



A Review on Indian Traditional Plant Aegle Marmelos (Bael)

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Abstract

Herbal drugs are conventionally used in various and many parts of the world responsible to cure and treat different types of diseases and disorders. The Ayurvedic system of medicine and Siddha system of medicine are very famous medical practices in Indian traditional medicines. Over the many years, many researchers have aimed at identifying and validation of plant derived substance for the treatment of various disease and disorders. Similarly, it has been already proved that various parts of plants such as leaf, fruits seeds, stem, bark, rootsetc. Where used to provide health and nutrition promoting compounds traditional used against various disease and disorder. Aegle Marmelos (Bael) has seen to use in the ethno medicine to exploit its' medicinal properties including astringent, Antidiarrheal antidycentric, demulcent, antipyretic, and anti-inflammatory activities. The present review aims to complete medicinal values of Aegle marmelos generated through the research activity using modern scientific approaches and innovative scientific tools.

Keywords: Aegle Marmelos, Bael, Lord Shiva, Antidiarrheal, traditional etc.

Introduction

Aegle marmelos (Bael) belongs to a family of Rutaceae, also being called as Bael in Indian system of medicine and has been used for various purpose of medicinal activity. The Baelis one of the dedicated trees of the Hindus. The leaves are offered in prayers to lord Shiva and Mata Parvati since ancient times.¹ Bael is one of the deciduous blessed tree, analogous with Lord Shiva having useful medicinal action, principally as a cooling agent. This tree is very popular in Lord Shiva and Lord Vishnu temples and it has been grown in Thrimurthies at each and every house in ancient times. Its leaves are trifoliated symbolizing the -Brahma, Vishnu, Shiva, with spear shaped leaflets. It is also called

as Thrisoolam the weapon of Lord Shiva. Many legends, stories and myths are correlated with this tree. The leaflets has been given to devotees as prasadam in Lord Shiva temples and as Tulsi in Lord Vishnu temples. In India, flowers are developed or seen in the month of April and May. Then soon the new leaves get appeared slowly. And the fruits get ripened in 10 to 11 months from bloom March to June Of the following year.²

Bael trees are habitually planted near temples dedicated to Lord Shiva and routinely worshiped by the devotees.³ Bael is one of the most appreciated plants used in Indian Ayurvedic medicine by the Indian and other South Asian inhabitants in ancient history.⁴



Figure No.1: Aegle Marmelos.

According to the historical records, Bael is used as a medicinal and food item since 5000 B.C.⁵ and known to human beings even when Ramayana was written in the famous Sanskrit language.⁶ Herbal medicines are heavily used and immensely popular in developing countries.⁷ In addition to the essential medicinal values, Bael is reported as an important item in industrial food processing and an excellent source for extracting pharmaceuticals and many other economically important herbal compounds.

Unfortunately, Bael is still considered an underutilized tree fruit species in South Asian countries, and its real economic potentials have not been exploited.

Biological source

The fruit from the genus *Aegle marmelos*, a native tree from India, where the fruit is known as “Bael,” is also known as the wood apple. The fruit shape resembles an apple and the name wood apple is due to the fruit hard shell.

Family: Rutaceae.



Figure No.2: Tree of Aegle Marmelos

Geographical Source

Indian culture believed in Bael. The species has been reached to various countries in prehistorical times.⁸ Bael trees are developed well in dry, mixed deciduous and dry forests and soils of India, Sri Lanka, Thailand, Pakistan, Bangladesh, Myanmar,

Vietnam, the Philippines, Cambodia, Malaysia, Java, Egypt, Surinam, Trinidad, and Florida. Bael occurs in India since 800 B.C. as a crop according to the historical reports.⁹ In West Bengal, there are 13 types of fruits in *Aegle marmelos* based on the fruit’s morphology. The fruits were grouped

