

Review Article (Open access)

A Review on Medicinal Values and Commercial Utility of Bael

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ABSTRACT- Bael (*Aegle marmelos*) fruit is one of the blessings from nature for the mankind which is packed with enormous medicinal advantages. Its medicinal properties have been described in the ancient medical treatise in Sanskrit, Charaka Samhita. All parts of this tree from stem, bark, root; leaves and fruit at all stages of maturity have medicinal value and have been used as medicine for a long time. Many antioxidant compounds such as flavonoids, flavones, isoflavones, coumarin, anthocyanin, lignans, catechins and isocatechins are found in the fruit pulp (Maity and Hansda, 2009). This plant has tremendous uses listed in Ayurvedic and Unani and Siddha Systems of medicine. This plant is having great potential to cure the disease like diabetes, cholesterol, peptic ulcer, inflammation, diarrhoea, and dysentery, anticancer, cardio protective, anti bacterial, anti fungal, radio protective, anti pyretic, analgesic, constipation, respiratory infection, antioxidant, hepatoprotective, wound healing and many more. The present review summarizes the scientific information of various aspects of *Aegle marmelos* plant used in traditional system of medicine for variety of purpose and its commercial importance.

Key Words: Bael, Medicine, Antioxidants, Flavonoids, Lignans, Catechins

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INTRODUCTION

Bael, *Aegle marmelos*, a plant of Indian origin having tremendous therapeutic potential and it is belong to family Rutaceae, it is known by the several other names in the different parts of the country and also outside of the country (Sharma *et al.* 2007). In India, the plant is widely cultivated particularly in Uttar Pradesh and Bihar. So far around fifteen distinct cultivars, viz., Basti No. 1, Kagzi Gonda, Gonda No. 1, Gonda No. 2, Gonda No. 3, Kagzi Etawah, Sewan Large, Mirzapuri, Deorya Large, Chakaiya, Baghel, Lamba, Pant Shivani and Pant Urvashi have been reported. It is called by different names over different parts of India such as bilva, bel, sadaphal and shripthal. It is used in the worship of Lord Shiva from historic times and hence commonly known as tree of Shiva. Tree is slow-growing and of medium size (12-15 m), generally cultivated in the vicinity of temple garden. It also vigorously grows in dry forest. Almost every part of this tree viz. stems, barks, roots, leaves, flowers & fruits at all stages of maturity have medicinal virtues and have been used in various Ayurvedic medicines since long time for the

treatment of specific disorders such as respiratory disorders, constipation, ulcer, diarrhea, dysentery and many others (Agarwal, 1997). It is also an important environmental protector as leaves and bark act as a sink by absorbing dust and foul and poisonous gases from surrounding atmosphere and makes them clean. Owing to its environment friendly nature, *bael* is being placed among plant species group called "climate purifiers" which emit a greater percentage of oxygen in sunlight as compared to other plants (Anurag *et al.*, 2004). Due to its endless uses, *bael* is also known as *Mahaphala* or Great fruit (Parichha, 2004).

Nutritional value

Different studies have shown that bael fruit has significant mineral and vitamin contents. It also contain moisture 64.2%, protein 1.8%, fat 0.2%, mineral 1.5%, fibre 2.2%, carbohydrate 31.8%, calcium 0.06%, phosphorous 0.05%, potassium 0.6%, vitamin C 0.01%, riboflavin 1.2%, nicotinic acid 0.9%, thiamin 0.01% and iron 0.3% per 100 gm (Rathore, 2009). Its calorific value is 137 (Panda, 2000).

Medicinal Value

Diarrhoea and dysentery

Generally dried fruit pulp and its powder are used for the treatment of diarrhoea. The dried powder is also used as an important remedy for chronic dysentery conditions characterized by alternate diarrhoea and constipation (Sharma *et al.*, 2007).

Antidiabetic activity

It has been found that bael extract significantly reduces blood urea and cholesterol level in diabetic animals. It also decreases oxidative stress in

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diabetic animal. Leaf juice is directly employed in Unani system of medicine for antidiabetic activity (Akhtar *et al.*, 2005).

Cardioprotective activity

The protective effect was estimated by administration of leaf extract in isoprenaline induced myocardial infarction in experimental animal (Prience and Rajadurai, 2005).

Anticancer activity

Studies showed that Indian bael extract possess significant antiproliferative effect. It inhibits *in vitro* proliferation of human tumor cell lines including the leukemic K562 and Tlymphoid Jurhat (Lampronti *et al.*, 2003).

Leucoderma

Psoralen present in the pulp of *Aegle marmelos*, increases tolerance of sunlight which aids in the maintenance of normal skin color and thus, it is employed in the treatment of leucoderma (Gupta *et al.*, 2006).

