



## Pharmacological potential study on bael (*Aegle marmelos*): Rutaceae

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### Abstract

*Aegle marmelos* (Linn) correa, commonly known as bael, belonging to the family Rutaceae. The whole plant is an important ingredient of a number of Ayurvedic and Siddha formulations. It is an important source of various types of chemical compounds as well as pharmacological activities. The present paper deals with botanical description, chemical constituents and Pharmacological potential studies of this medicinal plant.

**Keywords:** ayurvedic and siddha, medicines, herbal drugs

### 1. Introduction

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 [1]. From time immemorial, people of India have been using thousands of medicinal plants for curing various diseases and about 8000 herbal remedies have been codified in Ayurveda [2]. Generally it is believed that natural medicines are better and more risk-free or safer than unnatural or synthetic medicines [3, 4]. Instead of great achievement in synthetic medicines herbs are still playing a vital role regarding the human health as a preventive or curative agent because many green plants derived medicines are in use like quinine, morphine, paclitaxel, camptothecin, etoposide, mevastatin and artemisinin [5]. The reason is that along with the high cost of synthetic medicines they are also associated with some frequent side effects. In the light of this background searching of new and novel herbal drugs are still necessary to treat diseases because beside of their low cost and negligible side effects they have vast pharmacological and biological properties [6].

*Aegle marmelos* (L.) Corr. is a medicinal tree which belongs to the family Rutaceae and its various parts are used in Ayurvedic and Siddha medicines to treat a variety of ailments. Bael is highly habitated to tropical and subtropical climate of India, Burma, Pakistan, Bangladesh, Sri Lanka, Northern Malaya, Java and Philippine [7]. *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.

A number of chemical constituents and various therapeutic effects of leaves of *A. marmelos* have been reported by different workers. Apart from leaves the fruits of the plant also having many of the phytochemicals such as carbohydrates,

protein, fiber, fat, calcium, phosphorus, potassium, Iron, minerals and vitamins (Vitamin A, Vitamin B1, Vitamin C and Riboflavin), steroids, terpenoids, flavonoids, phenolic compounds, lignin, fat and oil, inulin, proteins, alkaloids, cardiac glycosides and flavonoids [8].

### 2. Chemical Constituents

**Table 1:** Phytoconstituents isolated from various parts of *Aegle marmelos* [9].

S. No	Part	Phytoconstituents
1	Leaf	Skimmianine, Aegeline, Lupeol, Cineol, Citral, Citronella, Cuminaldehyde, Eugenol, Marmesinin
2	Bark	Skimmianine, Fagarine, Marmin
3	Fruit	Marmelosin, Luvangetin, Auraptin, Psoralen, Marmelide, Tannin

### 3. Botanical Description

*Aegle marmelos* is a moderate sized, slender, aromatic tree, 6.0 -7.5 m in height, and 90 to 120 cm in girth, with a some what fluted bole of 3.0-4.5 meter growing wild throughout the deciduous forests of India, ascending to an altitude of 1200 meter in the western Himalayas and also occurring in Andaman island [10]. The flowers are greenish white and sweet-scented, fruits are yellowish grey and globose with woody rind and seeds are numerous, oblong and compressed. The roots are fairly large, woody and often curved [11]. This is generally considered as sacred tree by the Hindus, as its leaves are offered to Lord Shiva during worship. According to Hindu mythology, the tree is another form of Lord Kailashnath [12]. The proportion of Sattva component is more in bilva patra and hence it has more capacity to absorb and emit Sattvik frequencies. This has various effects. One of them is the reduction of raja-tama particles present in the atmosphere. A Sattvik leaf like bilva patra when brought in proximity of a person suffering from negative energy, distress than the black energy present within him is reduced [13].



**Fig 1:** Whole Plants of *Aegle marmelos*

#### 4. Phytopharmacological Activity

##### 4.1 Analgesic

The methanol extract of leaves of *Aegle marmelos* at a dose level of 200 and 300 mg/kg showed significant analgesic activity on acetic acid-induced writhing and tail flick test in mice [14].

##### 4.2 Hepatoprotective Activity

Singanan *et al.* [15] reported that the leaf extract of *Aegle Marmelos* have excellent hepatoprotective effects. Similarly, Rannik also demonstrated that aqueous extract of bael fruit pulp and seeds are effective in the treatment and prevention of CCl<sub>4</sub> induced hepatic toxicity [16].

##### 4.3 Anti-fertility

*A. marmelos* reduced fertility of male rats by 100% at the 300-mg dose level. Serum testosterone levels also decreased significantly in all the experimental groups. The protein, glycogen and lipid peroxidation content of the testes was significantly reduced at the highest dose level, a highly significant increase in testicular cholesterol was observed along with a highly significant reduction in the sialic acid contents of testes, epididymis and seminal vesicles. Blood tests did not point to distress in any of the vital organs. Withdrawal of the extract restored all the altered parameters including organ weights, fertility, testosterone levels and tissue biochemistry to control levels after 120 days. The leaf extract of *A. marmelos* suppresses fertility in male rats. Complete recovery of fertility was observed following the withdrawal of drug. Absence of any deleterious effect on the vital organs points to the safe use of the extract [17].

##### 4.4 Anti-inflammatory Activity

This activity may be due to the presence of some anti-inflammatory and anti-allergenic constituents, such as Lupeol and Citral present in the alcoholic extract, as most of the anti-inflammatory and anti-allergenic compounds act through inhibition of histamine mediated signaling [18].

##### 4.5 Wound Healing Activity

Effect of topical and intraperitoneal administration of methanolic extract of *Aegle marmelos* ointment and injection was studied respectively on two types of wound models in rats, the excision and the incision wound model. Both the injection and the ointment of the methanolic extract of *Aegle*

*marmelos* produced a significant response in both of the wound type tested. In the excision model the extract treated wounds were found to epithelialize faster and the rate of wound contraction was higher, as compared to control wounds. The extract facilitated the healing process as evidenced by increase in the tensile strength in the incision model. The results were also comparable to those of a standard drug nitrofurazone [19].

##### 4.6 Anti thyroid Activity

Panda and Kar isolated, Scopoletin (7-hydroxy-6- methoxy coumarin) from *Aegle marmelos* leaves and evaluate for its potential to regulate hyperthyroidism. It was observed that scopoletin (at 1.00 mg / kg, p.o. for 7 days) to levothyroxine treated animals, decreased serum thyroid hormones level. It was also proved that the scopoletin have superior therapeutic activity than the standard antithyroid drug, propylthiouracil [20].

##### 4.7 Anticancer Activity

Leticia and Costa evaluated the anticancer potential of folk medicine used in Bangladeshi and used extracts of *Aegle marmelos* for cytotoxic action using brine shrimp lethality assay; sea urchin eggs assay, and MTT assay using tumor cell lines. The extract of *Aegle marmelos* was found to exhibited toxicity on all used assays [21]. Similarly, Gagetia reported the anticancer effect of hydroalcoholic extract of bael leaves in the animal model of Ehrlich ascites carcinoma and proposed that induction of apoptosis may be due the presence of skimmianine in extract [22].

#### 5. Conclusion

It is quite evident from this review that *Aegle marmelos* contains a number of phytoconstituents which reveals its uses for various therapeutic purposes. This plant has great potential to develop the Ayurvedic, modern medicine and athletic supplements by pharmaceutical industries. This is the tree that is effective in treatment of various disease without producing any side effect. This review will serve the purpose of aiding in future Research work on this plant.

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