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Available online at: www.jpardonline.com**Review on Pharmacognostic and Pharmacological Activities of *Aegle marmelos*: A sacred Plant**K. Sudheer Kumar^{1,2*}, K Suresh², E. Pohita²¹Department of Pharmacology, Dr. Samuel George Institute of Pharmaceutical Sciences, Markapur-523316, Prakasam, Andhra Pradesh, India.²Department of Pharmacology, Mother Theresa Institute of Pharmaceutical Education and Research (MIPER), A-Camp, Kurnool-518002, Andhra Pradesh, India.

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ABSTRACT: Herbs have always been the principal form of medicine in India and presently they are becoming popular throughout the world, as people strive to stay healthy in the face of chronic stress and pollution and to treat illness with medicines that work in the count with the body's own defense. There is a widespread belief that green medicines are healthier and more harmless or safer than synthetic ones. World is endowed with a rich wealth of medicinal plants. Man cannot survive on this earth for long life without the plant kingdom because the plant products and their active constituents play an important role. *Aegle marmelos* (*Rutaceae*), commonly known as Bael, Bengal Quince is a tree of Indian origin, well known from pre-historic time. The utilization of bael fruit in day-to-day life has great nutritional, environmental as well as commercial importance. All the parts of this tree including stem, bark, root, leaves, fruit, and seeds at all stages of maturity have medicinal virtues and have been used in Ethno-medicine to exploit its medicinal properties including antidiarrhoeal, anti dysenteric, antipyretic, and anti-inflammatory activities. Thus the purpose of this review article is to explore the Pharmacognostic and Pharmacological potentials.

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E. Mail ID: sudheer.y2k8@gmail.com**INTRODUCTION:**

Traditional medicine becomes an integral part of patient care and around 80 % of the World's population depends wholly or partially on traditional medicine for its primary health care needs ^[1]. Phytochemicals obtained from medicinal plants became sources for getting novel drugs in traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates, bioactive principles and lead compounds in synthetic drugs ^[2]. The Ayurvedic remedies, which are both preventive and therapeutic, are mostly of plant origin ^[3]. Preclinical studies with experimental animals have shown that many

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of the commonly used Ayurvedic plants are effective and have the potential to be of human use in the future.

Aegle marmelos (L.) commonly known as Bael belonging to the family *Rutaceae*, has been widely used in indigenous systems of Indian medicine due to its various medicinal properties. *A. marmelos* is native to Northern India, but widely found throughout the Indian Peninsula and in Ceylon, Burma, Bangladesh, Thailand and Indo-China 4. It is a medium to large-sized deciduous glabrous, an armed tree with the axillary and 2.5 cm long alternate, trifoliate leaves (Fig 1), short flower, and globular fruits (Fig 2) ¹³. According to Charaka (1500 BC), the high priest of Ayurveda, Bael is one of the most important medicinal plants in Ayurveda, which has been in existence for a long time and is extensively used by inhabitants of India 5. A sweet drink prepared from the ripe fruit pulp of Bael is supposed to be effective against bacillary dysentery. The unripe fruits of Bael are reported to be useful in treating diarrhea, dysentery with spells of constipation, and stomach aches. The roots are also one of the important ingredients of the Ayurvedic traditional drug Dashamula, a panacea for colitis, dysentery, diarrhea, flatulence, and fever ¹⁴. The leaves are supposed to reduce bowel complaints, bleeding piles, dropsy (edema), diarrhea, and dysentery ¹⁴.

The essential oil and extracts obtained from wild varieties of *A. marmelos* were reported for several biological activities such as antidiarrhoeal, Radiation protection, anticancer, Antipyretic, ulcer healing, chemoprevention, antigenotoxic agent, diuretic, anti-inflammatory, and anti-fertility ¹⁵.

The *A. marmelos* tree is held sacred by Hindus and offered in prayers to deities Lord Shiva and Parvati and thus the tree is also known by the name *Shivaduma* (the tree of Shiva). Hindus also believe that goddess Lakshmi resides in Bael leaves. It is therefore widely cultivated and commonly found in the vicinity of temples. All parts of this tree, viz. root, leaf, trunk, fruit and seed are useful in several ailments. The major chemical constituents isolated from *Aegle marmelos* fruit are marmelosin, luvangetin, psoralen, tannins, marmin ¹⁵⁻⁷.

TAXONOMICAL CLASSIFICATION:

Kingdom: Plant

Order: Sapindales

Family: Rutaceae

Scientific name: *Aegle marmelos*

Genus: *Aegle*

Species: *marmelos*



Fig 1. The leaf of the *A. marmelos*.



Fig 2. The *A. marmelos* fruits.

The phytochemicals present in the *A. marmelos* as derived from the qualitative phytochemical analysis revealed that active Phenolic compounds such as Alkaloids, Flavonoids, Tannins, and Saponins were present in acetone, methanol, ethanol and chloroform extracts of *A. marmelos* ^{18,9}.

Pharmacological Actions:

Antidiabetic activity:

Diabetes mellitus (DM) is the most common endocrine disorder that affects more than 100 million people worldwide (6 % of the population). It is caused by the deficiency or ineffective production of insulin by the pancreas which results in an increase or decrease in concentrations of glucose in the blood. The effect of *A. marmelos* fruit extract in Streptozotocin-induced diabetes, a histopathological study was evaluated for its

anti-diabetic property. This study was designed to elucidate the protective effect of an aqueous extract of *A. marmelos* fruits on the histopathology of the pancreas in streptozotocin-induced diabetic rats. It was observed that the *A. marmelos* showed antidiabetic activity ^[10-12].

