Bangladesh J. Environ. Sci., Vol. 36, 67-70, 2019 **@ BAED ISSN 1561-9206**

VARIABILITY ESTIMATION AND GENETIC PARAMETER ANALYSIS OF INDIGENOUS AROMATIC RICE

N. Sultana[1] and I. Sultana[2]
[1]Dept. Genetics and Plant Breeding, Patuakhali Science and Technology University, Patuakhali
[2]Dept. of Agriculture, Ghior Govt. College, Manikgonj

ABSTRACT

Thirteen indigenous aromatic rice cultivars were studied during July to December 2018 to find out the variability and genetic parameters for grain yield and its component characters. There is significant variation among the genotypes for the tested characters. The high genetic variability was obtained for no. of filled grain per panicle. Phenotypic variances were higher than genotypic variance for the tested characters. The highest genotypic co-efficient of variation was observed for harvest index followed by grain yield, no. of filled grain per panicle, thousand grain weight and no. of plant per hill. High heritability were coupled with high genetic advance in percent of mean in case of thousand grain weight, plant height, no. of filled grain per panicle, panicle length, harvest index and grain yield signifying greater scope for selection for these traits.
Key words: Aromatic rice, indigenous, variability, genetic parameters.

Introduction

Being Rice {Oryza sativa (2n=24)} the staple cereal food of Bangladesh, there is an urgent need to increase and improve the production to satisfy the future demand whereas it is the staple food for one-third of the world's population (Poehlman and Sleper, 1995). Fine and aromatic rice, is a part of the rice family. It is closely related to social and cultural heritage of Bangles and consumed during different festivals, special events such as weddings, entertaining guests etc. Nearly 70% of the land area of the country has been brought under rice cultivation. Out of this 70%, fine rice is cultivated in roughly 10% land (Anonymous, 2000). This lower coverage is primarily due to the emphasis of government policy and research on food grain production but with low input technology. The government is more concerned about the basic staple rice of the country. As a result, very little supports found to be on fine rice. Fine rice is a profitable farming venture for the farmers and a good source of livelihood. The traditional fine rice varieties such as kalijira, kataribhog, badshabogh have higher market demand as well as price. The farmers grow fine rice primarily to take the advantage of higher revenue. Bangladesh should take the challenge to raise income of the farmers through marketing high value crops both at home and abroad, especially for fine rice. Though Bangladesh takes pride in being home to exclusive fine aromatic rice kalijira, it has done precious little to retain this much-valued product. The traditional kalijira varieties with excellent aroma are almost at the verge of extinct from the fields. The government and policymakers should provide appropriate attention for the development of fine rice. The pre-requisite for expansion of rice cultivation doesn't only depend on cultural practices and management; it also depends on the suitability of varieties, which must be drawn from existing germpalsm (Ng *et al.*, 1988). A successful breeding program will depend on the amount of genetic variability for characters present in the population and the extent to which the desirable traits are heritable. But direct selection for yield is often misleading as rice yield is polygenically controlled and influenced by its component characters. Therefore, it is essential to know the genetic parameters of the characters to formulate an efficient breeding scheme as it provide the basis of selection and valuable indication related to selection of parents to be hybridized. The present research was entirely concentrated upon studying genetic variability among the available genotypes and to find out the genetic parameters in the selected genotypes.

Materials and Methods

The experiment was conducted at Agronomy Field Laboratory in Patuakhali Science and Technology University during the period from July to December 2018. Thirteen indigenous cultivar of aromatic rice collected from diverse source were used. They were Kalijira, Sakkorkhana, Chinisakkor, Chinikamini, Khasha, Kataribhog, Thakurbhog, Badshabhog, Rajbhog, Jirabhog, Banaful, keora and Radhunipagal. The experiment was laid out using Randomized Complete Block Design with 3 replications. Single seedling/hill was spaced at 2 5cm x 15 cm. The yield was adjusted at 14% moisture level. Data were recorded on plant height (PH), no. of panicles per hill (NPH), days to maturity (DM), no. of filled grain per panicle (NFP), thousand grain weight (TGW), panicle length (PL), harvest index (HI) and grain yield per hill (GY). Data were analyzed following Singh and Chaudhary 1985.

