

THE PHARMA INNOVATION

Recent Trends in Medicinal Uses and Health Benefits of Indian Traditional Herbs *Aegle Marmelos*

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Nature produces several food items for every season. Their use in that particular season proves to be highly beneficial for our body and the entire state of health. Bael fruit is one such blessing from nature for the mankind which is packed with enormous medicinal advantages. The Bael (*Aegle marmelos*) is one of the most useful medicinal plants of India. Its medicinal properties have been described in the ancient medical treatise in Sanskrit, Charaka Samhita. All parts of this tree—stem, bark, root, leaves and fruit at all stages of maturity—have medicinal virtues and have been used as medicine for a long time. The fruit's medicinal value is very high when it just begins to ripen. The fruit is aromatic, cooling and laxative. It arrests secretion or bleeding. The unripe or half-ripe fruit is good for digestion. It is useful in preventing or curing scurvy. It also strengthens the stomach and promotes its action. In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. Over the last few years, researchers have aimed at identifying and validating plant derived substances for the treatment of various diseases. Similarly it has been already proved that various parts of plants such as Leaves, fruits, seeds etc. provide health and nutrition promoting compounds in human diet. Bael fruit is popularly used in diarrhea, dysentery and GI disorders and has digestive and carminative properties. It helps in the healing of ulcerated intestinal surfaces. It possesses anti-viral, anthelmintic and anti-inflammatory properties and has appreciable activity against intestinal pathogenic organisms.

Keyword: *Aegle Marmelos*, Medicinal Uses and Health Benefits

1. Introduction

‘Bael tree’ is native to India and a sacred plant to Hindus. It has got immense medicinal values. All the parts of the plant are useful and used in Ayurvedic medicines. Hindus use the leaves to worship Lord Shiva (Bilwa patra) and keep them on Shivling and they consider it is very auspicious and to get the blessings of Shiva. The Bael leaves are also used on Vinayakachavithi festival to worship Lord Ganesha. The plant is of medium sized hard and the fruits are yellowish or green with soft pulp inside of medicinal value.

The Bael fruit is bitter in taste and used in Ayurvedic medicine to cure Vatha and Kaphay disturbances in the body. The fully ripened fruit is not much used in medicines. Half ripe fruits are mostly used in medicine. *Aegle marmelos*, a plant indigenous to India has been used by the inhabitants of the Indian subcontinent for over 5000 years. The leaves, bark, roots, fruits and seeds are used extensively in the Indian traditional system of medicine the Ayurveda and in various folk medicine to treat myriad ailments.

1.1 Biological Sources

Scientific classification	
Kingdom:	Plantae
(unranked):	Angiosperms
(unranked):	Eudicots
(unranked):	Rosids
Order:	Sapindales
Family:	Rutaceae
Subfamily:	Aurantioideae
Tribe:	Clauseneae
Genus:	<i>Aegle</i> Corrêa
Species:	<i>A. marmelos</i>
Binomial name	
<i>Aegle</i>	<i>marmelos</i>
(L.) Corr.Serr.	

Bael are also used in the treatment of chronic diarrhea, dysentery, and peptic ulcers, as a laxative and to recuperate from respiratory affections in various folk medicines. Scientific studies have validated many of the ethnomedicinal uses and reports indicate that the fruit possesses broad range of therapeutic effects that includes free radical scavenging, antioxidant, inhibition of lipid peroxidation, antibacterial, antiviral, anti-diarrheal, gastroprotective, anti-ulcerative colitis, hepatoprotective, anti-diabetic, cardioprotective and radioprotective effects. *Aegle marmelos* commonly known as “bilwa” or “bael”, is highly valued plant for its characteristic aroma and medicinal value. The oil and dry fruit powder is an important export commodity from India giving a handsome amount of foreign earning to the country. A number of chemical constituents from different parts of plant have been extracted like aegelin marmelosin, coumarin, β -sitosterol and alkaloids. The plant is a rich source of amino acid, galactose & fatty acid. The compound isolated from plant show a variety of pharmacological activity.

