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Research Article

Study of Correlation, Heritability and Genetic Advance in Pearl Millet

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Abstract: The present investigation was carried out to explore the genetic diversity of five Pearl millet genotypes: MGP-02, MGP-09, MG-P74, MGP-104 and MGP-117 for grain yield, days to 50% flowering, plat height, number of nodes, panicle length and panicle girth. Grain yield showed positive and significant/highly significant correlation with panicle length panicle girth, number of nodes and plant height indicating that grain yield can be boost up by improving these characters through phenotypic selection. Further, high PCV and GCV for the traits studied also suggested that theses parameters can be genetically improved through phenotypic selection in the subsequent generations. Comparatively higher heritability along with high genetic advance for grain yield, plant height and panicle length pointed out that these agronomic characteristics were controlled by additive genes and hence can be improved by gene pyramiding through visual recurrent selection from advanced generations.

Keywords: Pearl millet, genetic diversity, MGP

INTRODUCTION

Pearl millet is an annual cross pollinated multipurpose cereal crop with protogynous nature of flowering. It is planted as grain or fodder crop across a wide range of environments around the world. It is of much importance in arid and semi arid tropics. It plays prominent role in the integrated agriculture and hence economy of the country particularly in rain fed areas due to its drought hardiness. It is a drought tolerant and fast growing crop (Shakoor, A. *et al.*, 1983). Pearl millet has minimum water requirement and grain yield can be improved under water limited environment. It is cultivated in areas with meager rainfall of 300 to 500 mm where other cereal crops such as maize or sorghum fail to grow (Basava, R. K. *et al.*, 2019). It can thrive under adverse conditions like low rainfall and poor soil fertility. Currently area under Pearl millet crop in Pakistan is 456 thousand hectares with total production of 350 thousand tonnes. Production increased by 3.2%. (Anonymous 2018-19). Its production can be increased through hybridization and utilization of appropriate germplasm having sufficient diversity for quantitative traits.

The basic aim of any crop improvement program is to increase yield potential of concerned crop. Information of genetic variability of a crop is a prerequisite for crop improvement program. In particular the genotypic and phenotypic coefficients of variability are used as tools to assess the genetic variability. Genetic advance can be used to determine the expected actual gain while heritability is used for phenotypic variation in a population (Ogunniyan, D.J., & Olakojo, S.A. 2015). Therefore, this study was conducted to assess the magnitude of genetic variability, heritability and genetic advance for quantitative traits of 20 F_1 hybrids of pearl mill*et al.*,ong with their five parents.

MATERIAL AND METHODS

Five phenotypically diverse pearl millet lines, sown in the Research area of Millets Research Station, Rawalpindi Pakistan during kharif 2017, were crossed in all possible combinations to produce filial generation seed. The resultant 20 F_1 crosses along with five parents were evaluated in complete randomized block design with three replications during kharif 2018. The row to row and plant to plant spacing was kept as 75cm and 25 cm respectively. At maturity five plants from each entry were selected randomly for collection of data on grain yield and yield related characters viz. days to 50 % flowering, plant height, number of nodes per plant, panicle length and panicle girth. The average data was subjected to analysis of variance to test the significance level of variation for all the characters under study (Steel, R.G.D., & Torrie, J.H. 1980). Genetic

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parameters and correlation coefficients were computed according to the methods suggested by (Singh, R.K., & Chaudhary, B.D. 1985). Statistical analysis was done by using software Statistics 8.1.

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among all the F_1 hybrids for all the characters studied, indicating the presence of considerable genetic variation in the experimental material which can be exploited by adopting proper breeding methods (Table-1).

Table -3 revealed that grain yield had positive and significant correlation with plant height (0.3016), panicle length (0.3741) and panicle girth (0.3626) while panicle length and panicle girth showed significant and positive correlation among them. It is suggested that selection should be based on plant height, panicle length, panicle girth and grain yield towards development of dual purpose hybrids/open pollinated varieties in pearl millet (Vidyadhar, B. *et al.*, 2006). So delayed indirect selection can be of worth in advance generations to improve yield.

