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GENETIC VARIABILITY, CORRELATIONS AND PATH-COEFFICIENTS IN *INDICA* RICES

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ABSTRACT

Genetic variability, simple correlations and path-coefficients were studied on eight quantitative characters in 80 *indica* rice varieties, including HYV and indigenous high quality rices in two environments each at two locations during rainy season. Statistical analyses were done based on character means on pooled data. A wide range of variation was recorded for most of the characters. Heritability in broad sense was very high for all the characters except harvest index. Spikelets per panicle and plant height exhibited high heritability coupled with high genetic advance. Grain yield per plant showed significant positive correlation with plant height, panicle length, spikelets per panicle, panicle weight, and test weight. Path-analysis indicated a greater contribution of panicle weight to grain yield.

Key words: Genetic variability, path-coefficient, harvest index, heritability, genetic advance.

Correlations between characters is important in estimating the relative influence of various characters on yield and the magnitude of direct and indirect effects of yield attributes on grain yield. The latter aspect is made possible by the technique of path-analysis developed by Wright [1]. The present investigation aims to assess the extent of genetic variability and other genetic parameters, besides correlation and path-analysis, in a set of high yielding and indigenous high quality varieties of rice, *Oryza sativa* ssp. *indica*, so as to determine the possibility of developing better quality, high yielding varieties.

MATERIALS AND METHODS

The study was conducted using 80 varieties of rice, which included indigenous high quality and high yielding varieties. The complete set of varieties was grown at two locations, viz., Varanasi and Cuttack, both under high and low soil fertility levels during rainy season.

The seedlings were transplanted one per hill in three replications at a distance of 15 x 30 cm. Three rows of 30 plants each per variety were planted in each replication. The recommended cultural practices were followed to raise a good crop. At maturity the data were recorded on five randomly selected plants for eight quantitative traits (Table 1). Calculations were done according to the standard statistical procedures.

RESULTS AND DISCUSSION

VARIABILITY, HERITABILITY AND GENETIC ADVANCE

The estimates of phenotypic coefficient of variation (PCV) were higher than those of genotypic coefficient of variation (GCV) for all the traits, which was also reported earlier [2–4]. However, the highest PCV and GCV were recorded for spikelets per panicle and lowest for panicle length, which was at variance from the reports cited above.

All the characters showed high heritability, the highest being for test weight and lowest for harvest index (Table 1). The estimates of genetic advance (GA) were highest for spikelets per panicle and lowest for harvest index. Although these are not realised values, the

Table 1. Pooled estimates of genetic parameters for grain yield and yield traits in rice

Character	PCV (%)	GCV (%)	Heritability (%)	Genetic advance	Genetic advance (% of mean)
Plant height	27.7	26.9	94.2	42.9	53.8
Productive tillers	21.0	18.9	81.1	2.9	35.1
Panicle length	15.7	15.1	92.4	6.1	29.9
Spikelets/panicle	36.7	36.0	95.9	76.5	72.6
Panicle weight	21.1	20.0	89.3	4.7	38.9
Test weight	18.5	18.1	96.6	7.1	36.7
Grain yield/plant	24.2	22.4	85.8	4.5	42.8
Harvest index	20.3	11.6	32.8	5.8	13.7

observations form a good guideline for future planning. Johnson [5] suggested that for a more reliable conclusion, heritability and genetic advance should be considered together. In this study, high estimates of heritability and genetic advance were obtained for spikelets per panicle and plant height which supports the results of Sundaram et al. [4]. Similar observations were reported for plant height [3, 6] and grains per panicle [7, 8].

