A Concise Review on God’s Fruit “Bilva” (Aegel Marmelos)

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Abstract: Aegle marmelos (Bael or Bel) considered as most sacrad tree in Hindu culture commonly known as God’s fruit or Shri Phala belongs to the family rataceae. In Ayurveda it is used solely or in different medicinal preparations as an ingredient, proven its immense medicinal potential. All the major ayurvedic texts including Nighantus (Ancient ayurvedic herbal pharmacopoeia) mentioned medicinal value of this plant. Now scientists try to re establish all the qualities of Aegle marmelos on modern parameters as said by ayurveda. This results extraction of several chemical constituents from this plant and various therapeutic effects of A. marmelos also have been reported by researchers. Common medicinal properties of Aegle marmelos are anti-diabetic, antiallergic, anti-oxidant, anti-malarial, anti-inflammatory, anti-cancer, radioprotective, anti-hyperlipidaemic, anti-fungal, anti-bacterial and anti-viral activities. In this presented review summarizes the medicinal property described by Ayurveda and its relevant modern co-relation based on different scientific works

Keywords: Aegle marmelos, bael, sacrad tree, Ayurveda, medicinal property.

Introduction

“Bael or Bilva tree” is a sacred tree to Hindus since vedic time. All the ancient Ayurveda scholars mainly Charaka, Sushruta and Vagbhata described its immense medicinal values. In ayurveda the leaves, bark, roots, fruits and seeds are extensively used in the preparation of different medicine. Alternative medicines other than ayurveda like Unani, Siddha, Chineese medicinal system gave this plant same importance. Aegle marmelos is native to Bangladesh and India. Its fruits are used as a food throughout its range. Apart from medicinal use, the plant and its leaves and fruit are of deep religious importance[1]. In Hinduism, the leaves and fruit of the plant are being offered to Gods specially lord Shiva by Keeping the leaves(Bilwa patra) on Shivlinga it is considered very auspicious and to get the blessings of Shiva[2]. The Bael leaves are also used to worship Lord Ganesha. The tree is of medium sized hard and contains yellowish or greenish fruit with soft pulp inside which is used as fruit and medicine in Indian subcontinent.

The Bael fruit used in Ayurvedic medicine to cure Vata and Kapha disturbances in the body[3]. Half ripe fruits having better medicinal values than fully ripened fruit so they are mostly used in medicine. Ripened fruit pulp is used to prepare different dishes like murabba, puddings and juice. Unripe bael fruits are also used in the treatment of chronic diarrhea, dysentery, peptic ulcers, as a laxative and in respiratory diseases

Ethnomedicinal scientific studies[4] have revalidated many of the traditional medicinal uses of this plant on the ground of modern parameters. These studies suggest that the fruit, leaves, seeds, root and bark of this plant possesses broad range of therapeutic effects that includes anti-diabetic, antiulcer, antioxidant, anti-malarial, anti-inflammatory, anticancer, radioprotective, antihyperlipidaemic, anti-fungal, anti-bacterial, antiviral, anti-diarrheal, gastroprotective, hepatoprotective and cardioprotective activities. This review critically assesses the medicinal properties of Aegle marmelos (Bael) on the basis of different preclinical scientific studies.

Morphology

A medium sized armed deciduous tree upto 8.0 m height with straight sharp axillary spines and yellowish brown shollowly furrowed corky bark. The yellow spines are found near the axis of the leaves in single pairs. The stem bark is grayish and soft. The branches have hairs. The leaves are divided into three lance like leaflets (appears like clove leaf). The leaflets are smooth, brittle and emits lemony odor when crushed. The flowers are sweet scented, fleshy, and creamish-white. The flowers are arranged in branched clusters at the axis of the leaf. The fruit is a woody berry. The berry is egg shaped with a beak near the attachment of the fruiting stalk. It has greenish gray to yellowish-green woody rind, which encloses yellow-orange pulp. The fruit pulp is sticky and tastes sweet and astringent. Fruits globose, woody berry, the berry is egg shaped with a beak near the attachment of the fruiting stalk. It has
greenish gray to yellowish-green woody rind, which encloses yellow-orange pulp. The fruit pulp is sticky and tastes sweet and astringent. It contains yellowish, rind seeds numerous oblong, compressed, embedded in orange brown sweet gummy pulp. Leaves trifoliolate, alternate, aromatic potin 2.5-6.5 cm long. Leaflets ovate or ovate lancedate, Crenate, Pel lucid punctate, the latter opposite, sub sessile, the terminal long, Petioluted. The leaves are divided into three lance like leaflets (appears like clove leaf). The leaflets are smooth, brittle and emits lemony odour when crushed[5].

