

BILWA (AEGLE MARMELOS) - A REVIEW ARTICLE

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ABSTRACT

Aegle marmelos is one of the important plants in a medicinal field with its properties, belongs to Rutaceae family. *Bilwa* is used to cure variety of diseases. This plant is known from pre-historic time. All the parts of this plant like fruit, leaves, bark, stem, roots are used in different diseases, as variety of alkaloids are found in it. Its medicinal properties are antidiarrheal, antidyentric, antipyretic and anti-inflammatory in nature. Compounds purified from fruit have been proven to have biological potential against several diseases like diabetes, gastric ulcer and hyperlipidemia. There are many studies done about its medicinal uses and properties which shows its value in today's era. This review article summarized information about its morphology, distribution, nutritional action, *ayurvedic* uses and its pharmacological properties.

Keywords: alkaloids, pharmacological properties, morphology, antidiabetic, antidyentery

INTRODUCTION

There are many plants which have been used for its medicinal properties since thousands of years. About 80% of the world's population depends wholly or partially on traditional medicine for its primary health care needs. These plants are used by *Ayurveda*, Siddha, Tibetan and all other system of medicines. Our ancient literature like *Rigveda*, *Yajurveda*, *Atharvaveda*, *Charak Samhita* and *Sushrut Samhita* also describes about their properties and uses for treatment of various diseases¹. *Bilwa* is one among them commonly called as wood apple plant. Bael is one of the holy trees of *Hindus*. Leaves are presented in prayers to *Shiva* and

Parvati since ancient times². Its leaves are trifoliate with spear shaped leaflets resembling *thrisoolum*, the weapon of Lord *Shiva*. Many stories and myths are associated with this tree³. One more fact about *bael* is, the fraction of *Sattva* component is more in *bilwa patra* and hence it has more power 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 near to person suffering from negative energy, distress than the black energy present within him is reduced⁴. *Bael* is reported to contain several

phytochemicals, coumarins, alkaloids, sterols and essential oils showing antimicrobial, antidiabetic, anti-inflammatory, analgesic, antipyretic, hypoglycaemic, wound healing, antifertility, insecticidal properties⁵.

Plant profile- *aegle marmelos* is slow growing, medium sized tree, up to 12-15-metre-tall with short trunk, thick, soft, flaking bark and sometimes spiny branches. Young suckers wear many stiff, straight spines. *Bael* is deciduous tree having alternate leaves, borne singly or in a group, are composed of 3-5 oval, pointed and shallowly toothed leaflets, -which are 10 cm long 2-5 cm wide, the terminal one with a long petiole⁶.

Habitat and Distribution- *Bael* is native to India and usually available in the range of Himalaya to west Bengal. It grows around foothills of Uttar Pradesh, Chhattisgarh, Bihar, Madhya Pradesh, Uttranchal, Jharkhand⁷. The exotic range of *bael* is Bangladesh,

Egypt, Malaysia, Myanmar, Pakistan, Srilanka, Thailand⁸.

- Family- Rutaceae.
- Kingdom- Plantae
- Subfamily- Aurantioideae.
- Genus- *Aegle*.
- Species- *Marmelos*.

Chemical Constituents of *Bilwa*: Alkaloids: The alkaloids comprise the largest single class of secondary plant substances. New alkaloids from the leaves of *Aegle marmelos* were reported viz., ethyl cinnamamide, O-3,3-(di methylallyl) halfordinol, N-2-methoxy-2-[4-(3',3'-dimethylallyloxy) phenyl] ethyl cinnamamide etc⁹. Marmelosin, skimmianine and umbelliferone are the therapeutically active principle of *bilwa*¹⁰.

