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Pharmacological activity of *Feronia limonia* (Kothambari)

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Abstract
This study is a small attempt to study the geographical distribution, morphology and Pharmacological activity of an under rated plant *Feronia limonia*. (Kothambari)
Feronia limonia, commonly known as the wood apple, elephant apple, or curd fruit, is a traditional plant recognized for its multifaceted medicinal properties. Originating from the Indian subcontinent and Southeast Asia, it has been utilized in various systems of traditional medicine, including Ayurveda and Unani. The fruit, leaves, bark, and roots of *Feronia limonia* all contribute to its ethno-medicinal profile. Various reports have proved that the Plant and its different parts has Anti-microbial, Anti-diabetic, Diuretic, Anti-tumor Muscle Relaxant, Anti-inflammatory, Anti-histaminic, Anti-spermatogenic, Hepatoprotective, Analgesic, Wound Healing abilities. Tribals of Rajasthan Specially the Bhil Tribe uses it for medicine, ethnofood, ethno fodder and also for material culture. In nutshell, the *Feronia limonia* (Kothambari) is not a tree for the tribals but is a way of living their life as each and every part of this tree is useful in all aspects of tribal life.

Keywords: Bhil, wood apple, *feronia limonia*, ethno medicine, kothambari

Introduction

Rajasthan (meaning 'Land of Kings') is a state in north-western India, covering 342,239 square kilometres (132,139 square miles), which constitutes 10.4 per cent of India's total geographical area. It is the largest Indian state by area and the seventh largest by population. Located on India's north-western side, Rajasthan encompasses much of the vast and arid Thar Desert, also known as the Great Indian Desert. It shares borders with the Pakistani provinces of Punjab to the northwest and Sindh to the west. Additionally, it is bordered by five Indian states: Punjab to the north; Haryana and Uttar Pradesh to the northeast; Madhya Pradesh to the southeast; and Gujarat to the southwest. The state's geographical coordinates are between 23°.3' to 30°.12' North latitude and 69°.30' to 78°.17' East longitude, with the Tropic of Cancer passing through its southernmost tip. (Katewa *et al*, 2004) [7]
Rajasthan is home to many tribes scattered across the state, including the Bhil, Garasia, Damor, Kathodi, and Meena (Salvi, 2012) [16] Living in harmony with nature, these tribes have developed extensive knowledge about the use of wild flora, much of which remains unknown to the outside world. If scientifically examined, this rich Ethno medicinal knowledge could greatly benefit humanity. However, the encroachment of modernization poses a significant threat to this valuable expertise and wisdom, risking its permanent loss. The habitats of these tribal and hill communities, along with the environment that nurtured their folklore on wild plants, are rapidly disappearing due to outsider interference. (Katewa, 2001) Tribals have traditionally managed their own system of food supply. However, recent changes, such as habitat displacement and deforestation, have led to the decline and even disappearance of this valuable knowledge. Many wild plants used in traditional tribal diet are important sources of biodynamic compounds. (Sebastian & Bhandari, 1990) [17]
Fruits should be an essential part of our daily diet for a disease-free life, as they offer numerous health benefits due to their vital nutrients and minerals. Most people tend to stick to common fruits like apples, bananas, blueberries, oranges, and grapes. However, there are many other lesser-known fruits with essential nutrients which used by tribals. Present study is done for the documentation of functional properties of an underrated fruit Kothambari i.e *Feronialimonia*).

Material and methods

- To document various aspects of plant *Feronia limonia*, field surveys were conducted throughout the year from 2022 to 2023 in various tribal, rural, and sub-rural areas.
- Various localities in Southern Rajasthan (Districts of Udaipur, Dungarpur, and Banswara) were selected to gather information from all the predominant tribes particularly Bhil
- Before conducting interviews, rapport was established with the tribal people, and a Prior Informed Consent (PIC) form was signed by each informant. Simmonds (2009) emphasizes the importance of including "Prior Informed Consent (PIC)" and "Access and Benefit-Sharing" clauses in research agreements, especially when dealing with traditional knowledge.

Taxonomical classification: *Feronia limonia*
Kingdom: *Plantae*
Subkingdom: *Tracheobionta*
Super division: *Spermatophyta*
Division: *Magnoliophyta*
Class: *Magnoliopsida*
Subclass: *Rosidae*
Order: *Sapindales*
Family: *Rutaceae*
Genus: *Feronia*
Species: *Feronia limonia*

Geographical distribution

Feronia limonia is an angiosperm, aboriginal to India, Bangladesh, certain parts of Srilanka, Pakistan and some regions of South East Asia. Being a fruit of tropical regions it requires dry arid conditions for growth with certain amount of monsoon. In India, it is habituated in the states such as Maharashtra, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Karnataka, Kerala and certain regions of Western Himalayas.

