

## A REVIEW ON MEDICINAL USES OF AEGLE MARMELOS

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## ABSTRACT

*Aegle marmelos* is the plant that widely present in India, Pakistan, Bangladesh, shrilanka and Nepal it belongs to family rutaceae genus aegle and order sapindales. Not only the fruit but the leaves, stem, bark and roots have the medicinal value. *Aegle marmelos* is commonly known as golden apple, stone apple or wood apple and Japanese bitter orange. it is also occurred in south asia where it is known as bael and it is widely use for to treat diseases and disorders . It is also used as dietary supplement and it possess antioxidant properties. *Aegle marmelos* is a small or shrub size to medium size tree with long branches. This plant have medicinal value the each part of the plant contain therapeutic constituent. It is investigated that these compound have biological activity and medicinal properties against various

infectious diseases and disorders including diabetes, cancer and heart related problems. Besides medicinal value the bael plant has cultural and environment this plant absorb the hazardous gases and chemical pollutants from the atmosphere and it release oxygen in higher percentage than other plant hence it is known as "climate cleaner". It is also have the great cultural value in Hindus it offers leaves to lord Shiva. The present review emphasizes and covered the pharmacological activity and bioactive constituents of the bael plant. The motive of this study to investigate the biological activity of chemical constituent that are present in the bael plant.

**KEYWORDS:** Bael Fruit Extract, Medicinal Value, Phytochemistry, pharmacology.

## INTRODUCTION

Aegle Marmelos normally called bael is an underappreciated fruit native to the Indian subcontinent, which includes Nepal, India, Sri Lanka, Bangladesh, and Thailand. It's far a medium-sized deciduous tree belonging to the rosaceae family. It's miles a subtropical plant that can adapt to a huge range of habitats and can be grown global. The plant grows as much as 1200 meters above sea stage in preferred, however it's been recorded that the trees develop up to 1500 meters in Nepal, stretching from the hills to the terai region, and it has a extensive variety of adaptability to opposed soil and surroundings. Temperature tolerances variety from 7 to 48 stages Celsius and it grows well inside the swampy, alkaline, and sandy wilderness. (18) 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, end result and seeds are used considerably in the Indian traditional system of drugs the Ayurveda and in diverse folks remedy to treat myriad illnesses. Bael end result are of dietary use and the fruit pulp is used to put together cuisine like murabba, puddings and juice. Bael fruits are also used inside the remedy of persistent diarrhoea, dysentery, and peptic ulcers, as a laxative and to recuperate from respiratory affections in numerous people drug treatments. scientific research have verified many of the medicinal uses and reviews indicate that the fruit possesses wide variety of healing outcomes that includes unfastened radical scavenging, antioxidant, inhibition of lipid peroxidation, antibacterial, antiviral, anti-diarrheal, gastro protective, anti-ulcerative colitis, hepatoprotective, antidiabetic, cardio protecting and radio defensive outcomes. For the first time, this evaluation severely assesses the dietary values, phytochemistry and preclinical pharmacological homes of the bael fruit. tries also are made at emphasizing the dietary and pharmaceutical ability of bael fruit that has been largely underutilized and neglected. besides food and medicinal cost, it also has environmental and cultural importance. The plant acts as a sink a take a seat absorbs chemical pollutants and harmful gases from the surroundings. it's far called a "climate cleanser" because it emits a higher percent of oxygen than different plant life. It has wonderful Cultural significance amongst Hindus and, therefore, has been regularly cultivated on temple premises to offer fruit and leaves to lord Shiva. The objective of this paintings is to study the nutritional and healing benefits of bael along side the phytochemicals found in various parts of the plant. This evaluate Distinguishes itself from preceding paintings by using addressing the need for innovative fruit processing techniques which can enhance the marketability of bael as a functional food factor. Such techniques are critical to facilitate the clean intake of bael and add price to its purposeful houses and add price to its purposeful houses

- Botanical description: The complete descriptions of the biological functions of bael are available.<sup>[1]</sup> the size and the architecture of the bael tree are extraordinarily variable depending at the soil and climatic elements; but, the essential botanical features stay consistent irrespective of the climatic factors. From an agricultural perspective, growers need to prune and manage the tree to a convenient size and hold a appropriate range of branches for maximum fruit manufacturing.<sup>[1]</sup>
- Tree morphology: Bael tree is deciduous, and the crown is compact or dense, without a weeping branches. every so often the lower limbs are drooping. The tree is difficult and broadly adaptable to destructive soil and climatic situations. The bael tree can develop up to 10 m or higher with medium or big sizes with severa branches. The end result particularly arise in the periphery of the canopy. The trunk is short and thick with narrow oval shape ends The timber is inflexible and gradual-growing and young wood has a significant pith. underneath natural habitats, the bushes are smaller and abnormal. The timber possess quick, sturdy, non spiny, or piercing-spiny branches.



