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Genetic evaluation of *Shorea robusta* Garten. f. in Saranda Forest of Jharkhand based on morphological traits

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ABSTRACT

Saranda Forest division in the state of Jharkhand accounts for one of the largest species richness of the Sal tree. The species naturally grows throughout the area, and dominates the forest cover. It is one of the main sources of subsistence, in the region that are dominated by tribes. In recent years, the richness of the species is reduced due to biotic and abiotic reasons such as poor and erratic rainfall, changing temperatures, degraded soil, forest fires, tree felling, overexploitation of NTFPS, etc. It was important to genetically evaluate the species in the region based on its growth attributes and morphological traits to know the current status of the species in the region and devise the conservation and genetic improvement programs accordingly. In the present study, a total of 30 different trees were selected randomly throughout the area, each of which had a GPS point tagged and was spaced at least 100 meters away from the others. Through the study it was observed that, the mean volume (individual tree volume) ranged from 0.07 m3 (tree Sar-08) to 7.13 m3 (tree Sar-13), with a mean value of 2 m3. Similarly, the mean DBH (Diameter at breast height) was observed to be 0.45 m, ranging from 0.14 m (tree Sar-08) to 0.80 m (tree Sar-13). Besides, the mean PH (plant height) was observed to be 21.73 m, ranging from 10 m (tree Sar-08) to 30 m (tree Sar-13). The genetic correlation study revealed that the tree volume was positively and significantly correlated with DBH at a significance level of 0.1% and with plant height (PH) and clear bole length (CBL) at a significance level of 5%. Therefore, the tree volume can be an important trait for the selection of superior and productive genotypes under the tree Improvement programs. Through the study it was also found that the Saranda Forest is highly diverse and the Sal trees are very vigorous hence can be utilized as seed source for raising the quality plantations of the species.

Key Words - *Shorea robusta,* morphological traits, correlation, conservation, seed source

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INTRODUCTION

According to Ashton (1982), the *Shorea robusta* Gaertn. f. belongs to the Dipterocarpaceae family of tropical tree species, which has 3 subfamilies, 17 genera, and 511 species. The *Shorea robusta* forests, according to Champion and Seth (1968), also extend into Himachal Pradesh, Haryana, Uttar Pradesh, Bihar, West Bengal, Odisha, Madhya Pradesh, Chhattisgarh, Maharashtra, Jharkhand, Sikkim, Assam, and Meghalaya. It is by far the most common and economically significant species in north India and one of the main commercial timbers used in Jharkhand. In tribally dominant states like Jharkhand, the species *Shorea robusta* is one of the major sources of livelihood and is

recognized as the state tree. It is dry-deciduous in drier regions and is evergreen in more humid climates. It may reach heights of 50 meters and a width of 4 meters. It grows at a modest to moderate rate. One of the most important hardwoods in India, it has tough, coarse-grained wood that is resilient to fire and long-lasting. Light-colored wood that has just been cut gradually turns brown over time. The wood is robust and resinous. The wood is highly sought after for furniture construction. According to Suoheimo *et al.,* (1999), genetic diversity and natural population distribution patterns are very important for the conservation and development of forest plant species in general and *S. robusta* in particular.

MATERIALS AND METHODS

Surveying and economic traits data recording

The study was performed in the Saranda Forest division state of Jharkhand in the month of November 2022, which lies between latitude 22.097379 N and longitude 85.369637 E. Based on geomorphological features Saranda division comes under the Singhbhum region of the Jharkhand state. Grid mapping systems (5 x 5 km) adopted by the Survey of India (SoI) are used in the Saranda division for sal occurrences point mapping. 30 individual trees were surveyed throughout the division keeping each tree a minimum of 100 m distance apart from the other, and GPS points in each tree were tagged. Morphological economic trait data from each tree was recorded for genetic diversity and correlation study.

Genetic diversity and correlation analysis

Observation on various economic traits *viz.,* Plant height (PH), diameter at breast height (DBH), basal girth (BG), clear bole length (CBL), crown length (CL), etc. were recorded during the field survey, the individual tree volume was estimated using FSI, (1996) regression equation. Correlation among various traits was also calculated to identify the relationship between traits. The researched qualities have been analyzed using Pearson correlation (r). Calculating the Coefficient of correlation, which always provides a quantitative assessment of the degree of similarity between two traits, has been used to determine the degree of link between two variables (Kumar and Singh, 2019). A measure of the link between two or more variables is the correlation coefficient. It actually measures how symmetrically two variables are associated.

RESULT AND DISCUSSION

In the Saranda Forest division, morphological diversity for growth traits such as individual tree volume (V), plant height (PH), diameter at breast height (DBH), clear bole length (CBL), basal girth (BG), crown length (CL) was studied.

