



## Variation in seed quality seed parameters of teak clones (*Tectona grandis* L. F.)

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### ABSTRACT

In the present study, various qualitative and quantitative fruit traits were studied from seed lots collected from 18 clones located at teak clonal seed orchard of Wada, Thane. Variation in qualitative fruit traits was recorded among the selected 18 clones. Among these clones, 13 clones showed high level of hairiness on fruit wall and 10 clones showed fruit splitting characteristics. Interestingly, 12 clones showed loose type of calyx with high density hairiness. There was a significant variation in fruit diameter, fruit length, fruit weight, number of seeds per fruit, thickness of mesocarp and endocarp among clones. Clones such as MHAL-P1, MHAL-P2 and MHAL-P4 showed good seed filling having 4 seeds/fruit. Seed parameters studied were subjected to divergence analysis and result showed that all the 18 clones were grouped into 4 clusters. The cluster group 1 was observed of having maximum number of 13 clones, which are closely related with each other. 3 clones viz. MHAL-A5, MHAL-P4 and MHAL-P6 were comparatively less related and were grouped in cluster 2, whereas, clone MHAL-P2 was observed to have maximum of cluster distance were grouped in 2 separate clusters i.e. 3 and 4.

### Key words:

Clone, fruit traits, seed orchard, teak.

### INTRODUCTION

Teak is most important commercial tree species of India. State Forest Departments are collecting quality seeds from different seed orchards for large scale production of planting materials to improve the productive potential of teak timber in the country. Teak (*Tectona grandis* L.F.) is an economically important plantation species of the tropics, which has a large distribution in the Indian subcontinent and South-East Asia (Troupe 1921). Teak wood is one of the strongest, most durable hardwoods in the world. Teak plantations account for 5 to 8 per cent of the total forest area in the tropics (Ball et

al. 1999); however, teak accounts for about 90 per cent of the quality hardwood plantations for timber production (Granger 1998). In India, total area under teak plantation is about 1.5 mha and around 50,000 hectare of teak plantations are raised annually (Subramanian et al. 2000; Katwal 2005). Maharashtra forest department raised about 2,75,907 ha of teak plantations (Wood 1992). There is a great demand for quality planting materials both in the state as well as in the country. Moreover, the quality and quantity of timber production is depends mainly on quality planting materials which are raised from seeds of either Clonal seed orchard (CSO) or other

improved sources like seed production area/ seed stands. Gunaga and Vasudeva (2002) and Hanumantha (2000) reported significant variation in quantity as well as quality of fruits produced in teak clonal orchards from Karnataka. Such information is scanty in the state. Therefore, present study was undertaken to study the variability in fruit and seed characters among 18 clones of teak.

## MATERIALS AND METHODS

The present study was carried out in the research field of College of Forestry, KKV, Dapoli during 2013-14. Seed samples were collected from CSO of teak located at Wada in district Thane (Latitude 19.63 and Longitude 73.13) This CSO was established by Maharashtra Forest Department during 1996-97. Orchard consists of 18 clones raised through grafts from original phenotypically superior trees. Among 18 clones, one clone each from Tamil Nadu and Kerala and rest from Maharashtra State.

For the study, fruits were collected from individual clones. For each clone, fruits were collected from three ramets. Qualitative fruit traits such as nature of calyx enclosed to fruit (*i.e.*, loose, medium, tight), hairiness on fruit wall (*i.e.*, high, medium, low) and presence or absence of splitting if any, were recorded. Quantitative fruit traits such as fruit diameter (mm), fruit length (mm), fruit weight (gm), number of seeds per fruit, mesocarp thickness (mm) and endocarp thickness (mm) were assessed.

All the quantitative data was analyzed by using ANOVA technique. Complete linkage cluster analysis was made by using quantitative fruit character data in SAS software.

## RESULTS AND DISCUSSION

Results showed that there was a variation in qualitative traits like nature of calyx enclosing fruit and hairiness (Table 1). Further, quantitative fruit traits showed significant variation among clones (Table 2).