**Fig. 1: bael plant with frui.**

## **MONOGRAPH OF BAEL PLANT**

### **Synonyms**

Golden apple, stone apple, wooden apple, bael, Bengal quince.

### **Biological Source**

It encompass complete dried in addition to fresh a part of plant acquired from the plant *Aegle marmelos*.

**Family:** Rutaceae

Morphological character

Character	Sparkling unripe fruit	Dried unripe fruit
colour	darkish inexperienced	Brownish purple
Odour	aromatic odour	aromatic odour
taste	Mucilaginous	Mucilaginous
size	12-13.5cm in diameter	5.7cm
Texture	clean	Hard
Fracture	fibrous	fibrous

Chemical materials: It contain

1. Skimmianine
2. Fagarin
3. B –carotene
4. Marmin
5. Vitamin A
6. CITRAL

Uses

It use as an antidiabetic and antilipidemic

It gives antidiarrheal activity.

It used as a nutritional complement.

It have antiviral and anticancer interest.

It used as an antioxidant.

It additionally have radioprotective interest.

it's far used in the ayurvedic coaching.

**Flower Morphology:** The vegetation are aromatic and shape four–7 clusters along the branches. Flower has 4 or five recurved and fleshy petals (the outdoors color is inexperienced, and the inside shade is yellow) with 50 or extra greenish-yellow stamens. The flower is 2 cm huge, sweet-scented, stalked, lax, erect, and happened axillary or terminal cymes. The calyx is shallow, with five short, huge enamel, and pubescent out of doors. The stigma is capitate, and the ovary is rectangular-ovoid and barely tapering into the thick short style.

**Leaf Morphology:** The leaves are alternate, unmarried, or compound with one or sometimes two pairs of shortly stalked contrary leaflet. The leaf petioles are glabrous and long, and without a wings absent.

**Table 1: The Different Names Of *Aegle Marmelos* i.e Bael In India.**

Language	Names
Sanskrit	Shriphal
Hindi	Bael
Telugu	Maredu
Bengali	Bel
Guajarati	Bil
Kannada	Malura
Tamil	Kuvalum

Biologically active Phytochemicals present in bael: all the element of the bael tree are wealthy in phytochemicals which include coumarin, scoparone scopoletin, umbelliferone and marmesin alkaloids and terpenoid.<sup>[16]</sup>

Phytochemicals in fruit: bael fruit comprise xanthoxol imperatorin, alloimperatorin, B-sistosterol tannins and alkaloid which include aegeline and marmeline. Tannin turned into found to increase through out ripening in which the very best tannin content material was located in fully ripe end result. Riboflavin an critical vitamin is most effective discovered in completely ripe fruits but the ascorbic acid content material decrease appreciably with fruit ripening, implying a marked reduction of antioxidant pastime with fruit maturation. A glycoprotein became discovered in bael and its partial structure turned into proposed through Mandal and Mukherjee.<sup>[4]</sup> Bael has phenyl propanoid which are established to be anticancer.<sup>[2]</sup> The profile of the phytochemicals present in unripe bael culmination is given, in which marmelin is offered as the key bioactive compound.<sup>[5]</sup> The principle risky compound are present in bael are monoterpene and sesquiterpenes. Some other compound referred to shanhidine is likewise present, which is a newly said molecule having very excessive labile oxazoline hobby towards few gram effective bacteria,<sup>[19]</sup> The gum of the surrounding environment of the seeds in bael fruit also incorporates phytochemicals.

Phytochemicals in Leaves: Stem, and Roots. Leaves comprise alkaloids, marmesinin, rutin, phenylethyl cinnamides, anhydromarmeline, and aegelinosides.<sup>[2,3,4,7]</sup> sterols and vital oils,<sup>[7]</sup> stem, barks and roots include a coumarin as aegelinol. Roots additionally include psoralen xanthotoxin coumarin, tembamide mermesins and skimmianine.<sup>[14]</sup>

**Table 2: Phytochemicals present in different parts of the plant and their medicinal value.**

Parts	Bioactive compound	Medicinal value
Fruit	Marmelosin Luvangetin Aurapten Psoralen Marmelide Tannin Riboflavin B-carotene	Anthelmintic, antibacterial, Antiulcer, Heartbeat inhibitor, hypertension, Cytotoxic, antispasmodic, artemiside, Antiviral, Antidiarrhea, astringent, Essential for growth, prevent glossitis and cheilosis Glaucoma, cataract
Leaves	Skimmianine Cuminaldehyde Lupeol Eugenol, Cineol Citronellal Marmesinin Aegelin Citral	Hypothermic, antimethamphetamine, antipyretic, anticancer Antibacterial Anti-inflammatory Antioxidant antiulcer hepatoprotective Antiulcer Antiseptic Cardioprotective, antioxidant Antidyslipidemic, cardioactive Antiseptic, antiallergic
Bark	Marmin Fagrin	Antiulcer Abortifacient