Morphology of the plant

This deciduous, slow-growing, erect tree reaches approximately 9 meters in height and has slender branches with rough, spiny bark. The leaves, which emit a citrus scent when crushed, contain 5-7 leaflets each measuring 25-30 millimeters long and 10-20 millimeters wide. The bisexual flowers, which appear in February and March, are dull red or greenish and form on lateral panicles. The tree bears a round or ovate fruit with hard outer pericarp, the fruit is 5-7.6 cm in diameter which resembles much of the Beal fruit, *Aegle marmelos*. The outer hard cover also termed as rind is grayish-white, 6 millimeters thick, and difficult to crack open, often requiring a hammer. The fruit's pulp is brown, aromatic, resinous, and can be either sour or sweet, containing many small white seeds. It thrives in a monsoon climate with a distinct dry season, growing at elevations up to 450 meters, and is well-adapted to light soils and capable of tolerating drought. The fruit matures in October and November, with ripening in India occurring from early October through March.

Fig 1: Tree: *Feronia limonia* (Kotambari)

Fig 2: Fruits of *Feronia limonia* (Kotambari)

Medicinal uses

The ripe fruits are consumed raw and also used for the preparation of chutney. Among different genital diseases *Feronia limonia*, are used for leucorrhea. The active component of Stem bark of *Feronia limonia* effectively seizes post prandial hyperglycemia. The Pharmacological activity of various Plant parts of *Feronia limonia* are tabulated as under:

Table 1

Plant part	Pharmacological activity	References
Fruit pulp	Anti-tumour	Saima, *et al* (2000) [15]
	Anti-bacterial	Kumar, *et al* (2010) [8]. Momin, *et al* (2013) [9, 10]
	Anti-microbial	Senthil kumar & Venkatesalu (2013)
	Anti-oxidant	Shermin, Aktar, Ahsan & Hasan (2012) [19]
	Hepatoprotective	Jain, *et al* (2011) [6], Dar, Saxena & Bansal, (2012) [3]
	Anti- speramatogenic, Anti-steroidogenic	Dhanapal *et al* (2012) [4].
	Wound healing	Ilango, K., & Chitra, V. (2010) [5].
Fruit Shell	Anti-fungal	Adikaram *et al* (1989) [1]
Stem bark	Anti-oxidant	Shermin, Aktar, Ahsan & Hasan (2012) [19]
	Anti-diabetic	Priya, *et al* (2012) [13]
	Cytotoxic	Shermin, Aktar, Ahsan & Hasan (2012) [19]
	Anti-histaminic	Chavan, *et al* (2014) [2]
Leaves	Anti-diarrhoeal	Momin, *et al* (2013) [9, 10]
	Analgesic	Momin, *et al* (2013) [9, 10]
	Anti-inflammatory	Smita Khare, Prabhat Khare & Jain (2014) [20]
	Muscle relaxant	Parveen, *et al* (2015)
	Diuretic	Parial, Jain, & Joshi, (2009) [11]
	Larvicidal	Rahuman, *et al* (2000) [14].
	Hepatoprotective	Jain, *et al* (2011) [6] Dar, *et al* (2012) [3]

Ethno food

Tribals uses the fruit of *Feronia limonia* as a delicacy. *Feronia limonia* due to its citric taste is used in certain tribal recipes in place of tamarind and bael, in chutneys etc. Unripe fruits, leaves are used commonly as salad.

Ethno–fodder

The wood apple tree is used as a Ethno-fodder for livestock by tribes.

Material culture

Timber from the tree is used in construction purpose due to its hard nature and durability, in manufacturing agricultural tools. Various designs are carved out from rind and heart wood. The Tree is planted along field boundaries as a barrier. Foliage of the wood apple tree is used as a fuel.

Conclusion

Feronia limonia, commonly known as the wood apple, is a traditional plant renowned for its extensive medicinal

properties. It holds a significant place in traditional medicine due to its diverse pharmacological activities. In addition to its medicinal benefits, *Feronia limonia* is also valued for its nutritional content and is used in various culinary applications. Its fruit is rich in vitamins and minerals, making it a nutritious addition to the diet.

Given its broad spectrum of pharmacological activities, *Feronia limonia* warrants further investigation through clinical trials to better understand its therapeutic potential and mechanisms of action. Such research could pave the way for its incorporation into modern medicine, providing new, natural alternatives for various health conditions. Expanding scientific knowledge about *Feronia limonia* will help validate its traditional uses and potentially lead to the development of novel treatments based on its bioactive compounds.

