



## ***Madhuca indica* J.F Gmel. (Mahua) candidate tree selection based on the perception of tribal community and scientific validation**

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### **Abstract**

*Madhuca indica* commonly known as Mahua belongs to family Sapotaceae. Mahua is believed to be back bone for livelihood and cultural prospective of tribal community. The variation within the species with respect to various parameters related to flowering and seeding recognized by tribal communities were included in the study for identification of candidate trees. A study was undertaken in three agro climatic zones of Maharashtra. Through people's participation, 58 Mahua candidate trees were selected and scientifically validated. The study revealed that highly significant differences were observed in flower dropping days ( $29.71 \pm 0.10$ ), fresh flower yield ( $342.43 \pm 24.30$ ), flower dry matter ( $94.93 \pm 0.20$ ), seed oil ( $39.69 \pm 2.14$ ), dry matter in seeds ( $94.80 \pm 0.21$ ) at Dhadagaon over Ettapalli and Jawhar clusters. The maximum mean value with respect to flower sugar ( $22.94 \pm 0.7$ ), Zn ( $4.42 \pm 0.2$ ) was significant at Ettapalli cluster over Jawhar and Dhadagaon. The maximum mean value of crude protein ( $5.33 \pm 0.2$  %) at Jawhar cluster and 'Fe' content in flower ( $81.48 \pm 13.0$ ) at Ettapalli was recorded. From one of selected candidate tree, the maximum potential of seed oil (50.47 %) at Dadagaon and sugar content (32 %) at Eattapalli cluster was recorded.

**Key words:** Perception, Candidate tree, Variation, Agro climatic zones.

### **Introduction**

*Madhuca indica* J. F Gmel commonly known as Mahua belongs to family "Sapotaceae". It is a deciduous, medium sized tree, attaining a height of 70 ft (Chaudhary *et al.*, 2015), usually with a short bole from the base and a girth varies from 4.2 - 4.8 m. The tree is essentially found in the dry tropical and sub-tropical climate, where the absolute maximum temperature varies from 28.5°C to 48.5°C and the absolute minimum temperature varies from 1.7°C to 11.7°C. The normal rainfall in its natural habitat varies from 750 to 2000 mm or more. It is widely grown in large parts of India from Indo-gangetic plains in the North to Tamil Nadu in South. Jha (2013), reported the concentration of alcohol in Mahua is 8.5mg/ml and protein contain of flower varies from 4.4-7% by Patel and Naik (2010). Besides, the plant is anti bacterial activity (Sarma *et al.*, 2013 and Patel *et al.*, 2012). It is worth to identify the best candidate tree

based on its essential characters and the perception of tribes in the forest area. Considering its potential and large diversity within the species, the study was undertaken at varied agro climatic zones of Maharashtra and basically, the candidate trees were selected based on the people's perception and support with scientific substantiation. The study will help to propagate genetically superior planting material in large scale and it will benefit the tribal community for their nutritional and livelihood security.

### **Material and Methods**

#### **Description of Study Area:**

A research based project named "Maharashtra Gene Bank" is being implementing in different agro climatic zones of Maharashtra. The main emphasis of the project is conservation and revival of native plant genetic resources in the field of forestry at tribal area of Jawhar (19.92N, 73.23E) of Palghar, Dadagaon (21.82N, 74.21E) of Nandurbar and Ettapalli (20.18 N, 80.00 E) of Gadchiroli Dist where, an average rain fall of 3522, 687, 1399 mm respectively. The Non Timber Forest Produce

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(NTFP) is a one of major component in the project, in which the *Madhuca indica* is prioritized by the local tribes as one of prominent tree species for food security, cultural prospective and their livelihood. The thousands of Mahua trees were grown naturally in forest and farm land. Among several Mahua trees, some trees are having specific good characters in flower and seed yield, time of flowering, size of the flower, taste, potential in mineral content etc. As mentioned by Wani (2013), the higher values for phenotype coefficient of variation as compared to genotypic coefficient of variation in corresponding germination and seedling growth characters, indicating that the characters are greatly influenced by the field environment. The identification and conservation of such important selective Mahua tree is one of main objective of the study. The following methods were followed for collection of basic information from tribal community related to *Madhuca indica* tree.