1.2 Cultivation and Ecology

History of cultivation: Mention of *Aegle marmelos* has been found in writings dating back to 800 B.C. It is cultivated throughout India, mainly in temple gardens, because of its status as a sacred tree; also in Pakistan and Northern Malaysia, the drier areas of Java, and to

a limited extent on Northern Luzon in the Philippine Islands where it first fruited in 1914. It is grown in some Egyptian gardens, and in Surinam and Trinidad. Seeds were sent from Lahore in 1909. Specimens have been maintained in citrus collections in Florida and in agriculture research stations but the tree has never been grown for its fruit in this state. *Aegle marmelos* fruit was resorted to by the Portuguese in the East Indies in the 1500's and by the British colonials in later times as a means of halting diarrhea and dysentery. Natural Habitat: The tree grows wild in dry forests on hills and plains of central and southern India and Burma, Pakistan and Bangladesh, also in mixed deciduous and dry dipterocarp forests. *Aegle marmelos* is a subtropical species. In the Punjab, it grows up to an altitude of 1,200m where the temperature rises to 48.89°C in the shade in summer and descends to -6.67deg C in the winter, and prolonged droughts occur. It will not fruit where there is no long, dry season, as in Southern Malaysia. Biophysical Limits Altitude up to 1200 m mean annual temperature: -6-48°C. Rainfall Soil type: *Aegle marmelos* is said to do best on rich, well-drained soil, but it has grown well and fruited on the oolitic limestone of Southern Florida. It also grows well in swampy, alkaline or stony soils having pH range from 5 to 8. In India it has the reputation of thriving where other fruit trees cannot survive. According to reproductive biology in India flowering occurs in April and May soon after the new leaves appear and the fruit ripens in 10-11 months from bloom-March to June of the following year.

1.3 Different Names of Bael Fruit

- Hindi- Bael, Beel, sriphal,
- Marathi- Bael,
- Gujrati- Bili,
- Bengali- Bilbam,
- Telgu- Maredu, Bilbpandu,
- Tamil- Bilbam,
- Panjabi- Bil,
- Sindhi- Katori,
- Oria- Belo,
- Pharasi- BehHindi, Bal,
- Latin- Aeglemarmelos Corr,

- English- Bael Fruit.

2. Description

It is a moderate-size, slender, aromatic tree, 6.0 - 7.5 m in height and 90 -120 cm in girth, with a somewhat fluted bole of 3.0 -4.5 m and spines are straight, strong and axillary on branches. Bark is soft, corky, light grey, exfoliating in irregular flakes. Leaves are alternate, foliate occasionally digitately five foliate. Leaflets ovate or ovate, lanceolate, crenate, acuminate, lateral sessile, terminal long petioled. Flowers are large, greenish white, sweet scented in short axillary panicles. Fruits are globose, grey or yellowish, rind, woody, seeds numerous, oblong, compressed, embedded in sacs covered with thick orange, coloured sweet pulp. It flowers during April-May and fruits ripen during March-April.

2.1 Properties and Uses

Part used are Fruits, seeds, leaves, bark and root. It is 'Madhura', palatable, Kashaya, pacifies deranged "pitla", beneficial in deranged 'Kapha', fever diarrhoea, appetizing and gastric stimulant. Different parts of the tree have their own medicinal importance.

A. Leaves

The fresh leaf juice in doses of 8 to 16 gm is given with honey as a mild laxative in fever, catarrh and asthma. The leaf juice is mixed with black pepper and given in dropsy (a disease marked by excessive collection of a watery fluid in the tissues or cavities of the body) with constipation and Jaundice. A decoction of the leaves is a febrifuge (agent used for reducing fever) and expectorant. It is particularly used for asthmatic complaints. A hot poultice of the leaves is applied to the eyes in ophthalmia, to the head in delirium (extreme mental disturbance marked by excitement restlessness and rapid succession of confused ideas) of fevers, to the chest in acute bronchitis and to inflamed part of the body. Fresh leaves are used in West Bengal as a remedy for beriberi (A deficiency disease caused by lack of vitamins especially B1)

B. Fruits

The fruit is of considerable medicinal value when it just begins to ripen. The ripe fruit is aromatic, astringent, cooling and laxative. The unripe or half ripe fruit is astringent, stomatic (a drug that strengthens the stomach and promotes its action), antiscorbutic (a drug which prevents or cures scurvy), and digestive. The fruit is said to act as a tonic for heart and brain. It is best given in sub-acute or chronic cases of diarrhoea and dysentery and in irritation of the alimentary canal. It is a useful adjunct in the after treatment of bacillary dysentery as it helps to remove constipation which hinders the healing of ulcerated surfaces of intestine. The ripe fruit is prescribed in intestinal disorders and certain terms of dyspepsia (indigestion), characterized by alternate constipation and diarrhoea. A 'Shortbet' of the ripe fruit is given for chronic constipation and dyspepsia.

