Research Article IJAER (2018); 4(2): 111 - 114

International Journal of Agricultural and Environmental Research
FREE AND OPEN ACCESS
Available online at www.ijaaer.com
ISSN 2414-8245 (Online)
ISSN 2518-6116 (Print)

GENETIC VARIABLITY IN RICE POUPLATIONS AT MINGORA SWAT

MUHAMMAD AYOUB KHAN[1]*, ZAID KHAN[2], SAJJAD AHMAD[2], BARKAT ALI[1] AND HAFEEZ UR RAHIM[3]

[1]Department of Plant Breeding and Genetics, The University of Agriculture, Peshawar
[2]Department of Agronomy, The University of Agriculture, Peshawar
[3]Department of Soil and Environmental Sciences, The University of Agriculture, Peshawar
Corresponding author's email: mak9129@yahoo.com

Abstract

An experiment entitled "genetic variability in rice populations at Mingora Swat" was conducted at Agriculture Research Institute (ARI) Mingora Swat during rice growing season 2015 in randomize complete block (RCB) design with three replications. A set of six rice lines in comparison with check cultivar were evaluated to study the genetic variability among rice genotypes. Data were recorded for days to 50% flowering, days to 50% maturity, plant height, tillers per plant, grains per panicle, 1000-grain weight and grain yield. Analysis of variance showed highly significant differences ($P \leq 0.01$) for most of the traits. The least days to flowering were recorded in line Japonica while maximum days were recorded for line Cibogo. Maximum days to maturity were recorded for lines Cibogo and PK3445-3-2 while minimum were recorded for line Japonica. Maximum plant height was attained by check cultivar fakhr-e-malakand while minimum by line Cibogo. Tillers per plant were observed maximum in check cultivar and minimum for line Pk3445-3-2. Line Pk3445-3-2 showed maximum grains per panicle and minimum by Japonica. The 1000-grain weight and grain yield were observed maximum in check cultivar and observed minimum in line Japonica. All of the traits were observed from moderate to high heritability. Grain yield showed positive and significant correlation with biological yield while other traits showed positive correlation with grain yield. Check cultivar Fakhr-e-malakand showed high grain yield while lines PK3445-3-2 and IR64 were nearer to check cultivar grain yield. Lowest grain yield was observed for line Japonica. A cross combination of line Japonica and Fakr-e-malakand can give beneficial result in breeding program to obtained a sustainable variety in future.

INTRODUCTION

Rice (*Oryza sativa*) is most important crop after wheat belongs to family *gramineae.* Rice is used as primary food by one third of the world population (Poehlman and sleeper, 1995). Rice is being consumed by people around the world as source of calories and had occupying 20% of land area which are uses for cereal crops (Micke et al., 1990). Asia with 60% population of the world grows and consumes more than 90% of the world rice (Khush, 1997). Worldwide it is planted on 165 million hectares with production of 740.9 million tons. The major rice producing countries are china (205.2 million tons), India (150 million tons), Indonesia (68.6 million tons), Bangladesh (51.3 million tons) and Vietnam (43.4 million tons) (FAOSTAT, 2013).In Pakistan, rice is planted on area of 2.789 million hectares with production of 6.798 million tons (FAOSTAT, 2013). In Pakistan, rice is termed as "Golden grain of Pakistan" as it gives foreign exchange earnings of about 23% of the total (Shah et al., 1999). In KPK it is planted on area of 0.05 million hectares with the production of 0.111 million tons (Pakistan Bureau of statistics 2013-14). To study genetic variability is most important because it is the basic thing for any breeding improvement program especially for selection of parents (Chaudhary and Singh, 1982). Crop improvement depends on presence of genetic variability in base population (Adebisi et al., 2001). When genetic variability attained then crop improvement become so easy because component characters of yield could be selected properly and yield will be improve with time.Heritability is important estimates as it give us proper knowledge on a variation that how much it is transmissible to next generation (Satheeshkumar and Saravanan, 2012). However, only heritability could not give satisfied results in selection of desirable lines because grain yield is complicated charater came from contribution of all morphological characters. Correlation of grain yield with its contributing traits is so much important for proper selection. Therefore, to get better results, the most contributing characters having positive impact on grain yield must be selected (Akinwale et al., 2011). The present study was focused to analyze genetic variability, heritability and correlation of grain yield with its contributing characters for positive development of future breeding program.

