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Review Paper

An Analysis of the Pharmacological Activity of Aegle Marmelos

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ABSTRACT

People on the Indian subcontinent have been using marmelos, a native plant, for more than 5000 years. In order to cure a wide range of illnesses, the Indian traditional medical system, Ayurveda, and diverse forms of folk medicine make considerable use of leaves, bark, roots, fruits, and seeds (Baliga, 2011) The fruit tree Aegle marmelos L., sometimes known as bael, is a member of the Rutaceae family and is grown extensively worldwide. (Anshid Venthodika, 2020) Abdominal disorders, ulcers, cholera, diarrhea, nerve disorders, gonorrhea, heart problems, dog bites, jaundice, snake bites, and many other conditions have all been treated traditionally with A. marmelos. (Ganesh N. Sharma, 2011) For dyspepsia, the ripe fruit is a nice and easy remedy. Numerous bioactive chemicals have been extracted from various plant parts and subjected to pharmacological analysis as part of the substantial scientific research on A. marmelos' therapeutic qualities. (Bansal, 2011).

INTRODUCTION

Since ancient times, plants have been used as a natural source of therapeutic chemicals. Many pharmacologically active principles and chemicals that are frequently utilized in home treatments for a variety of ailments can be found in Indian medicinal plants. India is the native home of the plant Aegle marmelos, also referred to as bael.

The Aegle marmelos (L.) tree, which is worshipped by Hindus and offered in the prayers of Lord Shiva and Parvati, is also known as Shivaduma (The Tree of Shiva). Traditional Chinese, Ayurvedic, Siddha, Unani, and Tibetan remedies all make use of these herbs. (Neeraj, 2017) In India, Aegle marmelos L. is a plant that is readily accessible in many locations. Also called the "Bale fruit tree," Bael (Aegle Marmelos (Linn)) is a moderately sized, slender, aromatic tree that is 6.0 to 7.5 m tall and 90 to 120 cm in girth. It grows wild throughout India's deciduous forests and can reach heights of 1200 m in the western Himalayas and Andaman Islands. Its

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somewhat fluted bole measures 3.0-4.5 m. (Ganesh N. Sharma, 2011)

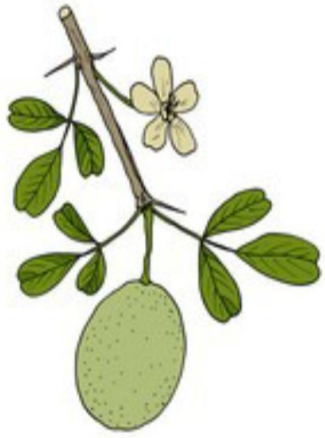

Fig. Bael plant with fruit

Plant Description

Aegle marmalos have Flowers with four recurved, fleshy petals are found in clusters of four to seven along the immature branchlets. the A. marmelos tree is mostly found in the foothills of the Himalayas, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, and Bihar. (Dinesh Kumar Sekar, 2011)

Taxonomical Rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliophyta
Family	Rutaceae
Genus	Aegle
Species	A. Marmalos
Common name	Bael, bael patra

Pharmacology and therapeutic purposes

Antimicrobial Activity –

The antibacterial activity of A. marmelos leaves was evaluated using the agar well diffusion method. Penicillium chrysogenum is inhibited by the ethanolic extract, while Fusarium oxysporum is inhibited by the petroleum ether and acetic extract. According to reports, A. marmelos has long been used to cure a variety of infectious disorders by blocking a wide spectrum of harmful microbes. Using leaf and fruit extract, inhibition zones of 11 mm and 9 mm against Roultella plantikola were noted. (Rahul Swarnkar, 2019)

Antidiabetic Activity –

In the conventional medical system, A. marmelos has been used to manage diabetes. Numerous in vivo scientific investigations have been carried out in animal models to assess the antidiabetic potential of various organic extracts and fresh A. marmelos juice. A. marmelos leaf methanolic extract demonstrated the most anti-diabetic activity among the several extracts; however, all of them were effective against diabetic rabbits. Alloxan-induced diabetic rats were given 50 mg/kg, p.o., of methanolic extract, and after 12 days, their blood sugar levels had dropped by 54%. 51. (Bhar, 2019, p. 220)

