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# Review Paper on Wood Apple

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***Abstract:*** ***Many Indian medicinal plants with remarkable healing properties remain underutilized, and the wood apple is one edible fruit among them. Various parts of the tree—including the leaves, bark, roots, fruits, and seeds—are widely used in Ayurvedic medicine to address chronic diarrhea, dysentery, peptic ulcers, and even as a laxative, among other conditions. In addition, numerous scientific investigations have confirmed its ethnomedicinal benefits by identifying an array of bioactive compounds with antihyperglycemic, antidiabetic, anticancer, antimicrobial, hepatoprotective, and other pharmacological activities. This review provides a detailed look at the nutritional content, phytochemistry, and both traditional and modern medicinal uses of the often-overlooked wood apple.***

***Keywords: Wood apple, ethno medicinal, phytochemicals, hepatoprotective, ayurvedic***

## I. INTRODUCTION

Wood apple, scientifically known as Feronia lemonia and a member of the Rutaceae family, is one of the most resilient fruits thriving in the semi-arid and arid regions of India. Although its unripe condition is marked by a distinct acidic taste, it develops a delightful flavor once it ripens (Das and Das, 2003) [1]. Native to South India and Sri Lanka, the wood apple is also widespread across the plains of southern Maharashtra, West Bengal, Uttar Pradesh, Chhattisgarh, and Madhya Pradesh. In English, it is known by several names, including wood-apple, elephant-apple, monkey fruit, curd fruit, and kathbel. Often grown as a border plant, the tree is regularly found in jungles rather than in commercial orchards. Its versatility makes it suitable for wastelands, roadsides, field edges, and occasionally orchards, as noted by Veeraraghavathatham et al. (1996) [2]. Remarkably hardy, the tree withstands drought and high salinity and flourishes best in deep, well-draining soils typical of dry forests.

The fruits are generally round to oval, measuring between 5 and 12.5 cm in diameter, and are encased in a tough, woody, greyish-white rind about 6 mm thick. Weighing between 150 and 500 grams each, the pulp makes up roughly 36% of the fruit's total weight. There are two variations of wood apple: a larger, sweeter type and a smaller, less sweet one. The pulp is brown, mealy, with a characteristic odorous, resinous, astringent texture that can be acidic or mildly sweet, interspersed with numerous small white seeds. These seeds are notable for containing a non-bitter oil rich in unsaturated fatty acids (Singh et al., 2009) [3]. In its unripe form, the pulp has a pale golden hue, but as it matures, the initially greenish-white shell transforms into a tough, brown, bark-like rind dotted with speckles. Ripe fruits exude a sugary yet musky aroma and display a color range from light brown to toffee brown. Additionally, wood apple pulp has an impressive shelf life, remaining fresh for up to two months when refrigerated. The fruit's market appeal is largely determined by its physical and chemical properties as well as its nutritional content (Shyamala Devi and Kulkarni, 2018) [4].Beyond its culinary appeal, wood apple holds significant medicinal potential, with every part of the fruit recognized for its therapeutic properties. Fruit is widely recognized in India for its use as a liver and cardiac tonic, while in its unripe form it is employed to arrest diarrhea and dysentery and to treat hiccups, sore throat, and gum diseases (Kerkar et al., 2020) [5]. The pulp exhibits anti-inflammatory, antipyretic, and analgesic properties. Moreover, wood apple is endowed with antioxidant, anticancer, antidiabetic, antimicrobial, and hepatoprotective activities (Vidhya and Narain, 2011) [6].

Its exceptional flavor and nutritional value make the fruit highly promising for value addition, particularly in the beverage industry. The pulp can serve as a base for a variety of value-added products such as preserves, candies, sherbets, juices, chutneys, jams, jellies, and squashes. Wood apple beverages are known to produce a cooling sensation, much like those made with bael. Some people also consume the raw pulp, either plain or with sugar (Anuradha, 2005) [7].

Given that many wood apple products are still unfamiliar to consumers, there is a need for enhanced market introduction and for evaluating consumer acceptance as well as the economic feasibility of commercializing these products. Such efforts could not only boost the utilization of this nutritious, high-yield fruit but also foster the development of a wood apple processing industry (Chandana, 2016) [8].

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Fig: 1 Wood Apple

## II. OBJECTIVE

*1)* Pharmacogonistic study of the ingredients.
*2)* Collection of various types of herbal powders.
*3)* To formulate the pediatric jelly.
*4)* To evaluate the pediatric jelly.

### *A. Drugs*

Limonia acidissim
Synonym -Wood apple (Shri- lanka , Pakistan India )
Biological source -The drug consists of fruit of wood apple.
Family -Rutaceae
Chemical Constituents: Lignans, phenolic acids, quinones, alkaloids, triterpenoids and volatile oil.