Among the 18 clones, for nature of calyx 15 clones were grouped into loose category and only 3 clone into medium category. For level of

fruit hairiness, 13 clones exhibited high levels and 5 clones had low level of hairiness on the fruits, whereas, 10 clones showed fruit splitting/cracking character. Out of 18 clones, 12 clones showed loose type calyx enclosure with more density of hairiness; in contrast, seeds collected from three clones showed loose type calyx enclosure with least density of hairiness. Clone from Kerala bears fruit with medium calyx enclosure having high density hairiness. However, clones such as MHAL-A4, MHAL-A6 showed fruits with medium calyx enclosure with low hairiness (Table 1).

Result recorded for fruit diameter, fruit length, fruit weight, number of seeds per fruit, mesocarp thickness and endocarp thickness showed significant variation among teak clones (Table 2). Maximum fruit diameter was found to be highest in clone MHAL-A2 (11.14 mm) whereas, MHEM-R1 (8.46 mm) recorded minimum, with overall mean of 12.793 mm. Similarly, fruit length ranged between 10.04 (MHEM-R1) to 13.49 mm (MHAL-P2) with mean value of 11.89 mm. Further, clones such as MHAL-P2 and MHAL-P5 showed maximum fruit weight of 0.59 and 0.57 gm, respectively. Seed filling was found to be superior among clones of CSO, Wada with overall mean of 3.7 numbers of seed per fruit (Table 2). MHAL-P1, MHAL-P2 and MHAL-P4 exhibited high *i.e.* 4 number of seeds/fruit. Clone MHAL-A5 recorded maximum mesocarp thickness (2.91 mm), followed by MHAL-A5, MHWY- K1; however, it was low in MHAL-P6 (1.54 mm). Similarly, endocarp thickness varied from 5.99 to 8.66 mm in MHAL-1 and MHAL-P5, respectively.

The data pertaining to seed parameters was subjected to divergence analysis to making clusters among teak clones. The minimum clusters distance of 0.18 was recorded between MHAL-P9 and KLN-2, whereas the maximum distance between the clones MHAL-A2 and MHWY-K1 was 0.46. Based on seed parameters, cluster analysis resulted into four groups (Fig. 1). The cluster group 1 was observed of having maximum number of 13 clones, which are closely related with each other. 3 clones viz. MHAL-A5, MHAL-P4 and MHAL-P6 were