Antidiarrheal Activity –

A. marmelos's antidiarrheal properties have recently been confirmed by a number of in vitro and in vivo investigations. (Dinesh Kumar Sekar, 2011) The fruit of A. marmelos is widely used to treat dysentery and chronic diarrhea. Owing to its astringent qualities, unripe bael is highly valued for its ability to prevent diarrhea and dysentery, which are common summertime illnesses in India. 46–48 using the MIC technique, antidiarrheal activity was demonstrated against a few diarrhea-causing pathogens. good activity against Shigella boydii, S. sonnei, and S. flexneri. (Bhar, 2019)

Anticancer Activity –

The cause of gastric ulcers was the stomach wall's ongoing erosion and destruction, which could lead to a perforation, peritonitis, and severe bleeding because it inhibited the production of mucus, bicarbonate, and prostaglandins 41, 42. Bael prevents human tumor cell lines, such as the

leukemic K562 and T-lymphoid 3 cell lines, from proliferating in vitro. The majority of powerful anti-cancer medications are costly, carcinogenic, and teratogenic. (Patel, 2012) The MTT assay method, brine shrimp lethality assay, and sea urchin egg assay were used to investigate the plant extract's anticancer efficacy against tumor cell lines. Against every assay that was utilized, the plant extract demonstrated harmful effects.93. Jagetia G.C. et al. further suggested that the plant extract's skimmianine may be the cause of the induction of apoptosis and reported that the hydroalcoholic extract of the leaves has anticancer properties in Ehrlich ascites carcinoma. (Shailja Choudhari, 2021)

Analgesic Activity-

It has been reported that A. marmelos leaves have analgesic properties. Swiss mice were used in an acetic acid-induced writhing test to screen for analgesic efficacy in a methanol extract of A. marmelos leaves. The results shown that methanol extract significantly reduced the writhing induced by acetic acid. Its capacity to lower inflammation, function as an antioxidant, and maybe alter pain pathways is what gives Aegle marmelos (Bael) its analgesic properties. Although its significance in pain treatment is supported by traditional use, further clinical study is required to completely comprehend its processes and therapeutic potential in humans. It has potential, nevertheless, as a natural supplement or substitute for traditional analgesics. (patel, 2012)

Hepatoprotective Activity-

A. marmelos leaves. The TBARS values in animals that were healthy, drunk, and treated with herbal drugs were 123.35, 235.68, and 141.85 µg/g tissue, respectively.This suggests that the leaves of A. marmelos have a superior hepatoprotective effect. (Dinesh Kumar Sekar, 2011)In their 2007 study, Singanan et al. studied the effects of Aegle marmelos leaf extract on alcohol-induced liver injury in albino rats and observed exceptional hepatoprotective findings. In a similar vein, Ramnik S. (2008) demonstrated that bael fruit pulp and seeds extracted in water are useful in treating and preventing liver toxicity brought on by CCI4. (Ganesh N. Sharma, 2011)

Antiulcer Activity –

The antiulcer activity of a polyherbal formulation made from the leaf portion of A. marmelos, It was discovered that the polyherbal formulation had a non-toxic impact at high concentrations and can be helpful in treating severe stomach ulcers. (Patel, 2012) According to Goel R. K. (1997), pyranocoumarin derived from Aegle marmelos Correa seeds administered orally showed a strong protective effect against stomach ulcers caused by aspirin and pylorus ligation in rats, as well as ulcers caused by cold confinement stress in rats and guinea pigs. [37] According to Dhuley J. N. (2007), pretreating rats with unripe bael fruit extract significantly reduces the harm that absolute ethanol causes to the stomach mucosa. (Ganesh N. Sharma, 2011)

Immunemodulatory Activity –

The goal of the current study was to investigate the immunomodulatory effects of a methanolic extract of Aegle marmelos fruit (FEAM) utilizing an experimental model of immunity. Methods: The carbon clearance assay and neutrophil adhesion test were used to measure cellular immunity, while the indirect hemagglutination assay and the mouse lethality test were used to assess humoral immunity. The FEAM dosage was chosen using the staircase approach (up and down), and it was given orally at 100 and 500 mg/kg. (Neeraj, 2017, p. 1880)The anti-inflammatory, antioxidant, and antibacterial qualities of Aegle marmelos

demonstrate encouraging immunomodulatory activity; nevertheless, further investigation is required to completely comprehend its processes and therapeutic potential. Using Aegle marmelos should be done carefully and under medical supervision, as with any herbal cure, particularly for people with immune-related disorders or those receiving immunosuppressive treatment.

