Wood Apple: A Fruit Rich in Nutritional and Medicinal Values

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Abstract

Wood apple is native to India and Sri Lanka. The tree is primarily wild, naturally distributed in forest and rarely found as single tree in farmer's field. It is distributed in the dry deciduous and semi-arid regions of Southern India, states of Gujarat, Madhya Pradesh, Orissa, West Bengal, Assam and Andaman & Nicobar Islands. The productive age of plant is 12-70 years. The fruit is rarely grown commercially in India but has enormous potential to be a major fruit. Existence of diversity in phenotypic characters of trees and fruits and quality parameters in fruit pulp provides a lot of scope for improvement of the species. Fruits innumerable number contains an of phytochemicals such as polyphenols, vitamins, saponins, coumarins, amino acids, tri-terpenoids, phytosterols, tannins, etc. In Indian traditional system of medicine, leaves, bark, rind of the fruit and pulp are used to prepare medicine. It is known to cure diseases like dysentery, diarrhoea, asthma, ulcer, wounds, tumours, hepatitis, cardiac debility etc. The trees are in threat of becoming an endangered species, as the wild trees are being cut without replanting. To conserve the species, efforts should be initiated to plant the tree in roadsides, social and community forest areas. Awareness among people may be created for its conservation.

Keywords: Wood apple, Medicinal values, Nutritional properties

Introduction

Wood apple (*Limonia acidissima* L. = *Feronia limonia* (L.) Swingle), belonging to the family, Rutaceae is only species within the monotypic genus *Limonia*. Common names are wood apple, elephant-apple, curd fruit, Indian wood apple and monkey fruit. The tree is native to India and Sri Lanka. Outside, the species is grown in fields, forests and along roadsides in Bangladesh, Cambodia, Malaysia, Thailand, Indonesia, and Pakistan. The tree is primarily wild, naturally distributed in forest and have not been selected for commercial cultivation. Fruit is labelled in fresh markets, based on its size. Larger size fruits are the most common in markets as they are valued for their sweet taste. Smaller size fruits are acidic and sour, making them less desired for culinary preparations. The trees were found mostly as single tree in farmer's field, whereas, in the forest, the population are scattered. The productive age of plant is believed to be 12-70 years. The fruit is rarely grown commercially in India but has enormous potential to be a major fruit. As ethnic value, the fruit is a customary offering to Lord Ganesh in India. It is important to note that wood apple is sometimes confused with bael fruit and may be called bael in some markets, but the two fruits are different species and should not be considered the same.



Tree bearing wood apple fruits

Distribution

Throughout the dry deciduous and semi-arid regions of Southern India, wood apple is distributed. Mainly, it is found in North-Western part of Tamil Nadu, Eastern Ghats of Andhra Pradesh, Northern, Central, and Southern parts of Karnataka, Northern region of Telangana and Central region of Kerala. It is also found in the states of Madhya Pradesh, Gujarat, Orissa, West Bengal, Assam and Andaman & Nicobar Islands.

Propagation and planting

It is a climate resilient fruit crop and can tolerate extreme dry conditions during flowering and fruit set. At the same time, it can tolerate wet condition





during fruit set. Wood apple can be grown in fallow and barren waste land which is even devoid of essential elements as well. It is propagated by seeds or by soft wood grafting and patch budding. Buds taken from mature trees budded on seedlings are said to produce dwarf trees which fruit early. Planting is done in the rainy season at a spacing of 10m x 10m. Wood apple starts bearing at an age of 5-6 years.



Flowering and fruiting

Flowering stars in the month of March-April. Fruits are ready to harvest after 225 to 245 days after fruit setting. The fruits ripen from November to March, sometimes appearing later in the summer, depending on the region and growing environment. Ripe fruits drop from the trees, and as they have a hard shell outside, the inner pulp keeps well for some days. Pulp of immature fruit is cream in colour whereas, pulp of ripened fruit is chocolate brown or light brown or orange in colour. An average tree yields 250-500 fruits per year; bigger and more vigorous trees may yield more. Each fruit weighs about 150-500 g.

Training and pruning

Wood apple is not trained at its natural habitat. Cross branches should be removed during initial 2-3 years. Also, lanky and spreading branches are trained and staked properly. Normally pruning is done in the month of December to January.

Pest and diseases

1. Fruit borer (*Deudorix isocrates***):** Caterpillar bores into young fruits and feeds on internal contents (pulp and seeds) leads to fruit rotting and dropping. Larvae is dark brown, short and stout, covered with short hairs. Adult is bluish brown butterfly, female has 'V' shaped patch on forewing.

2. Citrus butterfly (*Papilio demolious***):** Caterpillar feed on the leaves causes defoliation. Early-stage larva resembles bird dropping. Grown up larva is



cylindrical, stout, green with brown lateral bond. Adult looks dark brown swallowtail butterfly with numerous yellow marking.

3. Leaf cutter bee (*Megachile* **sp.):** Adult bees cut the tender leaves and causes semi-circular notches.

After harvest, oozes and eruptions at fruit stalk-fruit joining region, reduces the consumers preference. Besides, monkeys, squirrels and elephants damage the fruits, in its natural habitat.

Genetic improvement

Parameters consisting of tree height, age, stem girth, length, and breadth of branches in all the directions, canopy coverage, number of fruits per plant in a year, fruiting period, fruit weight, size, shape, pulp taste and colour are considered for the selection of trees to improve the species. Besides thorny and non-thorny variants are available in nature. ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru, Karnataka, Tamil Nadu Agricultural University-Horticultural College and Research Institute (HC&RI), Periyakulam, TNAU-



Regional Research Station (RRS), Aruppukottai, Tamil Nadu and Central Horticultural Experiment Station (CIAH), Godhra, Gujarat are working in this line to improve the wood apple. ICAR-NBPGR is collecting variable resources of this species across the country and depositing at cryopreservation unit. It also shares accessions to institutes working for the improvement of the species.

