GENETIC VARIABILITY STUDIES FOR YIELD,PHSICO- CHEMICAL AND COOKING QUALITY CHARACTER IN LAND RACES OF RICE (*ORYZA SATIVA* L.)

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Abstract: The experimental material consisted of twenty out of sixteen landraces The experiment was conducted in Randomized Block Design (RBD) with three replications at ZARS, Igatpuri, Nashik, Maharashtra in *kharif* 2011. Observations were recorded for seventeen characters viz., days to 50% flowering, days to maturity, plant height , panicle length.,no of panicles/m^2, 1000-grain weight, grain yield(kg/plot),grain yield(kg/ha), grain length , grain breadth , L:B ratio, Hulling, Milling , Alkali spreading value, Amylose content [3], Water uptake (ml), and Kernel length after cooking. Genotypic, phenotypic, and environmental variance, heritability and genetic advance were estimated for all seventeen characters. In the present study, high heritability along with high genetic advance was noticed for the traits, 1000 grain weight,Grain yield,Amylose content,water uptake and kernel length after cooking. Other characters showed high heritability along with moderate or low genetic advance which can be improved by intermating superior genotypes of segregating population developed from combination breeding.

Key words: genetic variability, heritability and genetic advance.

Introduction: Rice is one of the most important cereal crop of the world meeting the dietary requirements of the people living in the tropics and sub-tropics. Quantum jump in yield improvement has been achieved in rice with the development of high yielding heterotic hybrids under commercial cultivation. However, being the staple food of the population in India, improving its productivity has become a crucial importance [1]. Knowledge on the nature and magnitude of genetic variation governing the inheritance of quantitative characters like yield and its components is essential for effecting genetic improvement. A critical analysis of genetic variability is a pre-requisite for initiating any crop improvement programme and for adopting of appropriate selection techniques.

A paradigm shift in the rice (Oryza sativa L.) breeding strategies from quantity centered approach to quality oriented effort was inevitable, since India has not only become self sufficient in food grain production but also is the second largest exporter of quality rice in the world [2]. Improvement in grain quality that does not lower yield is the need of hour at present context in order to benefit all rice growers and consumers. Like grain yield, quality is not easily amenable to selection due to its complex nature. Lack of clear cut perception regarding the component traits of good quality rice is one of the important reasons for the tardy progress in breeding for quality rice varieties. With the increase in yield, there is also a need to look into the quality aspects to have a better consumer acceptance, which determines the profit margin of rice growers which in turn dictates the export quality and foreign exchange in India. Grain quality characteristics are very important in rice breeding as it is predominantly consumed as a whole grain. The milling percentage, grain appearance, cooking quality and biochemical constitute the quality traits.

The knowledge of variability and interrelationship among different quality characters will help the breeder in choosing the parents for hybridization programme. Due to the introduction of high yielding varieties and absence of conservation and improvement programmes most of the land races possessing desirable quality attributes have gone out of cultivation(genetic erosion). Some tribal people still cultivate these land races in small areas, primarily for their personal consumption. To achieve superiority in terms of quality, the "immense wealth" of indigenous land races may be included in the breeding programmes. Hence an attempt was made to study the variability in grain phsico-chemical and cooking quality traits of different land races collected from Western Ghat zone and sub-mountain zone, Maharashtra.

Material and Method: The experimental material consisted of twenty out of sixteen landraces viz., Tilsha,Ghotikolpi,Phulemaval,Sapri,Sidhhagiri2,Ambemohor157,Halvikolpi,Viveklocal,Kamod,Kalibhog,Pitrasal,Champakali,Ghansal,Halvisal,Radhanagari185-2,Kalajirga and four promising rice varieties viz.,Basmati 370, RP 4-14, Jaya and Ratna.

The experiment was conducted in Randomized Block Design (RBD) with three replications at Zonal Agricultural Research Station, Igatpuri, Nashik, Maharashtra in kharif 2011,with spacing of 20 cm x15cm was adopted for planting. Recommended packages of' practices were followed during the crop growth period. Observations were recorded for seventeen characters viz., days to 50% flowering, days to maturity, plant height , panicle length., no of panicles/m2, 1000-grain weight, grain yield(kg/plot), grain yield(kg/ha), grain length , grain breadth , L:B ratio, Hulling, Milling , Alkali spreading value, Amylose content [3], Water uptake (ml), and Kernel length after cooking. Genotypic, phenotypic, and environmental variance, heritability and genetic advance were estimated for all seventeen characters The data were analyzed by using ANOVA [4] and the genetic parameters such as PCV and GCV and heritability broad sense (h2) were calculated by the formula [5], and genetic advance in percent of mean (genetic gain) were work out as suggested[6].

Results and Discussion:

a) Variability parameters: Greater variability in the initial breeding material ensures better chances of producing desired forms of a crop plant. Thus, the primary objective of germplasm conservation is to collect and preserve the genetic variability in indigenous collection of crop species to make it available to present and future generations. The analysis of variance indicated the existence of significant differences among all the landraces for all the traits studied. The results of analysis of variance are presented in Table 1. The characters studied in the present investigation exhibited low, moderate and high PCV and GCV values. Among the characters, highest PCV and GCV values were recorded for 1000-grain weight and Plant height and lowest PCV and GCV was recorded for days to maturity, grain breadth, Hulling, Amylose content and Milling[7]. High phenotypic variations were composed of high genotypic variations and less of environmental variations, [8]which indicated the presence of high genetic variability for different traits and less influence of environment[9]. Therefore, selection on the basis of phenotype alone can be effective for the improvement of these traits. Similar results were observed [10].