#### **House hold primary data collection through, focused group discussion and Participatory Rural Appraisal (PRA)**

The PRA tools were used to get the basic information related identification and prioritization of NTFP species based on the peoples need and use. Out of 28 different NTFP species listed by villagers from all three zones, the five important tree species were prioritized using matrix method in PRA exercise and they categorized based on its food, fodder, medicinal values, yield and market value of produce. Further, among all five prioritized species, the *Madhuca indica* was considered as a first prioritized NTFP species by tribal communities in working area. The trees are found in natural forest as well in agricultural fields. The variation within the species is being well noticed by the local communities in the project villages and they recognized as a best candidate tree based on following characters 1) Age 2) Stem girth 3) Time of flowering 4) Flower and seed yield 5) Flowering period 6) Flower taste/sugar 7) Flower moisture 8) Seed oil 9) Size of fruit 10) Thickness of rind 11) Seed size 12) Flower fall in peak period.

The format was developed with questioners using the above characters and consecutive group discussions were held in all 31 villages and information was collected from farmers, resource persons, women and children. Based on perception of tribes, the 58 Mahua trees were identified as a

candidate tree in which 13 in Jawhar, 14 in Dhadagaon and 31 in Ettapalli clusters of Maharashtra state. The physical parameters related to tree height, girth, canopy length, flower and seed yield were measured in the field. The flower and seed samples were collected from each of selected tree and analysed the flower sugar, seed oil, flower moisture, dry matter, crude proteins and microelements.

## **Results and Discussion**

### **I) Physical parameters, crude protein and dry matter in Mahua**

The tree observations indicated that, the maximum mean value of flower dropping period ( $29.71 \pm 0.1$ ), fresh flower yield ( $343 \pm 24.3$ ) and flower dry matter ( $94.93 \pm 0.2$ ) were highly significant at Dadagaon cluster over Jawhar and Ettapalli. Similarly, the maximum mean value of sugar content in flower ( $22.94 \pm 0.7$ ) at Ettapalli and crude protein ( $5.33 \pm 0.2$ ) at Jawhar cluster was recorded. The crude protein content in flower was 0.33 per cent higher than report of Patel *et al.*, (2010). However, there was no significant difference with respect to plant height, canopy and girth of Mahua tree in all the three locations (Table 1).

### **II) Mineral composition in flowers, seed oil and dry matter.**

The tribal's in the project area are using dried flowers mainly for preparation of various sweets dishes and they consume during various local festivals and rituals. Beside this, they are also using the flowers after delivery and sickness as a source of nutritious food. Considering the importance, the flowers samples of candidate trees having more than 5.5 % crude protein were taken for the analysis of micro elements like Cu, Fe, Zn and Mn in laboratory. The maximum mean value of seed oil ( $39.67 \pm 2.1$ ) and dry matter in seeds ( $94.80 \pm 0.2$ ) was recorded at Dhadagaon cluster. The maximum mean value of Zn ( $4.42 \pm 0.2$ ) at Ettapalli and 'Fe' at Dadagaon was recorded. However, no significant variation in Cu and Mn in flower across all the three agro climatic zones (Table 2). The maximum potential of seed oil from selected candidate tree was 50.47 %; in the study of Pratap S Kulakani (2013) reported seed oil content 40-43 % only.



