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Spiritually significant natural resource of *Madhuca longifolia* (J. Koenig ex L.) J.F. Macbr. conservation and its value added products management

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Abstract
The dependency of many Indian rural households on natural resources for sustenance is widely acknowledged. Thus natural resources are good for the economy and they provide many resources, such as food and income to a community. There is a link between trees, green spaces and climate change, income and mortality in dry villages. Under the difficult climatic situations, farmers are forced to adopt tree-based systems to secure their income and livelihood. Natural resources are provides to humans food, fresh water and timber products. *Madhuca longifolia* (belongs to Sapotaceae) is one the crucial natural resources in forest and urban areas; it's commonly called as Mahua. Flowers and fruits are used as food and also in preparation of value added products such as Laddu, jam, pickle and selling in local market which were made out of mahua flowers for sustaining their livelihood; thus have rich source of sugar, protein, vitamin and minerals. From the seed, oil is prepared for cooking and lighting purposes, biodiesel, laundry soaps, and detergents and also used in medicinal field. Biodiesel is a renewable, biodegradable and non-toxic fuel. Thus seed oil contains sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides. Apart from these, in Hinduism and many other faiths lightings lamps and light in prayers symbolizers the absence of darkness, grief and sorrows. Using the Mahua seed oil there is a belief that vibration which emerges from the lamp will work as a 3 dimentional vastu protector, positive energy enhancer and bestower of peace and prosperity in home as well as in all Temples it was mentioned and currently in use by many literatures. Survey was carried out in different districts of Tamilnadu such as Coimbatore, Salem, Tirupur, Thiruvannamalai, Dharmupuri and Madurai. From our collection and vegetative propagation, afforestation programme was carried out in Eastern Ghats village areas, we planted high yielding mass propagated clones; through vegetative propagation, grafting and seedlings. High flower/fruit yielding trees were selected based on the number of flowers production in a branch, weight, length of flowers, fruits. The stem cuttings were collected from those selected trees and propagated in the nursery. This will give benefit to dry area dwelling farmers for sustainable harvest, value-addition and marketing.

Keywords: *Madhuca longifolia*, superior tree, natural resources, conservation, seed oil

Introduction
Madhuca longifolia, a member of the Sapotaceae family, is a multipurpose forest tree that provides answers to the three major resources Food, Fodder, and Fuel. The mahua tree can be found in forests, revenue areas, and private property. It is commonly known as Mahua (Hindi), Honey tree, Butter tree (English), Iluppai (Tamil), Vippa (Telugu), Mahua (Marathi), and Illipe (French). It is widespread in dry mixed deciduous forests, dry forests, and dry teak forests. In India they are distributed throughout Andhra Pradesh, Gujarat, Chhattisgarh, Jharkhand, West Bengal, Odisha, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Bihar, Punjab, and the Himalayan sub-mountainous region (Kishore & Sharma 2018) [6]. In tribal culture, the tree has religious and aesthetic value. The trees with the greatest girth in the forest are frequently Mahua trees which are protected and cared for by the forest dwellers. The mahua tree can be found in forests, revenue areas, and private property. The early settlers had rights to specific Mahua trees growing in these areas near the village. Some trees may even be located far from the village but are recognized as belonging to a family (Ekka and Ekka 2014) [1]. *M. longifolia* is an evergreen tree that grows up to 70 feet tall. The tree grows and begins yielding fruit at the age of 8-15 years, and it can bear fruit for up to 60 years. Anthers 16, 2-seriate subsessile, lips 3-toothed, thick and leathery; leaves 10-30 cm long, lanceolate, narrowed at both ends, glabrous distinctly nerved; small, fleshy flowers with a creamy white colour. When ripe, the fruits are 2-6 cm long, oval in shape, and greenish-yellow in colour.

Flowers bloom in March and April, and fruits ripen in April and May (Singh *et al*., 2020) [4]. One of the most widely used non-timber trees is *M. longifolia*, sometimes known as Mahua (Gavankar & Chemburkar 2016) [10]. The species is drought-resistant, has a high light requirement, and is easily suppressed in shade. It is not frost-resistant (Sinha *et al*., 2017) [3]. The tree produces edible flowers and fruits during the agricultural low season (March-May). It is used to treat coughs, biliousness, and heart problems, and its fruits are used to treat consumption and blood diseases. According to these findings, mahua flowers could be employed as a new natural sweetener. The flowers included an adequate amount of vitamins such as thiamine, riboflavin, niacin, folic acid, and ascorbic acid (Singh *et al.*, 2020) [4]. From the seed, oil is prepared for cooking and lighting purposes, biodiesel, laundry soaps, detergents and also used in medicinal field. Biodiesel is a renewable, biodegradable and non-toxic fuel. Thus seed oil contains sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides. From an economic standpoint, the oil yield from the crops is always the most important component in determining their viability for nutritional and industrial reasons. (Munasinghe & Wansapala 2015) [5].