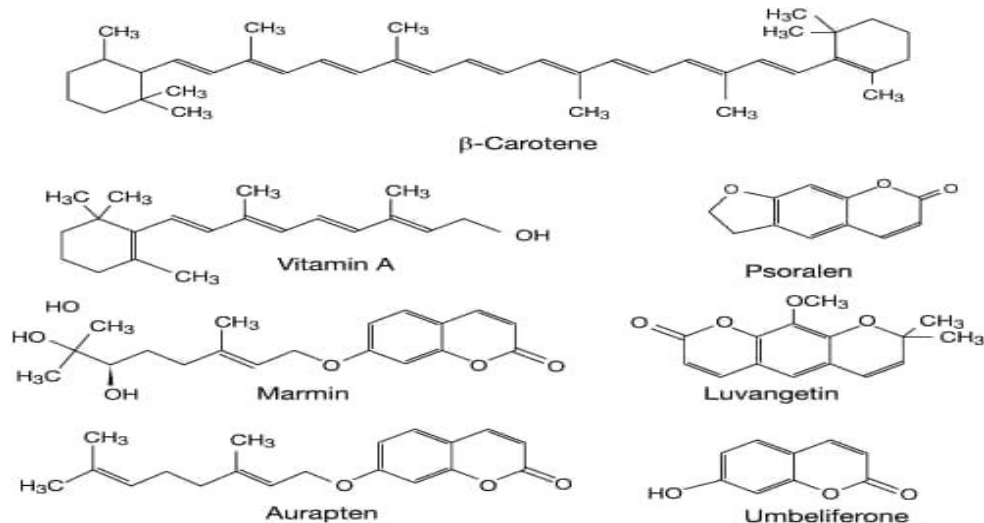
under five categories; oval, flat, spherical, oblong and pear shaped and in each group three subgroups (small, medium, big) were separated. It is also cultivated in Nepal, Myanmar, Tibet, Ceylon, Vietnam, Laos, Cambodia, Sri Lanka, Bangladesh, Thailand, Indonesia, Malaysia, the drier areas of Java, Fiji and to a limited extent on Northern Luzon of Philippine Islands where it first fruited in 1914.¹⁰⁻¹²

Chemical constituents

1) Alkaloids: The alkaloids composed and encompasses with the largest single unit of secondary plant substances. New alkaloids from the leaves of *Aegle marmelos* were reported viz., ethyl cinnamamide, O-3, 3-(dimethylallyl) haplorrhine, N-2-methoxy-2-[4-(3'3'-dimethylallyloxy) phenyl] ethyl cinnamamide etc.^{13, 14}

2) Terpenoids: P-Menth-1-en-3, 5-diol was isolated and characterized from *Aegle marmelos* leaves. Limonene (82.4%) was reported as the main constituent from *Aegle marmelos* leaves.¹⁵ Bael leaves are reported in which it contain biologically important phytochemicals such as the volatile compounds limonene, β -phellandrene, p-cymene, linalool, α -cubebene, cineole, p-cymene, citronella, citral, β -cubebene, β -caryophyllene.

3) Coumarins: Marmelosin, marmesin, imperatorin, marmin, alloimperatorin, methyl ether, xanthotoxol, scopoletin, scoparone, umbelliferone, psoralen and marmelidehas also been reported. Some chemical are as follows:¹⁶



4) Phenylpropanoids: These plants species are generally occurs naturally such as, phenolic compounds, which have an aromatic ring structures, to which three-carbon side chain is attached. Among the phenylpropanoids are included hydroxycoumarins, phenylpropenes and lignans. The most widespread plant coumarin is the parent. Compound, coumarin itself, which occurs in over twenty-seven plant families.¹⁷

5) Tannins: The Bael leaves contains maximum amount of tannins in it and which was recorded in the month of January. There is as much as 9% of tannins present in the pulp of wild fruits, less in cultivated type. Tannin is also present in leaves such as skimmianine, it is also named as 4, 7, 8 - trimethoxyfuro-quinoline.¹⁸

6) Polysaccharides: Galactose, arabinose, uronic acid and L-rhamanose are obtained by hydrolysis process.^{19, 20}

Pharmacological Actions

The most common pharmacological properties of Aegle Marmelos are as follows

- 1) Anti-bacterial activity
- 2) Anti-histaminic activity
- 3) Anti-inflammatory, anti-pyretic and analgesic activity
- 4) Hypoglycaemic and Anti-oxidant activity
- 5) Immunomodulatory activity
- 6) Testicular activity
- 7) Anxiolytic and Anti-depressant activity
- 8) Anti-convulsant activity