Results and Discussion

The analysis of variance showed highly significant differences among the rice genotypes for all the characters (Table 1). The variability of the characters was measured by range, phenotypic variance (PV), genotypic variance (GV), phenotypic co-efficient of variation (PCV), genotypic co-efficient of variation (GCV), heritability (H), genetic advance (GA) and Genetic advance in Percent of mean (GAPM).

The values of phenotypic variance and genotypic variance showed considerable variations (Table 2) for most of the characters except for HI, NPH and PL as also has been revealed by the findings of Biswas *et al*. (2000) and Pandey *et al*. (2012). The highest genotypic and phenotypic variance was found for NFP followed by PH, DM and GY indicating greater scope for selection to improve these traits.

Table 1: Analysis of Variance (ANOVA) for yield and yield contributing characters in 13 genotypes of indigenous aromatic rice

Sources of Variation	df	PH (cm)	NPH	DM	NFP	TGW (g)	PL (cm)	HI	GY (g)
Genotype	12	255.24**	7.09**	105.01**	609.13**	59.19**	11.39**	0.21**	48.19**
Replication	2	8.01	2.31	1.48	312.19	1.09	1.08	0.01	0.19
Error	24	3.19	2.59	1.69	150.91	0.87	0.91	0.07	13.59
CV%		14.02	9.91	3.79	18.21	3.97	0.78	5.01	18.72

**$p<0.01$, Legend: PH= Plant height in cm, NPH= No. of panicles per hill, DM= Days to Maturity, NFP= No. of filled grain per Panicle, TGW=Thousand grain weight, PL= Panicle length, HI= Harvest index, GY= Grain yield per hill.

Table 2: Estimates of Genetic Parameters for tested characters

Parameters	PH (cm)	NPH	DM	NFP	TGW	PL (cm)	HI	GY (g)
Mean	119.52	10.03	133.39	58.91	22.17	23.10	0.27	12.71
Range	105.0-142.3	6.5-14.1	110-149	35-88	15.45-30.39	18-27	0.21-0.39	6.50-26.39
Genotypic variance (GV)	86.14	3.23	35.57	253.35	20.02	4.1	0.093	20.59
Phenotypic variance (PV)	89.33	5.82	37.26	404.26	20.89	5.01	0.163	34.18
Genotypic co-efficient of variation (GCV)	7.77	17.91	4.47	27.02	20.18	8.77	113.15	35.70
Phenotypic co-efficient of variation (PCV)	7.91	24.05	4.58	34.13	20.62	9.69	149.68	46.00
Heritability (Hb)	96.42	55.47	95.46	62.67	95.84	81.84	57.14	60.24
Genetic advance (GA)	12.76	1.87	8.16	17.64	6.13	2.56	0.32	4.93
Genetic advance in percent of mean (GAPM)	10.68	18.67	6.12	29.95	27.66	11.10	119.75	38.80

The phenotypic variance was always higher than the genotypic variance for all the characters studied indicating presence of environmental influence on expression for all the characters. But it was much higher in case of NFP and GY indicating more environmental influence for expression of these two characters which implies selection must not be done only upon based on these two characters for the genotypes studied. The results are in harmony with Karim *et al*. (2007) and Iftekharuddaula *et al*. (2001). The GCV and PCV, heritability and Genetic gain partitioned the environmental influence into heritable and non-heritable portion. The PCV were higher than the respective GCV for all the characters indicating presence of environmental influence in all cases. But it was much higher in case of HI, GY, NPH and NFP implying greater influence of environment over these characters. The PCV and GCV were found to be differing very narrowly for PH, DM, TGW and PL denoting variability was due to genotypic differences. These types of results are also reported by Mahantashivayogayya *et al*. (2016) and Gangashetty *et al*. (2012).