The present findings are in accordance with (Pareek, S. 2002; Kulkarni, V. M. *et al.*, 2000; & Chaudhry, M. H. *et al.*, 2003), also reported significant and positive correlation of grain yield with panicle length. Negative correlation was observed for days to flowering (-0.1215) with grain yield. It, connote that selection of any one of these characters is likely useful to generate a correlated response over remaining characters.

In present study the estimates of PVC for all the characters except grain yield were higher than GCV (Table -3) which indicated influence of environmental manifestation on these characters. However the difference between PCV and GCV was less for days to flowering indicating low environmental influence and predominance of genetic factors controlling variability in this trait. It has been suggested by (Burton, G. W., & Devane, D. E. 1953) that GCV along with heritability estimates could provide better picture of amount of genetic advance expected by phenotypic selection. The amount of only genetic variation is not of much use without supplemented with the information on heritability estimates which give heritable portion of total variation.

The heritability estimates along with genetic advance is normally more helpful in predicting the gain under selection than heritability estimates alone (Johnson, H.W. *et al.*, 1955). In present study heritability in broad sense was estimated. Highest broad sense heritability was recorded in case of grain yield (125%) and medium heritability was recorded for plant height (65%) and number of nodes per plant (41%). It pointed out that these characters can be improved through direct phenotypic selection in subsequent generations (Sumathi, P. *et al.*, 2013; Kumari, V. N. *et al.*, 2013; & Kumar, R. *et al.*, 2014), had also reported similar results. High value of GCV, high heritability coupled with high genetic advance as percentage of mean for grain yield and most of its related traits investigated recommended higher additive gene action and lower environmental factors in the expression of these traits with possibility for improvement through selection.

Table 1: Mean square values of different parameters of pearl millet in 5x5 diallel crosses

S.O.V	d. f	DTF	Plant height (cm)	No. of nodes	Panicle Length	Panicle girth	Grain yield kg/ha
Replications	2	0.173	31.61	0.33	7.034	0.174	22.80
Genotypes	24	66.10**	406.58**	1.72**	46.68**	2.80**	693.94**
Error	48	1.13	61.40	0.45	3.83	0.61	56.12

*Significant at 5%, ** highly significant at 1%

Table-2. Estimates of phenotypic correlation coefficient in quantitative traits of pearl millet

Characters	DTF	Plant height (cm)	No. of nodes	Panicle Length	Panicle Girth
Plant Height	-0.0174				
No. of nodes	-0.1969	0.0975			
Panicle Length	-0.2020	0.1503	0.2363		
Panicle Girth	-0.3334	0.1767	0.0561	0.3529*	
Grain Yield	-0.1215	0.3016*	0.3174*	0.3741**	0.3626**

*Significant, ** highly significant

Table -3 Genetic parameters for various quantitative characters of 20 F_1 hybrids and five parents of Pearl millet grown at Millets Research Station, Rawalpindi

S. No.	Characters	Mean	Standard error	Critical difference	Genetic variance	Phenotypic variance	GCV%	PCV&	H%	GA 5%
1	**Grain yield**	80.16	6.12	12.84	279.28	223.17	20.74	18.54	125	38.47
2	**Days to flowering**	46.23	0.87	1.82	21.66	83.06	10.07	19.79	26	4.88
3	**Plant height**	264.27	6.40	13.44	115.06	176.46	4.06	5.03	65	17.79
4	**No. of nodes**	7.69	0.55	1.16	0.42	1.03	8.43	13.20	41	0.86
5	**Panicle length**	28.75	1.60	3.36	14.28	70.39	13.13	29.15	20	3.46
6	**Panicle girth**	9.069	0.64	1.34	0.73	56.84	9.40	82.94	1.0	0.16

CONCLUSION

From above discussion it is clear that grain yield can be boost up by improving the characters studied through phenotypic selection. Further, high PCV and GCV for the traits studied also suggested that theses parameters can be genetically improved through phenotypic selection in the subsequent generations. Comparatively higher heritability along with high genetic advance for grain yield, plant height and panicle length pointed out that these agronomic characteristics were controlled by additive genes and hence can be improved by gene pyramiding through visual recurrent selection from advanced generations.

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