1) Anti-bacterial activity

These are those actions, which are used to treat bacterial infection and use to kill the micro-organisms. Antimicrobial action of different leaf extracts such as Petroleum ether, Dichloromethane, Chloroform, Ethanol and Aqueous extract of Aegle marmelos leaves were tested against selected Gram positive and Gram negative bacteria. However, petroleum ether extract was not seen much effective against any of the organisms tested than that of dichloromethane extract. Growth of *Lactobacillus bulgur*'s and *Bacillus cereus* was not inhibited by any of the tested leaf extracts of Aegle Marmelos.²¹

2) Anti-histaminic activity

Antihistamines are used to suppress the histamine-induced wheal response (swelling) and response (vasodilation) by blocking the histamine receptor by binding to its receptors or reducing histamine receptor activity on nerves, vascular smooth muscle, glandular cells, endothelium, and mast cells. Skimmianine markedly inhibited the histamine release from RBL-2H3 cells induced by DNP24-BSA, thapsigargin and ionomycin.²²

3) Anti-inflammatory, anti-pyretic and analgesic activity

These are those drugs which are used to prevent or reduce inflammation. NSAIDs

(nonsteroidal anti-inflammatory drugs) can reduce pain, fever and other types of inflammation. Common over-the-counter NSAIDs include aspirin, ibuprofen and naproxen sodium. A significant decreased in hyperpyrexia in rats was also produced by the most of the extracts. This study was established anti-inflammatory and antipyretic activities of the leaves of Aegle marmelos. (Bael)²³

4) Hypoglycemic and Anti-oxidant activity

Low blood glucose, also called low blood sugar or hypoglycemia, occurs when the level of glucose in your blood drops below what is healthy for you. For many people with diabetes, this means a blood glucose reading lower than 70 milligrams per deciliter (mg/dL). There was a decrease in blood glucose at the end of four weeks in group treated with it however it did not reach the control leaves.^{24, 25}

5) Immunomodulatory activity

These are those drugs modify the response of the immune system by increasing (immunostimulators) or decreasing (immunosuppressives) the production of serum antibodies. The Immunomodulatory action of methanolic extract of Aegle marmelos fruit (MEAM) in experimental model of immunity was carried out by neutrophil adhesion test and carbon clearance assay, whereas, humoral immunity was analysed by mice lethality test and indirect haemagglutination assay.. Both high and low doses of MEAM significantly prevented the mortality induced by cellular and humoral mediated mechanisms more at low dose (100 mg/kg) than high dose (500 mg/kg).²⁶

6) Testicular activity

In these, the production of both sperm and androgens, primarily testosterone get reduced or decreased slowly day-by-day.

Testosterone release is controlled by the anterior pituitary luteinizing hormone, whereas sperm production is controlled both by the anterior pituitary follicle-stimulating hormone and gonadal testosterone. The aqueous extract of leaf of *Aegle marmelos* at the dose 50 mg/100 g body weight resulted a significant diminution in the activities of key testicular steroidogenic enzymes along with low levels of plasma testosterone and relative wet weights of sex organs in respect to control without any significant alteration in general body growth. Therefore, it may be predicted that the aqueous extract of leaf of *Aegle marmelos* has a potent antitesticular effect at a specific dose.²⁷

7) Anxiolytic and Anti-depressant activity

Anxiolytics are medications that can treat anxiety and related conditions. Because so many medications have this effect, this includes many different medications across several types. The objective of the study was to evaluate the anxiolytic and antidepressant activities of methanol extract of *Aegle marmelos* (MEAM) leaves as well as its interaction with conventional anxiolytic and antidepressant drugs.²⁸

8) Anti-convulsant activity

These are those drugs or medication, which are used to control (prevent) seizures (convulsions) or stop an ongoing series of seizures. This medicinal plant belongs to the Rutaceae family and the leaves are popularly used in the treatment of inflammation, asthma, hypoglycemia, febrifuge, hepatitis and analgesic. It also increases the swimming endurance time significantly along with the post motor function like Rota rod falling time and spontaneous motor activity. The test extract also increases the cold swimming endurance time significantly. The test extracts could

restrict the increase in the level of these markers during stress.²⁹

Other uses

The common medicinal uses of *Aegle marmelos* leaves are as follows

- 1) Diarrhoea
- 2) Anticancer Activity
- 3) Constipation

1) Diarrhoea

These are those disease, which causes to get rid of waste material (faeces) from your body very often and in a more liquid form than usual. The unripe and half ripe fruit of Bael is most effective remedy for the diarrhoea. Among the GI infections the diarrhoea is a common symptom of the intestinal disorder and has remained a global threat to human health. It cause morbidity and mortality with over 1000 million episode and over 4 million death annually in children under five years of age.^{30,31}