Morphological diversity among economic traits

In order to better analyze the diversity present among the economic traits level, the Mean, standard error (SE), and range of dispersion for each trait were also derived (Table 2). From Table number 2, in the case of character volume (m), the significantly highest value above the mean was found to be (7.13 m^3) in tree Sar-13, followed by tree Sar-28 (5.94 m^3), followed by tree Sar-17 (4.97m^3), followed by tree Sar-23 (4.03 m^3), and the lowest value for the trait volume was found for tree Sar-8 (0.07). In the case of character diameter at breast height (dbh), the significantly highest value above the mean was found to be (0.80 m) in tree Sar-13, followed by tree Sar-17 (0.70 m), followed by tree Sar-23 (0.64 m), and the lowest value for the trait was found for tree Sar-8 (0.14 m). In the case of character plant height (m) the significantly highest value above the mean was found to be (30 m) in tree Sar-13, followed by tree Sar-17 (27 m), followed by tree Sar-23 & tree Sar-27 (26.5 m), and the lowest value for the trait was found for tree Sar-8 (10 m). In the case of character crown length, the significantly highest value above the mean was found to be (13 m) in tree Sar-11, followed by tree Sar-27 (10.5 m), followed by tree Sar-15, Sar-17, Sar-19, Sar-21, & Sar-25 (10 m), and the lowest value for the trait was found for tree Sar-08 (2 m). In the case of character, basal girth the significantly highest value above the mean was found to be (2.8 m) in tree Sar-13, followed by tree Sar-26 (2.6 m), followed by tree Sar-17, Sar-23, & Sar-27 (2.5 m),

and the lowest value for the trait was found for tree Sar-09 (0.45 m). In the case of character, clear bole length (CBL) the significantly highest value above the mean was found to be (22 m) in tree Sar-13, followed by tree Sar-23 (20 m), followed by tree Sar-3, & Sar-28 (18 m), and the lowest value for the trait was found for tree Sar-08 (8 m) (Figure 1). Similar trends were observed by Hareram *et al.,* (2022) in *Eucalyptus tereticornis* species and Kumar and Singh (2019) in *Melia composita*.

Pearson's correlation coefficient among the traits

Pearson correlation (r) has been evaluated among the studied traits (Table 1). It is in fact the measure of symmetrical association between variables. The improvement of one trait depends on the correlation of that trait in a positive direction or negative direction with another trait. In table number 1 the trait volume was found significantly highly positively correlated with DBH at a 0.1% level of significance, and the trait volume was

Table 1: Genetic correlation (Pearson's correlation coefficient) among the studied traits of Sal in Saranda Forest of Jharkhand

	CBL (m)	BG (m)	PH (m)	CL (m)	DBH (m)	Vol (m^3)
CBL (m)	1					
BG (m)	0.36 ^{ns}	1				
PH (m)	0.81*	0.24 ^{ns}	1			
CL (m)	-0.04	-0.10	0.75*	1		
DBH (m)	0.72*	0.18 ^{ns}	0.81*	0.36 ^{ns}	1	
Vol (m^3)	0.72*	0.16 ^{ns}	0.77*	0.28 ^{ns}	0.95***	1
Significance Levels	**0.05(*)**	**0.01(**)**			**0.001(***)**	
If correlation r =>	**0.71**	**0.83**			**0.92**	