References

1. Adikaram NB, Abhayawardhane Y, Gunatilaka AL, Bandara BR, Wijeratne EK. Antifungal activity, acid and sugar content in the wood apple (Limonia acidissima) and their relation to fungal development. Plant pathology,1989:38(2):258-265.
2. Chavan S, Jadhav R, Damale M, Pattan S. Antihistaminic effect of Feronia elephantum bark. World Journal of Pharmacy and Pharmaceutical Science,2014:3:1011-1016.
3. Dar AI, Saxena RC, Bansal SK. Assessment of hepatoprotective activity of fruit pulp of *Feronia limonia* (Linn.) against paracetamol induced hepatotoxicity in albino rats. Journal of Natural Products,2012:2(2):226-233.
4. Dhanapal R, Ratna JV, Sarathchandran I, Gupta M. Reversible antispermatogenic and antisteroidogenic activities of *Feronia limonia* fruit pulp in adult male rats. Asian pacific journal of tropical biomedicine,2012:2(2):S1024-S1030.
5. Ilango K, Chitra V. Wound healing and anti-oxidant activities of the fruit pulp of Limonia acidissima Linn (Rutaceae) in rats. Tropical Journal of Pharmaceutical Research, 2010, 9(3).
6. Jain M, Kapadia R, Jadeja RN, Thounaojam MC, Devkar RV, Mishra SH. Cytotoxicity evaluation and hepatoprotective potential of bioassay guided fractions from Feronia limmonia Linn leaf. Asian Pacific Journal of Tropical Biomedicine,2011:1(6):443-447.
7. Katewa SS, Chaudhary BL, Jain A. Folk herbal medicines from tribal area of Rajasthan, India. Journal of ethnopharmacology,2004:92(1):41-46.
8. Kumar AS, Venkatesalu V, Kannathasan K, Chandrasekaran M. Chemical constituents and antibacterial activity of the leaf essential oil of *Feronia limonia* Indian journal of microbiology,2010:50:70-73.
9. Momin MAM, Khan MR, Rayhan J, Afrose A, Rana S, Begum AA. Evaluation of antibacterial and antidiarrhoeal activities of *Feronia limonia* leaf extract. American journal of plant sciences,2013a:4(11):2181.
10. Momin MAM, Bellah SF, Khan MR, Raju MIH, Rahman M M, Begum AA. Phytopharmacological evaluation of ethanolic extract of *Feronia limonia* leaves. America Journal of Scientific and Industrial Research Science,2013b:4(5):468-472.
11. Parial S, Jain DC, Joshi SB. Diuretic activity of the extracts of Limonia acidissima in rats. Rasayan J Chem,2009:2(1):53-56.
12. Praveen D, Ranadheer CP, Sajel S, Vijey AM. Muscle relaxant and antibacterial activity of leaf extracts of *Feronia limonia*. Journal of chemical and pharmaceutical research,2015:7(9):809-812.
13. Priya EM, Gothandam KM, Karthikeyan S. Antidiabetic activity of *Feronia limonia* and Artocarpus heterophyllus in streptozotocin induced diabetic rats, 2012.
14. Rahuman AA, Gopalakrishnan G, Ghouse BS, Arumugam S, Himalayan B. Effect of *Feronia limonia* on mosquito larvae. Fitoterapia,2000:71(5):553-555.
15. Saima Y, Das AK, Sarkar KK, Sen Sr AK, Sur P. An antitumor pectic polysaccharide from *Feronia limonia*. International Journal of Biological Macromolecules,2000:27(5):333-335.
16. Salvi LL. Major Tribes of Rajasthan and their economy. Int. Res. & Rev,2012:1(1):69-70.
17. Sebastian MK, Bhandari MM. Edible wild plants of the forest areas of Rajasthan, India. Journal of Economic and Taxonomic Botany,1990:14(3):689-694.
18. Senthilkumar A, Venkatesalu V. Chemical constituents, *in vitro* antioxidant and antimicrobial activities of essential oil from the fruit pulp of wood apple. Industrial crops and products,2013:46:66-72.
19. Shermin S, Aktar F, Ahsan M, Hasan CM. Antioxidant and Cytotoxic Activity of Limonia acidissima L. Dhaka University Journal of Pharmaceutical Sciences,2012:11(1):75-77.
20. Smita Khare SK, Prabhat Khare PK, Jain SK. Anti-inflammatory activity of ethanolic extract of *Feronia limonia* (L.) leaves, 2014.