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Assessment of Genetic Variability for Yield and Quality Characters in Rice (*Oryza sativa* L.)

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ABSTRACT

The present investigation was carried out to study the genetic parameters for yield, yield attributing and quality characters in fifty rice genotypes. Analysis of variance revealed significant differences for all the traits under study. The characters viz., filled grains per panicle, test weight, kernel length after cooking, alkali spreading value and gel consistency exhibited high genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) along with high heritability coupled with high genetic advance indicating their amenability towards simple selection and it could be effective for improving these characters.

Key words: *Rice, GCV, Genetic advance, Heritability, PCV.*

Rice (*Oryza sativa* L.) is the world's second most important cereal crop and staple food for more than half of the global population providing about 75% of the calorie and 55% of the protein intake in their average daily diet and aptly describes the slogan "Rice is life". In India, rice is grown in an area of 45.5 M ha with a production and productivity of 106.54 M t and 2424 k ha^{-1} respectively (Ministry of Agriculture, Directorate of Economics and Statistics, 2013-14). It offers a wealth of material for genetic studies because of it's wide ecological distribution and enormous variation encountered for various qualitative and quantitative characters (Kotaiah,1983). The conservation of a large amount of genetic variability in rice gene pool provides plant breeder with raw material that can be recombined to produce new improved varieties for yield and quality traits. Keeping in view the above perspectives, an attempt has been made to assess the genetic variability and heritability for yield attributing characters and quality parameters in rice.

MATERIAL AND METHODS

A field experiment was conducted with fifty rice genotypes during *Kharif*, 2013 at Agricultural College Farm, Bapatla in a completely randomized block design with two replications. Twenty one days old seedlings of each genotype were transplanted in three rows of 5.0 m length by adopting a spacing of 20 cm between rows and 15 cm between plants within rows. Standard agronomic practices were followed to raise a good crop. A composite sample of five plants from each replication from the middle row was used to record observations on these plants for plant height, ear bearing tillers per plant, panicle length, number of filled grains per panicle, test weight and grain yield per plant. All the quality parameters *viz*., hulling and milling (%), head rice recovery (%), kernel length, kernel breadth, L/B ratio, kernel length after cooking, water uptake, alkali spreading value, amylose content, elongation ratio, gel consistency and days to 50 % flowering were recorded on plot basis per each replication. All the physical and chemical quality parameters were estimated by following the Mammal on rice grain quality procedures (DRR, 2006).The mean data collected for all the characters was utilized for estimation of variability parameters by following standard procedures.

RESULTS AND DISCUSSION

The analysis of variance for different characters is furnished in Table 1. A wide range of variation was observed among fifty rice genotypes for seven quantitative and quality traits. This suggested that there were inherent genetic differences among the genotypes for all the characters under study. The estimates of phenotypic coefficient of variation (PCV) were slightly higher than those of genotypic coefficient (GCV) for all the traits studied (Table 2). Indicating least environmental influence and consequently greater

Table 1. Analysis of variance for yield and yield components among 50 genotypes of rice (*Oryzasativa* L.).

Source	Replications	Treatments	Error
Degrees of freedom	2-1	49	49
MEAN SQUARES			
Plant height (cm)	98.20	371.64**	30.19
Ear bearing tillers/ Plant	0.05	11.96**	0.66
panicle length (cm)	1.29	15.74**	0.53
Days to 50% flowering	19.80	178.75**	7.33
Filled Grains/ Panicle	14.89	3769.75**	57.69
Test weight (g)	0.29	40.55**	0.37
Grain yield/ plant	1.73	13.29**	1.49
Hulling %	0.21	19.51**	2.07
Milling %	0.93	26.52**	2.17
Head Rice Recovery %	3.42	17.22**	1.03
Kernel length	0.009	1.26**	0.03
Kernel breadth	0.0017	0.05**	0.002
L/B ratio	0.02	0.47**	0.006
Kernel Length after Cooking	0.06	6.86**	0.12
Water uptake	41.11	1502.08**	11.71
Alkali spreading value	0.02	5.19**	0.01
Amylose content	1.13	3.87**	0.53
Elongation Ratio	0.003	0.16**	0.001
Gel consistency	0.11	587.34**	0.21

