

# "Phytopharmacological Evaluation of *Aegle marmelos* (Bael): A Potential Antipyretic Agent in Traditional Indian Medicine"

<sup>1</sup>Patil Sanika 1<sup>st</sup>, <sup>2</sup>Pituk Swapnanjali 2<sup>nd</sup>, <sup>3</sup>Patil Pranjali 3<sup>rd</sup>, <sup>4</sup>kumbhar Prashant 4<sup>th</sup>

<sup>1</sup>student 1st, <sup>2</sup> student 2nd, <sup>3</sup> student 3rd, <sup>4</sup> professor 5th

<sup>1</sup> Department of pharmaceuticas

<sup>1</sup>Ashokrao mane college of pharmacy, Peth -Vadgaon, Kolhapur, India

**Abstract:** One of the world's most extensive traditions of plant-based medicine is found in India. Scientists have tested compounds derived from plants to treat a range of illnesses. Evidence from studies shows that common plant parts have potential as medicines for a range of medical conditions. Sources consulted for this data set include Google Scholar, Scopus, Science Direct, and PubMed. Words like "Marmelosin," "Bael," and "A. marmelos" are common. Extensive study on *A. marmelos* has showed a wide range of beneficial properties, including actions against diarrhoea, viruses, cancer, chemoprevention, high body temperature, ulcer healing, genotoxicity, incontinence, and inflammation. This article provides an updated literature review that describes the components of *A. marmelos* and their most important biological activities; it aims to illuminate the existing state of research on *A. marmelos*.

## Keywords:

**Bael, *Aegle marmelos*, Vilvam, Marmelosin, plant-based medicine, phytochemicals, medicinal plants, antidiarrheal, antimicrobial, antiviral, anticancer, anti-inflammatory, traditional Indian medicine, bioactive compounds, ethnopharmacology**

## INTRODUCTION

Bael a fruit that is often overlooked, is originally from India [1]. It is a part of the Rutaceae family of citrus and frequently referred to as Indian quince, bilva, and Bengal quince. [2] The golden apple, which goes by many names in India, including maredo, sriphal, bel, belva, and the holy fruit. It arrived in Europe from India around 1759. In Hinduism, it is a blessed tree that is sacrificed when Parvati and Shiva pray. Another name for the tree is "Shivaduma" (The Tree of Shiva). Ancient texts such as the Charaka Samhita, Upvana Vinod, and Yajur Veda may have information about its therapeutic benefits. Additionally, artwork from the Ajanta Caves depicts it. [3]

Bael tree is revered by Hindus. They donate their leaves to be grown in India. Many illnesses and conditions can be treated with the help of these plants. They can serve as a herbal composition for fever treatment.[4] Temperature, body pain, weakness, and other symptoms are among the systems that are used to treat fever in cases of typhoid. typhoid Acute intestinal infections caused by poor hygiene cause fever. The spread of typhoid is caused by habits and inadequate sanitation. Herbal medicine is one way to cure them. The goal is to demonstrate that there are no contraindications to

the use of herbal remedies for easy healing. It's simple to treat this infection conventionally because it's dose dependant and can be managed with Ayurvedic or folk medicine.

Bael trees, native to South and Southeast Asian countries. It can withstand temperatures as low as -7°C.[6]

One of the most noticeable and significant symptoms of many diseases that can affect the human body is fever. Inflammation, infection, or any other disease brought on by outside forces is the root cause of these conditions. Infections, tissue damage, cancer, transplant rejection, and other inflammatory diseases can cause a person's body temperature to increase above the normal range (36.5-37.5°C), which is referred to as a fever. 1 Extremely ill patients may have fever or pyrexia in as many as 75% of cases. A overview of fever, fever patterns, and fever-related disorders by Ogoina D. Public Health Journal of Infectious Diseases, 2011

Therefore, purpose of this work is to record many traditional uses of bael Correa, a medicinal plant that is highly prized in India due to its inexpensive therapeutic value, and to highlight the necessity of preserving this plant for future generations. Because the fruit's medicinal worth is most at the peak of ripeness, it is recommended to consume the fruit at its peak of freshness. Traditional medicine has made use of both ripe and unripe fruits, as well as the plant's roots, foliage, and branches. Ayurvedic practitioners have traditionally recommended ripe fruit as a remedy for dysentery, chronic diarrhoea, and other gastrointestinal disorders. Additionally, the fruit has been used as an adjuvant treatment for dysentery and as a tonic for the heart and brain. Traditional Ayurvedic medicine makes extensive use of boiling the roots for the treatment of depression, intermittent fevers, and arrhythmias. [7]

#### Objective: -

1. To scientifically evaluate the antipyretic potential of aegle marmelos and its bioactive compound.
2. To assess it's potential as a natural and safe alternative for fever management.