An extract of the fresh half ripe fruit is given in doses of 2-4 gm repeated many times a day. An extract made from sundried slices of the unripe fruit is given in doses of 4-8 gm. As a tonic the powder of the dried pulp is given in 0.85 gm -1.0 gram doses; as an antiscorbutic and febrifuge in 1.1 to 1.25 gm doses; as a nauseant and anti-dysenteric in 5 gm to 8 gm doses.

The ripe fruit is eaten fresh. The ripe fruits are woody large, spherical up to 20 cm in diameter, oblong or pear shaped, with smooth or tuberculate surface. The peripheral part within the rind is fleshy and chambers are full of viscous, translucent pulp slightly sweet. The pulp diluted with water and added with requisite amount of sugar and tamarind forms of delicious cooling drink, commonly known as 'Sherbat'. The tender green fruit is utilized for making a preserve (morabba) which occupies an important place in the food industry of the North India. The fruit is rich in pectin but poor in acid and hence does not give a good jelly unless extra acid is added. Due to the presence of seeds and mucilage in the pulp, the ripe fruit cannot be eaten comfortably. Also due to the presence of oxidative enzymes, the pulp readily turns brown on exposure. To enhance its palatability and homogeneity, it is necessary to add water to the pulp (up to 50% of

the pulp) and heat it up to 70°C With constant heat to kill the harmful germs. The mass is then sieved while hot to separate the seeds, mucilage and fibre and is cooled immediately to prevent loss of flavour. The pulp, thus obtained is smooth, uniform and can serve as a base for various food products, like bael fruit squash, jam, and fruit nectar, etc.

C. Root and bark

The root and the bark are used in the form of a decoction as a remedy in meanchcholia, intermittent fevers and palpitation of the heart. Root is one of the ingredients of "Dashmula", a common Ayurvedic formulation, particularly useful in loss of appetite and puerperal diseases (the problems which arise in period between child birth and the return of the womb to its normal condition). The root bark has been used particularly in intermittent fevers and also as a fish poison.

2.2 Chemical Composition

Since all the parts of the Bael tree are showing medicinal properties. Their chemical composition is given here separately.

A. Leaves

Alcoholic and aqueous extracts of the leaves are reported to possess cardiotoxic effect, like digitalis on amphibian and mammalian heart. The alkaloid, aegeline, present in the leaves is efficacious in asthma. The leaves contain four new alkaloids viz, O-halfordinol, N-2-ethoxy-2-ethylcinnamid, N-2-methoxy--2-ethylcinnamid, besides aegeline and aegeline. Condensed tannins, phlobatannins, flavan-3-ols, leucoanthocyanins, anthocyanins, flavanoid glycosides, skimmianine and γ -sitosterol are also present.

On steam distillation, the leaves yield an essential oil. The essential oil has broad spectrum of anti-fungal activity comparable to that of 0.5% Hamycin.

B. Fruits

Analysis of the fruit gave the following average values: moisture 61.5%; protein 1.8%; fat 0.3%; Carbohydrate 31.8%; and fibre 2.9%. Besides the

following are present in small amounts (mg/100 gm); Calcium, 85.0; phosphorous, 50.0; iron 0.6; thiamina, 0.13; riboflavin 1.2; niacin, 1.1; oxalic acid 18.7; and Vit C, 8.0 and ; Carotene, 55 microgram/100 gm.

The fruit contains allo-imperatorin, marmelosin which are identical with imperatorin and B-sitosterol. It contains marmelide, an isomer of imperatorin, which exhibits tyrosinase accelerating and tryptophan pyrrolase -inhibiting affect in *Bufo melanosticus*. The presence of psoralin, a powerful germination inhibitor and tonic acid is also reported.

The fruits yield 2% of dried, water soluble gum. Hydrolysis of the gum gave: galactose 20.4; arabinose, 10.7; D-galacturonic acid 25.2% and traces of rhamnose.

C. Seeds

The seeds yield an oil (34.4% on dry weight basis). The fatty acid composition of the oil is as follows: palmitic 16.6; stearic 8.8%; Oleic 30.5%; linoleic 36.0%; and linolenic 8.1%.