Table 1: showing chemical composition of *bael*¹¹-

Part of plant	Chemical constituent	Therapeutic effect:
Leaf	Skimmiamine, Aegelin, Lupeol, Cineol, Citral, Citronellal, Cuminaldehyde, Eugenol, Marmesin	Anti-cancer, cardio active, Anti-inflammatory, Anti-septic, Antiallergic etc.
Bark	Immature- Marmin, Skimmiamine Mature- Fagarine	Abortifacient, Anti-ulcer, antidiarrheal
Unripe fruit	Tannin	Astringent
Fruit	Marmelosin, luvangetin, Auraptin, Psoralen, Marmelide	Cardio-protective, anti-ulcer, Heartbeat inhibitor, Antispasmodic, Anti-diarrheal

Nutritional Use of *Bilwa*: Physiochemical study of *bilwa* shows that this plant has incredible nutritional value as well. *Bilwa* pulp is rich source of glucose and sugar, also used as energy drink with milk. Other nutrients present in *bilwa* are proteins, fats, fibre, calcium, minerals, iron, vitamin A, vitamin B₁, vitamin C, riboflavin¹². The leaves and shoot are used as a green vegetable in Indonesia¹³.

Pharmacological Properties of *Bilwa*: **Antioxidant activity:** *Bilwa* is reported to possess antioxidant activity against a variety of free radicals. In a recent study of *bilwa*, it shows that percentage of free radical inhibition was high in unripe fruit than that of the ripe fruit. The aqueous extract of *bilwa* fruit was screened for antioxidant activity by DPPH radical scavenging¹⁴.

Antimicrobial activity- Maximum antibacterial activity was shown against *Bacillus subtilis* followed by *Staphylococcus aureus*, *E. coli* and *Pseudomonas*

aeruginos. The essential oil isolated from the leaves of *A. marmelos* tree has proved to have antifungal activity against animal and human fungi like *Trichophyton mentagrophytes*, *Trichophyton rubrum*, *Microsporum gypseum*, *Microsporum audouinii*, *Microsporum cookie*, *Epidermophyton floccosum*, *Aspergillus niger*, *Aspergillus flavus* and *Histoplasma capsulatum*¹⁵. Another study showed the methanol extract of *bilwa* has high antimicrobial activity against *Basillus subtilis*, *Staphylococcus aureus*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Escherichia coli*, *Salmonella paratyphi A* and *Salmonella paratyphi B*. Also, the antimicrobial activity of different extracts was evaluated by agar well diffusion method. The hexane, cold methanol, hot methanol and ciprofloxacin extracts showed high antimicrobial activity against *Escherichia coli*, *Klebsiella pneumonia*, *Proteus vulgaris*, *Micrococcus*

luteus, *Enterococcus faecalis* and *Streptococcus faecalis*¹⁶.

Antidiarrheal Activity- The unripe fruit of *bilwa* is most effective remedy for diarrhoea and dysentery and used by humans as a traditional medicine. Several study of *bilwa* showed the antidiarrheal property. The ethanolic extract showed good activity against *Shigella boydii*, *S. sonnei* and *S. flexneri*, moderate against *S. Dysenteriae*¹⁷.

Antidiabetic Activity- Many studies of *bilwa* shows the antidiabetic property. The antidiabetic activity of leaves of *bilwa* was reported in alloxan diabetic rats. The methanolic extract of leaves of *bilwa* reduces the blood sugar level. According to this it was found that there was reduction in blood sugar level after continuous administration of extract and after 12 days sugar level was found to be reduced by 54%¹⁸⁻¹⁹. Leaf extract has been used in ayurvedic system of medicine for diabetes. It enhances the ability to utilize the external glucose load in the body by stimulation of glucose uptake like insulin²⁰.

Anticancer Activity- Cancer is 2nd main cause of death in both men and women in developed and developing countries. The fruit extract of *bilwa* is used to improve the immune system that will finally increase the anticancer activity of a body. A study also showed that the *bilwa* has anticancer effect in animal model with carcimoma²¹. Preclinical studies have shown that *A. marmelos* leaf extracts were effective in inhibiting the growth of leukemic K562, T-lymphoid Jurkat, B-lymphoid Raji, erythroleukemic HEL, melanoma Colo38, and breast cancer cell lines MCF7 and MDA-MB-231²². Experiments have shown that the phytochemicals such as lupeol, eugenol, citral, cineole and d-limonene present in *A.marmelos* possess antineoplastic effects²³.

