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GENETIC VARIABILITY FOR DIFFERENT TRAITS IN *POPULUS DELTOIDES* BART

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ABSTRACT

Evaluation of twelve clones of *Populus deltoides* at the age of 6 years, indicated significant differences among the clones for all the characters. High estimates of heritability coupled with high genetic advance was observed for diameter, height, crown length, crown width, number of branches, branch length and duration of leaf fall. Diameter, height, crown length, crown width, branch length and number of branches showed a positive and significant correlation among themselves.

Key words: Poplar, *Populus deltoides*, genetic variability, heritability, correlation.

Poplar is a unique tree, suitable for agroforestry because of its wide adaptability, fast growth and multiple uses. Genus *Populus* has a large number of species but all are restricted to temperate region except *Populus deltoides* and few other which can be grown in the subtropical region. Being clonally propagated and highly heterozygous, much of breeder's effort goes in generating genetic variability and using the already existing and freshly generated variability for developing improved cultivars. The component traits are not independent in their action but are interlinked and in this complex genetic system, selection practiced for an individual trait might subsequently bring about a simultaneous change in the other. Thus an understanding of the association among component traits is essential to bring a rational improvement. The present investigation aims to assess the genetic variability and association of component traits among different clones.

MATERIALS AND METHODS

The experimental material comprised twelve different clones (D-121, I-214, 19/66, 6/64, Lux 69/55, Black hybrid, IC, D-61, Triplo, BL costa 420, VL Onda, 4/68) of *Populus deltoides*

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Bart., which were originally introduced in India from Europe and north America. These clones were planted in randomized block design with two replications at the agroforestry research area, Horticultural Research Centre, Pantnagar during February 1983. Twenty trees in each treatment were maintained at distance of 4 m between trees and 5 m between the rows.

Observations were recorded on ten random trees in the first week of March 1989 (6 years old) on various characteristics, viz trunk diameter at breast height, tree height, clear bole length, crown length, crown width, length of primary branch, number of primary branches, length of leaf blade, length of leaf petiole, total leaf length, leaf width, leaf area index and leaf fall duration. The data were subjected to statistical analysis and correlation coefficients according to [1].

RESULTS AND DISCUSSION

The success of selection depends on the extent of genetic variability present in a population. The present study showed high genotypic coefficient of variability for branch number, crown width, branch length, trunk diameter, leaf width and crown length (Table 1). These characters except leaf width were also observed to be least influenced by

Table 1. Estimates of mean, range, heritability, genetic advance and coefficients of variation in poplar

Character	Mean	Range	Heritability (%)	Genetic advance (% of mean)	GCV (%)	PCV (%)
Diameter (cm)	18.2	16.2 – 23.0	92.6	28.3	14.3	14.8
Height (m)	13.5	11.6 – 15.1	91.1	16.8	8.5	8.9
Clear bole length (m)	4.2	3.8 – 4.6	40.8	5.9	4.6	7.2
Crown length (m)	9.2	7.5 – 10.7	85.9	20.3	10.7	11.5
Crown width (cm)	568.7	320.5 – 710.5	98.9	34.5	16.9	16.9
Branch length (cm)	308.4	180.5 – 182.0	98.5	32.9	16.1	16.2
Primary branches	33.8	16.2 – 47.9	93.2	46.4	23.4	24.2
Leaf blade length (cm)	13.3	12.0 – 15.6	28.9	5.1	4.8	9.2
Petiole length (cm)	9.2	7.7 – 12.2	7.7	3.1	5.6	20.2
Leaf length (cm)	22.7	20.2 – 25.5	26.1	5.2	4.9	9.7
Leaf width (cm)	13.8	18.5 – 10.9	38.3	4.9	11.7	18.8
Leaf area (cm)	142.0	114.7 – 175.7	8.1	3.5	6.1	21.4
Leaf fall duration (days)	199.3	183.5 – 211.0	91.0	11.8	5.9	6.3

Table 2. Phenotypic (rp), genotypic (rg) and environmental (re) correlation coefficients between different characters in poplar