Even though after the Sangam period, the importance has been given to the worship of God and devotional movement focused on temple worship, and people thought nature and God are always something inseparable and considered nature is for God. Therefore many trees have been used as a sacred tree in many temples. Madhuca (Iluppai) is one of the trees which have being the sacred tree of various temples in South India, including Irumbai Mahaleswarar Temple, Iluppaipattu Neelakandeswarar Temple, Tirukkodimaada Senkundrur at Tiruchengode, Tamil Nadu and Thiruvanathapuram, Kerala. The Tamil saint-philosopher Valluvar is believed to have born under a Mahua tree within the Ekambareshwarar Temple at Mylapore,Tamil Nadu and hence madhuca remains the sanctum tree of the Valluvar shrine built within the Ekambareshwarar temple complex. During the Sangam period, before discovering the electricity the Mahua oil has been used in Temples and houses for lightening purposes because Mahua oil burning for long time. Therefore many kings created Mahua plantation and gifted to the temples. Thus many Mahua plantations are still available in many temples. Evidence for this can be found in various inscriptions. Mahua tree and uses of its flower, fruits and oil has been mentioned in the ancient Tamil literature such as Akananoor, Purananoor and Natrinai. Mahua tree has been used by human for various purposes, animals and bats used Mahua flowers and fruit as a food, however due the change life style and needs of human, Mahua tree became underutilized one and the population was decreased. In Tamil Nadu at 1950 there were 30,000 trees but according to 2015 senses there were only 10,000 trees. Hence, high spiritual pride oriented sacred tree Mahua conservation was aimed and managed to get a value added products, multiplied through the vegetative propagation and maintained for tree improvement.

Materials and Methods

Selection of superior trees

The tree has been divided into four parts, the number of flowers has been counted in one part, 100 fresh flower weights was measured then multiply with the number flowers, This will multiply with 4 to give total flower yield of tree. Trees with more flower yield will be selected. Morphological studies such as length, width and weight of flower, fruit and seed has been measured.

Fig 1: Madhuca tree, flower and fruit

Fig 2: Measurement of Madhuca flower & seeds

Stem cutting propagation

Stem cuttings were collected from selected superior trees at different regions of Tamil Nadu such as Sidhapudur, Vadavalli, Kokkulam 1, Kokkulam 2, Sundarapuri, Kanavaypatti, Madathukulam, Thamaraikulam and Aruppukottai. Semi hard wood cuttings with 3-4 leaves selected, considering them to be 15 to 20 cm in length. The cut end of stem cuttings was treated with copper oxychloride 50 WP to avoid contamination. The cuttings were carefully transferred from field to nursery. Cuttings were pretreated with carbendazim 50% WP to prevent the fungal contaminations. IBA was applied to the bottom positions of the cuttings as a 10 second quick dip for root initiation. Then the cuttings were placed into root trainers filled with vermiculite and kept under polytunnels. Rooting was observed after 45 days, the rooted cuttings were taken out from root trainers in polytunnels then transferred into polybags with red soil, sand and manure 2:1:1 ratio respectively and kept for hardening process under green house.

Fig 3: Stem cutting propagation

Fig 4: Planting of *M. longifolia*

Estimation of oil percentage

The mauha oil was extracted using soxhlet apparatus. Thimbles were made in three replications per tree after the seed kernels were ground. Petroleum ether was used to extract oil from seed kernel powder for 8-10 hours at 70-80 ºC. The solvent was removed/evaporated in a water bath at 40 °C. The oil percentage was computed.

Fig 5 and 6: Oil extraction from seeds

Results and Discussion

Selection of superior tree

In superior tree selection based on morphological characteristics such as length, width and weight of flower, seeds and fruit yielding percentage have been recorded in different places of Tamil Nadu. Flower morphology such as length, width and weight of *M. longifolia* was collected from different places and given in table 1, length and width of flowers range from 0.9 cm to 2.1 cm and 0.5 to 1.2 cm respectively. Flowers' weight (100) ranges from 14 -31 g. Seed morphology characters were shown in table 2, seed length and width range from 2.5 to 4.2 cm and to 1 to 2 cm respectively. Seeds weight (100) ranges from 150 to 252 g. High flower yields found in Kokkulam 2 (8.4 kg) village of Madurai district and Sidhaputhur (7.2 kg) regions of Coimbatore districts, showed in table 3.