#### Morphological Characters

Table 1 shows the differences that were noted between the accessions that were gathered. Babupara, located at site 6, had the tallest trees (8.67 m), whereas Reserve Gittim, located at location 4, had the smallest trees (5.67 m). Location-5, or Sampalgre, had the largest trunk girth (132.03 cm), whereas location-1, or Rongram, had the smallest trunk girth (66.13 cm). Location-8, also known as Sangsangre, had the most North-South tree spread at 7.62 meters, while Location-5, also known as Sampalgre, had the greatest East-West tree spread at 6.81 meters. The South-North and East-West orientations were recorded by the smallest tree at Location-3, also known as Sampalgre. Cherangre spans 4.83 meters and 3.57 meters. Trees vary substantially in height, breadth, spread, and fruit output per tree, according to studies on the morphological features of the fruit crop conducted by Patil et al.(2017), Kumar et al. (2014), Simla et al.(2017), and Goswami et al. (2011).

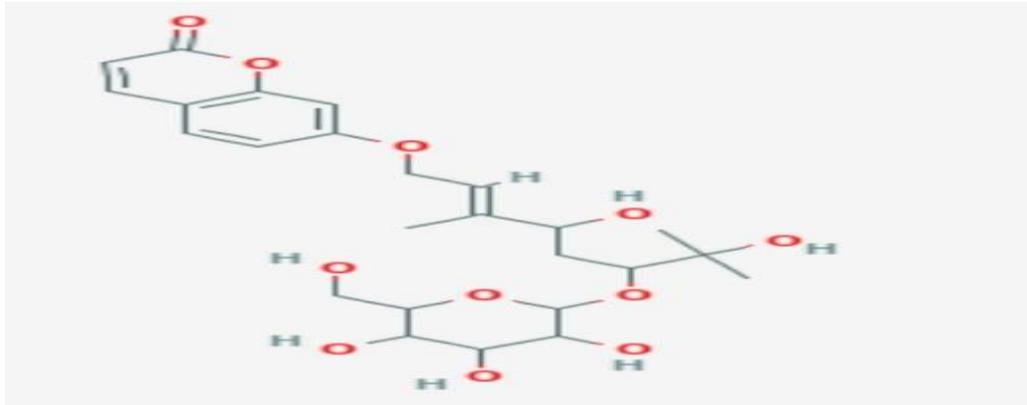
**Table.1** Morphological characters of the trees

Location	Tree height(m)	Trunk girth(cm)	Tree spread (m)	
			North- South	East-West
L <sub>1</sub> -Rr	6.53	66.13	6.45	6.03
L <sub>2</sub> -Rk	8.57	117.10	5.34	5.95
L <sub>3</sub> -Cg	7.13	84.66	4.83	3.57
L <sub>4</sub> -Rg	5.67	71.78	5.17	5.03
L <sub>5</sub> -Sp	7.40	132.03	7.20	6.81
L <sub>6</sub> -Bp	8.67	78.93	6.83	6.71
L <sub>7</sub> -Hk	7.47	77.40	5.73	6.37
L <sub>8</sub> -Sg	6.47	84.34	7.62	6.50
L <sub>9</sub> -Dp	6.30	75.53	5.36	5.56
L <sub>10</sub> -Sh	6.43	79.35	6.12	6.47
S.Ed	<b>0.68</b>	<b>7.01</b>	<b>0.54</b>	<b>0.53</b>
CD (5%)	<b>1.433</b>	<b>14.72</b>	<b>1.13</b>	<b>1.12</b>
CV%	<b>11.82</b>	<b>9.90</b>	<b>10.88</b>	<b>11.03</b>