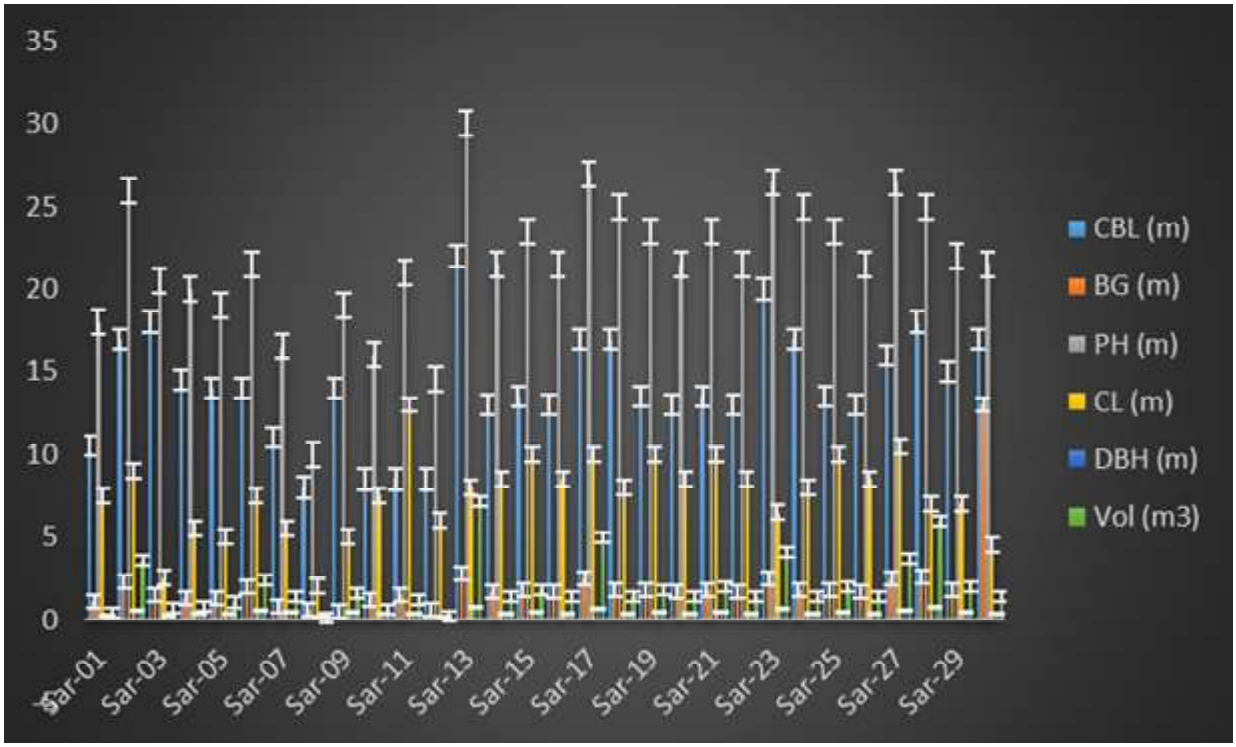

Figure 1: Performance of selected trees of Sal in Saranda Forest based on studied morphological traits

Table 2: Studied morphological traits of *Shorea robusta* in the Saranda Forest of Jharkhand

Sl No	Latitude (DD)	Longitude (DD)	Altitude (m)	CBL (m)	BG (m)	PH (m)	CL (m)	DBH (m)	Vol (m^3)
Sar-01	22.147516	85.212241	635.63	10.5	1.1	18	7.5	0.25	0.43
Sar-02	22.101106	85.276817	636.77	17	2.3	26	9	0.61	3.57
Sar-03	22.14023	85.324778	666.45	18	1.5	20.5	2.5	0.30	0.7
Sar-04	22.140931	85.346529	656.65	14.5	1.3	20	5.5	0.32	0.76
Sar-05	22.156144	85.335456	654.58	14	1.3	19	5	0.38	1.04
Sar-06	22.175918	85.349678	630.61	14	2	21.5	7.5	0.54	2.35
Sar-07	22.24284	85.274641	517.21	11	0.8	16.5	5.5	0.48	1.41
Sar-08	22.151243	85.351527	523.51	8	0.55	10	2	0.14	0.07
Sar-09	22.151459	85.351699	535.3	14	0.45	19	5	0.48	1.62
Sar-10	22.151356	85.351892	533.21	8.5	1.2	16	7.5	0.32	0.6
Sar-11	22.146555	85.301589	493.02	8.5	1.5	21	13	0.38	1.15
Sar-12	22.222285	85.289347	499.56	8.5	0.6	14.5	6	0.19	0.19
Sar-13	22.106031	85.241983	501.05	22	2.8	30	8	0.80	7.13
Sar-14	22.097379	85.199307	481.04	13	1.7	21.5	8.5	0.41	1.38
Sar-15	22.181744	85.253855	479.93	13.5	1.8	23.5	10	0.45	1.75
Sar-16	22.243284	85.253689	428.05	13	1.7	21.5	8.5	0.41	1.38
Sar-17	22.172936	85.286796	471.79	17	2.5	27	10	0.70	4.97
Sar-18	22.171574	85.369637	471.12	17	1.77	25	8	0.39	1.43
Sar-19	22.191678	85.354773	506.99	13.5	1.8	23.5	10	0.45	1.75
Sar-20	22.233124	85.368357	464.24	13	1.7	21.5	8.5	0.41	1.38
Sar-21	22.151365	85.2579	153.65	13.5	1.8	23.5	10	0.48	2.01
Sar-22	22.137433	85.139055	527.21	13	1.7	21.5	8.5	0.41	1.38
Sar-23	22.131556	85.266263	532.94	20	2.5	26.5	6.5	0.64	4.03
Sar-24	22.13771	85.237951	540.25	17	1.77	25	8	0.39	1.43
Sar-25	22.17278	85.325566	507.83	13.5	1.8	23.5	10	0.48	2.01
Sar-26	22.198025	85.210293	478.16	13	1.7	21.5	8.5	0.41	1.38
Sar-27	22.174211	85.187428	485.23	16	2.5	26.5	10.5	0.61	3.64
Sar-28	22.228692	85.33896	345.13	18	2.6	25	7	0.79	5.94
Sar-29	22.199465	85.258265	348.29	15	1.8	22	7	0.49	2.01
Sar-30	22.210183	85.313618	390.98	17	13	21.5	4.5	0.41	1.38
			Mean	**13.42**	**2.05**	**21.73**	**8.31**	**0.45**	**2.00**
			S. E	**0.75**	**0.39**	**0.75**	**0.64**	**0.03**	**0.30**
			Range	**8.00 - 22.00**	**0.45 – 2.80**	**10.00 - 30.00**	**2.00 – 13.00**	**0.14 - 0.80**	**0.07 - 7.13**