**= Significant at 1% level (0.252)

role of genetic factor on the expression of the traits. Similar observations were also noted earlier by kole *et al.* (2008) in rice. Among all the characters under study alkali spreading value and gel consistency showed higher estimates of GCV (57.42% & 48.14 respectively) and PCV (57.54 and 48.14% respectively) and therefore simple selection can be practiced for further improvement of these characters. This was in conformity with the findings of Kundu *et al*. (2008). The estimates of GCV and PCV were moderate for grain yield per plant, panicle length, ear bearing tillers per plant, plant height, kernel length, L/B ratio, water uptake and elongation ratio. The maximum estimates for genetic advance as percent of mean were manifested of alkali spreading value (118.02) followed by gel consistency (99.12) and filled grains per panicle (54.94). High estimates for genetic advance were recorded by kernel length after cooking (40.54), L/B ratio (35.08) and ear bearing tillers per plant (33.01).

The estimates of heritability for all traits ranged from 76 (Amylose content) to 100 (Alkali spreading value) suggesting high component of heritable portion of variation that can be exploited by breeders in the selection of superior genotypes on the basis of phenotypic performance. These findings were in consonance with the reports made earlier in rice by Sampath Kumar *et al.* (2008) and Kundu *et al*. (2008).

The estimates of genetic parameters for yield components and grain quality parameters revealed high estimates for phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance for 5 characters *viz.,* filled grains per panicle, test weight, kernel length after cooking, alkali spreading value and gel consistency suggesting the predominance of additive type of gene action in controlling these traits and directional selection could be profitably applied on these traits in the genetically diverse material. Thus apparently important contribution of additive

Table 2. Mean, variability, heritability and genetic advance as per cent of mean for yield and yield components in rice (*Oryza sativa* L.).

Character	Mean	Range		Coefficient of variation (%)		Heritability (%) (broad sense)	Genetic advance as percent of mean (5%level)
		Minimum	Maximum	PCV	GCV		
Plant height (cm)	97.53	72.7	134.20	14.53	13.40	85	25.44
Ear bearing tillers/ Plant	14.02	8.15	19.50	17.92	16.95	89	33.01
Panicle length (cm)	20.91	14.0	26.40	13.64	13.19	93	26.27
Days to 50% flowering	104.58	82.0	130	9.22	8.85	92	17.50
Filled Grains/ Panicle	159	93.15	239	27.50	27.08	97	54.94
Test weight (g)	19.13	10.41	33.87	23.64	23.42	98	47.81
Grain yield/ plant (g)	13.63	9.34	18.92	19.94	17.82	80	32.79
Hulling (%)	82.61	76.42	90.55	3.98	3.57	81	6.62
Milling (%)	69.75	63.95	77.44	5.43	5.00	85	9.49
Head Rice Recovery (%)	60.02	52.65	67.33	5.03	4.74	89	9.19
Kernel length (mm)	5.37	3.72	8.8	14.95	14.59	95	29.34
Kernel breadth (mm)	1.19	1.64	2.51	8.57	8.10	89	15.77
L/B ratio	2.82	1.91	4.7	17.46	17.24	98	35.08
Kernel Length after Cooking (mm)	9.15	6.93	17.1	20.44	20.06	96	40.54
Water uptake (ml)	261.13	197.12	307.83	10.54	10.45	98	21.37
Alkali spreading value	2.80	1.09	7.06	57.54	57.42	100	118.02
Amylose content (%)	25.53	20.9	26.23	6.31	5.50	76	9.86
Elongation Ratio	1.79	1.2000	2.19	16.06	15.96	99	32.67
Gel consistency (mm)	35.59	19.47	82.04	48.15	48.14	100	99.12

PCV= Phenotypic coefficient of variation GCV= Genotypic coefficient of variation

genetic variance is involved in the expression of these traits. The other characters under study *viz.,* plant height, ear bearing tillers per plant, panicle length, days to 50% flowering, grain yield per plant, kernel length, kernel breadth, L/B ratio, water uptake, amylose content, elongation ratio, hulling (%), milling (%), head rice recovery (%) manifested low to moderate estimates for phenotypic coefficient of variation and genotypic coefficient of variation, high heritability and low to high estimates for genetic advance indicating the improvement of these traits is possible by simultaneous exploitation of both additive and non-additive components by adopting breeding procedures like biparental mating, diallel selective mating system or cyclic hybridization.

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