**Table 1 Tree growth and flower parameter in *Madhuca indica***

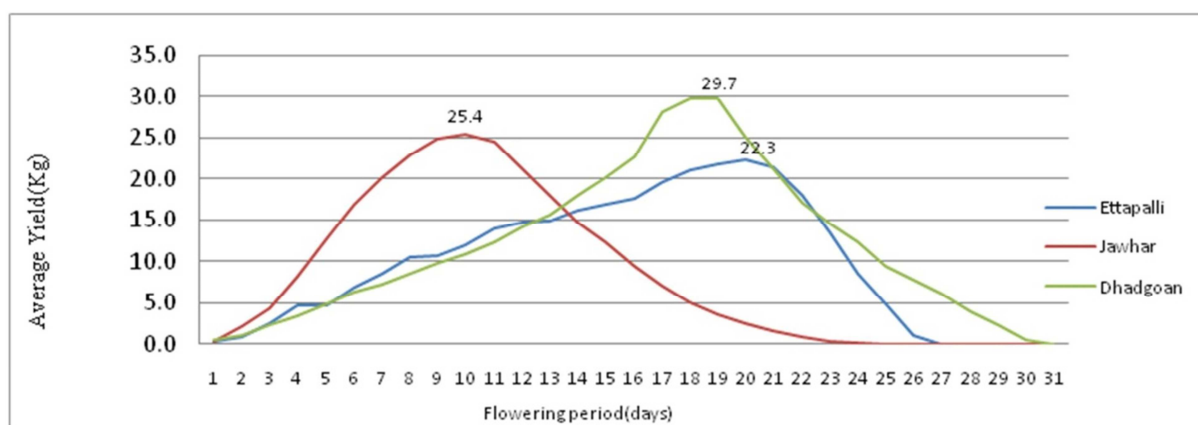
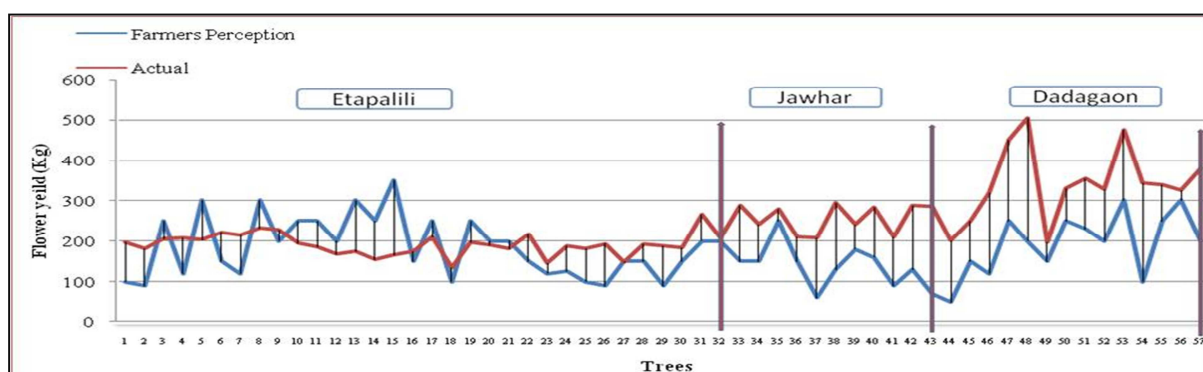
Place	Particular	Plant height (m)	Canopy (m)	Girth (cm)	Flower dropping days	Flower yield (Kg)	Flower dry matter (%)	Flower crude protein (%)	Sugar (%) #
Dhadoop	Mean	23.14±1.6	31.93± 1.0	357.14± 16.4	29.71 ± 0.1	342.43± 24.3	94.93± 0.2	4.34 ± 0.1	19.29 ± 1.0
	Mini	16.0	23.0	226.0	29.0	197.0	93.0	3.50	13.0
	Maxi	35.0	36.0	430.0	30.0	504.0	96.0	5.37	27.0
	N	14	14	14	14	14	14	14	14
Ettapalli	Mean	23.97± 0.6	30.03± 0.8	323.16 ±10.3	22.16 ± 0.3	191.55± 4.9	92.00± 0.2	5.14 ±0.2	22.94±0.7
	Mini	17.0	21.0	213.0	19.0	134.0	88.0	3.73	17.0
	Maxi	32.0	38.0	427.0	25.0	265.0	95.0	7.0	32.0
	N	31	31	31	31	31	31	31	31
Jawhar	Mean	22.15±1.2	29.92±1.4	320.23±17.2	21.62±0.6	252.54±10.4	93.23±0.3	5.33±0.2	17.77±0.7
	Mini	16.0	22.0	244.0	19.0	180.0	91.0	4.01	14.0
	Maxi	30.0	38.0	442.0	24.0	293.0	95.0	6.10	23.0
	N	13	13	13	13	13	13	13	13
Over all	Mean	23.36±0.6	30.47±0.6	330.71±7.9	23.86±0.5	241.64±10.6	92.98±0.2	4.99±0.1	20.90±0.5
	Mini	16.0	21.0	213.0	19.0	134.0	88.0	3.50	13.0
	Maxi	35.0	38.0	442.0	30.0	504.0	96.0	7.0	32.0
	N	58	58	58	58	58	58	58	58
R <sup>2</sup>		0.0291	0.0332	0.0625	0.8006	0.6008	0.4479	0.1829	0.2949
“p” value		NS	NS	NS	0.0001**	0.0001**	0.0001**	0.0039*	0.0001**



