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GENETIC VARIABILITY, CHARACTER ASSOCIATON AND PATH ANALYSIS IN THE TAMARIND (*Tamarindus indica* L.) POPULATION OF NALLUR TAMARIND GROVE

T.R. Singh* and R. Nandini

Department of Genetics and Plant Breeding, University of Agricultural Sciences, GKVK, Bengaluru – 560065, India.

ABSTRACT

An experiment was carried out during 2009-2010 on one hundred tamarind genotypes of the Nallur tamarind grove, a few kilometres away from Bengaluru International Airport, to investigate the genetic variability, character association and their direct and indirect effects on the fruit weight of tamarind. The genotypic coefficient of variation was high for seed weight, fibre weight, seed number, beak length and fruit weight. In all cases, phenotypic variances were higher than the genotypic variance. Moderate to high heritability as well as genetic advances were estimated for pod length, pod width, seed weight, seed number, number of ridges, number of furrows, pulp weight and fruit weight indicated that these traits was under additive gene control and selection for genetic improvement for these traits would be effective. Correlation studies revealed the highest significant association of fruit weight with seed weight followed by pulp weight, epicarp weight and seed number at genotypic and phenotypic level. Positive direct effects were produced by pulp weight and seed weight, while number of ridges had negative direct effects. The information obtained from the current studies can be used as selection criteria for genetic improvement of tamarind genotypes under study.

Keywords: Heritability, Correlation, Path analysis, Tamarin

INTRODUCTION

Tamarind (*Tamarindus indica* L., 2n = 24; x = 12) is a hardy evergreen monotypic tree which belongs to the family Leguminosae (Fabaceae). It is a multipurpose tropical fruit tree used primarily for its fruits, which are either eaten fresh or processed. The legendary tamarind grove at Nallur, Devanahalli taluk, derives its importance from the very old and gigantic trees among nearly 300 Tamarind trees spread over an area of 53 acres. Tamarind is a highly cross-pollinated and seed propagated crop; hence wide variability is common in this species. The individual variation between the trees within a population is of paramount importance and it may be worthwhile concentrating only on the very best trees in relation to neighbouring ones and plus trees may be selected within ecological zones for increasing their frequencies. The magnitude of variability and its quantitative estimation for each character would indicate the potential of each tree and the scope for improving the desirable and economic characters through selection. Very little knowledge is available on genetic components of variation, genetic correlation and path coefficient analysis on

*Corresponding author email: telem.ratan@gmail.com

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important pod traits in Tamarind (*Tamarindus indica* L.). This manuscript describes the quantitative genetic analysis of some horticultural important traits in tamarind in order to widen the genetic knowledge of this crop and improve the breeding programmes. Such information can be useful in articulating efficient selection program for development of new promising tamarind varieties.

MATERIALS AND METHODS

The experimental material comprised of 100 randomly selected tamarind genotypes consisting of very old trees, middle and young aged trees, from the Nallur tamarind heritage grove, Devanahally taluk, which is a few kilometres away from Bengaluru International Airport, Karnataka, India. The observations on twelve quantitative parameters like pod length (cm), pod width (cm), beak length(cm), number of ridges, number of furrows, epicarp weight (gm), fibre number, fibre weight (gm), pulp weight (gm), seed weight (gm), seed number and fruit weight (gm) were recorded on twenty pods per branch per tree and were analysed statistically. The biometrical analysis were carried out according to estimation of genotypic and phenotypic coefficients of variation (Burton and Devane, 1953), heritability in broad sense (Hanson et al., 1956) and genetic advance (Johnson et al., 1955). Correlation between twelve quantitative characters was estimated following the method given by Singh and Chaudhary (1985); whereas path coefficient analysis was done by method given by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The data represented in table 1 divulged that the values of phenotypic co-efficient of variability (PCV) were higher than genotypic co-efficient of variability (GCV) for all the parameters under investigation and moderate to high heritability coupled with higher genetic advances were estimated for pod length, pod width, seed weight, seed number, number of ridges, number of furrows, pulp weight and fruit weight indicated that these traits were under additive gene control and selection for genetic improvement for these traits would be effective. High heritability accompanied by lower genetic advance for fibre number is indicative of non additive gene action, and the high heritability is due to the environmental influence rather than phenotype. The results of present studies of variability in tamarind are in accordance with the studies of Patil Shekar and Hanamashetti (2009) and Divakara (2008).