MATERIALS AND METHODS

An experiment entitled "Genectic variability in rice populations at Mingora Swat" was conducted at Agriculture Research Institute Mingora Swat during 2015 rice crop growing season. The experiment was laid out in Randomize Complete Block Design (RCBD) having three replications and seven genotypes. Row to row distance was 20 cm, plant to plant distance was 20 cm, row length was 2.4 m, and rows per plot were four having thirteen plants per row. The experiment was carried out on seven rice genotypes in which six were lines while one was local check cultivar Fakhr-e-malakand.. The six lines were obtained from National Agricultural Research center (NARC), Islamabad. Genotypes used in experiment were lines (PK3445-3-2, OM5627, IR64, IR8225-9-3-2-3, CIBOGO and JAPONICA) and a variety Fakhr-e-Malakand was used as check cultivar.

Statistical Analysis: Data were subjected to analysis of variance (ANOVA) technique as outlined by steel and Torrie (1980). Least Significant Difference (LSD) test was also used for means separation and comparison.

Heritability: Broad sense heritability for all traits was calculated using the formulas suggested by Singh and Chaudhary (1985):

$Vg= [MSG-MSE/r]$, $Ve= MSE$, $VP= Vg+Ve$, $H^2= Vg/Vp$

Where,

Vg = Genetic variance, Ve = Environmental variance, VP = Phenotypic variance, H^2 = Broad sense heritability

Correlation: Simple correlation of grain yield and its contributing traits were calculated by Kwon and Torrie (1964).

RESULTS AND DISCUSSION

Days to 50% flowering: Analysis of variances showed highly significant (P≤0.01) differences for days to 50% flowering for all genotypes. Days to 50% flowering were ranges from 50 (Japonica) to 69 (Cibogo) days with an overall mean of 62 day. Duration for check cultivar (Fakhr-e-malakand) was observed as 60 days (Table 2)**.** Broad sense heritability was 87% for days to 50%flowering which indicates that it is highly heritable trait .Simple correlation of days to 50% flowering with grain yield was 0.5206, non-significant and positively correlated (Table 3). In correspond to our study similar results have been reported by Tahir et al. (2002) in rice. This type of variability might be due to the genetic makeup of the exotic lines and genotypic environmental interaction.

Days to 50% maturity: Analysis of variances showed highly significant (P≤0.01) differences for days to 50% maturity for all genotypes. Days to 50% maturity were ranges from 83 (japonica) to 108 (PK3445-3-2 and cibogo) days with an overall mean of 103 days. Duration for check cultivar (Fakhr-e-malakand) was observed as 106 days (Table 2). Broad sense heritability was 94% for days to 50% maturity which indicates that it is highly heritable. Simple correlation of days to 50% maturity with grain yield was 0.7482, non-significant and positively correlated (Table 3). Similar results were found by Karim et al. (2007) who studied 41 aromatic rice genotypes for variability and genetic parameter analysis and found highly significant mean sum of square due to genotypes for Days to maturity. He reported that variation for days to maturity was attributed by genetic constituent rather than environment. This suggested that short duration lines could be a good source for breeder to use as parents in a breeding program.

Plant height (cm): Data regarding with plant height validates highly significant (P≤0.01) differences among all lines and check cultivar. Plant height was range from 81cm (cibogo) to 96cm for check cultivar Fakhr-e-malakand with overall mean 89 days (Table 2). Broad sense heritability for plant height was observed 78% which indicated that it is highly heritable. Plant height was consider as directly non-contributing character towards grain yield, so its correlation was not estimated. Zahid et al. (2005) studied 14 genotypes of basmati rice and observed high heritability couple with high genetic advance for plant height and 1000-grain weight. He also reported that plant height has negative correlation with yield which suggested that plant height is more susceptible to lodging or other yield disastrous factors and hence, more height is not a desirable character to select for development of a better yielding variety.

Number of tillers per plant: Data regarding with tillers per plant were observed with significant (P≤0.01) differences among all lines and check cultivar. Tillers per plant were range from 12.47 (PK3445-3-2) to 16.80 (Fakhr-e-malakand) and having 14.47 overall mean. Check cultivar fakhr-e-malakand was observed as superior in comparison with lines (Table 2). Broad sense heritability for tillers plant was observed 45% which indicates its moderate level of heritability. Simple correlation of tillers per plant with grain yield 0.1109 non-significant and positively correlated (Table 3). In correspond with our study Savitha and Kumari (2015) found number of productive tillers per plant had positive significant correlation with single plant yield in F3 population which suggested that it has better value of being desirable character in a breeding program aimed for better yield.

