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Genetic parameters for quality characteristics in aromatic rice

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ABSTRACT

Variability and heritability studies both in parents and hybrids revealed the existence of significant differences for all the characteristics indicating wide variability among the genotypes. In general, the parents registered higher mean values for all the quality traits studied, suggesting that parents were superior in quality than the hybrids. Low to moderate estimates of variability, moderate to high heritability and low expected genetic advance for all the quality characters indicated the preponderance of both additive and non-additive gene effects in conditioning these traits. Hence, both these genetic components could be exploited effectively by practicing reciprocal recurrent selection.

Key words: *Variability, quality traits, aromatic rice, genetic parameters*

The scented rice has high premium value in national as well as in international market due to unique aroma and quality. Quality of rice is determined by a combination of many physico-chemical properties and also largely influenced by the environment. High level of genotypic and phenotypic coefficients of variation is essential for selection of desirable genotypes in any crop improvement programme. Moreover, heritability along with genetic advance is important selection parameter in predicting the gain under selection. Hence, the present study was undertaken to estimate different genetic parameters in scented rice.

Two popular high yielding non scented quality rice varieties (IR 64 and PR 109) and three fine grained aromatic rice lines *viz*., Gaurav, IR 62874-88-2-1 and PK 1379-9-1-1 were used as lines and crossed with 5 basmati testers (HBC 85, Karnal local, Basmati 410, Basmati 6129 and PGB) in line x tester mating design to obtain 25 crosses during kharif 1998. All these hybrids along with their parents were evaluated in a randomized block design with 2 replications at Directorate of Rice Research (DRR) farm, Hyderabad during 1999 wet season. Each replication consisted of 3 rows of 3.6 meter length with a spacing of 30 cm between and within the row. Ten randomly selected plants per replication were harvested and threshed separately. After six months of ageing, these samples were analysed for seven important physico-chemical quality traits *viz.*, kernel length, kernel breadth, length/ breadth ratio, kernel length after cooking, elongation ratio, alkali spreading value and amylose content at quality laboratory, DRR, Hyderabad using standard methods (Murthy and Govindaswamy 1967, Juliano *et al* 1965, Little *et al* 1958 and Juliano 1971). Mean data were used for calculating the genetic parameters. Phenotypic and genotypic coefficient of variation were computed according to the formulae given by Burtorn and Dewane (1952) and the heritability (broad sense), expected genetic advance and genetic advance percent over mean were worked out as per Allard (1960) for parents and hybrids separately.

Analysis of variance in parents as well as in hybrids revealed that significant differences were observed for all the quality characteristics indicating wide variability among genotypes involved in the crossing programme (Table 1). The mean value for kernel length in parents was 6.96 mm while in the study 6.76 mm (Table 2). The mean values of length/breadth ratio, kernel length after cooking and elongation ratio were also of higher magnitude in parents than in hybrids indicating that parents were of superior quality than the hybrids. Intermediate values are preferred for alkali spreading value (4-5) and amylose content (20-25%) in rice. Both parents and hybrids recorded mean

Table 1. Analysis of variance for seven physico-chemical quality traits

Source	Df		Kernel length		Kernel breadth		Length/breadth ratio		Kernel length after cooking		Elongation ratio		Alkali value		Amylose content	
	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids
Replications	1	1	0.024	0.010	0.000	0.001	0.007	0.002	0.028	0.242	0.000	0.003	0.029	0.335	0.026	0.005
Genotypes	9	24	0.179**	0.212**	0.019**	0.022**	0.200**	0.251**	2.653**	0.723**	0.029**	0.021**	3.19**	0.328**	12.107**	1.817**
Error	9	24	0.010	0.013	0.000	0.001	0.003	0.020	0.046	0.157	0.001	0.004	0.012	0.108	0.128	0.053

**Significant at 1% level

Table 2. Estimates of genetic components for seven physico- chemical quality characteristics

Quality trait	Mean (x)		Genotypic coefficient of variation (GCV)		Phenotypic coefficient of variation (PCV)		Heritability		Genetic advance		Genetic advance percent over mean	
	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids	Parents	Hybrids
Kernel length (mm)	6.96	6.76	4.17	4.67	4.43	4.95	89.02	88.69	0.565	0.611	8.12	9.04
Kernel breadth (mm)	1.87	1.86	5.17	5.50	5.24	5.76	97.19	91.29	0.200	0.206	10.70	11.08
Length/breadth ratio	3.75	3.68	8.35	9.25	8.49	10.02	96.70	85.13	0.636	0.647	16.96	17.58
Kernel length after cooking (mm)	12.81	12.59	8.91	4.23	9.07	5.27	96.56	64.29	2.311	0.878	18.04	6.97
Elongation ratio	1.84	1.87	6.39	4.94	6.63	5.97	93.09	68.51	0.235	0.155	12.77	8.29
Alkali spreading value	5.69	6.15	22.18	5.40	22.26	7.59	99.23	50.62	2.589	0.487	45.5	7.92
Amylose content	21.3	20.19	11.49	4.46	11.62	4.59	97.91	94.37	4.989	1.879	23.4	9.31

amylose values in the desirable range, while the alkali spreading value was slightly high both in parents and hybrids.

In general, the values of phenotypic coefficients of variation were higher when compared to genotypic coefficient of variation, but the difference was low suggesting the less environmental influence on these traits. Kernel length, kernel breadth and length/ breadth ratio registered higher variability estimates in hybrids than in parents both at genotypic and phenotypic level. While the remaining characters *viz.*, kernel length after cooking, elongation ratio, alkali spreading value and amylose content manifested higher values in parents when compared to hybrids. The lowest genotypic coefficient of variation was observed for kernel length (4.17) while it was high for alkali spreading value (22.18) in parents. Low coefficient of variation for length/ breadth ratio were reported by Deo Sarkar *et al* (1989) while Chauhan *et al* (1991) noted that amylose content exhibited least variation which were in accordance with the present results. In general, the heritability estimates of parents were of higher magnitude when compared to hybrids. The heritability estimates were moderate to very high which ranged from 50.62% to 99.23% (heritability for alkali spreading value in hybrids and parents respectively). Moderately high to very high heritability estimates for kernel length, kernel breadth and length/breadth ratio were reported earlier by many investigators. Kenzie and Rutzer (1983) and Chauhan (1998) reported high estimates of heritability for kernel length and kernel breadth while high heritability for length/breadth ratio was observed by Srivastava *et al* (1978), Deo Sarkar *et al* (1989), Chuhan *et al* (1992) and Lalitha and Sreedhar (1999). Pathak and Sharma (1996) reported high heritability estimates for kernel length ,kernel breadth, length/breadth ratio, elongation ratio and alkali spreading value which were in agreement with the present results. In the present study amylose content also showed high heritability estimates confirming the findings of Deo Sarkar *et al* (1989) and Lalitha and Sreedhar (1999). All the estimates of expected genetic advance were very low both in parents and hybrids. The maximum value recorded for genetic advance was 4.989 for amylose content in parents while the alkali spreading value in parents (45.5) showed highest value for genetic advance percent over mean.

All the seven important physico-chemical quality characteristics studied, indicated low to moderate variability (both at genotypic and phenotypic level) moderate to very high heritability accompanied with very low expected genetic advance which suggests that all these quality traits were under the influence of both additive and non-additive genetic components in their expression. Hence improvement of these characters could be attained by following recurrent or reciprocal recurrent selections to exploit both additive and non additive genetic components effectively.

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