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GENETIC VARIABILITY AND CHARACTER ASSOCIATION FOR QUALITY TRAITS IN UPLAND RICE (*ORYZA SATIVA* L.)

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ABSTRACT

Thirty four high yielding rice genotypes along with one local check (NDR-359) were evaluated for their variability with regards to qualitative traits during*kharif*2013at Field Experimentation Centre of the Department of Genetics & Plant Breeding, Allahabad, Uttar Pradesh, India.The data were recorded on six qualitative traits *viz*., Hulling%, Kernel length before cooking, Kernel length after cooking, Kernel breadth before cooking, Kernel breadth after cooking and L/B Ratio. Analysis of variance indicated the existence of significant differences among the genotypes for all the quality traits studied. On the basis of results characters *viz*., kernel length before cooking and kernel length after cooking showed high GCV, PCV, heritability and genetic advance. Hence, it is concluded that association of various quality traits *viz*., kernel length before and after cooking and kernel breath after cooking would serve as better parameters for choice of parents while developing hybrids with better rice quality.

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INTRODUCTION

Rice is the dietary staple food of masses, constituting half of the planet's human population. India being the second largest producer of rice still lags behind in productivity Sravan, *et al.,* 2012. It belongs to the family *Poaceae* and it is grown under diverse eco-geographical conditions in tropics and subtropics. Most of the land races are either out of cultivation or extinct but few are still cultivated by resource-poor traditional farmers practising subsistence farming in tribal regions. In recent times, there is heavy demand for good grain quality in national as well as international market. Quality rice also fetches premium price for the farmers (Das *et al.,* 2007; Babu *et al.,* 2012). A critical analysis of the genetic variability is a prerequisite for initiating any crop improvement programme through appropriate selection techniques. Like grain yield, quality is also not easily amenable to selection due to its complex genetic nature. Hence, there is also a need to take a glance at the quality aspects to enhance consumer acceptance, garner profitability, ensure export quality and augment foreign exchange earnings (Dhanwani *et al.,* 2013). Assessment of variability for yield and its component characters is essential before planning for an appropriate breeding strategy for genetic improvement. Genetic parameters such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are useful in detecting the amount of variability present in the germplasm. Heritability coupled with high genetic advance also useful tool in predicting the effect in selection of best genotypes. It helps in determining the influence of environment on the expression of the genotype. As a result, the present investigation is aimed to evaluate variability, heritability and genetic advance of quality parameters in rice that could be useful in quality improvement programmes of rice.

MATERIALS AND METHODS

The experiment comprised of 34 high yielding rice varieties with one local check (NDR-359) was collected and grown at Field Experimentation Centre of the Department of Genetics and Plant Breeding, Allahabad School of Agriculture,Sam Hingginbottom Institute of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India, during *kharif,* 2013. Trial was laid out in a Randomized Block Design in three replications with aplant to plant and row to row spacing of 20x15cm respectively. The recommended packages of practices like irrigation, weeding and fertilizer dosage were applied to obtain a good crop growth. Five plants were sampled randomly from each genotype in each replication for recording of data on six quality traits *viz.,* Hulling%, Kernel length before cooking, Kernel length after cooking, Kernel breadth before cooking, Kernel breadth after cooking and grain L/B Ratio. The variance analysis and test of significance was calculated as per the method of Panseand Sukhatme, 1967. The genotypic coefficient of variance (GCV) and phenotypic coefficient of variance (PCV) were calculated by the formula given by Burton 1952. Heritability in broad sense was calculated by the formula given by

Hansonet *al.* 1956. From the heritability estimates, the genetic advance was calculated by the following formula given by Johnson *et al.* 1955.Genotypic and phenotypic correlation coefficients between different characters were calculated by using the genotypic and phenotypic variances and covariance'sas suggested by Fisher and Yates, 1938,Al-Jibouri *et al.,* 1958. The genotypic and phenotypic correlation coefficient was tested for their significance against' values from 'r' tables of Fisherand Yates 1938 for (n-2) degree of freedom, where'n' is the number of varieties.

