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Pharmacology and phytochemical constituent of *aegel marmelous*

Anjali Babu*, Rupesh Kumar M, Karthik S, Sahana K G, Umakanth B S, Syed Sagheer Ahmed, Bharathi D R
Department of Pharmacology, Sri Adichunchanagiri College of Pharmacy Adichunchanagiri University, B G Nagar,
Mandya-571448

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Abstract

Aegle marmelos, sometimes known as "Bael," is an Indian medicinal herb. The medium-sized Bael (*Aegle marmelos*), commonly known as Bengal quince or golden apple, is a member of the Rutaceae family of deciduous trees. The stem, bark, root, leaves, and fruit of this tree, at all stages of maturity, contain medicinal characteristics and have been used in traditional medicine for a very long time. Alkaloids, terpenoids, vitamins, coumarin, tannins, carbohydrates, flavonoids, fatty acids, essential oils, and other diverse substances are among the isolated components found in *Aegle marmelos*. The plant also has a number of pharmacological properties, including anti-inflammatory, analgesic, anti-arthritis, anti-hyperlipidemic, anti-cancer, antiviral, anti-ulcer, immunomodulatory, and wound healing effects. It is also anti-oxidant, antibacterial, antifungal, antidiarrheal, anti-diabetic, ant proliferative and hepatoprotective activity. Therefore, those who are interested in conducting more study on *A. marmelos* might use this review as a helpful resource.

Keyword: *Aegle marmelos*, immunomodulatory, anti-arthritis, anti-hyperlipidemic, anti-oxidant, antibacterial, antifungal, antidiarrheal.

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*Corresponding Author

Anjali Babu

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Introduction

Medicinal plants are a significant component of the nation's natural resources. They contribute significantly to the rural population's access to primary healthcare services. They work as both a healing agent and a crucial raw element in the production of traditional medicines [1]. A spiny tree from the Rutaceae family is called *Aegle marmelos*, or Bael is a native tree that can be found in Bangladesh, Pakistan, Myanmar and India. The literature on Ayurveda indicates that Bael leaves have a number of medicinal benefits. There has been an increase in the usage of *A. marmelos* as a drug in various medical systems, including folk medicine, and there have been a number of studies recently to investigate the therapeutic potential of the plant on various sections [2].

One of India's best medicinal plants is the Bael tree. The historic Sanskrit medical text "Charka Samhita" has a description of its therapeutic powers. The ripe fruit is of considerable medical value such as aromatic, astringent, cooling and laxative. The fruit that is still green or only partially ripe is digestive, stomachic, and antiscorbutic [3].

Ayurvedic and other traditional medical systems consider each component of a tree, including its root, bark, fruit, leaf, and flower, to have therapeutic value in the treatment of various diseases. The anti-oxidant and anti-microbial properties of Bael have been discovered through studies, and these properties help to prevent gastrointestinal difficulties and various heart ailments. Additionally disclosed by Bael are properties that are hepatoprotective, radio protective, anti-diabetic, and wound healing [4].

Aegle marmelos has been employed as an herbal remedy in the Ayurvedic, Unani, and Siddha for the treatment of diabetes mellitus. By preparing a decoction from the tree's roots and bark, fever and ophthalmia can be treated. There have been claims that the plant's leaves

can be used as an analgesic, febrifuge, febrifuge for hepatitis and treatment for inflammation, asthma, and hypoglycaemia [5].

Botanical Description

A. marmelos is a medium-sized to tiny tree that grows slowly and reaches heights of 25 to 30 feet. Soft, thick and with a few prickly branches is the stem [6]. From broken branches, a clear, gooey sap that resembles gum, hangs down in long strands, and solidifies over time. It initially tastes delicious but eventually irritates the throat [7].

Geographical Distribution

A. marmelos is a semi-tropical plant that grows at a height of around 1200 metres above sea level. It is primarily found in hilly terrain and arid woodlands. There are practically all Indian states where it is present, including Himachal Pradesh, Andhra Pradesh, Bihar, Jammu and Kashmir, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu, and West Bengal. Additionally, Nepal, Myanmar, Vietnam, Tibet, Ceylon, Laos, Cambodia, Malaysia, Sri Lanka, Bangladesh, Thailand, Indonesia, the arid regions of Java, Fiji, and some of the Philippine Islands are places where it is grown [6].

