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Genetic Variability, Heritability and Genetic Advance in Rice (*Oryza sativa* L.)

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ABSTRACT

Twenty nine genotypes were studied for their genotypic, phenotypic and environmental coefficient of variation during *kharif* 2011. Results indicated significant differences among all the characters studied viz., days to 50 % flowering, plant height, no. of ear bearing tillers per plant, panicle length, testweight and grain yield per plant. Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) and environmental coefficient of variation (ECV) for all the traits but smaller differences between GCV and PCV were recorded for all the characters studied, which indicated less influence of environment on these characters. PCV was highest for plant height (15.73 %) followed by grain yield per plant (15.57 %), no.of ear bearing tillers per plant (13.83 %) and test weight (12.32 %). GCV and PCV were lowest for panicle length and days to 50 % flowering. High heritability coupled with high genetic advance was observed for plant height and days to 50 % flowering, indicating the predominance of additive gene action in controlling these characters, simple selection could be effective for improving these characters.

Key words : Genetic advance, Heritability, Rice, Variability.

Rice (*Oryza sativa* L.) is an important cereal food crop in India and Andhra Pradesh. The demand for rice is increasing as the population is increasing day by day. Its yield potential has reached to the maximum possible level. In order to further improvement in the yield of rice, development of high yielding varieties is necessary. A well planned plant breeding programme for developing high yielding genotypes requires complete knowledge on the genetic variability present in the germplasm (Kavitha and Sree Rama Reddi, 2002). Yield is a complex character being governed by a large number of cumulative, duplicate and dominant genes and highly influenced by environment. This necessitates a thorough knowledge of variability owing to genetic factors, actual genetic variation heritable in the progeny and the genetic advance that can be achieved through selection. Heritability estimates along with genetic advance was more useful than heritability estimate alone in predicting resultant effect for the selection of the best individual form of segregating population. In the present study an attempt was made to assess genetic variability for different characters in rice.

MATERIAL AND METHODS

The base material for the present study consisted of four lines (Sinna Sivappu, Sudu Hondarawala, PTB 33 and BM 71) and five testers (IR 64, BPT 5204, PLA 1100, MTU 7029 and MTU 1075) and 20 F_1 crosses generated through line × tester mating design (Kempthorne, 1957). The experiment was laid out in randomised block design with three replications during *kharif* 2011 at APRRI and RARS, Maruteru. The observations were recorded on five randomly selected plants from each treatment for plant height, no. of ear bearing tillers per plant, panicle length, test weight and grain yield per plant. For days to 50 % flowering data was recorded on plot basis. The treatment means for all the characters were subjected to analysis of variance technique on the basis of model proposed by Panse and Sukhatme (1961). The genotypic (GCV) and phenotypic (PCV) coefficient of variation was calculated by the formulae given by Burton (1952). Heritability in broad sense [h^2(bs)] was calculated by the formula as suggested by Johnson *et al.* (1955). From the heritability estimates, the genetic advance (GA) was estimated by the formula given by Johnson *et al.* (1955).

Table 1. ANOVA for different characters in rice.

Source	Df	Days to 50 % flowering	Plant height (cm)	No. of ear bearing tillers per plant	Panicle length (cm)	Test weight (g)	Grain yield per plant (g)
Treatments	28	367.42**	1427.81**	3.50**	15.58**	19.78**	31.24**
Replications	2	0.04	36.09	0.18	6.51	0.38	1.76
Error	56	5.33	84.17	0.20	3.30	0.41	2.86

** Significant at 1 % level.

Table 2. Estimates of genotypic and phenotypic coefficients of variation, heritability, genetic advance and genetic advance as per cent mean for different characters of rice.

Character	Genotypic coefficient of variation	Phenotypic coefficient of variation	Heritability	Genetic advance	Genetic advance as per cent mean
Days to 50 % flowering	9.71	9.92	95.80	28.38	25.10
Plant height (cm)	14.43	15.73	84.20	51.26	34.96
No. of ear bearing tillers per plant	12.69	13.83	84.20	2.53	30.74
Panicle length (cm)	7.31	9.82	55.30	3.97	14.35
Test weight (g)	11.94	12.32	94.00	6.50	30.57
Grain yield per plant (g)	13.64	15.57	76.70	7.11	31.54

RESULTS AND DISCUSSION

The analysis of variance revealed that the genotypes differed significantly for all the characters indicating presence of considerable variability for all the characters (Table 1). The phenotypic expression of the character is the result of interaction between the genotype and environment. The genotypic coefficient of variation measures the range of variability available in a crop and also enables to compare the amount of variability present in different characters. In the present study the estimates of phenotypic coefficients of variation for all the characters were higher than the estimates of genotypic coefficients of variation which may be due to higher degree of interaction of genotypes with the environment.

It can be seen (Table 2) that plant height exhibited highest genotypic coefficient of variation (GCV) followed by grain yield per plant, no. of ear bearing tillers per plant, test weight, days to 50 % flowering and panicle length indicating presence of high amount variability for improvement of these characters.

Genetic coefficient of variability along with heritability gave an idea of expected genetic gain from selection (Burton, 1952). Even though heritability estimates provide an indication of the relative value of selection based on phenotypic expression, heritability and genetic advance when calculated together gives more information in predicting resultant effect of selection. In the present study, high heritability, high genetic advance and high genetic advance as per cent of mean coupled with moderate to high variability was exhibited by plant height and days to 50 % flowering (Table 2). High heritability coupled with high genetic advance as per cent mean observed for these characters were due to additive gene effects.

Hence, selection in the segregating generation would be very effective. These results were in confirmation with the results of Bharadwaj *et al*. (2007).

Low variability, low heritability and genetic advance recorded for panicle length indicating influence of non-additive gene action in controlling the expression of this trait. Hence simple phenotypic selection for this trait may not be fruitful as this character is highly influenced by the environment. Similar results were also reported by Syed Sultan Ali *et al*. (2000). Grain yield per plant exhibited high heritability, high genotypic coefficient of variation but showed low genetic advance indicating the presence of both additive and non-additive gene action, hence simple selection for this trait would be less effective. These results were in accordance with the results of Karim *et al*. (2007).

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