**Table 2 Mineral Composition in flower (mg/100g) and Seed oil (%), Seed dry mater (%) of *Madhuca indica***

Place	Particular	Cu	Fe	Zn	Mn	Seed oil (EE)	Seed dry matter
Dhadagoan	Mean	27.77±15.0	81.48±13.0	3.10±0.1	5.66±0.4	39.67±2.1	94.80±0.2
	Mini	5.65	41.26	2.90	4.20	24.04	92.86
	Maxi	86.96	114.40	3.50	6.60	50.47	96.41
Ettapalli	Mean	36.33±7.2	42.74±8.0	4.42±0.2	6.09±0.6	31.87±1.1	81.34±3.0
	Mini	4.77	23.76	3.20	1.30	19.54	45.34
	Maxi	98.47	116.60	5.40	10.0	45.95	95.23
Jawhar	Mean	31.30±12.2	55.40±9.4	3.27±0.1	6.08±0.2	34.13±1.3	93.88±0.4
	Mini	6.31	32.90	3.10	5.40	26.88	90.86
	Maxi	63.69	77.17	3.50	6.50	42.47	96.16
Over all	Mean	33.47±5.6	53.84±6.6	3.91±0.2	5.99±0.3	34.26±0.9	87.40±1.9
	Mini	4.77	23.76	2.90	1.30	19.54	45.34
	Maxi	98.47	116.60	5.40	10.0	50.47	96.41
R <sup>2</sup>	N	22	22	22	22	58	58
		0.0196	0.2712	0.6345	0.0130	0.2000	0.2969
"p" value		NS	0.049*	0.0001**	NS	0.0022**	0.0012**

Significant at level of  $p < 0.05$  = \*, Highly significant at level of  $p < 0.01$  = \*\*

**Fig 1 The day wise flower dropping period at three agro climatic zones****Fig 2 *Madhuca indica* flower yield (Farmers perception Vs Actual measurement)**

period and 25.4kg with 24 days dropping period at Dadagaon, Ettapalli and Jawhar clusters respectively (Fig-1). The highest fresh flower yield was 504 kg from single *Madhuca indica* tree at Dhadagaon (Table 1) with long flower dropping period of 30 days. Pratap S Kulkarni (2013) reported average sized *Madhuca indica* tree yields of 50-100 kg of flower in a season that last around a month. The individual tree day wise yield was recorded in the field and it was compared with the approximate yield arrived during group discussion with the farmers. The actual yield of the tree is higher than the claim made by the farmers (Fig-2). This under estimation of fresh flower yield by the farmers is may be due to eating of flowers by wild and domestic animals in the forest were not considered.

## Conclusion

The study indicated highly significant differences in flower dropping dyas, fresh flower yield, flower dry matter, Sugar in flower, seed oil, seed dry matter of *Madhuca indica* among the three clusters. The maximum potential of fresh flower yield (504kg) was recorded at Dhadagaon with long flower dropping period of 30 days. The maximum potential of 'Fe' (114.4mg/g) and seed oil (50.4%) were recorded from same cluster. The maximum potential of crude protein (7.0%) in a tree was recorded at Ettapalli cluster. The diversity in *Madhuca indica* species across three locations having different agro-climatic conditions was observed. This study was helped further for mass multiplication of *Madhuca indica* tree having specific characters like high flower and seed yield, high microelements, seed oil content, which could meet out the requirement of local community in region.

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