

Genetic variability studies in clonal population of teak (*Tectona grandis* L)

R PATIL, DIPIKAAYATE* and VV UJJAINKAR

Department of Forestry, PGI, Dr Panjabrao Deshmukh Krishi Vidyapeeth
Akola 444104 Maharashtra, India

*Department of Tree Improvement and Genetic Resources

Dr YS Parmar University of Horticulture and Forestry

Nauni, Solan 173230 Himachal Pradesh, India

Email for correspondence: daayate@gmail.com

ABSTRACT

The study was carried out on genetic variability in clonal population of teak (*Tectona grandis* L) during the year 2011-12 at the Department of Forestry, Post Graduate Institute, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The study revealed that there was substantial variability among the clones used as experimental material whereas the estimates of heritability ranged from 69.60 per cent for number of branches to 98.70 per cent for leaf area while the expected genetic advance expressed as percentage over mean ranged from 18.66 per cent for number of branches to 56.41 per cent for volume reflecting the variability among the clones. In the present study the high value expected genetic advance was observed for volume (56.41%) while moderate for leaf area (33.61%), girth (22.55%) and plant height (21.33 %). These observed high to moderate estimates of expected genetic advance are indicative of the fact that improvement could be quickly achieved in these characters through selection. High heritability accompanied with high genetic advance in characters suggest that inheritance of characters is governed by additive gene effects. The estimates of high heritability along with low genetic advance were observed for the characters plant height, dry weight of leaf and number of branches and girth. Recurrent selection needs to be employed to carry out further improvement for these characters.

Keywords: Genetic variability; heritability; genetic advance; teak

INTRODUCTION

Teak (*Tectona grandis* L) belongs to the family Verbenaceae and is having chromosome number $2n=36$ (Kedamath and Raizada 1961). It can survive and grow under a wide range of climatic and edaphic

conditions. It is a fast growing species giving a mean annual increment (MAI) of 10 to 30 m³/ha at the age of ten years (Jha 1999). It is one of the world's premier hardwood timbers. It occurs naturally only in India, Myanmar, the Lao People's Democratic Republic and Thailand.

Teak is important species from a tree improvement point of view as it has great use as timber having high value and teak is easily established in plantation regimes which allow introduction of improved genetic material. Hence it is also essential to study the variation in it.

METHODOLOGY

The present investigation was carried out with thirty clones of teak established in 1974 and designated as the National Teak Germplasm Bank, Mohghata, district Bhandara. The clones were planted at a spacing of 8 x 8 m² with randomized block design. The data were collected for six morphological traits viz plant height, plant girth, leaf area, dry weight of leaves, number of branches per plant and volume which were subjected to analysis of variation and covariance. The genetic parameters viz genotypic (GCV) and phenotypic (PCV) coefficients of variance, heritability along with genetic gain were estimated from the data.

RESULTS and DISCUSSION

The estimates of coefficient of variation at phenotypic and genotypic levels are given in Table 1. The magnitude PCV was greater than GCV. The character volume (32.17) exhibited highest and the remaining characters expressed low PCV viz leaf area (16.53), plant height (13.38), plant girth (13.22) number of branches (13.01) and dry weight of leaves (9.76). The inherent genetic variability is expressed

by the GCV. The character-wise GCV was- volume (29.68), leaf area (16.43), plant girth (12.03), plant height (11.77), number of branches (10.86) and dry weight of leaves (9.57). The heritability in broad sense ranged from 69.60 to 98.70 per cent. The high heritability estimates were observed for leaf area (98.70%) followed by dry weight of leaf (96.10%), volume (85.10%), girth (82.80%), plant height (77.40%) and moderate to low (69.60%) for number of branches.

Overall these results indicate the presence of high heritability for all the characters. The expected genetic advance expressed as percentage over mean ranged from 18.66 to 56.41 per cent. In the present study high value expected genetic advance was observed for volume (56.41%) while moderate for leaf area (33.61%), girth (22.55%) and plant height (21.33%). During the present investigation low values of expected genetic advance were recorded for number of branches (18.66%) and dry weight of leaf (19.32%) indicating that these characters were more influenced by the environment. 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), Gera et al (2001) Siswamartana et al (2003).