Table 1: Flower length, width and weight of *M. longifolia*

Locations	Length of flower (cm)	Width of flower (cm)	Flower Weight (g) (100)
Sidhapudur	1.0 ± 0.29	0.6 ± 0.10	14.6
Vadavalli	1.6 ± 0.27	1.1 ± 0.12	31.2
Kokkulam 1	1.4 ± 0.31	0.8 ± 0.09	24.6
Kokkulam 2	1.6 ± 0.25	0.7 ± 0.11	31.5
Sundarapuri	1.7 ± 0.19	0.8 ± 0.13	30.2
Kanavaypatti	1.8 ± 0.12	1.0 ± 0.09	32.1
Kanniyampatti	1.5 ± 0.16	0.9 ± 0.08	30.5
Madathukualam	1.6 ± 0.22	1.0 ± 0.13	31.2
Thamaraikulam	1.7 ± 0.18	0.8 ± 0.11	29.6
Aruppukottai	1.9 ± 0.23	0.9 ± 0.12	31.6

Table 2: Seed length, width and weight of *M. longifolia*

Locations	Length of seed (cm)	Width of seeds (cm)	Seed Weight (g) (100)
Sidhapudur	3.8 ± 0.33	1.1 ± 0.11	240.60
Vadavalli	3.5 ± 0.29	1.3 ± 0.13	238.28
Kokkulam 1	2.7 ± 0.36	1.3 ± 0.15	150.84
Kokkulam 2	4.0 ± 0.12	1.8 ± 0.10	302.10
Sundarapuri	3.9 ± 0.17	1.8 ± 0.09	250.15
Kanavaypatti	3.7 ± 0.23	1.6 ± 0.14	247.24
Kanniyampatti	3.8 ± 0.11	1.2 ± 0.11	252.45
Madathukualam	4.1 ± 0.16	1.9 ± 0.15	310.07
Thamaraikulam	3.0 ± 0.21	1.4 ± 0.14	210.56
Aruppukottai	3.2 ± 0.26	1.5 ± 0.11	223.72

Table 3: Mahua flower yield

Locations	Flower yield (kg)
Sidhapudur	7.2
Vadavalli	6.4
Kokkulam 1	5.3
Kokkulam 2	8.4
Sundarapuri	4.5
Kanavaypatti	5.7
Kanniyampatti	5.2
Madathukualam	4.5
Thamaraikulam	5.2
Aruppukottai	5.7

Oil estimation

Oil has been extracted from the seeds of *M. longifolia* in different regions of Tamil Nadu as shown in table. 4 results revealed that *M. longifolia* collected from sidhapudhur shows the highest oil percentage 48.2 ± 2.86%. Similarly, Hedge *et al*., (2018) [2] studied the variation in seed oil content among 13 populations of Mahua in Gujarat and the results revealed that there was a great variation in oil yield with a range from 115.04 g to 283.84 g oil yield per kg of the kernel. Kulkarni *et al*., (2013) [7] extracted the oil from *M. indica* and found that the oil percentage ranged from 40–43%. The results obtained by Yadav *et al*., (2011) [8] reported the percent of oil content

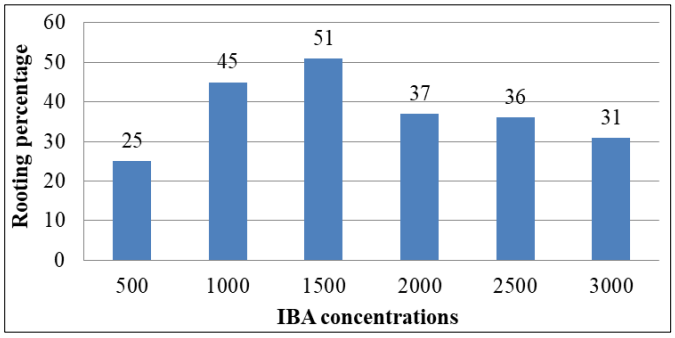
of *M. longifolia* kernel ranged from 44.4% to 61.5% with a mean value of 54.3%. The variability for oil content in mahua kernels is slightly higher than in the previous reports. The highest oil content was reported in accessions IC556617 (61.5%), followed by IC554529 (58.7%). 14 accessions had more than 55% kernel oil content, among the 37 accessions which is a desirable trait for industrial use of this tree. Divakara (2014) [9] studied the Relationship of Seed Traits on Initial progeny growth performance and divergence studies in *M. latifolia* and the results revealed that the oil percentage ranged from 40% to 51% and the lowest oil content was reported in the accession number CPT–21 (37.7%). Munasinghe & Wansapala (2015) [5] also studied the oil content and fatty acid profile in *M. longifolia* from different agro-climatic conditions ranging from 50.07-53.85% which is correlated with the previous results as well as with our results.