The estimates of phenotypic and genotypic correlation coefficient among different pairs of characters of tamarind are presented in table 2. Correlation studies showed that genotypic correlation appeared to be higher than corresponding phenotypic correlation. These observations indicated that in majority of the cases, the environment had not appreciably influenced the expressions of characters associations. Similar results were reported by Shivanandam and Raju (1988). Fruit or pod weight which is one of the most important economic traits, exhibited highest positive association with seed weight, pulp weight, epicarp weight and seed number at genotypic and phenotypic level. Therefore, selection for the improvement of one character will lead to the simultaneous improvement of the other character. Challapilli et al. (1995) reported similar results, where the fruit weight is positively and significantly associated with pulp, fibre, seed weight, fruit length and breadth.

The data on direct and indirect effects of different characters on fruit weight are presented in Table 3.The results of the path analysis revealed that seed weight per pod had the maximum positive direct effect (0.642) followed by pulp weight (0.273), number of furrows (0.180), pod length (0.177) and epicarp weight (0.172). Therefore, direct selection of these traits will be useful for the improvement of fruit weight .While number of ridges had negative direct effects (-0.297). Hence, such character should never consider as a parameter in selection programmes. The negative direct effect of pod width per pod was nullified by positive indirect effects through pod length, number of furrows, epicarp weight, number of fibre, fibre weight, pulp weight and seed weight. Therefore, using the characters showing positive indirect effect for selection the effect of character showing negative direct effect must be nullified. Similar results were reported by Prasad et al. (1998) and Kulkarni et al. (1995). The estimated residual effect was 0.10 indicating that 90% of the variability in tamarind fruit weight was contributed by the characters studied in the path analysis.

CONCLUSION

Although tamarind is an important crop in India, the research on this crop is at a very early stage. High heritability coupled with high genetic advances for pod length, pod width and pulp weight indicated that these traits are controlled by additive genetic action, thus suggesting individual plant selection for the improvement of these traits. Therefore, there is a definite scope for improvement in these characters through direct selection. Our study, thus, revealed that selection based on seed weight, pulp weight, number of furrows, pod length and epicarp weight could help in genetic improvement of fruit weight per pod in tamarind population under study.

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Table 1. Genetic components of different traits under study in tamarind

Characters	GM	Range	Variances			GCV (%)	PCV (%)	h2	GA (%) Mean
			GV	PV	EV				
1.Pod Length (cm)	10.43	6.65-20.04	5.52	7.99	2.46	22.61	27.19	0.70	58.74
2.Pod width (cm)	3.21	2.30-4.84	0.82	0.91	0.04	28.15	29.73	0.89	66.13
3.Beak length(cm)	0.13	0.04-0.45	0.00	0.00	0.00	31.78	44.52	0.51	46.74
4.No. of ridges	5.36	2.72-9.31	1.61	2.99	1.27	23.72	31.71	0.56	46.54
5.No. of furrows	4.37	1.75-8.33	1.64	2.91	1.27	29.40	39.12	0.56	45.53
6.Epicarp wt.(gm)	2.13	1.03-4.22	0.30	0.69	0.40	25.67	39.29	0.43	34.55
7.Fiber no.	3.72	2.64-5.62	0.40	0.68	0.28	17.14	22.43	0.58	26.97
8.Fiber wt.(gm)	0.33	0.12-0.89	0.01	0.05	0.03	36.14	67.68	0.29	39.76
9.Pulp wt.(gm)	3.28	0.93-6.99	1.51	2.70	1.19	38.21	51.07	0.56	58.88
10.Seed wt..(gm)	1.97	0.41-5.31	0.67	0.96	1.11	42.77	49.75	0.69	54.02
11.Seed no.	4.36	1.75-7.74	2.04	3.76	1.72	32.84	44.60	0.54	49.81
12.Fruit wt.(gm)	7.69	2.34-16.41	4.84	10.31	5.48	29.77	43.48	0.47	41.99

Table 2. Genotypic and Phenotypic correlation coefficient between different pod traits in tamarind