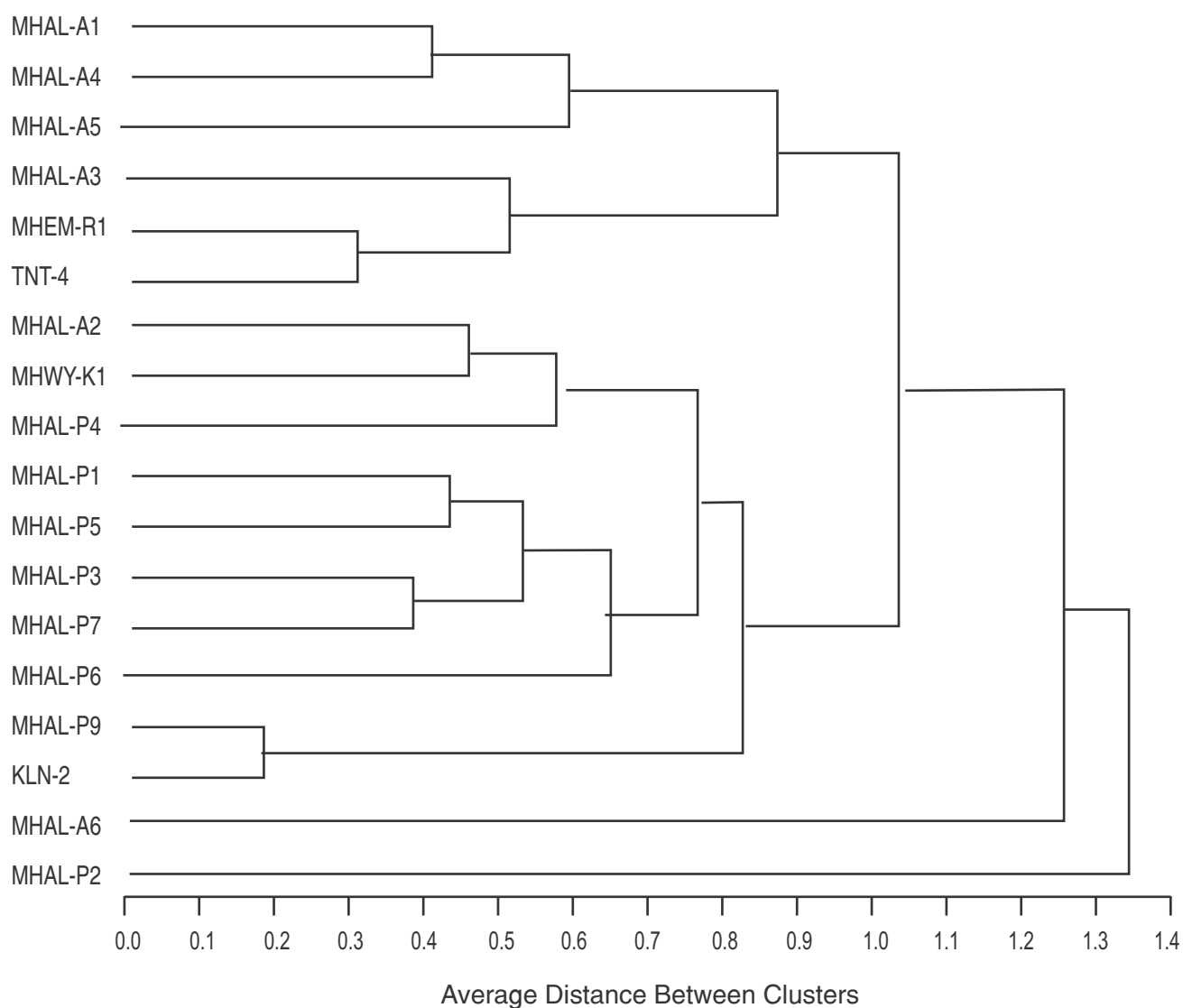
**Table 1:** Variation in qualitative fruit characters among eighteen teak clones of CSO, Wada

Sr. No.	Clone	Calyx	Hairiness	Splitting
1	MHAL -A1	Loose	High	Absent
2	MHAL -A2	Loose	High	Present
3	MHAL -A3	Loose	High	Present
4	MHAL -A4	Medium	Low	Present
5	MHAL -A5	Loose	High	Present
6	MHAL -A6	Medium	Low	Absent
7	MHAL -P1	Loose	High	Absent
8	MHAL -P2	Loose	Low	Present
9	MHAL -P3	Loose	High	Absent
10	MHAL -P4	Loose	Low	Present
11	MHAL -P5	Loose	High	Present
12	MHAL -P6	Loose	Low	Present
13	MHAL -P7	Loose	High	Absent
14	MHAL -P9	Loose	High	Present
15	KLN - 2	Medium	High	Absent
16	MHEM -R1	Loose	High	Present
17	TNT -4	Loose	High	Absent
18	MHWY - K1	Loose	High	Absent

**Table 2:** Variation for quantitative fruit characters of eighteen teak clones in CSO, Wada.

Sr. No.	Clone	Fruit Dia. (mm)	Fruit Length (mm)	Fruit Wt. (gm)	No. of Seed	Mesocarp Thickness (mm)	Endocarp Thickness (mm)
1.	MHAL-A1	10.32	11.32	0.34	3.5	2.60	5.99
2.	MHAL-A2	11.14	12.68	0.53	3.8	2.37	7.81
3.	MHAL-A3	9.50	10.16	0.33	3.8	2.33	6.76
4.	MHAL-A4	9.59	11.05	0.36	3.5	2.20	6.67
5.	MHAL-A5	8.97	11.87	0.40	3.5	2.91	7.12
6.	MHAL-A6	10.20	12.09	0.43	3.4	2.28	6.16
7.	MHAL-P1	9.73	12.15	0.54	4.0	1.97	8.53
8.	MHAL-P2	9.57	13.49	0.59	4.0	2.37	8.26
9.	MHAL-P3	10.50	11.98	0.48	3.8	1.86	7.24
10.	MHAL-P4	9.22	12.41	0.45	4.0	2.20	6.75
11.	MHAL-P5	11.00	12.46	0.57	3.7	2.05	8.66