Eye infections

The leaves of *Aegle marmelos* are considered an effective treatment for ophthalmia and various eye inflammations such as conjunctivitis (Sharma *et al.*, 2010).

Constipation

The riped bael fruit act as good laxative. It promotes peristaltic movements and thus helpful in the removal of fecal matter (Roy and Singh, 1980).

Peptic ulcer

Bael fruit and leaf infusion has been used for the treatment of peptic ulcer. One of the important advantages of this fruit is that it forms a mucilaginous layer on the gastric mucosa and thus prevents interaction of acid with mucosal layer (Goel *et al.*, 2000).

Antiburn and Radioprotective

Bael fruit powder mixed with mustard oil is used externally for the treatment of burn. It was found in various studies that due to free scavenging activity, bael fruits have radio protective effect (Kruawan and Kangsadalampai, 2006).

Ear Problems

The root of this tree possesses astringent activity and is used as a home remedy for curing ear problems. The astringent extract of the roots of *Aegle marmelos* combined with the antiseptic properties of neem helps in curing ear infection, chronic inflammation and pus discharge. The juice of leaves processed in oil is also used as ear drops to treat ear infection (Rusia and Srivastav, 1988).

Antifungal and antibacterial

The unsaponifiable matter from the oil obtained from the seeds of *Aegle marmelos* was effective as antifungal and antibacterial agent (Benerjee *et al.*, 1983).

Miscellaneous Properties

Bael tree is a holy tree and it has several medicinal properties, some of their practical applications are still under evaluation. Apart from the activity listed above there is little more important activity. The leaves of *Aegle marmelos* are useful in the treatment of the jaundice and leucoroea, conjunctivitis and defenses. Fruits give energy and nutrition. It is used in the carminative and astringent and also a good remedy for snake bite. Application are also reported in anemia, fractures, typhoid, coma, colitis (Sharma *et al.*, 2007). The methanolic extract of *Aegle marmelos* gives the anxiolytic and antidepressant effect (Kothari *et al.*, 2010).

General uses

Wood is used in house building, cart construction, combs and different household's articles, leaves as fodder, tooth brushes and chew sticks, flowers used in cooling drinks, stem gum used for adhesive and book binding, a yellow dye obtained from rind of unripe fruit is used in printing and whole tree is used as wind barrier.

Processed product

A large number of bael processed products have been prepared. Preserve and candy are prepared from mature (tender green fruit), fruit squash, fruit pulp, dehydrated bael, Ready to serve (RTS) drink, bael powder, jam, slab, toffee and panjiri are other product prepared from bael fruit.

Phytochemicals

It was found that leaves, stem and root of this plant contains significant amount of tannins, alkaloids, coumarins and steroids. Different phytochemicals are listed in Table 1.

Table 1: Phytochemicals present in different parts of *Aegle marmelos*

Plant part	Phytochemicals
Leaf	Skimmianine, Aeglin, Rutin, γ -sitosterole, β -sitosterol, Flavone, Lupeol, Cineol, Citral, Glycoside, O-isopentenyl, Hallordiol, Mameline, Citronellal, Cuuminaldehyde phenylethyle cinnamamides, Eugenol, Marmesinin, Aegelin, Glycoside
Fruit	Marmelosin, Luvangetin, Aurapten, Psoralen, Marmelide, Tannin, Phenol
Bark	Fagarine, Marmin, Furoquinoline, Alkaloids
Seed	Essential oil – D- limonene, A-D-phellandrene, Cineol, Citronellal, Citral, P-cyrnene, Cumin aldehyde
Root	Alkaloid, Halopine, Coumarins, Terpinens.

Marketed formulation of *Aegle marmelos*

Some of the marketed formulations of *Aegle marmelos* produced by different companies in tablets, capsules, syrups, etc. are listed in Table 2.

Table 2: Marketed formulation of *Aegle marmelos*

Marketed formulations	Company Name
Chyawanprash	Himalaya
Aegle Marmelos Capsules	La-Medicca (India) Pvt. Limited
Leucare capsules	Shrey Nutraceuticals & Herbals
Entrostat Syrup	Ambika Medico
Kof-Rid Syrup	Ambika Medico
Pregeight	Sydler Remedies Pvt. Ltd.
Ojamin	Tates Remedies
Manasamithravatakram	Oushadhi
Pushyanugam gulika	Oushadhi
Vilwadi gulika	Oushadhi
Glucomap	Maharishi Ayurveda
Ulco Bliss Tablets	Bliss ayurveda
Capsule Bilv Giri	Ayurvedic Sanjivani
R-Qunol Syrup	Vatsal Ayurvedic Products (P) ltd

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