Characters		Pod length	Pod width	Beak length	No. of ridges	No. of furrows	Epicarp weight	Fibre no.	Fibre weight	Pulp weight	Seed weight	Seed no.
Pod width	G	0.518**	-									
	P	0.446**	-									
Beak length	G	-0.078	0.048	-								
	P	-0.130	-0.013	-								
No. of ridges	G	0.662**	0.004	0.061	-							
	P	0.697**	0.045	-0.049	-							
No. Of furrows	G	0.660**	0.004	0.062	1.004**	-						
	P	0.702**	0.045	-0.053	0.986**	-						
Epicarp weight	G	0.274**	-0.033	-0.153	0.351**	0.365**	-					
	P	0.176	-0.013	-0.077	0.203*	0.207*	-					
Fibre no.	G	0.353**	0.145	0.074	0.382**	0.384**	0.262**	-				
	P	0.228*	0.082	0.087	0.226*	0.229*	0.324**	-				
Fibre weight	G	0.330**	0.255*	-0.058	0.118	0.140	0.487**	0.356**	-			
	P	0.201*	0.122	-0.009	0.103	0.100	0.460**	0.319**	-			
Pulp weight	G	0.482**	0.152	-0.209*	0.332**	0.345**	0.727**	0.296**	0.589**	-		
	P	0.332**	0.090	-0.100	0.229*	0.222*	0.649**	0.319**	0.469**	-		
Seed weight	G	0.303**	0.094	-0.291**	0.296**	0.309**	0.762**	0.262**	0.433**	0.690**	-	
	P	0.189	0.041	-0.119	0.190	0.184	0.623**	0.258**	0.397**	0.579**	-	
Seed no	G	0.210*	-0.054	-0.146	0.362**	0.373**	0.802**	0.209**	0.229**	0.498**	0.786**	-
	P	0.161	-0.025	-0.091	0.265**	0.262**	0.736**	0.289**	0.352**	0.516**	0.659**	-
Fruit weight	G	0.391**	0.028	-0.212*	0.344**	0.357**	0.862**	0.335**	0.599**	0.871**	0.936**	0.737**
	P	0.248*	0.020	-0.101	0.224*	0.215*	0.838**	0.408**	0.556**	0.816**	0.748**	0.765**

* and ** significant at 5 and 1 percent level probability respectively.

Table 3. Path coefficient analysis showing direct and indirect effects of pod traits on fruit weight

Characters	Pod length	Pod width	Beak length	No. of ridges	No. of furrows	Epicarp weight	Fibre no.	Fibre weight	Pulp weight	Seed weight	Seed no.
Pod length	**0.177**	-0.100	-0.007	-0.197	0.119	0.047	0.010	0.029	0.131	0.195	-0.013
Pod width	0.092	**-0.193**	0.004	-0.001	0.001	-0.006	0.004	0.022	0.041	0.060	0.003
Beak length	-0.014	-0.009	**0.083**	-0.018	0.011	-0.026	0.002	-0.005	-0.057	-0.187	0.009
No. of ridges	0.117	-0.001	0.005	**-0.297**	0.181	0.060	0.011	0.010	0.090	0.190	-0.023
No. of furrows	0.117	-0.001	0.005	-0.298	**0.180**	0.063	0.011	0.012	0.094	0.198	-0.023
Epicarp weight	0.048	0.006	-0.013	-0.104	0.066	**0.172**	0.007	0.042	0.198	0.489	-0.050
Fibre no.	0.062	-0.028	0.006	-0.114	0.069	0.045	**0.028**	0.031	0.081	0.168	-0.013
Fibre weight	0.058	-0.049	-0.005	-0.035	0.025	0.084	0.010	**0.087**	0.161	0.278	-0.014
Pulp weight	0.085	-0.029	-0.017	-0.099	0.062	0.125	0.008	0.051	**0.273**	0.443	-0.031
Seed weight	0.054	-0.018	-0.024	-0.088	0.056	0.131	0.007	0.038	0.188	**0.642**	-0.049
Seed no.	0.037	0.010	-0.012	-0.108	0.067	0.138	0.006	0.020	0.136	0.505	**-0.062**

Residual effect = 0.10, direct effects are in bold diagonals