

Original Research Article

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## Essential Oil Yield from *Aegle marmelos* Leaves and its Importance in the Agroforestry System in Villages of District Dehradun, Uttarakhand

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### ABSTRACT

*Aegle marmelos* or bael is a tree with enormous therapeutic, religious and ethno-botanical value. It is a highly sacred tree in Hindu religion and is worshipped as an offering to lord Shiva. It is a moderate size tree with the great importance in the rural economy and livelihood. Bael tree leaves are aromatic and the essential oil extracted from its leaves is of medicinal value. Its fruits, leaves, wood and other plant parts are used as edibles, fodder, timber, tannins, dyes and many more purposes. This is a valuable agroforestry tree and the essential oil obtained from its leaves is hardly being utilized. In this study, the essential oil from the leaves of bael tree was extracted and added as an additional income to the farmers along with its fruits, timber, fodder and other domestic usages. The essential oil yield from the leaves of bael tree was obtained by hydro-distillation. A socio-economic survey in the Bisht Village and Kirsali village of district Dehradun, Uttarakhand was conducted and the existing role of bael tree in rural agroforestry and economy was also assessed. The inclusion of bael tree especially the leaf extract has the potential to make a significant difference in the livelihood in Garhwal Himalaya.

#### Keywords

*Aegle marmelos*,  
leaves, Essential oil,  
Livelihood,  
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### Introduction

*Aegle marmelos* (L.) Corr. is commonly known as bael tree or bilwa and is a member of family rutaceae (John and Stevenson, 1979). This tree is indigenous to India and distributed in tropical to subtropical climate from the foothills of Himalayas, Uttarakhand, Jharkhand, Madhya Pradesh up to Deccan

Plateau and east coast of Indian subcontinent (Sharma *et al.*, 2007). The bioactive compounds extracted from the leaves, fruits, bark, seeds and roots of this tree are of high medicinal importance in various traditional and ethno-botanical remedies (Badam *et al.*, 2002; Gupta and Tondon, 2004). It is a medium size deciduas tree with the average height of 8.5 m which flowers during June-

July and takes about a year to produce mature fruits in May-June (Parmar and Kaushal, 1982). The extracts obtained from its leaves contain various phyto-chemicals such as tannins, saponins, flavanoides, alkaloids, terpenoides, carotenoides, cardiac glycosides and reducing sugars (Diana *et al.*, 2014). The essential oil extracted from the leaves of bael tree is identified as a cure for ulcers, heart problems, blood sugar related problems, diarrhea, animal injuries etc. (George *et al.*, 2003). The essential oil extracted from bael tree leaves is proved to have anti-fungal, anti-bacterial and fungicidal activities (Dhankhar *et al.*, 2011; Balakumar *et al.*, 2011). Different researches have proved the Radioprotective, anti-cancerous and anti-inflammatory activities of essential oil extract of bael tree leaves. Besides having high medicinal value, the essential oil from bael tree leaves is not very common to find and with insufficient commercial supply. It is a multipurpose agroforestry tree with various household usage like food, fodder, small timber etc. Bael tree based agroforestry system is very under-rated because commonly, it is seen only as a fruit and fodder yielding tree. Although people do earn a livelihood by selling the leaves near temples and religious places but the earning is very insignificant. The essential oil on the other hand could yield a handsome income along with the sale of fruits and proper utilization of its small timber. Although there are many constraints in the extraction, value addition and marketing of essential oil from its leaves but it has a great potential in uplifting the rural livelihood especially in Garhwal Himalayan regions where agroforestry systems are commonly preferred over conventional agricultural systems.

### **Materials and Methods**

To carry out this research, Bisht Village and Kirsali village in Dehradun district of

Uttarakhand were selected. A sample consisted of 35 respondents having 20% of total numbers of households comprising all categories of the land holders were drawn for household survey and the household head was treated as respondents. A socio-economic questionnaire based survey of these villages was conducted to obtain a general idea about people and their livelihood. A general idea and people's perspective towards the bael tree, its importance, usages and role in livelihood generation was gathered. The discussions regarding the adoption of essential oil based livelihood were also carried out.

To estimate the essential oil yield, the leaves of *Aegle marmelos* tree were plucked from the study villages and nearby areas. The leaves were chopped into fine pieces of about 1-2 cm. The hydro-distillation method was used for the essential oil extraction. The experiment was conducted on a Clevenger's apparatus containing one round bottle flask of 1000ml. capacity which was connected with another two way round flask holding raw material (Bael leaves). The chopped leaves were weighed and put inside round bottle flask. It was filled with water upto the level of chopped leaves and the flask is mounted on heating mantle. Plant material is heated with water for three (03) hours until the leaves are exhausted.

The essential oil collected is separated in separating funnel and with diethyl ether. The traces of water are further removed by the addition of anhydrous Sodium sulphate ( $\text{Na}_2\text{SO}_4$ ). The mixture of diethyl ether and essential oil is covered with foil with small holes and kept overnight for evaporation. After that the traces of ether was removed by hot water bath. The pure essential oil extract is then sealed with paraffin strip and is weight for yield estimation.