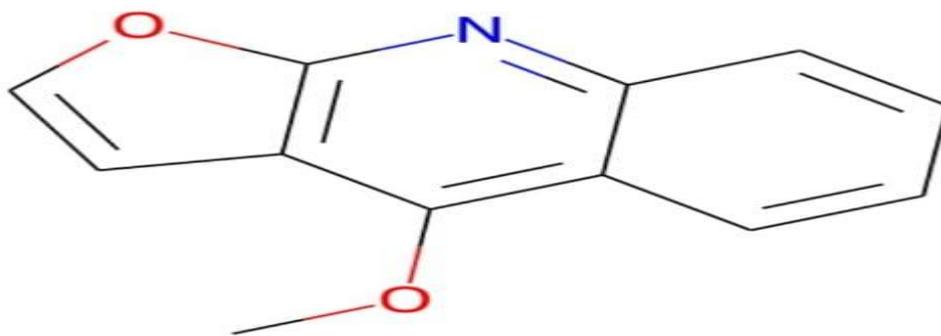
## Phytochemical constituents

### Alkaloids

Manandhar et al. (1978) found the following compounds: isopentenylhalfordi-nol33, fragrine, O-methylhalfordinine, and N-2-[4-(3', 3'-dimethylallyloxy) phenyl]. This molecule is N-2-hydroxy-2-[4-(3', 3'- dimethylallyloxy) phenyl] ethyl cinnamide conjugated with two hydroxyphenyl groups N-2-[4-(3', 3'dimethylallyloxy) phenyl] cinnamide, N-2-ethoxy-2-(4-methoxyphenyl) ethyl cinnamide (N-2-methoxy-2-(4-methoxy-phenyl)-ethylcinnamide) and ethyl-cinnamide, also known as O-(3, 3-dimethylallyl)halofordinol. The authors of the 1978 study were Anandhar, Shoeb, Kapil, and Popli. Aegle marmelos yields novel alkaloids. [Phenochemical Research, 17: 1814-1815.] [8]



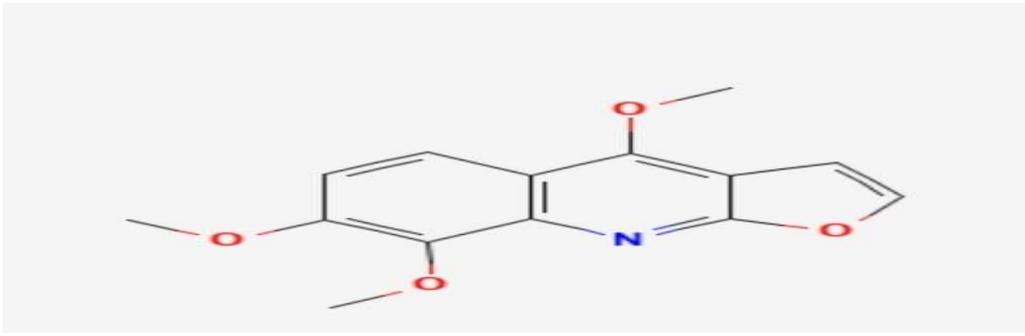
aeglin,



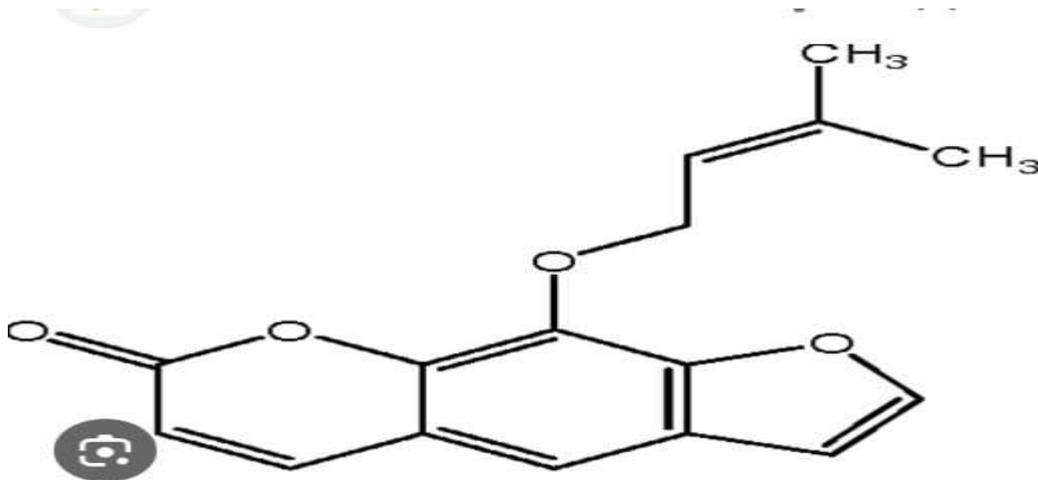
dictamine,

### Tannins

The tannins January is when the bael fruit has the highest tannin content. Wild fruit pulp can contain up to 9% tannin, although farmed fruit pulp has less. Leaves also contain tannin in the form of skimmianine, or quinoline.[9] Because carotenoids are present, the fruit has a pale tint. Because of the presence of umbelliferone, marmelosin, and skimmianine, the bael plant's carotenoids have medicinal properties. Additionally present are trace amounts of sitosterol, crude proteins, ascorbic acid, tannins,  $\alpha$ -amyrin, carotenoids, and crude fibers. Arooq, S. (2005). Medicinal Plants, 555. Dehradun: International Book Distributors, Field and Laboratory Manual, pp. 40–42[10]



