*International Journal of Farm Sciences* **8(1):** 107-109, 2018; doi: 10.5958/2250-0499.2018.00026.5

# Genetic variability studies in teak (*Tectona grandis* L)

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## ABSTRACT

The present study was carried out during 2009-2010 at the Department of Forestry, PGI, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra and the observations were taken from National Teak Germplasm Bank, Lohara, district Chandrapur, Maharashtra. The study was undertaken on thirty clones of teak (*Tectona grandis* L) using randomized block design with three replications. The teak plantation was established in the year 1979 at a spacing of 8 x 8 m. In each treatment there were three plants of each clone. One plant per treatment was selected randomly to record observations for six characters. The highest phenotypic coefficient of variation was observed for volume ($m^3$) and highest genotypic coefficient of variation for leaf area ($m^2$). The heritability for all the characters ranged from 10.70 to 91.67 per cent. Highest genetic advance was observed for the character leaf area (43.76%) that ranged from 5.26 to 43.76 per cent.

**Keywords:** Genetic variability; heritability; genetic advance; teak

## INTRODUCTION

Teak (*Tectona grandis* L) belongs to the family Verbenaceae and is one of the most important species for plantation in the tropics. It is naturally distributed in parts of India, Myanmar, Thailand, Laos and Indonesia (Troup 1921).

The Indian region is considered to be primary centre of genetic diversity and variability of teak with distribution over 8.9 Mha (Tewari 1992). Outside its natural range teak has been successfully introduced in pacific, African and central and south American regions. In India its natural zone of distribution is mostly confined to the peninsular region below 24°8' latitude (Kumarvelu 1991).

The species is known to have great genetic variability in India. Teak is large deciduous tree growing up to 30 m height and 100 cm or more diameter at breast height, often fluted at the base, a long straight, cylindrical bole up to 2/3$^{rd}$ of the height of the tree and sturdy quadrangular branches. Bark is thin, fibrous, pale brown or gray. In teak the crown varies with growth conditions.

## MATERIAL and METHODS

The material under study constituted thirty clones of teak (Table 1). The observations were recorded on single tree of each clone randomly selected. The characters were selected and the criteria were followed for recording the observations of each character for three replications. The analysis of variance was carried out to test the significance of difference between the clones for the characters under study as per the standard method given by Panse and Sukhatme (1954) and Singh and Chaudhary (1977).

The study was conducted at National Teak Germplasm Bank, Lohara, Maharashtra situated at a distance of 6 km from Chandrapur. The research station falls under the agro-climatic zone number VIII at latitude 19°28''32' N and longitude 79°20''11' E. Here

Table 1. Details of the clones under study

| S/N | Name of clone | Source | S/N | Name of clone | Source | S/N | Name of clone | Source |
|---|---|---|---|---|---|---|---|---|
| 1. | MHSC-A2 | Maharashtra | 11. | APT-20 | Andhra Pradesh | 21. | ORANR-3 | Orissa |
| 2. | MHSC-A1 | Maharashtra | 12. | APT-3 | Andhra Pradesh | 22. | ORPB-18 | Orissa |
| 3. | TNT-8 | Tamil Nadu | 13. | APT-16 | Andhra Pradesh | 23. | APKEC-2 | Andhra Pradesh |
| 4. | MHSC-J1 | Maharashtra | 14. | TNT-12 | Tamil Nadu | 24. | ORNAP-7 | Orissa |
| 5. | APT-22 | Andhra Pradesh | 15. | APT-17 | Andhra Pradesh | 25. | APNPL-10 | Andhra Pradesh |
| 6. | APT-11 | Andhra Pradesh | 16. | TNT-11 | Tamil Nadu | 26. | KLS-4 | Kerala |
| 7. | TNT-14 | Tamil Nadu | 17. | ORNAP-3 | Orissa | 27. | ORANR-2 | Orissa |
| 8. | TNT-13 | Tamil Nadu | 18. | KLS-3 | Kerala | 28. | ORPLM-1 | Orissa |
| 9. | KLN-2 | Kerala | 19. | APNPL-11 | Andhra Pradesh | 29. | ORANR-6 | Orissa |
| 10. | TNT-10 | Tamil Nadu | 20. | APKEA-24 | Andhra Pradesh | 30. | ORANP-6 | Orissa |

the average range of temperature is 23.6 to 38.6°C with mean annual rainfall of 1183 mm. The plants had been planted in the year 1979.