Table 4: Oil percentage of Mahua seeds

Locations	Oil %
Sidhapudur	48.2 ± 2.86
Vadavalli	41.5 ± 3.51
Kokkulam 1	44.2 ± 2.14
Kokkulam 2	46.5 ± 2.62
Sundarapuri	41.0 ± 2.39
Kanavaypatti	42.0 ± 2.92
Kanniyampatti	43.2 ± 1.32
Madathukualam	45.2 ± 1.61
Thamaraikulam	47.2 ± 3.35
Aruppukottai	45.3 ± 2.78

Stem cutting propagation

Here the selected superior trees are treated with IBA concentrations. Results of this experiment proved the effect of IBA in rooting of stem cuttings. Significant differences were found in stem cuttings treated with different concentrations of IBA. Highest rooting percentage was observed in the stem cuttings treated with 1500ppm followed by 1000ppm of IBA. Lowest rooting percentage was found in the cuttings treated with 500ppm, and 3000ppm, mortality rate also high in those concentrations. Mean number of root and length of root did not show significant difference based on the different concentrations of IBA shows in graph 1. Rooting was found 65 – 80 days after the insertion of cuttings in the medium. Different concentration of IBA did not affect the number of days needed for rooting. Highest rooting percentage was found in middle portion of cuttings followed by basal portion, however no sprouting was noticed in top portion of cuttings.



Graph 1: Effect of IBA on rooting of stem cuttings

Conclusion

M. longifolia is one of the economically and spiritually important multipurpose tree species distributed throughout India and sacred tree in various temples and its oil is used in temples for lightening purposes, the relationship between God and mahua tree has been mentioned in ancient Tamil literatures. One of the most widely used non-timber trees, in the present study survey has been carried out in different districts of Tamil Nadu and selected superior tree based on the flower and fruit yield percentage. Oil extract from mahua seeds used for cooking, lighting purposes and biodiesel energy; Helps in curing rheumatism, reduces body heat, relieves headache, constipation, piles and haemorrhoids. The mahua oil was considered to be holy by the ancients. It is believed that lighting deepam using mahua oil everyday at home destroys negative energy and brings in positive energy, happiness, peace and prosperity. However, due to the introduction of various alternative species for sugar and oil production better than mahua, nowadays mahua has become underutilized tree in this era. The self mind of man who thinks only of himself does not think a bit about the food of bears, the need for bats, the ecological necessity, or the biodiversity. As a result, it has lost much of its wildlife and also our ancient worshiped and utilized tree. Therefore conservation, multiplication and plantation of the mahua tree is very much mandatory in this junction and this genetic resource has been successfully propagated in Eastern Ghats village's area.

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References

1. Ekka A, Ekka NS. *Madhuca longifolia var. latifolia*: An Important Medicinal Plant used by tribes of North–East part of Chhattisgarh. Online International Interdisciplinary Research Journal. 2014;4:227-231.
2. Hedge HT, Gunaga RP, Thakur NS. Variation in seed oil content among 13 populations of Mahua (*Madhuca longifolia* var. *latifolia* (Roxb.) A. Chev.) in Gujarat. International Journal of Chemical Studies. 2018;6:35-38.
3. Sinha J, Singh V, Singh J, Rai AK. Phytochemistry, ethnomedical uses and future prospects of Mahua (*Madhuca longifolia*) as a food: a review. J Nutr. Food Sci. 2017;7(573):10-4172.
4. Singh V, Singh J, Kushwaha R, Singh M, Kumar S, Rai AK. Assessment of antioxidant activity, minerals and chemical constituents of edible mahua (*Madhuca longifolia*) flower and fruit of using principal component analysis. Nutrition & Food Science. 2020;51(2):387-411.
5. Munasinghe M, Wansapala J. Study on variation in seed morphology, oil content and fatty acid profile of *Madhuca longifolia* grown in different agro-climatic zones in Sri Lanka. Science Research. 2015;3(3):105-109.
6. Khare P, Kishore K, Sharma DK. Medicinal uses, Phytochemistry and Pharmacological profile of *Madhuca longifolia*. Asian Journal of Pharmacy and Pharmacology. 2018;4(5):570-581.
7. Kulkarni PS, Sharanappa G, Ramesh MR. Mahua (*Madhuca indica*) as a source of biodiesel in India. Int J Sci Eng Res. 2013;4(7):2319-2329.
8. Yadav S, Suneja P, Hussain Z, Abraham Z, Mishra SK.

Genetic variability and divergence studies in seed and oil parameters of mahua (*Madhuca longifolia* Koenig) JF Macribide accessions. Biomass and bioenergy. 2011;35(5):1773-1778.
9. Divakara BN. Relationship of seed traits on initial progeny growth performance and divergence studies in *Madhuca latifolia* Macb. For further use in tree improvement. Journal of Tropical Forestry and Environment, 2014, 4(2).
10. Gavankar R, Chemburkar M. Genetic analysis of *Madhuca longifolia* (J. Koenig ex L.) JF Macbr. Using RAPD markers. Int J Curr Microbiol App Sci. 2016;5(8):608-15.