skimmianine,

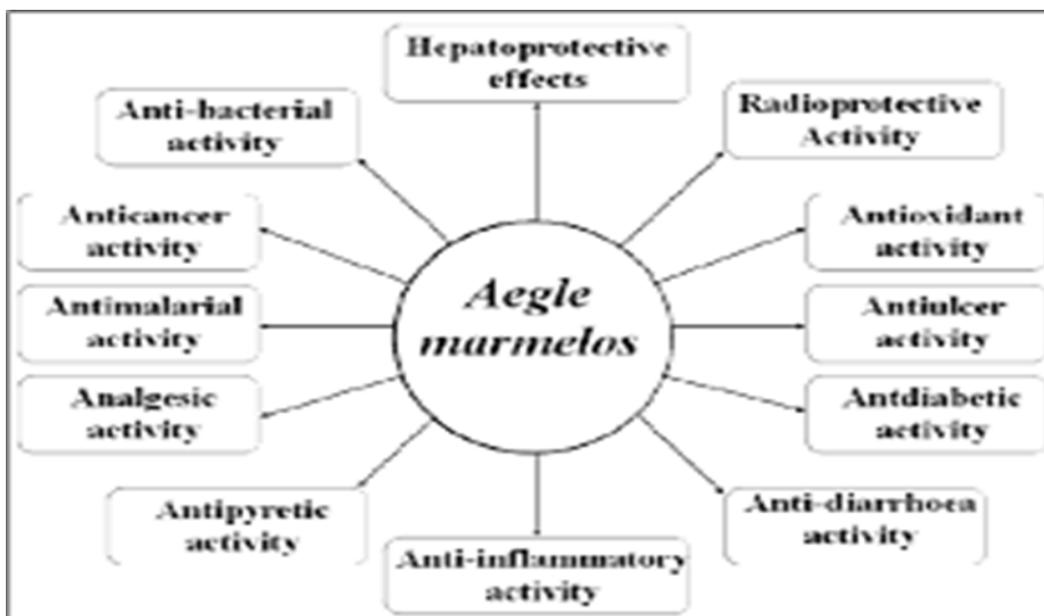


marmelosin,

### Medicinal uses

1. A. marmelo has radioprotective, antidiabetic, and anticancer properties, which are why it is employed.
2. Bael's therapeutic characteristics make its numerous components useful for controlling asthma, fractu anaemia, wound healing, hypertension, and typhoid through pregnancy.
3. Therapeutic significance of bael has been described in focusing on each section of the plant.
4. Leaves: Common medical conditions for which the leaves are recommended include dyspepsia, seminal weakness, swellings, nausea, vomiting, diarrhoea, and intermittent fever. The leaves of the Bael ptr plant are There have been claims that it can be used as an analgesic, febrifuge, haypogylacemia therapy, and inflammation treatment.

The decoction of the tree's roots and bark is used to treat fevers, thus researchers have been trying to determine whether the aegle marmelo and betal leaf plants have any antipyretic properties. [11]



### Mechanism

Anti-inflammatory or antipyretic properties inflammation of body parts is one of protection mechanisms used when foreign particles or viruses assault. Inflammation can manifest as heat, redness, swelling, or pain.[12] Analgesic action has been noted in paw oedema caused by carrageenan. This can also be observed in cotton-pellet granuloma.[13] Additional findings can include paw licking in both early and late-stage mice as well as a decrease in hyperpyrexia. These are the indications that bael leaf extract has analgesic and antipyretic properties. Bael aqueous leaf extract combined with nickel nanoparticle phytofabrication is more effective than leaf extract alone in a study that considers mosquito larvicidal activities.[14] Bael extract contains  $\beta$  caryophyllene and caryophyllene oxide, which have been demonstrated to have anti-inflammatory properties against both neuroblastoma and lymphoma cells. To do this, pro-apoptotic genes are upregulated and anti-apoptotic ones are downregulated. [15] When testing dried bael flower extract on Wistar rats, the ideal dose to examine its anti-inflammatory effects was found to be 200 mg/kg. Bael lowers the body temperature of albino rats that have Brewer's yeast-induced pyrexia. Lowering increased core body temperature is possible with Bael ethanol extract at doses of 200-400 mg/kg. In addition to its antioxidant, anti-inflammatory, and mast cell-stabilizing properties, bael fruit extract.[16] It also raises superoxide dismutase and lowers malondialdehyde levels, which prevent mast cells from degranulating. Research on carrageenan-induced paw oedema has shown that bael tree root bark has potent anti-inflammatory properties. [17] Roots of bael tree, when young, have potent anti-inflammatory effects because they block COX-2, which reduces cytokines that promote inflammation. Found in An in vitro investigation shown that Bael leaf extract, at a dosage of 100  $\mu$ g/mL, had anti-inflammatory properties. Marmelosin, an anti-inflammatory chemical derived from bael fruit, exerts its effects by reducing levels of the pro-inflammatory cytokine TNF- $\alpha$  and nitric oxide. Additional research has demonstrated that Bael's methanolic extract can alleviate pain by acting on both the central and peripheral nerve systems. A superior tail-flick radiant heat model was found to be dried ripe fruit according to the findings of the acetic acid animal model. [19] Bael is able to assist those who are experiencing discomfort. Animals administered 200 or 300 mg/kg of bael showed a reduction in pain responses to acetic acid-induced writhing and tail-flicking. [20]