**Habitat**

The tree is found in deciduous forests, and often planted in temple premises and garden.

**Distribution:**

1.1. India
Common throughout country, occurring from Sub Himalayas tract upto 1200m, from Jhelm eastwards; Central (Madhya Pradesh) and Southern India (Andhra Pradesh, Kerala, Karnataka, Maharashtra, Tamilnadu). Limited to dry and moist deciduous forests of Eastern Ghats and Western Ghats of the Peninsular India. Also cultivated in various places in India.

1.2. Global
Occurs in the Indo Malesian region.

**Part Used**
Pulp, Fruit, Root, Bark, Leaf

**2. Chemical Composition:**

2.1. Leaf
Leaves contain - 8 - Marmelosin (Imperatorin) Alkaloids, Sterols, Coumarin, aegelin , Marmelin, methylhayordinol, Alloimperatorin methyl ether, isopentany1 -hayordinol,Aegelenine aegelenine, a minor alkaloid, Lupeol, Rutin, Marmesinin and essential oil, consisting of a & b-phellandrene leaves contain 0.6% of essential oil mostly compound of d-limonone[6-8].

2.2. Bark
Bark contain Marmin from bark etc.

2.3. Fruit
Fruit contains coumarins Marmesin, Imperatorin, Xanthotoxol, Scoparone, scopoletin, Umbelliferone, Skimmin, Psoralen and Marmelide, Alkaloids- Aegelenine, Marmeline, Dictamine, O-methylhalfordinol, O-isopentenylhalfordinol, Pectin, alpha and B-amyrin, B-sitosterol, polysaccharide[6-8].

2.4. Heart Wood

Heart wood - Dictamine a ferroquine alkalod, coumarin – marmasin, Aurapten Aegelinol, alkaloid Fagarine, halfordinol, Halopine, coumarin Imperatorin, Marmelide, Scoparol, Sco poletin, Acetic acid etc[6-8].

2.5. Major active Constituents

Marmelosin

**Medicinal qualities of Aegle marmelos**

2.6. Antidiabetic

Aegle marmelos is very good antidiabetic. This antidiabetic effect of Aegle marmelos probably due to the presence of Coumarins in various parts of this plant, which potenti ate the insulin secretion from existing beta cells of the isles of langerhans [9].

2.7. Antiulcer

Aegle marmelos take part in number of ayurvedic preparations used in acidity. This activity may be due to the compound Luvangetin present in the plant which inhibits oxidative stress in the gastro duodenal mucosa which is the major cause of ulceration [10-11].

2.8. Antioxidant

Bilva is very good Rasayana (Rejuvenating) action as described in ayurveda this may be due to its potent antioxidant action. Eugenol and Marmesinin are probably responsible for such activity because these compounds are very good in reducing oxidative stress[12].

2.9. Antimalarial

The seeds of Aegle marmelos possess some sort of antimalarial activity which probably due to same alkaloids present in this plant which exhibit schizontocidal activity in vitro and in vivo[13].

2.10. Anti-Inflammatory

Bael is integral part of most famous anti-inflammatory ayurvedic medicine “Dashmoolaa”. The possible reason behind this activities may be due to the presence of Lupeol and Skimmianine in this plant[14] which inhibits H1-receptor activity[15]. Other possible reason is presence of some anti-inflammatory and anti-allergic constituents, such as Citral along with Lupeol which act through inhibition of histamine mediated signaling [16].