RESULTS AND DISCUSSION

The analysis of variances reveals the existence of highly significant differences among the genotypes studied suggesting that sufficient variability was present for the different characters and selection would be effective to develop the varieties with desired forms of crop plants. The results of analysis of variance are presented in (Table 1). In the present study maximum GCV and PCV were recorded for L/B ratio followed by kernel length before cooking and kernel length after cooking while they were lowest for hulling percentage (Table2). Therefore, selection on the basis of phenotype alone can be effective for the improvement of these traits similar findings in rice were also reported by Dhanwani *et al.,* 2013, Pandey *et al.,* 2013, Babu *et al.,* 2012 and Iftekharuddaula *et al.,* 2001.The high magnitude of phenotypic and genotypic coefficient of variations implied less influence of environment variations on characters under study. Therefore, selection on the basis of phenotype alone can be quite effective for the improvement of these traits similar study were also found by Gampala *et al.* (2015). Heritability in broad sense was calculated for all characters under study and is presented in (Table 2). Heritability is classified as high (above60%), medium (30%-60%) and low (below 30%) as suggested by Johnson *et al.,* 1955. High estimate of heritability were exhibited for all quality traits except that the L/B ratio. High heritability values indicated that the characters were less influenced by environment in their expression. Plant breeder can therefore adopt simple selection method on the basis of the phenotype to improve varieties based on these traits. Similar results were also quoted by Dhanwani *et al.* (2013), Pandey *et al.* (2013) and Babu *et al.* (2012).Genetic advance is usually expressed as percent of mean. The range of genetic advance as percent of mean is classified as suggested by Johnson *et al.* (1955). Low (less than 10%), moderate (10-20%) and high (more than 20%). In the present investigation, maximum genetic advance as percentage of mean were recorded for kernel length before cooking followed by kernel length after cooking and L/B ratio. However, it was recorded lowest for hulling % followed by kernel breath before cooking. if selection is made for improving the particular trait under study similar results have also been reported (Dhanwani *et al.*, 2013, Pandey *et al.*, 2013, Babu*et al.*, 2012, Das *et al.*, 2007 and Jaiswal *et al.*, 2007). The estimates of genotypic and phenotypic correlation coefficients between different characters of rice genotypes are presented in (Table 3.) The genotypic correlation coefficients in most of cases were higher than their phenotypic correlation coefficients indicating the genetic reason of association. In some cases, phenotypic correlation coefficients were higher than genotypic correlation indicating suppressing effect of the environment which modified the expression of the characters at phenotypic level. In present investigation, kernel length before cooking, kernel length after cooking and kernel breath after cooking showed highly significant positive correlation with L/B ratio at both phenotypic and genotypic level. However, hulling percentage and kernel breath before cooking exhibited non significant correlation with L/B ratio at phenotypic and genotypic level respectively. Hulling% exhibited no significant and positive association with kernel breath before cooking and kernel breath after cooking at both phenotypic and genotypic level. Hulling (%) showed highly significant correlation with L/B ratio at phenotypic level this knowledge on the association of various quality traits would serve as guideline for careful choice of parents for development of hybrids with better quality. Similar results in rice have been reported by Shivani *et al.* (2007). Kernel breath after cooking revealed that the highly significant and positive association with kernel length before cooking, kernel length after cooking and kernel breath before cooking while, hulling (%) showed strongly and positive correlation with kernel length after cooking and kernel length before cooking at both phenotypic and genotypic level. Therefore adopt simple selection method on the basis of the phenotype of the characters which ultimately improves the genetic background of these traits. Similar results were also quoted by Li-Yun *et al.* (2003)

Table 1: Analysis of variance for quality traits in upland rice

Characters	Mean sum of square		
Source of variation	Replications	Treatments	Error
d. f.	2	31	62
Hulling%	0.21	2.56**	0.36
Kernel length before cooking	0.04	0.55**	0.02
Kernel length after cooking	0.02	0.45**	0.03
Kernel breadth before cooking	0.001	0.01**	0.002
Kernel breadth after cooking	0.003	0.04**	0.005
L/B Ratio	0.03	0.09**	0.03

** 1% significant level

Table 2: Estimates of variability, heritability and genetic advance as percentage of mean

Characters	Range Lowest	Highest	Grand mean($\overline{X}$) ±SE	Coefficients of variability GCV	PCV	Heritability (b s) (%)	Genetic advance(GA)	Gen. advance as % of means (5%)
Hulling%	73.40	77.63	75.62 ±0.35	1.13	1.38	67	1.44	1.90
K L before cooking	5.27	7.23	6.42 ±0.09	6.54	6.95	89	0.81	12.69
K L after cooking	6.83	8.47	7.65 ±0.10	4.91	5.37	84	0.71	9.25
K B before cooking	2.04	2.35	2.14±0.03	2.87	3.57	64	0.10	4.75
K.B after cooking	3.09	3.53	3.28±0.04	3.37	3.98	71	0.19	5.86
L/B Ratio	2.49	3.38	3.01±0.09	4.70	7.08	44	0.19	6.42

KL- Kernel length, KB- Kernel breadth, L/B- Length breadth ratio, GCV- Genotypic coefficient of variation, PCV- Phenotypic coefficient of variation

Table 3: Genotypic and phenotypic correlation for quality traits in upland rice

Character	r.G/P	Hulling %	Kernel length before cooking	Kernel length after cooking	Kernel breadth before cooking	Kernel breadth after cooking	L/B Ratio
Hulling%	G	1.00	0.40**	0.50**	0.17	0.16	0.52**
	P	1.00	0.26**	0.33**	0.19	0.18	0.18
Kernal length before cooking	G		1.00	0.93**	0.81**	0.80**	0.94**
	P		1.00	0.81**	0.60**	0.60**	0.63**
Kernel length after cooking	G			1.00	0.87**	0.88**	0.70**
	P			1.00	0.65**	0.66**	0.44**
Kernel breadth before cooking	G				1.00	0.96**	0.56**
	P				1.00	0.63**	0.11
Kernel breadth after cooking	G					1.00	0.45**
	P					1.00	0.25*

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