significantly positively correlated with plant height (PH), and clear bole length (CBL) at a 5% level of significance. Whereas the trait volume was non-significant with crown length and basal girth respectively. The trait diameter at breast height (dbh) was significantly positively correlated with plant height (PH), and clear bole length (CBL) at a 5% level of significance, but non-significant with crown length and basal girth respectively. The trait plant height was found to be significantly positively correlated with clear bole length at a 5% level of significance but was non-significant with basal girth (BG). The trait clear bole length (CBL) was found to be significantly positively correlated with plant height (PH), diameter at breast height (dbh), and volume at a 5% level of significance, but non-significant with basal girth (BG). Both Tewari *et al.,* (2012) in *Prosopis juliflora,* Hareram *et al.,* (2021) in Eucalyptus species, Kumar *et al.,* (2019) in Melia species, and Gupta *et al.,* (2012) in *Acacia catechu* made similar observations. The amount of genetic variability present in the population for crucial economic qualities and how those characteristics interact determines whether the phenotypic selection is successful (Lone and Tewari, 2008).

SUMMARY AND CONCLUSION

According to the study, the average tree volume was found to be 2 m^3, ranging from 0.07 m^3 (tree Sar-08) to 7.13 m^3 (tree Sar-13), and the average DBH was found to be 0.45 m, ranging from 0.14 m (tree Sar-08) to 0.80 m (tree Sar-13). According to the correlation analysis, the trait tree volume was

found to be strongly positively linked with DBH at a significance level of 0.1% and with plant height (PH) and clear bole length (CBL) at a significance level of 5%. With respect to basal girth and crown length, the trait tree volume was not significant. The development of conservation methods depends on the genetic diversity of the species economically significant traits. From the research, the population of Saranda was discovered to be highly promising, and seeds from this source can be used to start plantations.

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REFERENCES

Ashton, P. S. 1982. *Flora malesiana. Series I-Spermatophyta, Flowering Plants*. vol 9, part 2, Dipterocarpaceae, Martinus Nijhoff Publications, The Netherlands.

Champion, H. G. and Seth, S. K. 1968. *A revised survey of forest types of India*. - Manager Publications, New Delhi.

FSI, 1996. *India State of Forest Report 1996*. Forest Survey of India, Ministry of Environment, Forests and Climate Change, Government of India, Dehradun.

Gupta, T., Tej, P. and Gupta, R. K. 2012. Genetic variability and correlation study in *Acacia catechu* seed source in Himachal Pradesh. *Range Management and Agroforestry*. 33 (1): 47-52.

Kumar, A. and Singh, S. 2019. Genetic evaluation of *Melia composita* progenies for growth performance and productivity. *Indian Journal of Tropical Biodiversity*. 27(1): 36-41.

Lone, A. and Tewari, S. K. 2008. Genetic variability and correlation studies in poplar (*Populus deltoides* Bartr.). *Indian J. Forestry*. 31 (2): 193-196.

Sahoo, H., Lenka, D., Mohanty, T.L., Mishra, P., Mishra, Y. and Kumar, A. (2021) Genetic variability in growth characteristics among different clones of *Eucalyptus tereticornis* Sm. *International Journal of Bio-resource and Stress Management*, 12(6): 759-765.

Sahoo, H., Kumar, A., Mishra, Y., Lenka, D., Mohanty, T.L., Mishra, P.J. and Dash, A.P. 2022. Genetic divergence study for yield and yield contributing traits among clones of *Eucalyptus tereticornis. Indian Forester*. 149(1): 52-59.

Suoheimo, J. 1999. Natural regeneration of Sal (*Shorea robusta*) in the Terai region, Nepal. University of Helsinki, Helsinki, Finland.

Tewari, J. C., Harsh, L. N., Sharma, N. K., Bohra, M. D. and Tripathi, D. 2012. Variation and interrelations among tree characters, pod-seed morphology, and pod biochemical characters in *Prosopis juliflora* dc. *Forests, Trees, and Livelihoods*. 11(2): 113-126.