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Short Note

Genetic Variability, Heritability, Genetic Advance and Correlation for Morphological Traits in Rice Genotypes

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Genetic variability and correlation coefficients were estimated from seventy four rice genotypes for morphological traits. Highest GCV and PCV were reported for total number of tillers per plant, number of secondary branches in panicle, leaf length and straw yield. High heritability was observed for all the traits estimated. High heritability accompanied by high genetic advance as percent of mean was observed for plant height, total number of tillers per plant, panicle length, number of secondary branches per panicle, leaf length, leaf width, kernel breadth, 100-grain weight, kernel length/breadth ratio, grain yield per plant and straw yield. Grain yield per plant was positively and significantly associated with days to 50 % flowering, number of productive tillers per plant, number of secondary branches per panicle and straw yield.

Key words: genetic variability, heritability, genetic advance, correlation, rice.

The current rice breeding programmes are directed towards the exploitation of indigenous and exotic varieties for improving grain yield. Crop improvement depends on the magnitude of genetic variability and the extent to which the desirable characters are heritable. Genetic improvement for quantitative traits can be achieved through a clear understanding of the nature and amount of variability present in the genetic stocks and the extent to which the desirable traits are heritable. The present investigation was undertaken on 74 rice genotypes to find out the extent of genetic variation present for agronomic and physical grain quality traits that could be successfully utilized for rice improvement programme.

Materials and Methods

Seventy four rice genotypes were evaluated at Paddy Breeding Station, Tamil Nadu Agricultural University, Coimbatore during September 2007 in a randomized block design with three replications with 20 x 20 cm spacing. Based on five randomly selected plants in each replications for each genotype, data were recorded on morphological traits *viz.,* days to 50 per cent flowering (days), plant height (cm), number of productive tillers per plant (no.), panicle length (cm), number of secondary branches per panicle (no.), leaf length (cm), leaf width (cm), 100-grain weight (g), grain yield per plant (g), straw yield (g), physical grain quality traits *viz.*, kernel length (mm), kernel breadth (mm) and kernel length/ breadth ratio.

Analysis of variance was carried out statistically utilizing the mean values (Panse and Sukhatme, 1995). GCV and PCV were calculated using the formula suggested by Burton (1952). The heritability estimate in the broad sense was calculated by the method proposed by Lush (1949).

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Results and Discussion

Genetic variability, heritability and genetic advance

The analysis of variance revealed highly significant difference among the genotypes for the characters studied. The mean, GCV, PCV, heritability (broad sense) and GA as percentage of mean worked out for thirteen characters are presented in table 1. PCV was higher than GCV for all the characters studied. PCV ranged from 7.37 (days to 50 % flowering) to 30.27 % (leaf length). GCV and PCV was low (<10%) for days to 50 % flowering and grain length. Similar findings of low GCV were reported earlier for days to 50 per cent flowering (Shivani and Sree Rama Reddy, 2000), moderate (10-20%) for Plant height, panicle length, leaf breadth, 100 grain weight, kernel breadth, kernel length/breadth ratio, grain yield per plant recorded moderate level of GCV indicating considerable amount of variability expressed for these characters and high (> 20%) for total number of productive tillers per plant, number of secondary branches, leaf length and straw yield. All the characters showed little difference between PCV and GCV, indicating lesser influence by environment.

The high GCV estimates for number of productive tillers per plant, number of spikelets per panicle, and grain yield per plant was in accordance with Shivani and Sree Rama Reddy (2000), Michael

Gomez and Rangasamy (2002) and Michael Gomez and Kalamani (2003). These traits showing high genotypic variability offer greater scope for genetic improvement through selection.

Heritability value alone may mislead during selection. Therefore, heritability and genetic advance together should be taken into consideration for selection based improvement (Johnson *et al*., 1955). The range of heritability (in broad sense) was from 86.70 % (panicle length) to 99.21 % (leaf length). In the present investigation, all the characters recorded generally higher heritability estimates in broad sense exceeding 75 per cent. The high heritable characters indicate, selection for the character should be fairly easy. This is because there would be a close correspondence between

Table 1. Estimates of variability and genetic parameters of rice germplasm

Characters	Grand Mean	S.E. of mean	CD %	GCV %	PCV %	Heritability %	GA % of mean
Days to 50 % flowering	100.35	1.84	3.67	7.14	7.37	93.82	14.25
Plant height (cm)	76.69	1.25	2.49	13.95	14.04	98.65	28.54
Number of tillers/ plant	14.46	1.02	2.04	20.01	20.29	87.81	36.69
Panicle length (cm)	21.82	0.90	1.79	10.56	11.34	86.70	20.26
No. of secondary branches /panicle (No.)	10.27	0.62	1.24	20.02	20.73	91.43	39.03
Leaf length (cm)	28.27	0.76	1.52	30.15	30.27	99.21	61.87
Leaf breadth (cm)	1.19	0.05	0.10	13.85	14.46	91.80	27.34
Grain length (mm)	6.36	0.08	0.16	8.67	8.76	98.00	17.68
Grain breadth (mm)	1.77	0.05	0.11	11.45	11.84	93.62	22.82
L/B ratio	3.66	0.14	0.28	16.54	16.97	94.97	33.19
Straw yield (g)	28.66	0.90	1.80	28.51	28.68	98.79	58.37
100 grain weight (g)	1.99	0.08	1.16	14.55	15.06	93.30	28.95
Grain yield per plant(g)	24.49	2.13	4.24	16.17	18.35	77.65	29.36