CONCLUSION

The observed high to moderate estimates of expected genetic advance

Genetic variability studies in teak

Table 1. Mean performance of teak clones for six quantitative traits

Clone	Plant height (m)	Plant girth (m)	Leaf area (cm ²)	Dry weight of leaves/plant (g)	# branches/plant	Volume (m ³)
A1	18.10	1.00	332.50	1.89	22.40	1.12
A2	16.13	0.90	367.23	2.05	23.17	0.82
A3	14.10	1.02	371.03	2.03	21.87	0.91
A4	12.30	0.70	345.27	2.09	26.30	0.38
A5	13.53	0.85	365.60	1.97	23.30	0.61
A6	13.07	1.03	335.63	1.89	19.90	0.86
A7	13.17	0.92	300.57	2.36	23.97	0.70
A8	12.23	0.90	399.17	2.39	25.17	0.61
A9	12.87	1.00	398.63	2.18	20.57	0.82
A10	11.83	0.98	415.87	1.79	21.53	0.71
A11	12.83	0.90	400.57	2.01	19.50	0.65
A12	12.57	0.85	443.00	2.01	26.07	0.57
A13	12.43	0.72	432.57	2.03	23.20	0.40
A14	14.70	0.93	524.93	2.47	22.37	0.80
A15	13.10	0.79	361.67	2.09	20.03	0.50
A16	13.83	0.92	364.77	2.13	19.33	0.73
A17	13.63	0.82	291.27	1.98	18.57	0.59
A18	12.27	0.69	347.60	1.87	24.27	0.37
A19	12.73	0.76	370.10	1.98	20.20	0.46
A20	12.57	0.78	385.70	2.11	18.93	0.48
A21	12.13	1.02	503.57	2.55	20.60	0.80
A22	11.97	1.01	466.10	2.09	17.23	0.76
A23	12.43	0.84	422.20	2.06	20.77	0.55
A24	17.47	0.75	394.40	2.14	19.67	0.61
A25	14.23	0.93	471.10	2.41	22.53	0.77
A26	14.73	0.78	341.20	2.25	20.20	0.57
A27	16.60	1.12	557.43	2.24	28.33	1.29
A28	12.80	0.95	327.27	2.14	23.17	0.72
A29	11.77	0.87	491.73	2.45	20.13	0.56
A30	12.20	0.83	403.87	2.55	22.67	0.53
Mean	13.48	0.89	397.75	2.14	21.86	0.68
SEm $\pm$	0.49	0.03	4.32	0.02	0.91	0.05
CD _{0.05}	1.40	0.08	12.24	0.07	2.56	0.14
CD _{0.01}	1.87	0.11	16.29	0.09	3.41	0.18
CV	6.36	5.48	1.88	1.92	7.17	12.40

were indicative of the fact that improvement could be quickly achieved in these characters through selection. Generally high heritability accompanied with high genetic advance in characters suggests that the

inheritance of such characters is governed mainly by additive gene effects and therefore selection based on phenotypic performance proved useful. In the present study the estimates of high heritability along with low

Table 2. Estimates of genetic parameters in teak

Character	Range	Mean	GCV	PCV	Heritability (%)	GA as % over mean
Plant height (m)	11.77-18.10	13.48	11.77	13.38	77.40	21.33
Plant girth (m)	0.69 – 1.12	0.89	12.03	13.22	82.80	22.55
Leaf area (cm ²)	291.27 – 557.43	397.75	16.43	16.53	98.70	33.62
Dry weight of leaves/plant (g)	1.79 – 2.55	2.14	9.57	9.76	96.10	19.32
# branches/plant	17.23 - 28.33	21.86	10.86	13.01	69.60	18.67
Volume (m ³)	0.37 - 1.29	0.68	29.68	32.17	85.11	56.42

genetic advance were observed for the characters viz plant height, dry weight of leaf, number of branches and girth. The genetic gain by selection would be low as observed in the present study for these four characters. Recurrent selection may be employed to carry out further improvement for these characters.

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