sala, Kottakkal, Indian medicinal plants, Vol 3, Orient Longman Ltd., Madras, 1995, 327-332.
- [2] Bakshi DNG, Sensarma P, Pai DC. A Lexicon of Medicinal Plants in India, Naya Prokash, Calcutta, 2001, 186-187.
- [3] Daniyan SY, Muhammad HB. Evaluation of the antimicrobial activities and phytochemical properties of extracts of *Tamarindus indica* against some diseases causing bacteria. *Afr J Biotechnol*, 7, 2008, 2451-2453.
- [4] Malviya R, Kumar A, Singh A, Kulkarni GT. Pharmacological Screening, Ayurvedic values and Commercial Utility of *Aegle Marmelos*. *IJDDR*, 2012, 4.
- [5] Nayak S. Influence of Ethanol Extract of *Vincetoxicum* on Wound Healing in Diabetic Rats. *Online Journal of Biological Sciences*, 6, 2006, 51-55. http://efloras.org/florataxon.aspx?flora_id=1&taxon_id=242415184 access on 7 December 2021
- [6] Khewkhom, N., Greger, H., & Shangchote, S. (2008). Antimicrobial activity of 16 plant extracts of the Rutaceae family against phytopathogenic fungi. In *Agricultural Sci. J*
- [7] Tyler V, Brady L, Robbers J. *Pharmacognosy*. India: Varghese Company; 1977, p. 103-141.
- [8] Guha, D. N., Sensarma, P., & Pal, D. C. (1999). A lexicon of medicinal plants in India. Naya Prokash, Calcutta, 1st Publication, 1, 389.
- [9] Panda, H. (2002). *Medicinal plants cultivation & their uses*. Asia Pacific Business Press Inc.
- [10] Mukherjee, P. K., & Wahile, A. (2006). Integrated approaches towards drug development from Ayurveda and other Indian system of medicines. *Journal of ethnopharmacology*, 103(1), 25-35.
- Nambiar, V. P. K. (1993). *Indian medicinal plants: a compendium of 500 species* (Vol. 5). Orient Blackswan.
- [11] Nadkarni, K. M. (Ed.). (1996). [Indian materia medica]; Dr. KM Nadkarni's Indian materia medica: with Ayurvedic, Unani-Tibbi, Siddha, allopathic, homeopathic, naturopathic & home remedies,

- appendices & indexes. 1 (Vol. 1). Popular Prakashan.
- [12] Dave, R., Nagani, K., & Chanda, S. (2010). Pharmacognostic studies and physicochemical properties of the *Polyalthia longifolia* var. *pendula* leaf. *Pharmacognosy Journal*, 2(13), 572-576.
- [13] Nandkarni KM. *Indian Materia Medica*, Vol. I, Popular Prakashan, Bombay, pp. 535-537.
- [14] Hiregoudar, L. V., Murthy, H. N., Hema, B. P., Hahn, E. J., & Paek, K. Y. (2003). Multiple shoot induction and plant regeneration of *Feronia limonia* (L.) Swingle. *Scientia Horticulturae*, 98(4), 357-364.
- [15] Senthilkumar KL, Kumawat BK, Rajkumar M, Senthilkumar. Antidiarrhoeal activity of bark extracts of *Limonia acidissima* Linn. *Res J Pharm Bio ChemSci*, 1, 2010, 550-553.
- [16] Jadeja BA, Odedra NK, Danger NR and Baxi US. Ethnomedicinal plants used by the people of Saurashtra to cure diarrhoea. *Plant Archives*, 5, 2005, 381-392.
- [17] Attarde DL, Chaudhari BJ, Bhambar RS. Phytochemical investigation and in vitro antioxidant activity of extracts from leaves of *Limonia acidissima* linn. (Rutaceae). *J pharm res*, 4, 2011, 766.
- [18] Harborne JB. *Phytochemical methods*. 2nd ed. London: Chapman & Hall; 1973.
- [19] Pandavadra M, Chanda S. Development of quality control parameters for the standardization of *Limonia acidissima* L. leaf and stem. *Asian Pac J Trop Med*. 2014; 7:S244-S248
- [20] Kumavat BK, Chand T, Singh Y. Pharmacognostical and physicochemical evaluation on stem bark of *Limonia acidissima* Linn. *Int J Pharm Bio Sci* 2012; 3(3): 198-209.
- [21] Kokate, C. K. (1986). *Practical pharmacognosy*. Vallabh Prakashan, New Delhi, 111.
- [22] Panda N, Patro VJ, Jena BK, Panda PK. Evaluation of Phytochemical and Anti-Microbial Activity of Ethanolic Extract of *Limonia acidissima* L. Leaves. *Int J Herb Med*, 1, 2013, 22-27.
- [23] Jayashree V H, Londonkar R. Comparative phytochemical studies and antimicrobial potential of fruit