Coefficients of variation studies indicated that the estimates of PCV were slightly higher than the corresponding GCV estimates for all the traits studied indicating that the characters were less influenced by the environment. Therefore, selection on the basis of phenotype alone can be effective for the improvement of these traits.

b) Heritability: The estimates of heritability act as predictive instrument in expressing the reliability of phenotypic value. Therefore, high heritability helps in effective selection for a particular character. Heritability is classified as low (below30%), medium (30-60%) and high (above 60%). The characters studied in the present investigation expressed low to high heritability estimates ranging from 39.00 to 99.70 percent. Among the yield characters, highest heritability was recorded by 1000 grain wt. followed by days to 50 percent flowering ,days to maturity and grain length, whereas, in grain quality characters Kernel length after cooking ,water uptake and Amylose content recorded highest heritability[11], whereas Hulling and Milling recorded lowest heritability value. High heritability values indicate that the characters under study are less influenced by environment in their expression[12]. The plant breeder, therefore, may make his selection safely on the basis of phenotypic expression of these characters in the individual plant by adopting simple selection methods. High heritability indicates the scope of genetic improvement of these characters through selection[10].

c) Genetic advance: The genetic advance is a useful indicator of the progress that can be expected as result of exercising selection on the pertinent population. Heritability in conjunction with genetic advance would give a more reliable index of selection value [6]. Genetic advance was highest for days to 50% flowering, plant height, No of panicles/m2, 1000-grain weight [13],Grain yield,Grain length, L:B ratio, Alkali spreading value, Water uptake and Kernel length after cooking[14]. Moderate genetic advance were observed for days to maturity , panicle length and Grain breadth (Table 1 and 2).The information on genetic variation, heritability and genetic advance helps to predict the genetic gain that could be obtained in later generations, if selection is made for improving the particular trait under study. Similar findings were also reported[10],[15].

In general, the characters that show high heritability with high genetic advance are controlled by additive gene action and can be improved through simple or progeny selection methods. Selection for the traits having high heritability coupled with high genetic advance is likely to accumulate more additive genes leading to further improvement of their performance. In the present study, high heritability along with high genetic advance was noticed for the traits, 1000 grain weight,Grain yield,Amylose content,water uptake and kernel length after cooking. Other characters showed high heritability along with moderate or low genetic advance which can be improved by intermating superior genotypes of segregating population developed from combination breeding [16].

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Table 1. Analysis of variance for different characters of land races

Sr.No.	Characters	Genotype	Error
1	Days to 50 % flowering	317.28**	0.90
2	Days to maturity	314.88**	0.75
3	Plant height (cm)	1482.67**	12.58
4	length of panicles	20.25**	2.82
5	No.of panicles/m2	2844.86**	36.98
6	1000 grain weight (g)	78.27**	0.02
7	Grain yield (kg/plot)	0.04**	0.003
8	Grain yield (kg/ha)	730756.38**	58163.82
9	grain length (mm)	1.53**	0.02
10	grain breadth (mm)	0.04**	0.01
11	L: B ratio	0.54**	0.03
12	Hulling(%)	3.04**	1.13
13	Milling(%)	2.33**	0.87
14	Alkali spreading value	2.23**	0.45
15	Amylose content (%)	16.96**	0.21
16	Water uptake (ml)	3594.02**	25.52
17	Kernel Length after cooking	5.21**	0.06

*,**significant at 0.05 and 0.01 level of significance respectively.

Table 2: Genotypic and phenotypic coefficient of variability (gcv and pcv), heritability(h^2), genetic advance and components of variance for different characters in land races of rice.

Sr. No.	Character	Range	Mean	$\sigma^2 g$	$\sigma^2 p$	GCV	PCV	h^2(bs)	GA	G.A. as % of mean
1	Days to 50 % flowering	71-107.33	93.78	105.33	106.33	10.95	11.00	99.10	21.07	22.47
2	Days to maturity	102.33-138.67	126.30	102.62	105.42	8.10	8.13	97.30	21.01	16.64
3	Plant height (cm)	73.33-136.33	105.67	490.03	502.61	20.95	21.22	97.50	45.03	42.61
4	length of panicles	17.60-26.73	22.13	5.79	8.67	10.87	13.31	66.80	4.05	18.30
5	No.of panicles/m2	160-285.67	224.80	936.19	972.47	13.61	13.87	96.30	61.84	27.51
6	1000 grain weight (g)	12.61-29.07	19.68	26.01	26.10	25.94	25.96	99.70	10.52	53.46
7	Grain yield (kg/plot)	0.614-1.078	0.86	0.01	0.02	13.25	14.93	78.76	0.21	24.22
8	Grain yield (kg/ha)	2558.33-4490.27	3568.54	223501.30	283753.70	13.25	14.93	78.76	864.32	24.22
9	grain length (mm)	4.50-6.90	5.79	0.50	0.52	12.25	12.49	96.20	1.43	24.75
10	grain breadth (mm)	1.63-2.06	1.88	0.01	0.02	4.92	7.16	50.00	0.13	6.96
11	L: B ratio	2.19-3.96	3.09	0.17	0.20	13.25	14.59	82.80	0.77	24.81
12	Hulling(%)	72.49-76.31	74.50	0.67	1.70	1.10	1.75	39.10	1.05	1.41
13	Milling(%)	62.92-66.27	64.68	0.51	1.31	1.11	1.77	39.00	0.92	1.42
14	Alkali spreading value	4.00-7.00	5.60	0.59	1.05	13.74	18.28	56.50	1.19	21.28
15	Amylose content (%)	19.76-27.71	24.54	5.58	5.79	9.63	9.81	96.30	4.78	19.47
16	Water uptake (ml)	172.33-277.33	222.02	1189.48	1215.05	15.53	15.70	97.90	70.30	31.66
17	Kernel Length after cooking	8.26-12.71	10.48	1.72	1.77	12.50	12.71	96.70	2.65	25.31