12.	MHAL-P6	9.99	11.25	0.52	3.5	1.54	7.96
13.	MHAL-P7	9.88	11.36	0.50	3.7	1.96	8.13
14.	MHAL-P9	9.88	13.46	0.53	3.3	2.43	8.05
15.	KLN- 2	10.75	12.88	0.53	3.4	2.49	8.09
16.	MHEM-R1	8.46	10.04	0.31	3.9	1.65	7.42
17.	TNT-4	8.655	10.603	0.34	3.9	1.86	6.87
18.	MHWY- K1	10.973	12.709	0.49	3.6	2.68	6.941
	<b>Mean</b>	<b>9.91</b>	<b>11.89</b>	<b>0.46</b>	<b>3.7</b>	<b>2.21</b>	<b>7.42</b>
	<b>Std Error (±)</b>	<b>0.09</b>	<b>0.12</b>	<b>0.01</b>	<b>0.03</b>	<b>0.04</b>	<b>0.06</b>
	<b>CD @ 5% P</b>	<b>0.37</b>	<b>0.50</b>	<b>0.04</b>	<b>0.12</b>	<b>0.16</b>	<b>0.24</b>



**Figure. 1.** Dendrogram of the cluster analysis using fruit parameters among teak clones.

comparatively less related and were grouped in cluster 2, whereas, clone MHAL-P2 was observed to have maximum of cluster distance.

Qualitative fruit traits such as loose type calyx having more hair density on fruit wall (12 clones) as well as splitting characters of fruit (10 clones) have been recorded among clones. Hairiness and splitting of fruits may help in better absorption and retention of moisture during pre-sowing treatment of fruits leading to better germination. Hanumantha et al. (2001) indicated that the splitting of fruits might facilitate quick germination of fruits. These morphological differences might be useful in easy identification of fruits of different SPAs and the variation in these qualitative traits may also be useful in teak improvement programme (Gunaga 2008 and Prabhu 2007). Similar variability in teal comes was also reported by Nagarajan et al. (1996) also studied variations for fruit characteristics of four teak clones planted in two different locations *i.e.* Chandrapur and Walayar. Clones differed with respect to fruit diameter and fruit weight and no difference with respect to two locations. Similarly, Hanumantha (2000) also reported variation among teak clones of Karnataka for fruit characters *viz.* fruit weight (43.07-70.56 g), fruit diameter (1.15-1.56 cm), fruit density (0.367-0.536 g/cc), Mesocarp (2.69-4.27 mm) and endocarp thickness (1.74-2.45 mm) and most of the traits are having higher heritability values, which indicates that the traits are controlled by genetic factor. Huge variation in various fruit characteristics among teak SPAs was also reported by Gunaga (2008). All these inferences are conformity with results of the present study, where fruit diameter, fruit length, fruit weight, number of seeds per fruit, mesocarp thickness and endocarp thickness significantly varied among clones.

Several scientists have been used various fruit and seed traits to study the diversity among clones/ provenances through cluster analysis. In the present study, 18 clones are grouped into four clusters. Clones MHAL-P2 and MHAL-A6 belonged to separate clusters indicating these

clones are most diverse than rests of the clones in terms of reproductive traits. Parthiban et al. (2005) and Kertadikara and Prat (1995) have used cluster analysis techniques to understand the diversity of different seed sources/ provenances through cluster analysis in Teak clones. Nicodemus et al. (2005) reported the genetic variation in teak populations from Western Ghats and Central parts of India through Random Amplified Polymorphic DNA markers.

### CONCLUSION

Study shows that there was a significant variation among 18 clones of teak for various qualitative and quantitative parameters. Cluster analysis resulted in four broad groups, where first group consists of 10 clones; second group consists of 6 clones. Interestingly, clones such as MHAL-A6 and MHAL-P2 formed separate groups and these clones supposed to be diverse in terms of fruit and seed traits. Such genetic base variation could be useful for further breeding programme.

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