Morphological Characteristic

There are one or occasionally two pairs of opposite leaflets with short stalks on the alternating, single or compound leaves. The leaves are alternating, solitary or complex. A leaflet is 2 to 5 cm wide and 4 to 10 cm long. The midribs of the thin leaflets can be seen clearly from below. The petiole of the terminal leaflet is longer. After a dormant or reproductive phase, fresh leaf appears, and it is glossy and pink or burgundy in colour [8].



Fig no: 1. *Aegle marmelos*

Botanical Classification

- Family: Rutaceae
- Order : Sapinales
- Genus: Aegle
- Species: marmelos
- Kingdom: Plantae
- Phylum: Tracheophyta
- Class : Magnoliophyta
- Subclass: Rosidae [9]

Vernacular Names

- Sanskrit: Bilva, sripthal, shivadruma, Shivapala
- Hindi : Bel, bael, sripal
- Telugu : Maredu
- Kannada: Bilpatra, kumbala, malura
- Tamil : Kuvalum [10]

Phytochemical Constituents

Alkaloids, tannins, essential oils, gums, resins, coumarin, and polysaccharides are just a few of the phytochemicals that make Bael effective for treating a variety of illnesses. In comparison to other fruits, its nutritional value is much more substantial. The environment also values it greatly [7]. Different portions of the tree have been used to isolate and identify chemical components like alkaloids, coumarin, and considerable [11]. Aegeline was also isolated from the leaves of *A. marmelos* is an alkaloidal-amide [12].

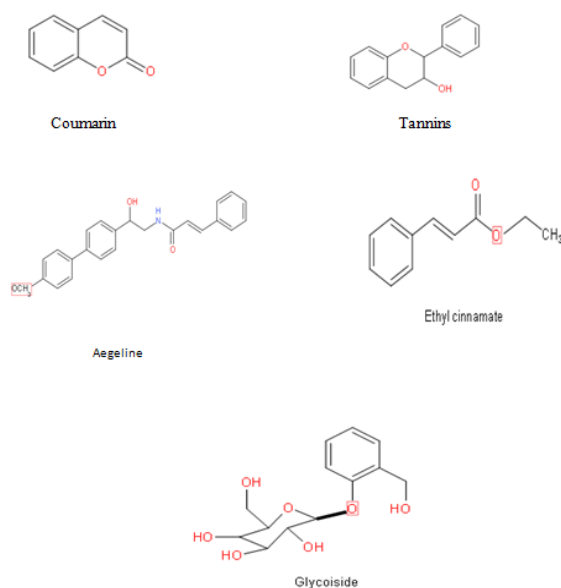


Fig: 2 phytochemical constituents of

Aegle Marmelos

Traditional Use

The treatment of many ailments with *Aegle marmelos* is extensively discussed in Ayurvedic literature. Traditional uses for *A. marmelos* include the treatment of jaundice, chronic diarrhoea, dysentery, constipation, fever, inflammations, acute bronchitis, snakebites, febrile delirium, indigestion, leprosy, myalgia, smallpox, spermatorrhoea, leukoderma, eye disorders, ulcers, mental illnesses, nausea, sores, swelling, thirst, thyroid issues, tumours and ulcers [13].

Pharmacological Activities

Hepatoprotective activity

Rathee et al., (2018) evaluated the hepatoprotective activity of ethanolic extract of *Aegle marmelos* leaf

extract in CCL4 induced liver injury in albino rats. Results of the study revealed that *Aegle marmelos* leaf extract at a dose of 50 mg/kg (p.o.) possesses hepatoprotective activity. The *A. marmelos* leaf extract was determined the hepatic damage biomarkers in serum samples and oxidative stress biomarkers (malondialdehyde, reduced glutathione, glutathione reductase, glutathione peroxidase, glutathione-S-transferase, superoxide dismutase and catalase), pro-inflammatory and anti-inflammatory cytokines were determined in liver homogenates [2].

Anti-diabetic Activity

Sabu and Kuttan (2004) reported anti-diabetic activity of the leaves of *Aegle marmelos* in alloxan induced diabetes in rats. The methanolic extract (120 mg/kg body weight, i.p.) of the leaves of *Aegle marmelos* reduces the blood sugar level. Reduction in blood sugar could be seen from 6th day after continuous administration of the extract and on 12th day sugar levels were found to be reduced by 54% [14].