Antipyretic Activity- The use of modern medicine is not safe as herbal one. *Bilwa* shows anti pyretic property and used in fever and pain. The study of *bilwa* also showed 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)²⁴⁻²⁵.

Hepatoprotective Activity-There was some study on animals with four group, administrated 30% ethyl alcohol for 40 days with control group of *Aegle marmelos* leaves. The experiment results indicate that the *Aegle marmelos* leaves have excellent hepatoprotective effect²⁶.

Cardioprotective Activity- The leaf extract of *bilwa* has preventing effect in isoprenaline induced myocardial infarction in rats. Use of *bilwa* as a cardiac depressant and in palpitation has also been reported²⁷. Fresh fruit juice of *bilwa* with different dilution were used for cardiotoxic activity. The present studies confirm the better cardiotoxic activity of *bilwa* than digoxin²⁸

Other properties of bilwa are – antihistaminic, anti-inflammatory, insecticidal, antioxidant property, immunomodulatory, wound healing activity, anticonvulsant, antifertility property²⁹.

Ayurvedic Uses-

The root is sweet, cures fevers due to “*tridosha*”, pain in the abdomen, palpitations of the heart, urinary trouble, hypochondriasis, removes “*vata, pitta* and *kapha*”.

The leaves are astringent, digestive, laxative, removes “*vata* and *kapha*”, useful in ophthalmia, deafness and inflammations.

The flowers allay thirst and vomiting, useful in dysentery

The ripe fruit is hot and dry, tonic, restorative, astringent, laxative, good for the heart and the brain. Ripe fruit is sweet, aromatic and cooling and made into morning *sherbet*, simply cures dyspepsia. The unripe fruit is digestive and is prescribed in diarrhoea and dysentery.

The root, leaves and bark are prescribed as an antidote to snake venom (*sushruta, vagbhata, brihannighantaratanakara, nighantaratanakara, bapat, vrindamadhava, yogaratnakara, sharangdhara samhita*)³⁰.

DISCUSSION

Bilwa plant is holy plant and has many properties. *Bilwa* is useful to treat many conditions caused by toxins. In Ayurveda, it is mentioned as antidote of snake venom. It has *kasaya*, *Madhur* and *tikta* rasa and *ushna virya*. So, it is said to be that the *bilwa* fruit is very useful in diarrheal conditions. It has constituents like Coumarins and Sterols and have properties like antimicrobial, anti-inflammatory, antipyretic, analgesic, anti-cancerous, antidiabetic, hepatoprotective in nature. *Bilva* is an indigenous plant used in the management of various toxicities. Toxicity can harm an organ, or a system and it has been proved through research works that *Bilva* is useful in the management of different conditions caused by toxins.

Bilva has got both hepatoprotective and nephroprotective activities caused by CCl₄ and Gentamycin respectively. The antioxidant, antibacterial and antifungal activities also indicate the antitoxic properties of *Bilva*. Pain and inflammation are the most common symptoms of corrosive and irritant types of poisoning and *Bilva* has got significant effect on it. It also effectively protects genotoxicity. In addition to it a recent study has shown that activated carbon prepared from bael fruit shell is an efficient adsorbent to remove the toxic metal chromium from aqueous phase 16.

CONCLUSION

From above article it's clear that *bilwa* is one of the auspicious plants with its valuable properties. In today's world man went towards modern medicine to get instant relief from diseases, knowing the side effect of that medicine. Our environment is full of medicinal plants, but some people don't know the value of that plant. So, it is the way to inform the people about what they left behind. This article shows the antimicrobial, antioxidant, antidiabetic, antipyretic, anti-inflammatory activity due to many phytochemicals present in it and is cost effective too. Although a systemic research and development work should be done for improvement of products for their better economic and salutary utilization.

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