**Medicinal importance**

Antimicrobial activity: many in vitro research were pronounced to inhibit a extensive spectrum of pathogenic microorganism together with micro organism fungiand viruses with the aid of the one of a kind extract of bael plant. In a observe achieved by using Rani and Khullar, the methonolic extract of bael in opposition to salmonella typhi became located to be powerful.<sup>[15]</sup> In addition in every other study, the ethanolic extract showed antibacterial homes in opposite to E. coli Staphylococcus aureus pseudomonas aeruginosa and Bacillus subtilis.<sup>[20]</sup> By examine the leaf extract of the fruit became found to be effective towards diffusion of gram high quality microorganism consisting of Bacillus cereus, Staphylococcus aureus, Staphylococcus epidermidis, enterobacter aerogenes, usually a concentration of 40g/ml.<sup>[17]</sup> This could be because of the presence of the compound eugenol and cuminaldehyde through specific mechanism like blockage of protein synthesis or peptidoglycan synthesis at the membrane degree.<sup>[8]</sup> Furthermore the antiviral pastime of diverse component of the plant has been validated towards human coxsackie virus B1-B6. The compound marmelide at an attention of 62.5g/ml indicates the best viricidal activity through interfering with the early level of the viral replicate cycle.<sup>[15]</sup>

Cardio protective activity: coronary heart and blood vessel ailments are the maximum common reasons of cardiovascular disorder, which consist of arrhythmia, stroke, hypertension, myocardial infarction, and atherosclerosis. Numerous hazard factors, like cell-derived micro particles and hypercholesterolemia, are associated with the ones ailments. Medicinal plant life are effective in opposition to the ones cardiovascular ailments, which assist in the inhibition of lipid peroxidation, decrease the level of low-density lipoprotein, and enhance endothelial disease.<sup>[14]</sup> A bioactive compound named linear furanocoumarin marmesinin, extracted from Bael, can protect towards lipid peroxidation. In a examine completed on albino Wister rats having myocardial harm at the same time as tested via manner of the compound at a dosage of 200 mg/kg, the end result confirmed a lower in serum restored the electrocardiographic modifications toward normalcy.<sup>[19]</sup>

### **Antidiabetic activity**

Bael extracts are proven to have appreciably higher antidiabetic sports whilst examined the use of animal fashions.<sup>[11]</sup> The fruit extracts of bael have confirmed shielding consequences on pancreatic tissues of diabetic rats.<sup>[9]</sup> Aqueous and alcoholic extracts of end result admimistrated at a dose of 500 mg according to kg of frame weight produced hyperglycemia in rabbits. An elevation of diet C content material changed into additionally followed by hyperglycemia when rats were administered with bael fruit extracts.<sup>[3,11]</sup> in addition commentary of hyperglycemic hobby and antihypoglycemic interest of the bael aqueous extracts have been made the usage of rat models. those antidiabetic and hyperglycemic consequences were similarly showed by using Choudhary et al. using aqueous extracts of bael seeds. Bael leaves have additionally shown the hyperglycemic effect. The bael leaf extracts can lower Mi receptor gene expression and inhibit aldose reductase pastime, anticataract activity and loose radical scavenging pastime, and they all are related to diabetes.<sup>[12,13]</sup>

Antiulcer activity: An ulcer is a common gastrointestinal tract ailment that can be as a result of the infection of *Helicobacter pylori* or by means of the usage of nonsteroidal anti-inflammatory drugs capsules. This ends in publicity of acid-pepsin secretions to the upper gastrointestinal tract. similarly, to evaluate the efficiency of Bael against gastric ulcers and oral management of one g/kg of the aqueous extract of leaves of Bael for 21 days towards *Helicobacter pylori* lipopolysaccharide-brought about gastric ulcer in rats confirmed a substantial discount within the ulcer the accountable compound for antihyperglycemic hobby