Analgesic activity

Shankarananth et al., (2007) evaluated the analgesic activity of methanolic extract (200 and 300 mg/kg body weight, p.o.) of leaves of *A. marmelos* in acetic acid-induced writhing test and tail flick test in Swiss mice. The results of the study indicated significant reduction in the writhing induced by acetic acid. Even in tail flick test, methanol extract showed significant analgesic activity by extending the latency to the pain induced by the intense light [15].

Antioxidant activity

Rathee et al., (2018) evaluated the antioxidant activity of ethanolic extract of *Aegle marmelos* leaf extract in CCL4 induced liver injury in albino rats. Results of the study revealed that a leaf of *A. marmelos* at a dose of 50 mg/kg (p.o.) was screened for antioxidant activity by the DPPH radical scavenging. The extract showed efficient antioxidant activity [2].

Diuretic activity:

Singh et al., (2015) assess the diuretic effect of several organic extracts and their fractions of *A. marmelos* fruit. Experimental rats received intraperitoneal dosages of 300, 400, and 500 mg/kg of the extracts. By analysing urine volume and sodium content, they assessed the diuretic impact. They discovered that the larger dose (500 mg/kg) of ethanolic extract significantly increased sodium excretion [16].

Antifertility Effect

Sekar et al., (2011) reported the antifertility effect on aqueous extract of the leaves of *Aegle marmelos* in male

Albino rats. For 45 days, extracts of the *Aegle marmelos* (250 mg/kg body weight) were given to the rats. Treatment resulted in reduction in the weights of testis, epididymis and seminal vesicle. The extract also resulted in reduction of testicular sperm count, epididymal sperm count and motility and abnormal sperm count [13].

Antithyroid Activity

Panda and Kar (2006) assess the anti-thyroid activity leaves of *Aegle marmelos*. It was shown that administering scopolamine to levothyroxine-treated rats resulted in a drop in the amount of serum thyroid hormones (1.00 mg/kg, p.o. for 7 days). Additionally, it was established that scopoletin had better therapeutic effect than the common antithyroid medication and propylthiouracil [17].

Antiarthritic activity

Sekar et al., (2011) evaluation, collagen-induced arthritis in Wistar rats was prevented by *A. marmelos* leaves. Rats treated with methanol extract demonstrated a decrease in paw oedema and arthritic index. In rats treated with methanol extract, radiological and histological alterations were also dramatically reduced [13].

Anticancer activity

Seema et al., (2011), an animal model of Ehrlich ascites carcinoma responded favourably to the hydro alcoholic extract of Bael leaves. The highest anticancer effect was seen after extract administration (400 mg/kg). Both the MTT-based experiment and the brine shrimp lethality assay show that the plant extract is cytotoxic to tumour cell lines [11].

Toxicity Studies

Sharma et al., (2011), the toxicity of the complete alcoholic, total aqueous, whole aqueous and methanolic extracts that were taken from the leaves of *A. marmelos* was investigated in experimental rats. When *A. marmelos* extracts were given intraperitoneally for 14 days in a rat at a dose of 50 mg/kg body weight, there were no noticeable histological alterations. The gathered data show that there is a large drug safety margin for the extracts of *A. marmelos* leaf [5].

Antipyretic potential

Shukla et al., (2011) evaluated the antipyretic property of *A. marmelos* on Brewer's yeast induced pyrexia in albino rats. They reveal that the ethanolic extract, at dose of 200 mg/kg body weight and 400 mg/kg body weight, produced significant ($P < 0.001$) reduction in elevated body temperature in a dose dependent manner. This antipyretic effect of extracts was comparable to that of paracetamol (100 mg/kg body weight) [18].

Conclusion

It is abundantly clear from this review that *A. marmelos* is a significant medicinal herb and is widely used in Ayurveda, Siddha, and other healing systems. Almost all components of this plant, including the leaf, fruit, seed, bark and root are employed in the treatment of many ailments. These have anti-oxidant, anti-bacterial, anti-fungal, anti-diarrheal, anti-diabetic, anti-proliferative, cytoprotective, hepatoprotective, anti-fertility, analgesic, anti-arthritis, anti-hyperlipidemic, cardio protective, radio protective, anti-cancer, anti-viral, anti-ulcer, immunomodulatory, and wound healing properties. Modern drug development from *A. marmelos* can be stressed for the management of numerous disorders, since pharmacologists are eager to create novel medicines from natural sources.

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