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*B. Morphological Characteristics*

Colour: Greenish-Brown
Taste-sour
Size-5-10cm
Uses: Antidiarrheal, antioxidant, anti-hyperglycaemic, Appetite.

*C. Role in jelly*

More wood apple applied to the jelly resulted in a greater overall phenol concentration.
Contributing the flavor, texture and quality

*D. Nutritional Composition and Phytochemicals*

A range of bioactive compounds—including phenols, flavonoids, alkaloids, terpenoids, tannins, saponins, fat steroids, glycosides, gum mucilage, and fixed oil—have been identified in various extracts of the wood apple, contributing to its diverse pharmacological effects. Different parts of the plant such as the roots, fruits, bark, and leaves have been traditionally employed to treat ailments like diarrhea and dysentery. Fruits, in general, serve as vital sources of vitamins, minerals, carbohydrates, and proteins, which is why they are often referred to as protective foods (Srivastava and Kumar, 2002) [9].

Dietary and nutritional surveys reveal that many Indians suffer from deficiencies in vitamin A and vitamin C, as well as minerals such as calcium and iron, underscoring the importance of fruits in daily diets. Ripe wood apples offer a sour yet sweet, aromatic, and refreshing pulp that is highly prized in Ayurveda for its therapeutic benefits, including the treatment of liver disorders, diarrhea, and dysentery (Rao et al. [10]). The pulp comprises about 70% of the fruit's total weight, embedding seeds within it. Its composition includes approximately 70% moisture, 7.3% protein, 0.6% fat, 1.9% mineral matter, 2.3% acidity, 7.2% sugars, with trace amounts of iron (0.07%) and phosphorus (0.08%), and it is a rich source of riboflavin (77 mg per 100 g) and calcium (0.17%) (Chundawat, 1990) [11].

The fruit also contains various phytochemicals such as polyphenols, phytosterols, saponins, tannins, coumarins, and triterpenoids, as well as vitamins and amino acids. In the leaves, compounds like polyphenols, flavonoids (including imperatorin, bergapten, and xanthotoxin), alkaloids, steroids, and amino compounds have been reported to exhibit antimicrobial, anti-inflammatory, diuretic, antiasthma, and analgesic properties. Additionally, oil extracted from the wood apple has yielded 32 isolated compounds, with major constituents including methyl chavicol (27.2%), thymol (24.4%), trans-anethol (10.94%), p-cymen-7-ol (7.3%), and 1,4-dimethoxy-2-allylbenzene (Ahmad et al., 1989) [12].

## III. ETHNO MEDICINAL USES OF WOOD APPLE

The wood apple's significance stems from its remarkable curative attributes, making the tree one of India's most valuable medicinal resources. It is highly sought after in the traditional Ayurvedic system and is commonly prescribed for the treatment of various ailments (Khare, 2007) [13]. The plant exhibits a broad spectrum of biological activities, including adaptogenic and hepatoprotective effects, and is used to combat blood impurities, leucorrhoea, dyspepsia, and jaundice. In India, the fruit serves as a liver and cardiac tonic and is employed in the management of diarrhoea, dysentery, hiccups, sore throat, and gum diseases (Anitha et al., 2016) [14]. Often, it is used either on its own or in combination with Aegle marmalade and other medications to treat diarrhoea and dysentery (Panda, 2000) [15].

Moreover, the pulp mixed with cardamom, honey, and cumin seeds is used to alleviate indigestion, diarrhoea, piles, and even cirrhosis of the liver in malnourished children. Ripe pulp is also applied topically to relieve pain from venomous stings (Pullaiah, 2006). Additionally, traditional practices highlight its efficacy in treating asthma, tumours, and as a liver tonic (Pandey and Dravyaguna, 2001) [16]. Ayurveda further recommends its use for various ear-related conditions such as earache, putikarna, and karnsarva, with freshly collected lukewarm juice of kapittha (Feronia limonia), matulunga, or smgvera being specifically used to treat earache (Dash and Kashyap, 1984) [17].

*A. Fruit Medicinal Uses*

1) It is used to address certain heart conditions, alleviate sore throats, reduce chronic coughs, purify the blood, manage stone-related issues, help control diabetes, and serve as a tonic for the liver.
2) It is also effective in treating skin cancer, jaundice, and various gastropathies.
3) The ripe fruit pulp can be employed to relieve stomach ailments in children.

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*4)* The semi-ripe fruit is considered particularly effective for treating dysentery.
*5)* The crushed pulp is used as a remedy for diarrhea and piles.
*6)* Rich in carotene, it provides benefits for individuals with cataracts.
*7)* Wood apple juice helps regulate body temperature and offers protection against extreme heat during the summer.