## Results and Discussion

### Essential oil yield

The essential oil yield of 1.56% was obtained from the *Aegle marmelos* leaves collected from the trees present on and nearby study area. That means from 1 Kg. leaves, 15.6 ml. essential oil may be obtained.

### Household and Socio-economic survey

The data on livelihood contributions of *Aegle marmelos* tree along with the aspect of essential oil yield was collected by personal interviews and the observations. The data regarding *Aegle marmelos* tree, its involvement in income earned by sale and its importance in other household usage was also collected. The fruits are edible when ripe and made into jam when unripe. The young leaves/shoots are used as vegetable and the leaves and twigs are often lopped for cattle fodder. Timber is used to make the handles of small agricultural implements and knife handles. The gum obtained from unripe fruits is used as household glue. The local people do know that the decoction of fruit with fennel and ginger is effective in hemorrhoids and its pulp has laxative properties. The sale of bael leaves (Rs. 1-5 for each 3 leaf set) near temples and religious places earns a minor additional income. The common household monthly income of the farmers from these two villages ranged from Rs. 5500-8000 by the sale of agricultural and/or dairy products. The farmers, who were practicing *Aegle marmelos* based agroforestry system on their farms or even as a component of boundary plantation earns a good periodic income from the sale of its fruits. An annual income of Rs. 3500-4500 only by sale of bael fruits at the rate of Rs. 80-100 per Kg is earned by the farmers. Although bael trees could be used and utilized in so many ways to generate an additional income, still local people do not

seem to be aware towards the potential of this tree. Local people/villagers mostly prefer to sell the leaves and fruits on the religious occasions to the nearby temple areas only up to a very little extent.

In conclusion, bael tree as an agroforestry tree contributes the livelihood of rural people from the villages of Dehradun in both direct and indirect way. The tree is a source of fodder for cattle, edible fruit and small timber for tool handles mainly. As an additional source of income, the fruit and to some extent, the leaves do contribute by the direct sale. The lack of proper awareness regarding essential oil extraction, processing and marketing does exist. As the aromatic grass based essential oil market is commonly commercialized as compared to tree leaf based industries especially bael leaf oil which is very limited to the wellness products. If considering essential oil as a perspective for livelihood improvement, it may contribute to an additional household income improving the annual income by 30-40%. The leaves of *Aegle marmelos* are sold at the rate of Rs. 5-6 for each leaf (Three leaf set). Even on the online giants like Amazon and Flipkart, the sellers are selling the bael leaves at the rate of Rs. 5-10 for each leaf. The leaf oil extract along with tea tree oil is commonly sold by many wellness companies with a handsome amount of profit from bael leaf extract. Despite possessing various bioactive ingredients and medicinal properties, *Aegle marmelos* leaf essential oil extraction and marketing aspect is very much ignored. Bael tree essential oil based agroforestry system has a great potential in generating an additional income for the farmers combined with the sale of its fruits.

### References

Badam L, Bedekar SS, Sonawane KB and Joshi SP. (2002). In vitro antiviral

- activity of Bael (*Aegle marmelos*) upon human coxsackie viruses B1-B6. *Journal of communicable*. 34(2):88-99.
- Balakumar S, Rajan S, Thirunalasundari T and Jeeva S. (2011). Antifungal activity of *Aegle marmelos* (L.) Correa (Rutaceae) leaf extract on dermatophytes. *Asian Pacific Journal of Tropical Biomedicine*. 1(4): 309–312.
- Dhankhar S, Ruhil S, Balhara M, Dhankhar S and Chhillar A. (2011). *Aegle marmelos* (Linn.) Correa: A potential source of phytomedicine. *Journal of Medicinal Plants Research*. 5(9):1497–1507.
- Diana VT, Kondala RK and Antony VS. (2014). Antibacterial activity and phytochemical screening of *Aegle marmelos*. *International Journal Of Pharma and Bio Sciences*. 5(4): (B) 895 – 902.
- George KV, Mohanan N and Nair SS. (2003). Ethnobotanical investigations of *Aegle marmelos* (Linn.) Corr. in: *Ethnobot. Med. Plants India and Nepal*, by Singh V and Jain AP (Scientific Publishers, Jodhpur): 29-35.
- Gupta AK and Tondon N. (2004). Review on Indian medicinal plants. Indian Council of Medicinal Research, New Delhi, 312.
- John L and Stevenson V. (1979). The complete book of fruit. Angus and Robertson Publishers, Sydney.
- Parmar C and Kaushal MK. (1982). *Aegle marmelos*. p. 1–5. In: *Wild Fruits*. Kalyani Publishers, New Delhi, India.
- Sharma PC, Bhatia V, Bansal N and Sharma A. (2007). A review on Bael Tree. *Natural Product Radiance*. 6(2): 171-178.

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