D. Roots and root bark

The roots contain auraptine, marmin, umbelliferone and lupeol. The alcoholic extracts of the root gave psoralen, xantho-toxin, dimethoxy coumarin, scopoletin, lembamide, umbelliferone, marmesin, marmin, skimmamine, and a glycoside identified tentatively as skimmianine. The presence of decursinol an alkaloid haplopine, skimmianine, γ -jagarine, marmesin, marmin, xanthotoxi, umbelliferone and lupeol is also. Reported from the root bark.

2.3 Natural Health Benefits of Bael

the fruit is of considerably medicinal value when it just begins to ripen. The ripe fruit is aromatic, astringent which helps construction of skin, coolant and laxative. The unripe or half-ripe fruit is astringent, digestive stomachic which improves appetite and antiscorbutic, i.e. which helps to fight scurvy caused due to vitamin C deficiency.

2.3.1 Constipation

Ripe bael fruit is regarded as best of all laxatives. It cleans and tones up the intestines. Its regular

use for two or three months helps evacuate even the old accumulated faecal matter from the bowels. For best results, it should be taken in the form of sherbat, which is prepared from the pulp of the ripe fruit. After breaking the shell, the seeds are first removed, and contents are then taken out with a spoon and passed through a sieve. Milk and little sugar may be added to make it more palatable. The pulp of the ripe fruit can also be taken from the spoon without the addition of milk or sugar. About 60 grams of the fruit will suffice for an adult.

2.3.2 Diarrhea and Dysentery

The unripe or half ripe fruit is perhaps, the most effective food remedy for chronic diarrhea and dysentery where there is no fever. Best results are obtained by the use of dried bael or its powder. The bael fruit, when it is still green, is sliced and dried in the sun. The dried bael slices are reduced into powder and preserved in air-tight bottles. The unripe bael can also be baked and taken with jaggery or brown sugar.

The fruit appears to have little effect in acute dysentery when there is definite sensation to defecate but instead of significant amount of faeces, blood and mucus alone are passed. The powdered drug is specially recommended in this condition. Its beneficial effect is, however, most evident when the condition has become sub-acute or chronic. After the use of the fruit in these conditions, the blood gradually disappears and the stool assume a more feculent and solid form. The mucus also disappears after continued use for some time. It is also a valuable remedy for chronic dysenteric conditions characterized by alternate diarrhea and constipation.

2.3.3 Peptic Ulcer

An infusion of bael leaves is regarded as an effective food remedy for peptic ulcer. The leaves are soaked overnight in water. This water is strained and taken as a drink in the morning. The pain and discomfort are relieved when this treatment is continued for a few weeks. Bael leaves are rich in tannins which reduce inflammation and help healing of ulcers. The bael fruit taken in the form of beverage has also great

viscous content. This substance forms a coating on the stomach mucosa and thus helps in the healing of ulcers.

2.3.4 Respiratory Affections

A medicated oil prepared from bael leaves gives relief from recurrent colds and respiratory affections. The juice extracted from bael leaves is mixed with equal quantity of sesame oil and heated thoroughly. A few seeds of black pepper and half a teaspoonful of black cumin are added to the hot oil. It is then removed from the fire and stored for use when necessary. A teaspoonful of this oil should be massaged into the scalp before a head bath. Its regular use builds up resistance against colds and coughs.

A common practice in south India is to give the juice of bael leaves to bring relief from wheezing and respiratory spasm. The leaf juice, mixed in warm water with a little pepper, is given as a drink.

2.3.5 Medicinal uses of the Bael:

- a) Bael is bitter and acrid. It stimulates production of bile
- b) It is a restorative and increases body's resistance and immunity.
- c) Bael improves digestion
- d) Ripened fruits are used in the preparation of a drink (Sharbhat)
- e) Bael powder is also used for medicinal purpose
- f) The leaves of the Bael plant are used in Ayurvedic medicine to cure and control diabetes. The juice is extracted from the leaves and taken every day morning on empty stomach. It is said that it controls the blood sugar levels and bring it to normal levels in about a month.
- g) The fruits are used to control diarrhea. The unripe fruits are collected and the pulp is dried and powdered. The dry powder if taken with water or fresh curd three times a day will control diarrhea.
- h) Bael extracts are also used to control cholesterol and blood urea.
- i) Bael is also useful in relieving constipation. Regular use of Bael extract or powder prevents constipation.

- j) Fresh Bael leaves extract mixed with honey and taken can cure stomach pain and constipation.
- k) The paste of the leaves is said to relieve joint pains and swellings if used as a poultice.