### In Vivo Antipyretic Activity

- Fever Induction: Fever was induced in animal models using methods such as injection of pyrogens. [21]
- Extract Administration: The extract was administered orally or intravenously to the animals after fever induction. [22]

- Temperature Monitoring: Body temperature was monitored regularly using rectal thermometers or other Methods. [23]
- Antipyretic Effect: ability of extract to decrease fever was assessed by comparing temperature changes in treated animals with control groups [24]

### **In vitro Antipyretic Action of *Aegle Marmelos* extract**

Animal used: *Aegle marmelos* extract's antipyretic effects in a controlled laboratory setting For the antipyretic trial, Wistar albino rats weighing  $150 \pm 20$  g were utilised. Albino mice weighing approximately  $25 \pm 5$  g were used for the acute toxicity assessment of the crude extracts. [25] The Project approval (919/ac/08/CPCSEA) has been granted by the Institutional Animal Ethics Committee. Prior to and during the studies, the animals were housed in an animal house belonging to the relevant department for a duration of one week. Light and dark cycles of 10 and 14 hours, respectively, were present in the room, together with sufficient ventilation, a temperature of  $27 \pm 20^\circ\text{C}$ , and a relative humidity of 44-56%. [26] After being fed their usual diet of Lipton tea from India, the animals were fasted for 18 to 24 hours before to the experiment. [27]

### **Toxicology study**

There have been no known toxicological consequences from bael ingestion in studies, therefore it is safe to eat. [28] the mice showed no signs of harm following 30 days of treatment with 250 mg/kg bodyweight of bael extract. According to pathology investigations, there has been no indication of histological changes produced by bael use over a long length of time. After running the TA 100 *Salmonella typhimurium* strain through the Ames test, it was concluded that Bales had no effect on gene expression. Veerappan et al. (2007) found no histological alterations in the brain, liver, kidneys, heart, testicles, or brain after administering 50 mg/kg bodyweight of bael extract intraperitoneally. The acute and sub-acute values, as well as the lethal dose (LD50) for rats, have been calculated using bael extract in aqueous, methanolic, and ethanolic forms. Not a single safety concern has been raised regarding the 14-day intraperitoneal administration of 50 mg/kg body weight. [29] Research conducted later on confirmed the safety of intraperitoneal administration of Bael leaf extract at doses of 50, 70, 90, and 100 mg/kg body weight for 14 days to both male and female Wistar rats. According to [30], bael essential oil is safe because it lowers triglyceride levels and changes urea levels without affecting creatinine levels in a study with Wistar rats. cited as [31] within Nothing bad has happened when pregnant rats have been given bael extract. [32]

### **Conclusion:**

Incorporating *Aegle marmelos* into functional food products has the potential to improve health, and it could potentially be a future nutraceutical resource. Furthermore, its characteristic colour, flavour, and texture make it a potential culinary ingredient. The findings can help improve bael fruit cultivation quality, which in turn increases the fruit's worth and utility.

Results exhibited that both experimental plant extract and its solvent fraction had antipyretic efficacy, and the plant extract was deemed safe for mice to consume. The results of this study point to the possibility of using extracts from *Aegle marmelos* leaves as a starting point for the creation of novel plant-based antipyretic medications. On both a yeast-induced pyrexia and a TAB-induced pyrexia model, results show that ethanol extract of bael leaves significantly reduces body temperature.

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