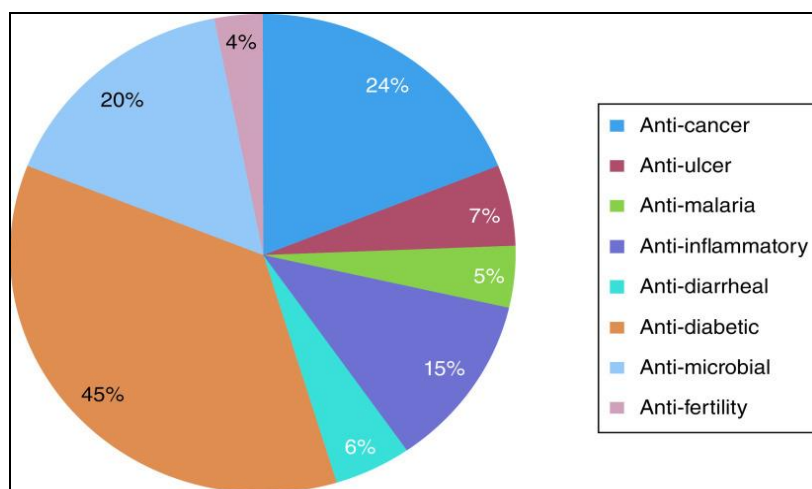


lesion remember, the volume of gastric juice, and acidity and an boom in pH and hexosamine.<sup>[19]</sup>

Bael fruit in traditional medicinal drug: Inside the Ayurvedic system of drugs, bael culmination are taken into consideration as an super remedy for diarrhea (Das & Das, 1995). The unripe end result are bitter, acrid, sour, and astringent, and aids digestion and stomach infection. The half-ripe fruit is astringent, digestive and anti-diarrheal. The ripe fruits are supposed to be greater beneficial than the uncooked and are used to save you sub-acute and continual dysentery. The fruit pulp acts as a mild stimulant to the intestinal mucus membrane and stops diarrhea. The ripe fruit are aromatic, cooling and acts as a laxative.<sup>[20]</sup>

The pharamacological activity of Aegle Marmelos plant have been reported scientifically and illustrated in pie chart no. 01.

This pie chart repoted the scientific conclusion of pharmacological activity of active constituent present in Aegle Marmelos plant by the percentage.



## CONCLISION

The record paper of the Aegle Marmelos suggests the pharmacological activity in opposition to many sickness and it have the healing value. the therapeutic in addition to pharmacological value of bael plant is examined and investigated on this paper. This investigation concludes that the bael fruit have treating and stopping belongings in opposition to specific medicinal situation like infectious illnesses most cancers, and viral infection other like used as antipyretic, nutritional supplement, appetite improver, antiulcer and preclinical research on A. Marmelos. This investigation suggests that the Aegle Marmelos lively materials which



possess the medicinal value via making use of this energetic constituent the brand new medicinal dosage shape may be prepared for the prevention mitigation and treatment of the type of pathogenic infection like cancer, diabetes and malaria etc. considering clinical literature, many fit to be eaten plant species, due to their traits, may be advanced as new substances useful to generate fitness advantages or to be exploited for the instruction of meals dietary supplements or medicinal meals. Such plants are gaining importance around the world, in each bad and evolved countries, owing to the excessive expense of artificial drugs, in addition to their commonplace destructive aspect consequences. herbal pills are abundantly to be had as they are cheap and haven't any side results. humans's changing behavior toward wholesome food habits and their health has led to the developing improvement of practical meals merchandise within the marketplace. consequently, the take a look at of underutilized plant life and their products has been explored for several ethno botanical purposes. historically, Bael has been used to deal with numerous human diseases. The presence of various bioactive compounds and their nutritional composition makes it a capability fruit to be evolved as a nutraceutical. despite having many fitness advantages, the fruit remains underutilized and has been used regionally. other than exploring the opportunities of using the different plant parts as medicine, the manufacturing of various useful products via the usage of its fruits must be promoted at a business degree. within the future, it can be developed as a purposeful meals product and play a significant. *A. marmelos* has been historically used for a diffusion of ethno botanical purposes. regrettably, most compounds still need to be thoroughly assessed to investigate novel lead molecules or pharmacophores. furthermore, the mechanisms of some bioactive chemical compounds had been determined so far. comprehensive research is important to ascertain the mechanisms of action, the bioactivity of numerous phytochemicals, and the effectiveness of *A. marmelos* medicinal characteristics. *A. marmelos* has been traditionally used for a spread of ethno botanical functions. unfortunately, most compounds still need to be very well assessed to investigate novel lead molecules or pharmacophores. moreover, the mechanisms of a few bioactive chemicals were discovered thus far. complete studies is necessary to examine the mechanisms of action, the bioactivity of numerous phytochemicals, and the effectiveness of *A. marmelos* medicinal characteristics. it's far important to increase clinical research on this medicinal plant and research from traditional healers who have gathered knowledge through many generations of trial and errors. the use of bael has won popularity worldwide as its useful characteristics are being researched to develop new treatments probably. As a result,

the demand for novel healing pills with focused action and restricted adverse effects justifies in addition clinical and preclinical research on *A. Marmelos*.

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