Antihyperlipidemic activity:

A higher concentration of blood triglycerides, fatty acids, and cholesterol levels leads to atherosclerosis by arterial damage and may lead to ischemic heart disease, myocardial infarction, and cerebral vascular accidents. Oral administration of aqueous extract of bael fruits and seeds separately to a dose of 250 mg/kg to streptozotocin-induced diabetic rats significantly lowered the serum and tissue lipid profile ^[13].

Antioxidant activity:

Oxidative stress produced during normal metabolic processes in the body as well as induced by a variety of environmental and chemical factors causes the generation of various reactions free radicals and subsequent damage to the macromolecules like DNA, proteins, and lipids. In artificially induced diabetic animals the lipid peroxidation level was evaluated using an aqueous extract of *A. marmelos* fruit, which revealed that bael exhibited the antioxidant activity ^[14,15].

Cardioprotective effect:

Unripe fruit alcoholic extract has been found to produce a cardioprotective effect in isoproterenol induced myocardial infarction. This activity is due to the presence of a potent compound known as auraptin ^[16].

Antidiarrhoeal and Antidysentric activities:

The unripe or half ripened fruit is the most effective remedy for chronic diarrhea and dysentery without fever. The *A. marmelos* fruit pulp has been shown to possess antiprotozoal activity in chronic dysentery conditions accompanied by loose stool alternately with occasional constipation. The unripe fruit is used in different formulations for the treatment of chronic diarrhea. After the use of the fruit powder in these conditions, the blood gradually disappears and the stool resumes a more feculent and solid form. Sometimes it has been observed that on continuous use of the bael, the mucous also disappears ^[17].

Anticancer activity:

Most of the potent antineoplastic drugs available are expensive, mutagenic, and teratogenic inducing drugs derived from natural sources (paclitaxel). Hence

attention is being given to developing inexpensive and nontoxic drugs from alternate sources. The extracts of *A. marmelos* were tested for cytotoxicity using brine shrimp lethality assay; sea urchin eggs assay, and MTT assay using tumor cell lines. The extract of *A. marmelos* exhibited toxicity on all used assays ^[18].

Antiviral activity:

The virus is the smallest pathogen with its dual form: a living entity inside the host body and a non-living inert form outside the host. This causes various seasonal outbreaks including conjunctivitis and influenza and usually does not respond to any synthetic drugs. It is very important to develop antiviral drugs from natural bio-resources to overcome these problems. The 50 % ethanolic bael fruit extract has shown antiviral activity against Ranikhet disease virus. The fruit extract has also reported interferon-like activity against the same virus but not against vaccinia virus. Marmilide is the most effective viricidal agent interfering with early events of replicating cycle. Thus bael fruit has better viricidal potential and may be exploited as a potent antiviral agent in near future ^[19].

Antibacterial activity:

Bacteria are the most versatile unicellular pathogens, which are normally transmitted through soil, water, air, and food and cause diseases in human beings and animals. Such types of diseases could be treated with various natural products including bael. Methanolic and aqueous extract of bael fruit has shown strong action against multi-resistant *Salmonella typhi*. The methanolic extract is more potent than the aqueous extract ^[20].

Radioprotective activity:

Recently radiotherapy is one of the most important therapies to cure cancer particularly for those who are suffering from vital visceral malignancies. A large number of cancer patients are regularly being cured all over the world with this treatment. However, radiotherapy also has some side effects. The hydroalcoholic extract of bael fruits has also been studied for its radioprotective effect in mice exposed to various doses of gamma radiation. The extract (20 mg/kg) is administered intraperitoneally for 5 consecutive days before irradiation of gamma-ray has been found to afford maximum protection as evidenced by the highest number of survivors after 30 days post-radiation ^[20].

Antiulcer activity:

An infusion of leaves is an effective remedy for peptic ulcers. The fruit taken in the form of beverage has also great healing potential on account of its mucilage, which forms a coating on the stomach mucosa and thus helps in the healing of ulcers. This activity is due to the compound Luvangetin present in the fruit [8,9].

Constipation activity:

Ripe fruit is regarded as the best of all laxatives. It cleans and tones up the intestine. Its regular use for two to three months helps in the evacuation of even the old accumulated fecal 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 [7,8].

Miscellaneous uses:

The fresh ripe pulp of the higher quality cultivars and the "sherbet" made from it are taken for their mild laxative, tonic, and digestive effects. A decoction of the unripe fruit, with fennel and ginger, is prescribed in cases of hemorrhoids. It has been summarized that the psoralen in the pulp increases tolerance to sunlight and aids in the maintaining of normal skin color. It is employed in the treatment of leucoderma. Marmelosin derived from the pulp is given as a laxative and diuretic. In large doses, it lowers the rate of respiration, depresses heart action, and causes sleepiness. For medicinal use, the young fruits, while still tender, are commonly sliced horizontally and sun-dried, and sold in local markets. They are much exported to Malaya and Europe. Because of the astringency, especially of the wild fruits, the unripened bael is most prized as a means of halting diarrhea and dysentery, which are prevalent in India in the summer month [7,20].

CONCLUSION:

It is worthwhile to cultivate this plant on large scale especially on unproductive and wasteland. This will help in the financial upliftment of the poor and landless farmers besides providing a base for the Research and Development of the best, cheap, and efficacious drug. Furthermore, systematic and scientific research is required to explore the maximum potential of this under-utilized plant.

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