*B. Traditional Uses*

*1)* The fruit's hard shell is crafted into snuffboxes and other small containers.
*2)* The rind yields an oil prized for its use as a hair fragrance and also produces a dye for coloring silks and calico.
*3)* Due to its soap-like properties, the pulp of the wood apple has been utilized as a household cleaner for centuries.
*4)* Boiling coconut oil with the fruit's outer shell creates a remedy used to treat dandruff.

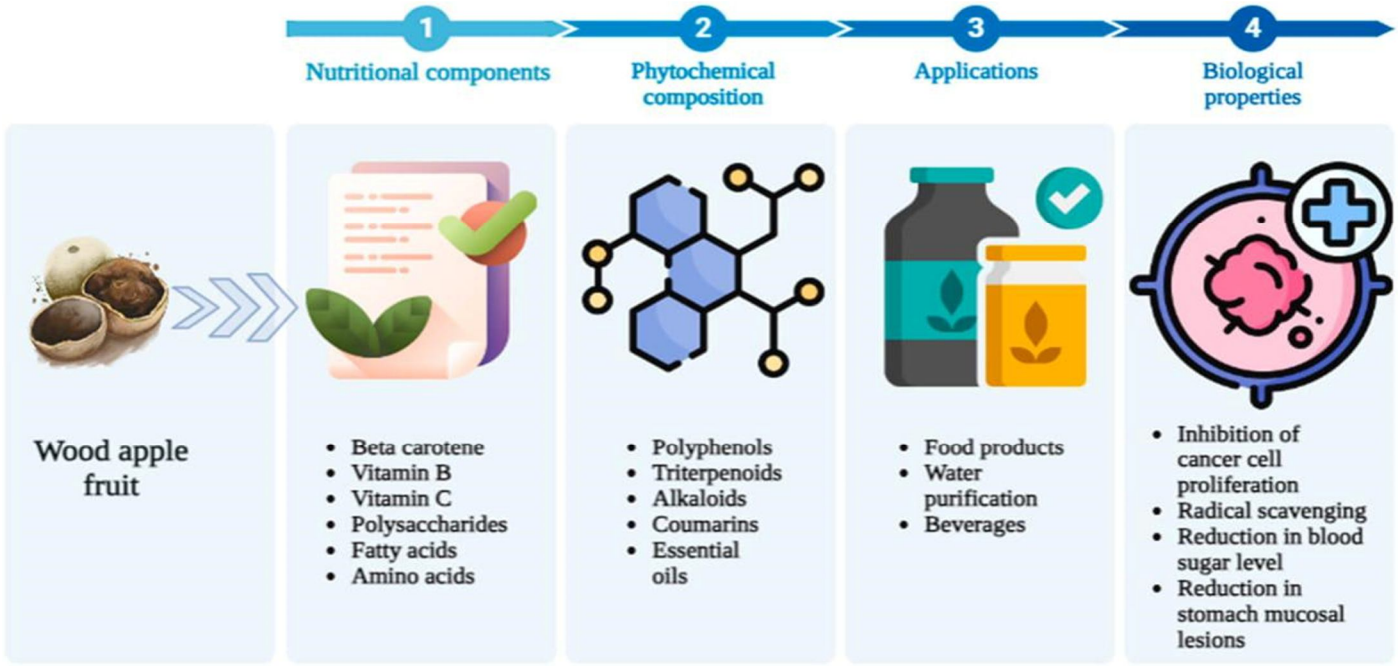
## IV. PHARMACOLOGICAL ACTIVITIES

*A. Analgesic Activity*

The analgesic study using acetic acid-induced writhing in mice revealed that methanol and acetone extracts of the wood apple fruit peel achieved 60.53% and 59.65% inhibition of writhing, respectively, compared to 78.07% inhibition by the standard drug Diclofenac [19].

For antidiarrheal activity, Semilunar et al. (2010) evaluated an aqueous bark extract and observed notable antidiarrheal effects, including reductions in both the average weight of feces and overall gastrointestinal motility (Senthilkumar et al., 2010). Likewise, using the Thomas method in castor oil-induced diarrhea, 500 mg/kg doses of methanol and acetone peel extracts showed inhibition rates of 47.13% and 44.83%, respectively [20].

Regarding appetite, the aromatic pulp of the wood apple contains 170 mg of riboflavin, 2 mg of vitamin C, and key minerals such as 0.17% calcium, 0.08% phosphorus, and 0.7% iron. Another study reported an average composition of 2.6 mg of vitamin, which helps improve digestion, prevents constipation, and boosts the immune system [21].