Grains panicle^{-1}: Analysis of variances showed highly significant (P≤0.01) differences for grains per panicle among all lines and check. Grains per panicle were ranges from 137.27 (japonica) to 273 (PK3445-3-2) with an overall mean of 188 grains per panicle. Check cultivar fakhr-e-malakand was observed with 199 grains per panicle. (Tabl 2). Broad sense heritability for grains per panicle was 88%, which indicates its high level of heritability. Simple correlation of grains per panicle was 0.3034 non-significant and positively correlated (Table 3). Similar results were found by Mirza et al. (1992) who found that number of grains panicle is positively correlated with grain yield. Prasad et al. (2001) also reported highly genetic heritability for the number of grains panicle^{-1} which suggests that it is highly desirable character for improvement of yield.

1000-Grain weight: Data regarding with 1000-grain weight was observed with significant (P≤0.01) differences among all lines and check cultivar. 1000-grain weight was ranges from 26.36 g (IR8225-9-3-2-3) to 29.25 g (fakhr-e-malakand) with an overall mean 27.45 g. check cultivar fakhr-e-malakand was observed as superior over all lines (Table 2). Broad sense heritability for 1000-grain weight was observed 53%, which indicates its moderate level of heritability. Simple correlation of 1000-grain weight with grain yield was 0.0647, non-significant and positively correlated (Table 3). In correspond with our result Tahir et al. (2002), reported highly significant variation for 1000-grain weight and other traits. This concludes that these traits are under the control of genotypic difference among the genotypes which indicates that different combinations of genotypes for these could be useful in breeding program for improvement of yield.

Grain yield (kg ha^{-1}): Data regarding with grain yield was observed with highly significant (P≤0.01) differences among all lines and check cultivar. Grain yield was ranged from 4751 kg/ha (japonica) to 9198 kg/ha (fakhr-e-malakand) with an overall mean of 7364 kg/ha. Check cultivar fakhr-e-malakand was observed as superior over all line (Table 2). Broad sense heritability of grain yield was observed 62%, which indicates its high level of heritability. Simple correlation of grain yield was positive with all contributing traits (Table 3). In corresponds to our study Mirza et al, (1992), reported positive correlation of panicle length, number of grains panicle^{-1}, 1000-grain weight with grain yield plant^{-1}.

Table 2: Mean values of Days to 50% flowering (DF), Days to 50% maturity (DM), Plant height (PH), Tillers per plant (TPP), Grains per panicle (GPP),1000-Grain Weight (1000-)GW and Grain Yield (GY).

GENOTYPE	DF	DM	PH	TPP	GPP	1000-GW	GY
PK3445-3-2	62.00	108.00	92.73	12.47	273.33	26.37	8301.28
OM5627	64.00	107.00	85.47	14.80	181.47	26.77	7637.22
IR64	65.00	107.00	82.67	16.00	142.67	28.07	8253.21
IR8225-9-3-2-3	64.00	107.00	91.27	14.93	231.00	26.36	6097.76
CIBOGO	69.00	108.00	81.47	16.47	150.53	26.58	7315.71
JAPONICA	50.00	83.00	92.67	15.13	137.27	28.74	4751.60
F MALAKAND	60.00	106.00	96.07	16.80	199.13	29.25	9198.72
MEAN	62.00	103.71	88.90	14.47	187.91	27.45	7346.93
LSD (0.05)	**3.96**	**3.77**	**5.11**	**2.59**	**131.56**	**1.79**	**1889.24**

Table3: Heritability (broad sense) of all traits and Simple correlation of grain yield with related traits.

