

Beal: A Nutritional Properties Beneficial for Human Health

Dharmendra Kumar Gautam*, Om Prakash, Vikas Kumar, Siddharth Kumar, Satyendra Verma, Vikki, and Milind Sagar

Introduction:

Beal (*Aegle marmelos* L.) Bael is believed to have originated in India. Prehistorically, this species spread to surrounding countries, and more recently, through human migration, it has spread to other distant regions. The dry, mixed deciduous and dry dipterocarp forests and soils of India, Sri Lanka, Thailand, Pakistan, Bangladesh, Myanmar, Vietnam, Philippines, Cambodia, Malaysia, Java, Egypt, Suriname, Trinidad and Florida are all adapted to it. Growth of Bael tree. Although it can thrive in tropical settings, the vine is a subtropical species. The vine can survive temperatures as low as 7 °C and as high as 1,200 m without any apparent growth retardation. Fruiting may stop during prolonged drought, but the plant can still survive with only superficial soil moisture. Generally, vine trees require well-draining soil (pH: 5-8). that it may thrive in stony, alkaline, and shallow soils equally. On the "oolitic-limestone" soils of southern Florida, the vine thrives and yields abundant crops of fruit.

Bael is a fruit species that is well-known in India and Sri Lanka because it can thrive in extremely unfavorable soils, where other trees and other crops cannot. The deciduous vine tree has a dense or dense crown without any weeping limbs. The lower limbs can hang loosely at times. The tree is resilient and has a wide range of climate and soil adaptations. The Bael tree has many branches and can reach a height of 10 m or more. The fruits are primarily located on the edge of the canopy.



Fig. 1: Bael fruit

Dharmendra Kumar Gautam*, Om Prakash, Vikas Kumar, Siddharth Kumar, Satyendra Verma, Vikki, and Milind Sagar

Banda University of Agriculture and Technology, Banda, U.P.-210001

Economic Importance of Bael

In addition to its culinary and medical uses, activated carbon made from the rind of bael fruit is an effective and reasonably priced adsorbent for the removal of heavy metals such as chromium from contaminated or potable water. Bael leaves are another potential biosorbent that can be used. By absorbing harmful lead ions in vine leaves, it was shown that lead ions could be removed from an aqueous solution. The vine is valued as a natural environmental purifier and can be used as a support tree for wildlife and important species in reforestation of urban, rural and drier areas. It is also useful as a shading tree for recycling nutrients. Bael seed oil contains an unusual fatty acid called 12-hydroxyoctadec-cis-9-enoic acid (ricin oleic acid).

Nutritional Value

According to modern thinking, eating fruits is the best way to get the vitamins and antioxidants needed for a healthy life. Fruits are valued as a rich supply of natural dietary additives that promote health in modern society. The vine is mostly eaten as a fresh fruit, and both the pistil and the inner fleshy layer of the pericarp are delicious. Cakes, juices, custards and jams can all be made using these ingredients. The nectar of the fruit can be extracted and used to make value added products. Bael fruits also contain high

concentrations of carotenoids, antioxidants, volatile chemicals with reducing sugars, and soluble dietary fiber.

Properties of bael

Phytochemicals in Fruits

Bael fruits contain tannins, alkaloids such as azalide and marmaline, xanthotoxol, imperatorin, alloimpertorin and -sitosterol. An increase in tannins was observed with fruit ripening, with fully ripe fruits having maximum levels of tannins. Only fully ripe fruits contain the vitamin riboflavin, which is important. Nevertheless, as the fruit ripens, ascorbic acid levels decrease substantially, indicating a sharp decline in antioxidant effectiveness. Phenyl propanides, which have been shown to be non-carcinogenic, are present in the vine. The two main volatile substances found in the vine are monoterpenes and sesquiterpenes. Phytochemicals are also present in the gum that surrounds the seeds of the vine.

Pharmacological Values

All parts of the Bael plant have immense medicinal properties. Herbal medicinal preparations of Bael are used to treat chronic diarrhea, dysentery, peptic ulcer, laxative for astringency, and respiratory ailments. Cancer is one of the important causes of death worldwide, and new drugs are needed for efficient treatment. A total of 187 plant species from 102 genera and 61 families have

proven antitumor properties. Bael is of greater importance as it contains several compounds with anticarcinogenic properties. Bael fruits, leaves and other parts of the tree contain phytochemicals that have many medicinal properties. supported that argument by validating marmelosin as the primary therapeutic bioactive compound in the vine using high-performance liquid chromatography (HPLC). Marmelosin has detoxifying, restorative, astringent and laxative properties that make it an excellent substance for the heart and brain.

Antidiabetic Activity

Bael extracts have been shown to have significantly higher antidiabetic activity when tested using animal models. Bael fruit extract has shown protective effect on pancreatic tissue of diabetic rats.

Anticancerous Activity

Cancers are the most nuisance of all noninfectious diseases. The phytochemicals in herbs often hailed as a gold mine for discovering anticancerous drugs. A considerable amount of work is reported on the anticancer activity of bael. The anticancerous potential of bael has been conducted using brine shrimp lethality assay, sea urchin eggs assay, hemolysis assay, and 3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyl tetrazolium bromide (MTT) assay using tumor cells, and significant toxic effect. High tech

state-of-the-art imaging techniques such as single photon emission computed tomography (SPECT), positron emission tomography (PET), and nuclear magnetic resonance (NMR) were used to prove the anti-inflammatory and antiangiogenesis activities of bael.

Antimicrobial Activity

Bael extracts have shown antibacterial, antifungal and antiviral activities. The antibacterial effect of the vine was found on the pathogenic *Shigella dysenteriae*, and the inhibitory activity was ascribed to the coumarin compounds present in the extract. As an alternative to conventional antibiotics, a combination of BELL and a popular antibiotic β -lactam was used, and β -lactam-resistant *S. Dysenteriae* and *S. Inhibitory* activity was obtained on flexneri. Sensitivity was conferred by differential expression of membrane porins, outer membrane proteins (Omp) C and OmpF, and OmpR, a cytosolic protein. When bael extract is given, the OmpF gene is overexpressed, and OmpR is downregulated. Generally, these bacteria are resistant to β -lactams; However, the fruit extract restores the inhibitory activity of β -lactams by altering the mobility of porin channels. Antifungal activity is observed in the essential oils extracted from bael leaves. In addition, a potential antifungal compound anthraquinone was also isolated from the seeds of the vine.

Conclusion

Indigenous fruit trees are significantly contributing to alleviating hidden hunger, and bael is significant in this regard. Given the numerous food, pharmacological, and other bael values, it could be considered a promising fruit tree species in large-scale agriculture. In addition to the large-scale cultivation, proper harvesting practices, apposite storage, and transportation facilities are required for the efficient industrial processing of fruits for efficient food and pharmaceutical industries. This would ultimately uplift bael from its underutilized status as an important cash crop to improve rural people's livelihood and develop the economy through value-added food and pharmaceutical industries.