2.11. Anticancer

Now a days extensive work has been going on anticancer effect of Aegle marmelos. This property mainly due to the presence of Skimmianine in the Bael plant which Induce apoptosis in tumor cells which ultimately killed these cell [17].

2.12. Radio Protective

Aegle marmelos leaves exhibit significant radio protective action in experimental animal models. The mechanism of this type of radio protective activity may be due to the free radicals scavenging activity of
Aegle marmelos which are produced by radiation [18-19].

2.13. Antihyperlipidaemic
Aegle marmelos used as major anti-obesity medicine in Ayurveda. Ethnopharmacological studies showed that it potentiates glucose utilization in body. The higher level of fatty acid and their metabolites such as acyl carnitine and long chain acyl CoA usually interfere with NA+/K+ATPase activity level resulting in hypolipidaemia [20].

2.14. Antifungal
Aegle marmelos exhibit very good antifungal effect. The germination of any spore (that is bacterial or fungal) requires Ca+2 dipicolonate and/or free Ca+2 ions availability in the medium as well as within cytoplasm of microbes. This Ca+2 ion uptake and utilization by spore is one of the key factors that determine whether the spore will germinate or remain dormant [21]. The essential oil from the Bael leaves may interfere with the Ca+2 dipicolonic acid metabolism pathway and possibly inhibit spore germination. This may be the possible mechanism of the protective role of Bael plant against fungal infection [22].

2.15. Antibacterial
Bael also show significant antibacterial this may be due to the presence of Cuminaldehyde and Eugenol because these compounds probably block of protein synthesis either at transcription or translation level and for peptide-glycan synthesis at membrane level in various bacterial strains [23].

2.16. Antiviral Activities
In ayurveda Aegle marmelos used in most of the viral related infections. This action mainly due to the presence of Marmelide which has interferes with early events of its replicative cycle [24] with minimum host cytotoxicity in contrast to modern virucidal chemotherapeutic agents, which usually act in the later stages of viral replication and have potent side effect [25].

2.17. Antihyperthyroid Activity
A marmelos exhibit some sort of antihyperthyroid action. It mainly decreases T3 concentration indicating its possible use in the regulation of hyperthyroidism [26].

2.18. Cardio protective Activity
In Ayurveda bael is frequently used for heart diseases, probably because it contains Aurapten which was the most potent inhibitor the which is comparable with that of Verapamil, a calcium antagonist. Also significantly reduced the ratio of morphologically changed myocardial cells which originated from calcium overload caused by successive treatment with calcium containing solutions in animal models [27].

2.19. Insecticidal Activity
Mild Insecticidal activity of Aegle marmelos probably due to the presence of Skimmiarepin C and Skimmiarepin A so that it is important ingredient of most of the ayurvedic insecticidal preparations [28].

3. Conclusions
Aegle marmelos (Bael) is a prime sacred plant since vedic period. Our ancient scholars and saints were well aware about its medicinal and spiritual qualities. Aegle marmelos (Bael) is integral part of several hindu rituals mostly it is used to praise lord shiva. Ayurvedic and other medical system confidently used this plant in several medicinal preparation showed its immense therapeutic values. It is used in inflammation, diabetes and different gastric, liver, skin, cardiac disorders in Ayurveda. A number of ethnopharmacological studies showed that, it contains number of bioactive chemical which exhibit antidiabetic, antiulcer, antioxidant, antiinflammatory, anticancer, radioprotective, antihyperlipidaemic, antifungal, antibacterial, antiviral and insecticidal activities. It is also useful in different liver, skin and cardiac disorders. Unfortunately, most of the bioactive ingredients are unexplored and there is only limited knowledge of mechanisms of action of bioactive compounds present in Aegle marmelos (Bael). Hence, extensive preclinical and clinical studies are required to find out the mechanisms of action and bioactivity of the various phytochemicals to reestablish the traditional therapeutic potential on scientific ground to serve the mankind with this sacred God’s fruit.

References