Characters	Height	Clear bole length	Crown length	Crown width	Branch length	Branch No.	Blade length	Petiole length	Leaf length	Leaf width	Leaf area	Fall duration
Diameter	rg 0.95	0.89	0.94	0.72	0.73	0.82	−0.23	1.28	0.59	0.80	1.08	−1.01
	rp 0.89**	0.55	0.85**	0.71**	0.72**	0.79**	−0.03	0.33	0.31	0.42	0.26	−0.97**
	re 0.20	−0.01	0.19	0.68	0.79	0.35	−0.36	−0.04	0.09	−0.25	−0.13	−0.56
Height		0.86	0.99	0.70	0.71	0.80	−0.06	1.43	0.63	0.77	1.08	−0.94
		0.56	0.97**	0.68*	0.68*	0.78**	−0.09	0.25	0.20	0.39	0.31	−0.93**
		0.15	0.81	0.47	0.08	0.57	−0.25	−0.42	−0.30	−0.25	0.26	−0.51
Clear bole length			0.81	0.42	0.43	0.46	0.05	1.32	0.46	1.42	1.31	0.90
			0.35	0.24	0.27	0.34	0.06	0.31	0.31	0.57	0.27	−0.49
			−0.45	−0.27	−0.04	0.30	0.07	0.09	0.24	−0.02	0.04	0.24
Crown length				0.73	0.74	0.84	−0.08	1.41	0.65	0.62	1.00	−0.92
				0.70**	0.69**	0.78**	−0.12	0.19	0.14	0.29	0.27	−0.88**
				0.59	0.10	0.34	−0.27	−0.43	−0.51	−0.21	0.03	−0.60
Crown width					1.00	0.81	0.13	1.35	0.81	0.42	0.73	−0.76
					1.00**	0.80**	0.07	0.35	0.39	0.24	0.21	−0.74**
					0.63	0.53	0.05	−0.24	−0.24	0.28	0.02	−0.44
Branch length						0.82	0.07	1.25	0.76	0.45	0.76	−0.77
						0.79**	0.10	0.37	0.41	0.28	0.21	−0.75**
						0.09	0.59	0.20	0.20	0.04	−0.06	−0.56
Branch number							−0.24	1.23	0.47	0.53	0.88	−0.85
							−0.14	0.28	0.23	0.25	0.35	0.78**
							−0.10	−0.17	−0.00	0.33	0.38	−0.07
Blade length								−0.20	0.54	0.23	1.88	0.17
								0.00	0.32	0.18	0.12	−0.02
								0.03	0.25	0.15	−0.18	−0.42
Petiole length									0.28	0.19	−0.20	−1.27
									0.82**	0.37	0.51	−0.25
									0.88	0.41	0.49	0.26
Leaf length										0.11	0.81	−0.62
										0.38	0.38	−0.25
										0.52	0.29	0.19
Leaf width											2.11	−0.72
											0.25	−0.41
											−0.14	0.06
Leaf area												1.12
												−0.26
												0.15

*,**Significant at 5% and 1% levels, respectively.

the environment. Clear bole length and all leaf traits—leaf blade length, petiole length, leaf length, leaf width, leaf area index showed high environmental influence. Wide range of variability had been reported for height earlier [2].

High estimates of broadsense heritability for height and diameter are confirmatory to the earlier finding [3]. High estimates of heritability observed for crown length, crown width, primary branch length and branch number were in line with the earlier report [4]. Generally, characters showing high heritability also possess high value of genetic advance. High heritability coupled with high genetic advance indicated that such characters are controlled by additive gene action and will respond effectively on phenotypic selection. Hence these characters are suitable for selection. Low values of genetic advance were obtained for other characters. Similar results were reported earlier [2, 4]. On the basis of mean performance, clones D-121, D-61, 19/66, 4/68, IC, Triplo and BL costa 420 were identified as superior genotypes.

Inter-character correlation at phenotypic level showed positive and significant correlation of diameter with height, crown length, crown width, branch length and number of branches (Table 2). Height also showed a positive and significant correlation with all above traits. Clear bole length, length of leaf blade, leaf width and leaf area index showed a nonsignificant correlation with all other traits. Crown length, crown width, branch length and number of branches showed a positive and significant correlation between themselves. Duration of leaf fall showed a negative and significant correlation with diameter, height, crown length, crown width and branch length while a positive and significant correlation with branch number. Almost similar trend had been observed at genotypic level but with higher degree and environmental correlation coefficients were found random in degree and direction. The findings for correlation coefficients are in accordance with earlier reports [5–7]. It is important to note that diameter, height, crown length, crown width, branch length and number of branches were positively correlated and had high estimates of heritability and expected genetic advance. These could be considered as important traits for improving poplar.

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