Table 2. Genotypic and phenotypic correlation coefficients among different characters of rice

Characters		DTF	PH	NT	PL	NSB	LL	LB	GL	GB	L/B	SY100	GW	GY
Days to 50 % flowering (Days)	G	1.000	0.172	-0.227	0.096	0.091	0.057	0.212	0.011	0.011	0.009	0.244	0.021	0.215*
	P	1.000	0.169	-0.206	0.106	0.078	0.053	0.197	0.012	0.008	0.009	0.238	0.018	0.190
Plant height (cm)	G		1.000	-0.139	0.469	-0.229	0.633**	0.163	0.174	-0.040	0.117	0.121	0.197	-0.063
	P		1.000	-0.127	0.435	0.215	0.625**	0.156	0.170	-0.036	0.112	0.121	0.189	-0.049
Number of productive tillers/plant	G			1.000	0.081	0.050	0.025	0.013	-0.005	0.072	-0.040	0.160	0.007	0.549**
	P			1.000	0.065	0.054	0.024	0.015	0.000	0.043	-0.020	0.149	0.011	0.521**
Panicle length (cm)	G				1.000	-0.091	0.298	0.266	0.170	-0.213	0.249	0.043	0.100	0.160
	P				1.000	-0.080	0.275	0.230	0.163	-0.211	0.246	0.049	0.100	0.119
Number of secondary branches/panicle	G					1.000	-0.171	0.035	-0.0446	-0.074	0.027	0.131	-0.003	0.307**
	P					1.000	-0.167	0.037	-0.045	-0.074	0.030	0.125	0.001	0.272*
Leaf length (cm)	G						1.000	0.174	0.244	0.000	0.125	0.312	0.173	0.089
	P						1.000	0.168	0.241	-0.000	0.122	0.308	0.163	0.078
Leaf breadth (cm)	G							1.000	-0.010	0.093	-0.088	-0.073	0.011	0.127
	P							1.000	-0.005	0.079	-0.074	-0.070	0.002	0.107
Grain length (mm)	G								1.000	-0.276	0.702**	0.162	0.212	0.149
	P								1.000	-0.273	0.692**	0.159	0.209	0.123
Grain breadth(mm)	G									1.000	-0.874**	-0.006	-0.053	-0.176
	P									1.000	-0.875**	-0.011	-0.052	-0.157
L/B ratio	G										1.000	0.102	0.151	0.207*
	P										1.000	0.103	0.146	0.176
Straw yield (g)	G											1.000	-0.157	0.373**
	P											1.000	-0.148	0.333*
100 grain weight (g)	G												1.000	0.044
	P												1.000	0.041
Grain yield / plant (g)	G													1.000
	P													1.000

**Significance at 1% level * Significance at 5% level

the genotype and phenotype due to a relatively smaller contribution of the environment to the phenotype. Such high heritability estimates were reported in the earlier experiments for days to 50 per cent flowering, plant height and number of productive tillers per plant by Sreedar (2000), Michael Gomez and Rangasamy (2002), Monalisa Manna *et al.* (2006) for flag leaf and filled grains per panicle.

Shivani and Sree Rama Reddy (2000), Ushakumari *et al*. (2002) and Michael Gomez and Kalamani (2003) reported high heritability estimates for panicle length. High heritability estimates for grain yield per plant and 100 grain weight were earlier reported by Sreedhar (2000) and Michael Gomez and Rangasamy (2002).

The genetic advance as per cent of mean was found to be high for plant height, number of productive tillers per plant, number of secondary branches per panicle, 100 grain weight, grain yield per plant, kernel breadth, kernel length/breadth ratio and straw yield. While considering heritability and genetic advance together, characters like plant height, number of productive tillers per plant, panicle length, number of secondary branches per panicle, leaf length, leaf breadth, 100 grain weight, grain yield per plant, grain breadth, grain length/breadth ratio and straw yield had recorded high estimates. These results indicated the existence of greater scope for improvement of these characters through direct phenotypic selection by fixing additive gene effects. Such high heritability coupled with high genetic advance was reported for plant height and number of productive tillers per plant (Michael Gomez and Kalamani, 2003), panicle length (Ushakumari *et al.*, 2002), grain yield per plant (Michael Gomez and Rangasamy, 2002: Monalisa Manna *et al.*, 2006, Kernel length/breadth ratio (Mishra and Verma, 2002).

Association analysis

The genotypic correlations were of higher magnitude than the corresponding phenotypic correlation coefficients in most of the characters (Table 2). This is due to the modified effect of environment on character association at the genetic level and a strong inherent association between these characters. Single plant yield exhibited highly significant positive correlations with days to 50% flowering, total number of tillers per plant, number of secondary branches per panicle, L/B ratio and straw yield at genotypic level. This observation supports the earlier findings by Khhedikar *et al*. (2004) for number of panicles per plant, Borbora et al. (2005) for secondary branch number per panicle, filled grain number per panicle and Panwar and Mashiat Ali (2007) for filled grains per panicle, secondary branches per panicle and productive tillers per plant. Single plant yield exhibited highly significant negative correlations with plant height, grain breadth at both genotypic and phenotypic level. This indicates the relative utility of all these traits for selection with respect to grain yield. This was in conformity with the findings of Rita Binse *et al.* (2006), Panwar and Mashiat Ali (2007) for plant height. The result of the present study suggested that due emphasis should be given on number of tillers per plant, number of secondary branches per panicle for improvement of higher yield.

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