Radioprotective Activity -

In their 2005 study on the radioprotective impact of Aegle marmelos extract, Jagatai GC and Venkatesh P exposed mice to several doses of gamma radiation and discovered that oral administration of the extracted The effects of plant extract on the peripheral blood and small intestine of Swiss albino mice were examined by Jagetia GC and associates (2006). (Ganesh N. Sharma, 2011)

Cytoprotective Activity -

When freshwater fish (Cyprinus carpio) are exposed to heavy metals, Aegle marmelos leaves have been demonstrated to have a cytoprotective effect. Following exposure to heavy metals, C. carpio was given dried Aegle marmelos leaf powder.The stability of the plasma membrane and the modification of the antioxidant enzyme system produced a cytoprotective impact. (Dinesh Kumar Sekar, 2011)

Activities for wound healing-

Two types of wound models in rats—the excision wound model and the incision wound model—were used to examine the effects of topical and intraperitoneal administration of methanolic extract of Aegle memarmelos ointment and injection, respectively. In both of the examined wound types, there was a notable reaction to both the injection and the ointment of the methanolic extract of Aegle marmelos. (Neeraj, 2017, p. 1880)

Diuretic Activity –

The drug is used to increase the quantity of salt and water that the body excretes through urination. People who have excessive water retention in their bodies are typically given these medications (Elango, Rahuman, Kamaraj, Bagavan, & Zahir, 2011). A. marmelos's leaves and roots naturally have diuretic action, which raises urine levels in these people. At larger doses (500 mg/kg), ethanolic extracts of A. marmelos fruit greatly increase salt excretion. Petroleum ether, fruit extract in chloroform, and ethyl acetate fractions are also potent diuretics (anshid venthodika, 2020, p. 12)

Antiarthritis activity-

In Wistar albino rats, it was discovered that A. marmelos leaves were effective against collagen-induced arthritis. 61, 62 Additionally, rats treated with methanol extract showed a considerable reduction in radiological and histological alterations. (bhar, 2019, p. 221)

Antispermatogenic Activity –

Once more, the same researchers—among them Bhattacharya D. (2002)—provided information on rat sperm antimotility via an in vitro investigation. Additionally, a higher concentration of the extracts was thought to reduce sperm motility. (ganesh N sharma, 2011, p. 16)

Peptic Ulcer –

An imbalance between defensive and attacking factors, such as acid, causes the mucosal layer of the gastrointestinal tract to fail defensively, leading to ulcers. A number of things, including the H. pylori bacterium, acid production, alcohol consumption, smoking, and many more, can cause peptic ulcers. Additionally, after stopping medication, there is a significant risk of ulcer

recurrence. Approximately 70% of ulcers may reoccur. An efficient treatment for gastric ulcers is a leaf infusion. (patel, 2012, p. 335)

Antithyroid Activity –

Thyroid hormone levels were lowered by an extract from A. marmelos leaves. The cause was scopoletin, which has a stronger therapeutic impact than propylthiouracil. (Rahul swarnkar, 2019, p. 1604)

Contractile Activity –

Because it depresses H1 receptors, the alcoholic extract was observed to considerably relax the guinea pig's ileum and tracheal chain at dosages of 1 mg/ml and 2 mg/ml. (Shailja Choudhari, 2021, p. 152)

CONCLUSION

The review of Aegle marmelos concludes by highlighting its varied pharmacological activity, indicating its potential in a number of therapeutic domains. Anti-inflammatory, antioxidant, antibacterial, antidiabetic, hepatoprotective, and cardioprotective qualities are all displayed by its bioactive components. Aegle marmelos has also demonstrated potential in treating respiratory conditions, controlling diabetes, and enhancing digestive health, among other advantages. Even though Ayurvedic medicine has long used it, further clinical study is required to confirm these results and fully comprehend its mechanisms of action. All things considered, Aegle marmelos exhibits considerable therapeutic potential and is a remarkable medicinal plant.

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