2.4 Modern Nutritional Value of Bael

Amount of Bael: 100 gms

Nutrients	Amount
Proteins	1.8 g
Carbohydrates	
Total Carbohydrates	31.8 g
Fats	
Total Fat	0.3 g
Vitamins	
Riboflavin	1.19 mg
Niacin	1.1 mg
Thiamin	0.13 mg
Vitamin A	55 mg
Vitamin C	8 to 60 mg
Minerals	
Calcium	85 mg
Phosphorus	50 mg
Potassium	600 mg

2.5 Health & Nutrition Benefits of Eating Bael

- Consumption of unripe or half-ripe bael fruits is excellent for curing chronic stages of dysentery and cholera, where there is no fever. The use of dried bael, in normal or powdered form, is also good for this purpose. The fruit is also beneficial for the chronic dysentery that is characterized by alternate constipation and diarrhea.
- Bael is a high source of tannin and its rind contains about 20% of the compound, with around 9% in the pulp of the fruit. Hence, the fruit is considered to be the treatment of choice for curing cholera.

- The fruit is considered highly beneficial for the digestive system and can also be used as a mild laxative.
- An infusion made from the bael leaves is regarded to be an effective cure for peptic ulcer. The concoction is prepared by soaking the leaves in water overnight and then drinking the water in the morning, after straining it. The tannins present in the leaves help alleviate the pain and discomfort associated with peptic ulcer and also aid healing, by reducing the inflammation.
- A very ancient practice involves the use of the bael leaves, barks and roots for treating snakebites.
- The fruits, leaves and roots of the plant have antibiotic properties and can be used to treat a wide range of ailments and infections.
- Respiratory ailments, like wheezing, spasm and even common cold, can be treated by using medicated oil made from the leaves of bael plant. This oil is prepared by heating together equal quantities of bael juice and sesame oil. To this hot oil, half a teaspoon of black cumin and a few black pepper seeds are added. A thorough massage of this oil on the scalp, prior to a head bath, is considered to build resistance against such respiratory conditions.
- A decoction made from the bark of the plant is often used in the cure of malaria. The pulp of the fruit, on the other hand, is used in the treatment of vitiligo.
- The juice of bael leaves, consumed after mixing it with honey, is often used for relieving fever and catarrh.

2.6 Modern Research

Researchers of Banaras Hindu University (BHU) have successfully isolated a new molecule from the seeds of 'bael' fruit that shows anti-fungal properties. The research also promises to pave the way for development of new drug with medicinal value. While the research study attracted attention during poster presentation on the last day of two-

day national symposium on emerging trends in chemical sciences, organised by department of chemistry, BHU, on April 8, 2012. it also marked a breakthrough in the isolation and synthesis of designer molecule with medicinal value. "The molecule-- homo imperatorin-- responsible for anti-fungal properties in the seeds of 'bael' fruit (*Aegle marmelos* Correa) has been isolated for the first time and it has taken five long years of research work," said Bhuwan B Mishra, one of the members of research team while talking to TOI on April 8, 2012. It was conducted in continuation of work on discovery of bioactive constituents from Indian medicinal plant, especially anti-fungal constituents, he added. The research study for isolation of 'imperatorin' and 'iso imperatorin' from the seeds of the fruit has been already published in *Phytochemistry*, a reputed European Journal in its December, 2010 issue.

3. Conclusion

Ripe bael fruit is one of the best known natural laxatives. Unripe or half-ripe fruit is very useful in treating chronic diarrhea and dysentery. It is also used for the treatment of hepatitis, tuberculosis, colitis and dyspepsia. The fruit is also regarded as a heart and brain tonic. The raw fruit is an appetizer. The pulp of raw fruits is effective in treating bleeding piles and bacillary dysentery. Apart from the fruit, bael leaves are also highly effective medicinally. The leaves contain large amounts of aromatic oils and infusion of leaves is considered a potent medicine for peptic ulcers. Fresh juice of leaves is used to treat eye infections. Roots of the young tree are used to treat ear infections. A small, stiff piece of root is dipped in neem oil and lighted. The oil that drips from the burning end is collected. This is an excellent medicine for treating ear infections. An *ayurvedic* preparation made from oils of leaves is used to treat recurrent colds and respiratory infections. A decoction of root and leaves has anti-pyretic effect and helps in reducing fevers.

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