Nutritional properties

Wood apple is known to possess excellent amount of nutrients. Fruits contain an innumerable number of phytochemicals such as polyphenols, vitamins (A, B1, B2 and C), saponins, coumarins, amino acids, tri-terpenoids, phytosterols, tannins, tyramine derivatives, etc. The fruit is an enormous source of antioxidants and has potential to scavenge free radicals in human body. The fruit has 55-58% edible part, which contains 74% moisture, 8% proteins, 1.5% fat, 1.9% minerals, 5.2% fibre, 7.5% carbohydrates, 170 mg/ 100g riboflavin, 2 mg/100 g vitamin C, 0.13% calcium and 0.11% phosphorus. The seeds contain non-bitter oil high in unsaturated fatty acids.

Medicinal properties

In Indian traditional system of medicine, wood apple is known to cure diseases like dysentery, diarrhoea, asthma, ulcer, wounds, tumours, hepatitis and cardiac debility. Both ripe and unripe fruit is known to possess excellent medicinal properties. Ripe fruit is known to cure liver problems and is good for heart. It has good cholesterol lowering potential as well. Unripe fruit is having enormous potential to cure diarrhoea and dysentery. Ripe fruit consumption can reduce problems and cure in longer run the problems associated with gums and teeth, hiccough, sore throat and diseases of the gums. Ripe fruit, leaves, stem, bark and root have anti-venomous capability against snake bite. The essential oils which are extracted from fruits and seeds are effective against bacteria causing human disease. Fruit pulp is also known to possess antipyretic, anti-inflammatory and analgesic activity. The pulp of wood apple when used for the preparation of face cream can remove lesions and small spots from the skin. Fruits are also known to be larvicidal property and can kill insect larvae. Wood-apple is

believed to be hepato-protectant with some adaptogenic activity like cleansing of blood impurities, leucorrhoea, dyspepsia and jaundice. Acidic hetero-polysaccharide extract of wood apple fruit surprisingly exhibited cell growth inhibition of *in-vivo* carcinoma. Wood apple fruits and seeds are also known to be anti-diabetic.

The leaves and bark have medicinal values. It is antiscorbutic. It is an antidote for poisons and helps in curing sore throat. After the rains, the trunk and branches give off a gum called' Feronia gum', which counteracts diarrhoea, dysentery and diabetes. Even



Composition of wood apple

juice extracted from young leaves of wood-apple when consumed solely or with milk can cure intestinal problems associated with worms. It is also good against piles.

The pulp and rind are poulticed onto bites and stings of venomous insects. Leaves, bark, roots and fruit pulp are used against snakebite. The spines are crushed with those of other trees and an infusion taken as a remedy for menorrhagia. The bark is crushed with that of Barringtonia and applied on venomous wounds.

Post-harvest processing and other applications

Wood apple is consumed in fresh or processed to make jam, jelly and squash or incorporated into Ayurvedic practices as a natural medicine. The fruit have a complex sweet, sour, musky, and fermented flavour. The hard shell must be cracked open before consumption. Once opened, the pulp can be consumed straight. or sprinkled with sugar for a sweeter flavour. Wood apples are a culinary



ingredient in select regions of India and Sri Lanka, and the fruits are added to chutney, sauces, and salad dressings. In India, it is frequently added to rasam, a soup-like dish and pachadi, a fresh pickle side dish. The flesh is popularly mixed with coconut milk and palm sugar to create a sweet, slightly acidic beverage, a favourite drink during summer. The pectin content of the pulp is 3 to 5% (16% on the basis of dry weight) and forms an excellent material for making jelly. The jelly is purple and much similar to that made from black currants. Pulp is also used to flavour smoothies and shakes, blended into ice-cream, or cooked with coconut milk or palm syrup for sweet desserts. In rural villages, immature wood-apple is sometimes sliced thin and dipped into a sauce of shrimp paste, shallots, spices, and chilli peppers. Wood apple pair well with citruses such as limes, calamondins, oranges, and lemons, aromatics such as chilli peppers, onions, garlic, and tamarind, and spices including cardamom, curry leaves, and mustard seed. Whole, unopened wood apple can be kept at room temperature for up to ten days until mature. Once ripe, the fruits should be stored in the refrigerator for 1 to 2 months. Opened fruit pulp should be eaten immediately for the best quality, or it can be frozen in a mixture of lemon juice for up to six months.

Threats and way overcome

Wood apple trees are found mostly in forest as wild and rarely in farmer's field. The trees are in threat of becoming an endangered species, as the wild trees are being cut without replanting, and the fruits are being foraged unsustainably for sale in markets. In order to conserve the species, efforts should be initiated to plant the tree in roadsides, social & community forest areas, public parks, botanical gardens, zoo and in educational institutes. Further, awareness among people may be created for its conservation.



Pulp colour in matured wood apple fruit

Summary

Wood apple trees are found naturally in scattered manner in the forest of dry deciduous and semi-arid regions of India. The fruit has enormous potential to be a major fruit. Existence of diversity in wood apple provides a lot of scope for the improvement of this species. Fruits contains number of phytochemicals. Leaves, bark, rind of the fruit and pulp are used in Indian traditional system of medicine to cure diseases like dysentery, diarrhoea, asthma, ulcer, wounds, tumours, hepatitis, cardiac debility etc. The species is in the edge of becoming an endangered species as the wild trees are being cut without replanting. Therefore, serious efforts should be initiated to plant the tree in roadsides, social and community forest areas. Also, awareness among people may be created for conservation of this species.

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