The estimates of heritability act as predictive strategy in expressing the reliability of phenotype. Heritability is classified as low (<30%), medium (30-60%) and high (>60%). The characters exhibited medium to high heritability in the present study (ranging from 55.47 to 96.42). Among the characters studied, highest heritability was recorded for PH which was followed by TGW, DM and PL, respectively. High heritability value indicates that these characters are less influenced by environment in their expression. The breeder, therefore, may make selection safely on the basis of phenotypic expression of these characters in the individual plant by adopting simple selection methods. The higher heritability suggested greater effectiveness of selection as the genetic variance is mostly due to additive gene action. Heritability was moderate for NPH, NFP, HI and GY among the characters studied implying selection should not be based upon only heritability estimates. The results are in accordance with Kumar and Santosh, 2015; Sarawgi *et al*. (2015) and Satish, 2013. Heritability in conjunction with genetic advance provides a more reliable index of selection value. According to Panse and Sukhatme (1957), high heritability with high genetic advance is controlled by additive gene action and can be improved through simple and progeny selection methods. In the present study, the character PH, DM, NFP and TGW have exhibited high heritability with high genetic advance signifying selection will be more useful in predicting the effect for selecting the best individual. On the other hand, the high heritability was accompanied by low genetic advance in case of PL, HI and GY indicating the non-additive type of gene action and genotype-environment interaction play a significant role in the expression of the trait. The similar types of results were also reported by Gomathinayagam, *et al*. (1990).

Conclusion

The present investigation is a successful venture to dissect out appropriate genetic parameters based upon of selection, would be effective for further improvement of indigenous aromatic rice breeding program.

References

Anonymous. 2000. Handbook of agricultural statistics. MOA (Ministry of Agriculture), Government of Peoples Republic of Bangladesh.p. 27.

Biswas, P. S., Prasad, B. and Dewan, S. B. A. 2000. Variability, character association and path analysis in rice (*Oryza sativa* L.). *Bangladesh J. Pl. Breed.Genet.,* 13(1): 19-25.

Gangashetty, P., Salimath, P. and Hanamaratti, N. 2012. Genetic variability studies in genetically diverse non-basmati local aromatic genotypes of rice (*Oryza sativa* L.). *Rice Geno. Genet.,* 4(2): 4-8.

Gomathinayagam, P., Nataranjan, S. and Subramanian, M. 1990.Genetic Variability in drought tolerant genotypes in rice.*Oryza*. 27: 328-330.

Iftekharuddaula, K. M., Badshah, M. A., Hassan, M. S., Bashar, M. K. and Akter, K. 2001. Genetic variability, character association and path analysis of yield components in irrigated rice (*Orya sativa* L.). *Bangladesh J. Pl. Breed. Genet*., 14(2): 43-49.

Karim, D., Sarkar, U., Siddique, M. N. A., Miah, M. A. K., and Hasnat, M. Z. 2007. Variability and Genetic Parameter Analysis In Aromatic Rice. *Int. J. Sustain. Crop Prod*., 2(5):15-18.

Kumar, N.C. and Kumar, S. 2015. Genetic divergence for yield and related attributes in aerobic rice (*Oryza sativa* L.)*The Ecoscan*, 9(1&2): 475-480, (Supplement on Rice).

Mahantashivayogayya, K., Mahendrakumar, Lakkundi, B. S., Kuchunur, P. H. and Vishwanath, J. 2016. Genetic variability studies on rice (*Oryza sativa* L.) mutants for yield and yield components in normal and saline stress soil. *Electronic J. Pl. Breed.*, 7(4): 1162-1168.

Ng,N.Q., Chang, T.T. and Vaughan, D. A. 1988. Africa Rice Diversity: Conservation and Prospect for Crop Improvement. *Crop Genet. Res. Afr*., II: 213-227.

Pandey, V. R., Singh, P. K., Verma, O. P. and Pandey, P. 2012. Inter-relationship and path coefficient estimation in rice under salt stress environment. *Indian J. Agric. Res*., 7(4): 169-184.

Panse, V.G and Sukhatme, P.V. 1957. Genetics and quantitative characters in relation to plant breeding. *Indian J. Gene.*, 17: 312-328.

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

Sarawgi A. K., Ojha, G. C., Koshta, N. and Pachauri, A. 2015. Genetic divergence and association study for grain yield in rice (*Oryza sativa* L.) germplasm accessions. *The Ecoscan.* 9(1&2): 217-223, (Supplement on Rice).

Satish, K. R., Chakravarti, S., Singh, H. K, Lal, J. P. and Vishwakarma, M. K. 2013. Study of induced polygenic variability in M1 and chlorophyll mutations in M2 generations in aromatic rice. *Bioscan*. 8(1): 49-53.

Singh, R.K. and Chaudhary, B.D. 1985. Biometrical Methods in Quantitative Genetic Analysis. Revised Edn.kalyani Publishers, Ludhiana, India. P. 318.