SIMPLE CORRELATIONS

At the phenotypic level, correlations of grain yield with plant height, panicle length, spikelets per panicle, panicle weight and test weight were significantly positive (Table 2). These observations support the earlier findings [6, 9, 10]. Productive tillers and grain yield

Table 2. Phenotypic correlation coefficients among grain yield and its attributes in rice

Characters	Productive tillers	Panicle length	Spikelets per panicle	Panicle weight	Test weight	Yield per plant	Harvest index
Plant height	-0.42^{**}	0.81^{**}	0.68^{**}	0.42^{**}	-0.04	0.42^{**}	-0.37^{**}
Productive tillers		-0.29^{**}	-0.39^{**}	0.08	0.04	0.07	0.20
Panicle length			0.71^{**}	0.60^{**}	-0.05	0.59^{**}	-0.27^{*}
Spikelets/panicle				0.45^{**}	-0.32^{**}	0.45^{**}	-0.24^{*}
Panicle weight					0.35^{**}	0.95^{**}	-0.19
Test weight						0.32^{**}	0.01
Grain yield/plant							-0.20

* **Significant at P = 0.05 and 0.01, respectively.

did not exhibit phenotypic correlation when pooled data were analysed, but analyses of data independently in respect of 4 environments gave significant correlation for these in 3 of the environments. However, the character combinations reported here are many. The usefulness of conducting experiments in large number of environments is proved by the present study. The results reported here, particularly on panicle weight, may provide useful information for rice improvement programmes, especially for developing better quality types.

PATH ANALYSIS

Among all the yield traits, panicle weight showed the highest direct effect (1.01) on grain yield per plant. Positive correlation of a particular trait with yield does not necessarily mean a direct, positive effect of that trait on yield. From path analysis, Jangale [11] also reported that panicle weight and size of flag leaf were the most important traits contributing to grain yield. The present findings support this conclusion. The direct effects of the remaining traits in the present study were either positive or negative although comparatively lower in magnitude than mentioned in the earlier reports. The indirect effects were also either positive or negative but lower in magnitude, except those contributing via panicle weight. However, it may be emphasised that direct effect of panicle length was negative and very

low but indirect effect of this trait via panicle weight was as high as its genotypic correlation with grain yield (0.65). Thus, greater importance of panicle weight in breeding involving the present set of varieties is suggested.

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REFERENCES

1. S. Wright. 1921. Correlation and causation. Agric. Res., **20**: 557–585.

2. J. P. Lal, A. K. Richharia and R. K. Agrawal. 1983. Correlation and genetic parameters in semi-dwarf cultures of rice. Oryza, **20**: 195–203.

3. R. S. Singh, S. P. Chauhan and D. M. Maurya. 1986. Genetic variability in 98 upland rice cultivars of India. Intern. Rice Res. Newsl., **11**: 9–10.

4. T. W. Sundaram, W. Manual and S. Palanisamy. 1988. Genetic variability and correlation coefficient in early rice (*Oryza sativa* L.). Indian J. agric. Sci., **58**: 629–630.

5. H. W. Johnson, H. F. Robinson and R. E. Comstock. 1955. Estimates of phenotypic and genotypic correlations in soyabeans and their implications in selection. Agron. J., **47**: 477–482.

6. M. L. H. Kaul and V. Kumar. 1982. Genetic variability in rice. Genet. Agrar., **36**: 257–268.

7. K. S. Paramasivan. 1980. Study of genotypic and phenotypic variability in quantitative characters in hybrids of tall and dwarf *indica* rice varieties. Crop Improv., **7**: 141–142.

8. A. K. M. Shamsuddin. 1982. Analysis of genetic variation for panicle and grain characteristics in relation to grain yield in rice. Pakistan J. Sci. Res., **34**: 75–78.

9. A. Unikrishnan. 1982. Studies on genetic variability and selection indices for grain yield in three F_2 populations of rice (*Oryza sativa* L.). Thesis Abstr., **8**: 71–72.

10. G. S. V. Prasad, A. S. R. Prasad, M. V. S. Sastry and T. E. Srinivasan. 1988. Genetic relationship among yield components in rice (*Oryza sativa* L.). Indian J. agric. Sci., **58**: 470–472.

11. R. D. Jangale, S. D. Ugale and A. D. Dumbre. 1987. A study of cause and effect relationship among quantitative traits in upland paddy. J. Maharashtra Agric. Univ., **12**: 31–34.