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CORRELATION AND HERITABILITY STUDIES IN PEARL MILLET

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ABSTRACT

Genotypic and phenotypic variability, heritability, genetic advance for grain yield and different quantitative characters were conducted in ten genotypes of pearl millet. High heritability coupled with high genetic advance for plant height, grain yield and panicle length revealed the influence of additive gene effect is important in determining these characters. High heritability with low genetic advance for number of tillers per plant, inter nodal length and days to 50% flowering indicated the influence of dominant and epistatic genes for these attributes. Grain yield had positive and significant correlation with number of tillers per plant and panicle length.

Key-words: Pearl millet; genotypic variance; phenotypic variance; heritability; genetic advance; correlation.

INTRODUCTION

Pearl millet is an important crop of arid and semi arid areas where the grain and vegetative products are used for human and animal consumption. It is drought tolerant, short duration and fast growing crop (Shakoor *et al.,* 1983). Due to high tolerance to environmental stress, pearl millet crop can successfully be grown under rain fed conditions and marginal lands where other cereal crops cannot grow. Pearl millet production is low in most of the countries due to lack of high yielding improved varieties. Less effort were made to exploit the genetic potential of pearl millet germplasm for the development of improved varieties. Therefore, precise information pertaining to association of grain yield with other quantitative characters is useful to breeders in selecting genotypes possessing groups of desired traits. Some earlier researchers successfully used correlation and heritability technique for this purpose. Significant and positive correlation coefficient was observed for grain yield with days to flowering, head length and head girth, plant height, flag leaf area and bio mass by Abraham *et al.,* (1989), Harer and Karad (1998), Kulkarni *et al*., (2000) Sukhchain and Sindhu (1992) and Yadav *et. al.,* (2001). Similarly Chaudhry *et al*.,(2003) and Vidyadhar *et al., (*2007)found that grain yield was positively and significantly correlated with days to flowering, plant height, number of leaves per main tiller, leaf area, head length and head girth. A high estimate of broad sense heritability was observed for days to flowering (Abraham *et al.,* (1989) and Kulkarni *et al*., (2000), grain yield and plant height Harer and Karad (1998).The aim of correlation studies is primarily to know the suitability of various characters for indirect selection because selection of any particular trait may bring about undesirable chang*es* in other associated characters (Singh, 1998).

MATERIALS AND METHODS

The present study was under taken at Millets Research Station, Rawalpindi with ten pearl millet genotypes i.e. YBS-95, YBS-85, YBS-94, YBS-98,YBS-83,YBS-93, YBS-70, 18-BY(Check), YBS-92,YBR-5 during kharif 2013. The genotypes were sown in randomized complete block design replicated thrice. Four rows of five meter length of each genotype were planted by keeping inter row and inter plant distances 60cm and 20cm, respectively. The recommended doses of NPK fertilizer was applied at the time of sowing. Standard cultural practices were followed for raising the crop. Birds were controlled by scaring and no disease out break was observed. At maturity, data were recorded on randomly five selected plants per genotype per replication for grain yield (kg/ha), days to flowering, plant height (cm), number of tillers per plant, inter nodal length (cm) ,panicle length (cm) and panicle girth (cm) .

Analysis of variance was performed (Steel and Torrie, 1980) to find out the significant differences among different genotypes. The genotypic and phenotypic coefficients of variation, broad sense heritability, genetic advance and simple correlation were calculated as suggested by Singh and Chaudhary (1985).

RESULTS AND DISCUSSION

Analysis of variance of all genotypes revealed highly significant differences for all the characters under study indicating a considerable range of genetic variability (Table 1). The maximum grain yield was recorded in the genotype YBS-95 while the lowest grain yield was obtained in the genotype YBR-5. Genetic parameters including genotypic and phenotypic variances, genotypic and phenotypic coefficients of variability, heritability and genetic advance were also computed (Table 2). The values of phenotypic coefficient of variability were higher than genotypic coefficient of variability indicating the influence of environment upon the all recorded characters except for internodal length. Similar results have been reported by Abraham *et al.,* (1989), Harer and Karad (1998), Kulkarni *et al*. (2000) and Chaudhry *et al.* (2003). In the present study the estimates of PCV for all the characters except internodal length were higher than GCV which may be due to interaction of genotypes with environment.