2) Anticancer Activity

In these, the uncontrol growth of abnormal cells of cancer are destroyed or decreased in numbers. *Aegle marmelos* for cytotoxic action using brine shrimp lethality assay. The extract of *Aegle marmelos* was found to be exhibited toxicity on all used assay 6. The fruit extract of Bael is also used to improve the immune system that will finally increase the anti-cancer activity of the body. Gastric ulcer resulted from persistent erosion and damage of the stomach wall that might become perforated and develop into peritonitis and massive hemorrhages as a result of inhibition of synthesis of mucus, bicarbonate and prostaglandins.^{32, 33}

3) Constipation

Constipation is a problem due to the loss of water from the fesses, that's why the person feel difficulty, the ripe fruit of *Aegle marmelos* is a great remedy for the constipation patient, as it is a rich source of fiber, and fiber are essential for the forcing

the GIT material towards the excretion. The fiber of Bael cleans the intestine. Its regular use up to three months help in the evacuation of even the old. Accumulated fecal matter from the bowels. In the villages it is mostly consumed as a energy food and in the summer season its ripe pulp is mixed with water or milk to serve as a great drink and as well as a treatment for the constipation suffering person.³⁴

Religious Importance of Aegle Marmelos³⁵

Bael has been considered as one of the hallowed trees of Hindus. Preliminary evidence of religious importance of Bael appears in Shri Shuktam of Rig Veda which reveres this plant as the residence of goddess Lakshmi, the deity of wealth and prosperity. Bael trees are considered an incarnation of Mata Sati. Since, Bael has multiple useful properties, its overexploitation has had historical concerns. In order to prevent its over-exploitation, the ethno conservationists had attached this tree with the Lord Shiva and goddess Lakshmi so that people can pay regard to this important useful plant species and avoid destroying it. The traditional herbal healers collect the required plant parts of Bael at particular season and also chant some mantras just before collection of Bael fruits, leaves and bark for preparing medicine. They avoid disclosing the medicinal properties of Bael to anyone in the society. Earlier, the management of important ethnobotanical species such as Bael was enforced by traditional beliefs, which, even though they are being eroded, have been kept alive in the name of their traditional culture. Other than, being a medicinal plant, Aegle marmelos Correa is a hallowed tree, dedicated to Lord Shiva. The offering of Bael leaves is a compulsory ritual of the worship of Lord Shiva in the hills. This

importance seems largely due to its medicinal properties.

In ancient times, the old peoples believe that Bael and tree of baek is favourite tree of Lord Maha Shiva, the goodness of this botanical wonder found a special mention in Rig Veda and is also believed as the residence of Goddess Lakshmi for wealth and prosperity.

Extraction procedure Soxhlet Extraction

Extract was prepared by Soxhlet extraction method.³⁶ A thimble was prepared by using 0.5 mm Whatman No. 1 filter paper. About 100 gm of pulverized material was uniformly packed into a thimble and run in Soxhlet extractor. It was extracted with methanol and chloroform for the period of about 48 hours or 22 cycles or till the solvent in the siphon tube of extractor became colourless. Soxhlet apparatus comprises of extractor, condenser and a round bottom flask. It is heated on the heating mantle and evaporated solvent goes to extractor. Here, it is cooled by the water moving in the condenser and then solvent moves back to the round bottom flask with soluble bioactive components. After that solvent was evaporated to get the crude plant extracts. Extract was kept in a refrigerator at 4°C for anti- bacterial activity.³⁷

Conclusion

It is quite evident from this review that Aegle marmelos contains a number of phytoconstituents which reveals its uses for various therapeutic purposes. Looking upon wide prospects and potential of Bael for various purposes, this will help in financial upliftment of the poor and landless farmers besides providing base for the Research and Development. The Plant or its individual parts can be used for the treatment of various disorders in human being such as, diabetes, liver toxicity, fungal infection,

microbial infection, inflammation, pyrexia and to relieve pain. Still, so much work is required with the *Aegle marmelos* to investigate the mechanism of actions with other therapeutic activities

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