## RESULTS and DISCUSSION

The data given in Table 2 reveal that genotypic coefficient of variation (GCV) for different characters ranged from 6.99 (girth) to 22.39 per cent (leaf area). The estimates of GCV were recorded slightly higher for dry weight of leaf (15.88%) followed by volume (14.58%) whereas the magnitude of it was comparatively moderate for number of branches (12.71%) and low for girth (6.99%) and plant height (7.94%).

Phenotypic coefficient of variation (PCV) for different characters ranged from 10.57 (plant height) to 44.57 per cent (volume). The estimates of PCV were recorded higher for leaf area (23.38%) followed by girth (19.21%) whereas moderate for dry weight of leaf (18.48%) and it was comparatively lesser for number of branches (13.89%).

The heritability estimates in broad sense ($h^2$) were found in higher magnitude in traits like leaf area (91.67%) followed by number of branches (83.73%), dry weight of leaf (73.82%) and plant height (56.44%). However low heritability was observed in traits like girth (13.26%) and volume (10.70%).

The expected genetic advance (EGA) as per cent over mean estimated for different characters ranged from 5.26 (girth) to 43.76 (leaf area) per cent. Higher estimates of genetic advance were recorded for dry weight of leaf (27.10%) number of branches (23.93%) and lower for volume (9.02%) and plant height (12.26%).

The characters plant height, leaf area, dry weight of leaf and volume exhibited higher GCV and PCV values indicating large amount of variation. Moderate and low GCV values were noted in the characters such as number of branches and plant height which means that the extent of genetic variation observed was somewhat lesser for these characters among the clones studied. There was not much difference observed between GCV and PCV values in almost all the characters indicating less influence of environment.

With the genetic coefficient of variation alone it is difficult to determine the relative amount of heritable and non-heritable components of variation present in the population. Estimates of heritability and genetic gain would supplement this parameter. The heritability in broad sense ranged from 10.70 per cent for volume to 91.67 per cent for leaf area. The higher heritability estimates were observed for leaf area (91.67%) followed by number of branches (83.73%), dry weight of leaf (73.83%) and plant height (56.44%) and moderate to low heritability was observed for girth (13.26%) and volume (10.70%). These results indicate the presence of high heritability for all the characters.

The expected genetic advance (EGA) expressed as percentage over mean ranged from 9.02 per cent for volume to 43.76 per cent for leaf area. In the present study high value of EGA was observed for leaf area (43.76%) while moderate value was recorded for dry weight of leaf (27.10%), number of branches (23.93%) and plant height (12.26%). Low values of EGA were recorded for the characters girth (5.26%) and volume (9.02%) indicating that these characters were more influenced by the environment. This is indicative of the fact that improvement could be quickly achieved in these characters through selection. During present

Table 2. Estimation of mean, range, GCV, PCV, heritability and expected genetic advance (% over mean)

| Character | Mean | Range | | GCV (%) | PCV (%) | Heritability ($h^2$) (%) | Expected genetic advance (%) |
|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | |
| Plant height (m) | 22.01 | 16.16 | 25.83 | 7.94 | 10.57 | 56.44 | 12.26 |
| Girth (m) | 0.93 | 0.76 | 1.15 | 6.99 | 19.21 | 13.26 | 5.26 |
| Leaf area ($cm^2$) | 686.8 | 459.7 | 1013.60 | 22.39 | 23.38 | 91.67 | 43.76 |
| Dry weight of leaf (g) | 1.66 | 0.99 | 1.91 | 15.88 | 18.48 | 73.82 | 27.10 |
| Number of branches | 18.30 | 14.66 | 22.66 | 12.71 | 13.89 | 83.73 | 23.93 |
| Volume ($m^3$) | 1.33 | 0.71 | 1.94 | 14.58 | 44.57 | 10.70 | 9.02 |

GCV= Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation, Min= Minimum, Max= Maximum

study estimates of high heritability along with low genetic advance were observed for the characters plant height, dry weight of leaf, number of branches and girth. According to Panse and Sukhatme (1954) when heritability is predominantly due to non-additive gene effects (dominance and epistasis) then the genetic gain by selection would be low as observed in present study for these four characters. Recurrent selection may be employed to carry out further improvement for these characters. These results are in conformity with the findings of the earlier workers like Swain et al (1996), Kumar et al (1997), Swain et al (1999), Gogate et al (1997) and Gera et al (2001).

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