- extracts of *Feronia limonia* Linn. Int J Pharm PharmSci, 6, 2014.
- [24] Vijayvargia P, Choudhary S, Vijayvergia R. Preliminary phytochemical screening of *Limonia acidissima* Linn. Int J Pharm PharmSci, 6, 2014, 134-136.
- [25] Chakroborty DP. Chemical examination of *Feroniaele phantom* Corr. J Sci. Industr. Res, 18 B, 1959, 90-91.
- [26] Patra A, Misra SK, Chaudhury SK. Constituents of *Limonia acidissima* application of two dimensional NMR spectroscopy in structure elucidation. J. Indian. Chem. So, 65, 1988, 205-208.
- [27] Rahman Mohd. Mukhlesur, Gray Alexander I. Antimicrobial constituents from the stem bark of *Feronia limonia*. Phytochem, 59, 2002, 73-77.
- [28] Patel BD, Shrivastava R, Uppadhyay RK. Phytochemical and pharmacological studies of root and root bark of *Feronia limonia* (L.) Swingle. Indian J Forestr, 5, 1982, 14-17.
- [29] Kokoski CJ, Kokoski RJ, Salma FJ. Fluorescence of powdered vegetable drugs under ultraviolet radiation. J Am Pharm Assoc Am Pharm Assoc (Baltim) 1958; 47(10): 715-717.
- [30] Momin MAM, Khan MR, Rayhan J, Afrose A, Rana S, Begum AA. Evaluation of Antibacterial and Antidiarrhoeal Activities of *Feronia limonia* Leaf Extract. Ameri J Plant Sci, 4, 2013, 2181-2185.
- [31] Naidu GK, Sujatha B, Naidu KCS. In vitro Antibacterial Activity Analysis of Leaves of *Limonia acidissima*. Notulae scientia biologicae, 6, 2014, 155-157.
- [32] Gupta C, Singh VP. In-vitro antifungal effect of essential oil of some medicinal plants. Sci. Cult, 48, 1982, 441-443.
- [33] 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, 9, 2010, 223-230.
- [34] Nanasombat S, Khanha K, Phan-im J, Jitaied J, Wannasomboon S, Patradisakorn S, et al. Antimicrobial and antioxidant activities of thai local fruit extracts: application of a selected fruit extract, *Phyllanthus emblic* Linn. as a natural preservative in raw ground pork

- during refrigerated storage. The Online J Sci Tech, 2, 2012.
- [35] 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, 6, 2012, 468-473.
- [36] Parial S, Jain DC, Joshi SB. Diuretic activity of the extracts of *Limonia acidissima* in rats. Rasayan J Chem, 2, 2009, 53-56.
- [37] 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, 9, 2010, 223-230.
- [38] MohanaPriya E, Gothandam KM, Karthikeyan S. Antidiabetic activity of *Feronia limonia* and *Artocarpus heterophyllus* in streptozotocin induced diabetic rats. American J. food. Tech, 7, 2012, 43-49.
- [39] Joshi RK, Patil PA, Muzawar MHK, Kumar D, Kholkute SD. Hypoglycemic activity of aqueous leaf extract of *Feronia elephantum* in normal and streptozotocin-induced diabetic rats. Pharmacologyonline. 3, 2009, 815-821.
- [40] Pokale S, Kushwaha R. A Review on Antidiarrhoeal Activity of Herbals. Int J Res Pharm Biomed Sci, 2, 2011, 1357-1362.
- [41] Abdul RA, Geetha G, Saleem GB, Arumugam S, Himalayan B. Effect of *Feronia limonia* on mosquito larvae. Fitoterapia, 71, 2000, 553-555.
- [42] Divya Tamboli, Bharti Saindane, Pallavi Sonwane, H. P. Suryawanshi, S. P. Pawar. Phytopharmacological screening of *Feronia limonia* Linn. Saudi J. Med. Pharm. Sci.; vol-3, Iss-3A (Mar, 2017): 133-137.
- [43] Chavan S, Jadhav R, Damale M, Pattan S. Antihistaminic effect of *Feronia elephantum* bark. World j pharm pharmsci, 3, 2014, 1011-1016.
- [44] Dhanapal R, Ratna JV, Sarathchandran I, Gupta M. Reversible antispermatic and antisteroidogenic activities of *Feronia limonia* fruit pulp in adult male rats. Asian Pacific J Trop Biomed, 2012, 1024-1030.