TRAITS	HERITABILITY (broad sense) (%)	Correlation with grain yield
Days To 50% Flowering	87.29	0.5206
Days To 50% Maturity	94.82	0.7482
Plant Height	77.98	- - - - -
Tillers Per Plant	45.74	0.1109
Grains Per Panicle	88.62	0.3034
1000-grain Weight	53.04	0.0647
Grain Yield	62.51	**- - - - -**

CONCLUSION

All genotypes revealed significant differences. Maximum tillers per plant, 1000-grain weight, and grain yield were recorded in check cultivar Fakhr-e-malakand. However, lines PK3445-3-2 and IR64 produced grain yield closer to check cultivar. Lowest yield components and grain yield were recorded in line japonica. Line japonica was observed as early maturing while two lines Cibogo and PK3445-3-2 were noted as late maturing. Grain yield had positive correlation with yield contributing traits. Cross combination of PK3445-3-2 and IR64 with japonica in a breeding program could results in a high performing variety in future.

REFERENCES

Adebisi, M.A., O.J. Ariyo and O.B. Kehinde. 2001. Variation and Correlation studies in quantitative characteristics in soybean. Proceedings of the 35th Annual conference of the Agricultural Society of Nigeria held at the University of Agriculture, Abeokuta. 16(20): 121 – 125.

Akinwale, M.G., G. Gregorio, F. Nwilene, B.O. Akinyele, S.A. Ogunbayo and A.C. Odiyi. 2011. Heritability and correlation coefficient analysis for yield and its components in rice (*Oryza sativa* L.). Afr. J. Plant Sci. 5(3): 207-212.

Chaudhary, V.S and B. Singh. 1982. Heterosis and genetic variability in relation to genetic diversity in soybean. Ind. J. Genet. 42: 324 – 328.

FAOSTAT. 2013. Available at http:// faostat. Fao.org.

Karim, D., U. Sarkar, M.N.A. Siddique, M.A.K. Miah and M.Z. Hasnat. 2007. Variablity and genetic parameter analysis in aromatic rice. Int. J. Sustain. Crop Prod. 2(5):15.

Kuhsh, G.S. 1997. Origin, dispersal, cultivation and variation of rice. Plant Mol Biol. 35(1-2): 25-34.

Kwon, S.H and J.H. Torrie. 1964. Heritability and interrelationship of traits of two soybean populations. Crop sci. 4: 196-198.

Micke, A., B. Donini and M. Maluszynski. 1990. Induced mutations for crop improvement. Mutation Breeding Review, IAEA, Vienna. 7: 1-16.

Mirza, J.M., A. Faiz and A. Majid. 1992. Correlation Study and Path Analysis of Plant Height, Yield and Yield Component. Sarhad J. Agric: 8(6): 647-651.

Pakistan Bureau of Statistics. 2013-14. Economic Survey of Pakistan, statistical supplement finance division, Economic Advisors Wing,Islamabad.

Poehlman, J.M and D.A. Sleper. 1995. Breeding Field crops. Panima Publishing Corporation. New Delhi, India, app.278.

Prasad, B., A.K. Patwari and P.S. Biswas. 2001. Genetic Variability and selection criteria in fine grain rice (*Oryza sativa* L.). Pak. J. Bio. sci. 4(10): 1188-1190.

Satheeshkumar, P and K. Saravanan. 2012. Genetic variability, correlation and path analysis in rice (*Oryza Sativa* L.). Int. J. Current Res. 4: 82-85.

Savitha, P and U.R. Kumari. 2015. Assessment of genetic variability and correlation studies among traditional land races and improved cultivars for segregating generations of rice (*oryza sativa* L.). Int. J. Sci and nature. 6(2): 135-140.

Shah, R., M.Z. Sulemani, M.S. Baloch and G. Hassan.1999. Performance of coarse rice genotypes in the plains of D.I. Khan, Pakistan. Pak. J. Biol. Sci. 2: 507-509.

Singh, R.K. and B.D. Chaudhary.1985. Biometrical Methods in Quantitative Genetic analysis. Kalyani Publ., Ludhiana, New Delhi.

Steel, R.G.D. and Torrie, J.H. (1980). Principles and Procedures of Statistics. A biometrical approach. 2nd edition. McGraw-Hill, New York, USA. 20-90.

Tahir, M., D. Wadan and A. Zada. 2002. Genetic variability of different plant yield characters in rice. Sarhad J. Agric.18 (2): 207-210.

Zahid A.M., M. Akhtar, M. Sabar, M. Anwar and M.Ahmad. 2005. Interrelation-ship among yield and economic traits in fine grain rice. Proceedings of the International Seminar on Rice Crop. October 2-3. Rice Research Institute, Kala Shah Kau, Pakistan. 21-24