*B. Properties*

*1)* Mature fruit pulp is effective for alleviating stomach problems in children.
*2)* The half-ripe fruit is recognized as the most potent remedy for dysentery.
*3)* Mashed pulp is used to treat diarrhea or piles.
*4)* A mixture of 50 mg wood apple fruit juice, warm water, and sugar helps purify the blood and eliminate toxins.

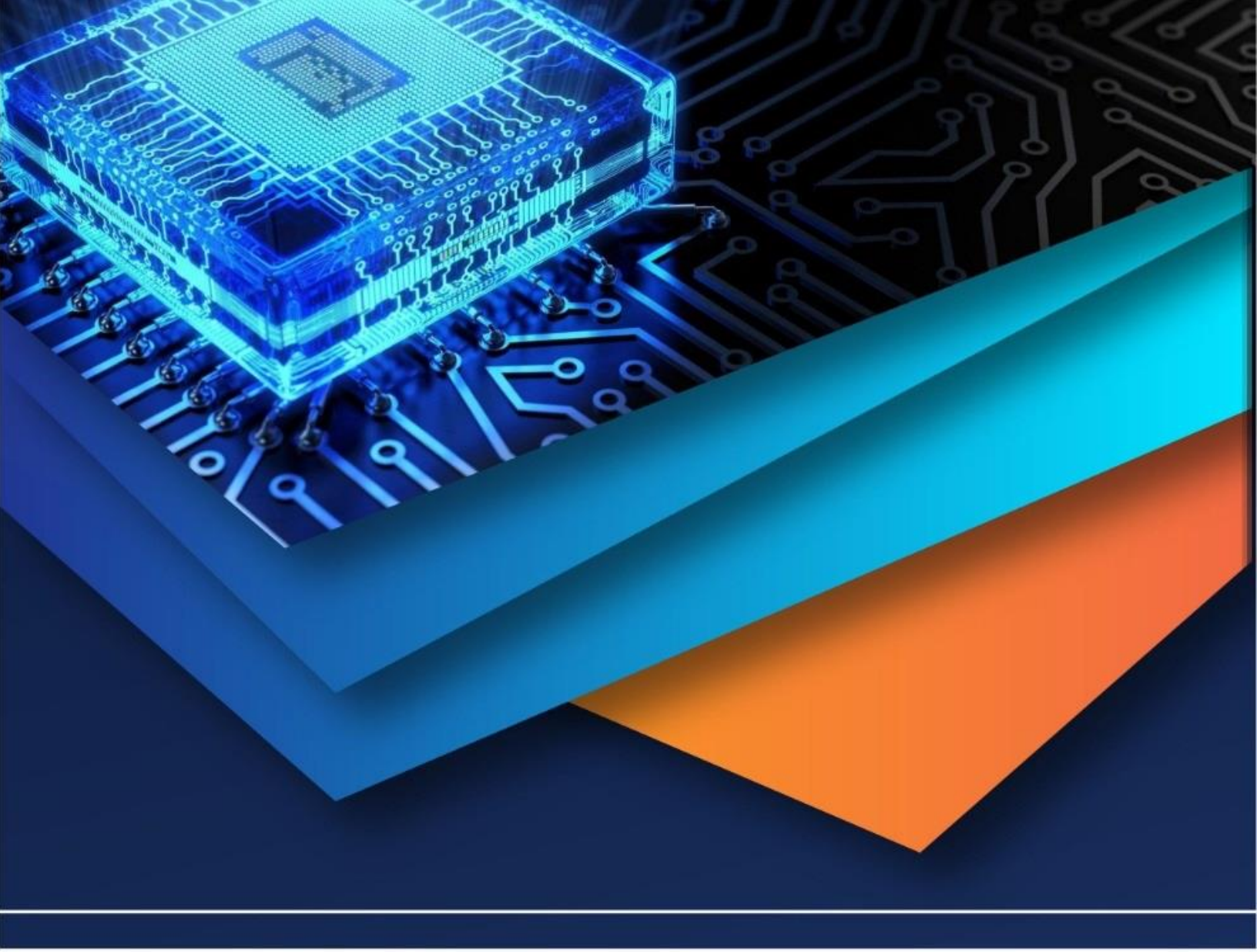
## V. CONCLUSION

Several published studies suggest that consuming wood apple may relieve a wide array of ailments. The fruit's diverse benefits and remarkable capabilities indicate significant potential for commercial processing into value-added products such as jams, jellies, sweets, savory chutneys, and juice. With proper focus, these products could successfully penetrate both national and international markets. However, currently, the fruit is employed only to a limited extent in product preparation. The review paper primarily highlights the nutritional, culinary, and medicinal properties of this underutilized fruit, while also outlining considerable opportunities for future research and further pharmacological investigation on wood apple.

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