Table 1. Mean square values of different quantitative characters in pearl millet.

Source of variation	D.F	Grain Yield	No. of Tillers	Plant Height	Internodal Length	Days to Flowering	Panicle Length	Panicle Girth
Replication	2	39.01	0.23	79.23	20.00	10.03	2.23	2.43
Genotype	9	245.03	6.08	989.19	20.00	28.40	127.41	6.80
Error	18	16.11	0.46	40.42	1.45	1.40	4.12	0.77

Table 2.Genetic parameters for various quantitative characters of 10 genotypes of pearl millet grown at Millets Research Station, Rawalpindi

S.No.	Characters	Mean	Standard Error	Critical Difference	Genetic Variance	Phenotypic variance	GCV%	PCV%	H%	G.A
1	Grain Yield	37.85	3.28	6.88	76.30	92.40	23.55	23.64	83	16.24
2	No. of tillers	4.23	0.55	1.16	1.87	2.33	32.30	36.06	80	2.52
3	Plant Height	223.33	5.19	10.90	316.25	356.67	7.96	8.46	88	34.63
4	Internodal Length	21.23	0.98	2.06	6.19	7.64	11.65	5.09	80	4.61
5	Days to flowering	58.03	0.97	2.03	9.0	10.40	5.09	5.56	87	5.78
6	Panicle Length	33.57	1.66	3.48	41.09	45.21	5.17	20.03	90	12.47
7	Panicle Girth	8.93	0.71	1.50	2.01	2.78	15.88	18.66	72	2.47

GCV = Genotypic Coefficient of Variability, PCV = Phenotypic Coefficient of Variability, H= Heritability and GA= Genetic Advance

Table 3. Estimates of phenotypic correlation coefficients in quantitative traits of pearl millet.

S. No.	Characters	Grain Yield	No. of Tillers	Plant Height	Internodal Length	Days to Flowering	Panicle Length
1	No. of tillers	0.83**	-	-	-	-	-
2	Plant Height	0.11	0.09	-	-	-	-
3	Internodal Length	0.09	0.13	0.88**	-	-	-
4	Days to Flowering	-0.07	0.01	0.62**	0.56**	-	-
5	Panicle Length	0.84**	0.89**	0.07	0.09	-0.11	
6	Panicle Girth	0.32	0.48**	0.24	0.32	0.39*	0.48**

*and ** = Significant at 0.05 and 0.01 percent probability level, respectively.

High estimates of broad sense heritability were observed for all the traits ranging from 72 % for panicle girth to 90 % for panicle length. The genetic advance (5% selection intensity) was highest for plant height (34.63) followed by grain yield (16.24) and panicle length (12.47) which indicated that maximum progress for improvement by selection is possible in these characters. While lowest genetic advance (2.47) was recorded for panicle girth.

Heritability alone is not very useful but heritability estimates along with genetic advance is valuable (Johanson *et al.,* 1955). High heritability coupled with high genetic advance was observed for plant height, grain yield and panicle length which indicated that these are governed by additive gene action and amenable for selection at phenotypic level. These results are in close agreement to that Chaudhry *et al.,* (2003) and Pricop (1998). High heritability estimates accompanied by low genetic advance was observed for number of tillers per plant, inter nodal length and days to 50% flowering indicating the influence of dominant and epistatic genes (non additive) for these characters.

Correlation analysis (Table 3) at phenotypic level showed that grain yield has highly significant and positive correlation with number of tillers per plant (0.83) and panicle length (0.84). Pareek (2002) reported same results. Abraham *et al.,* (1989), Harer and Karad (1998), Kulkarni *et al*. (2000) and Chaudhry *et al.* (2003) also found significant and positive correlation of grain yield with panicle length. Number of tillers per plant showed high positive significant correlation with panicle length (0.89), and panicle girth (0.48). Association of plant height with internodal length (0.88) and days to flowering (0.62) was positive and highly significant. Similarly, positive and highly significant correlation between internodal length and days to flowering was found. Days to flowering was positively and significantly correlated with panicle girth. Panicle length was positive and highly significant correlated with panicle girth. Positive and strong association of number of tillers per plant and panicle length with grain yield revealed importance of these characters in determining yield.

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