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RESEARCH PAPER

Genetic variability for quantitative traits in line x tester crosses of pearl millet

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Abstract : Sixty genotypes comprising of 45 F_1s along with five male sterile lines, nine testers and one standard check hybrid (GHB-744) were evaluated for grain yield and eight component traits, to study genetic variability, heritability and genetic advance in pearl millet at Jamnagar during *Kharif* season of 2011-12. The analysis of variance revealed highly significant differences among the genotypes for all the nine characters studied. The relative magnitude of phenotypic co-efficient of variation (PCV) was slightly higher than corresponding genotypic co-efficient of variation (GCV) for all the characters studied which indicated that these characters had interactions with environment to some extent. The variability analysis revealed that ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant had high magnitude of phenotypic range, genotypic co-efficient of variation, phenotypic co-efficient of variation, heritability and genetic advance expressed as percentage of mean thereby suggesting the importance of additive gene action. Hence, these characters can be improved through simple selection process.

Key Words : Pearl millet, GCV, PCV, Heritability, Genetic advance

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INTRODUCTION

Pearl millet is the fourth most important food grain after rice, wheat and sorghum in India and producing 9.5 m t from an area of 9.3 m ha, with average grain yield 1000 kg/ha (AICPMIP, 2011). The major pearl millet growing states in India are Rajasthan, Maharashtra, Gujarat, Haryana, U.P., Tamil Nadu, Karnataka, A.P. and M.P., with fist five states accounting for more than 90 per cent of pearl millet acreage in the country (AICPMIP, 2011). Crop improvement depends on the magnitude of genetic variability and the extent to which the desirable characters are heritable. To improve yield, information on genetic variability and heritability of these characters is necessary. Grain yield is a complex character being governed by a large number of minor genes with cumulative, duplicate and dominant effect and highly influenced by environment. This necessitates a through knowledge of variability owing to genetic factors, actual genetic variation heritable in the progeny and the genetic advance that can be achieved through selection. Therefore, the present investigation was undertaken to estimates the genetic variability, heritability and genetic advance for grain yield and its eight components in pearl millet during *Kharif* season of 2011-12.

MATERIALS AND METHODS

Five cytoplasmic-genetic male sterile lines (ICMA-98444, JMSA-20081, JMSA-20091, ICMA-65550, ICMA-841)and nine diverse restorer lines (J-2340, J-2405, J-2433, J-2480, J-2482, J-2495, J-2496, J-2507, J-2526) were crossed following line x tester mating design during summer-2011. A set of 60 genotypes comprising of 45 F_1s along with fertile counter parts of five male sterile lines, nine pollinators and one standard check hybrid (GHB-744) were sown on 13th July during rainy season of 2011-12 in a randomized block design replicated thrice at Pearl millet Research Station, Junagadh Agricultural University,

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Jamnagar (Gujarat), India. Each genotype was grown in a single row of 5.0 m length each with inter and intra row spacing of 60 cm x 15 cm. The recommended cultural practices and plant protection measures whenever necessary were adopted for raising the good crop. Observations were recorded on five randomly selected competitive plants for each entry, in each replication for nine characters (Table 1). The analysis of variance was done as suggested by Panse and Sukhatme (1985). The phenotypic and genotypic variances were calculated by utilizing respective mean square value (Johnson *et al*., 1955). The genotypic and phenotypic co-efficient of variations were estimated as per the formula given by Burton and Devane (1953). Heritability and genetic advance was worked out for each character as per the formula suggested by Johnson *et al*. (1955). The range of heritability was categorized as suggested by Robinson *et al*. (1949).

RESULTS AND DISCUSSION

The analysis of variance (Table 1) revealed highly significant differences among the genotypes for all the nine characters studied. The results indicated that vast genetic variability existed among the genotypes for all the characters under study. The similar results were reported by Bhadalia *et al.* (2011). The present study showed wide range of phenotypic variability for threshing index, ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant, indicating thereby the possibility of effective selection for these traits. On the other hand, number of nodes per plant and ear head girth exhibited narrow range of phenotypic variability. The remaining characters showed moderate magnitude of phenotypic variability. The present results corroborate the findings of Bhadalia *et al.* (2011). In the present study, the higher estimates of genotypic variance over environmental variance in all the characters except number of nodes per plant, ear head girth and threshing index revealed that the variation among the genotypes had a genetic basis. The estimates of phenotypic and genotypic variances were high for ear head weight, threshing index, fodder yield per plant and grain yield per plant. The phenotypic and genotypic variances were moderate for harvest index and ear head length; while, they were low for rest of the characters. The results are in close correspondence with findings of Borkhataria *et al.* (2005) and Bhadalia *et al.* (2011).

The relative amount of variation expressed by different traits was judged through estimates of phenotypic and genotypic co-efficient of variation. The characters like ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant exhibited high magnitude of GCV and PCV indicating the presence of wide genetic variability for these traits and chances for improvement in these characters are fairly high. The present results are in confirmation with the findings of Pawar *et al.* (2010) and Bhadalia *et al.* (2011). Ear head girth exhibited low magnitude

Table 1: Analysis of variance showing mean squares, and variability parameters for different traits studied in pearl millet

Sr. No.	Characters	Mean sum of squares			Mean	Phenotypic variability		Pheno typic variance	Geno typic variance	Environmental variance	PCV (%)	GCV (%)	Heritability (h^2) %	Genetic advance	Genetic advance as % of mean
		Replications (2 d.f.)	Genotypes (59 d.f.)	Error (118 d.f.)		Min.	Max.								
1.	Grain yield /plant (g)	75.17*	169.28**	10.56	36.39	19.50	50.70	63.47	52.90	10.56	21.89	19.99	83.40	13.68	37.59
2.	No. of nodes/plant	0.37	2.10**	0.54	6.76	4.60	8.27	1.06	0.52	0.54	15.24	10.66	49.90	1.04	15.36
3.	No. of effective tillers/plant	0.32	2.10**	0.18	4.09	2.53	5.77	0.82	0.64	0.18	22.07	19.56	78.60	1.46	35.72
4.	Ear head girth (cm)	0.02	2.24**	0.64	8.36	9.74	10.43	1.17	0.53	0.64	12.96	8.75	45.50	1.02	12.16
5.	Ear head length (cm)	0.45	27.10**	1.60	19.77	13.65	28.10	10.10	8.50	1.60	16.07	14.74	84.20	5.51	27.86
6.	Ear head weight (g)	13.92	364.59**	11.21	51.23	25.03	73.70	129.01	117.79	11.21	22.17	21.19	91.30	21.36	41.71
7.	Fodder yield/plant (g)	5.02	249.07**	20.72	51.16	34.55	68.00	96.84	76.12	20.72	19.24	17.05	78.60	15.93	31.15
8.	Harvest index (%)	86.47*	70.04**	13.02	35.52	26.06	48.20	32.03	19.01	13.02	15.93	12.27	59.30	6.92	19.48
9.	Threshing index (%)	512.18**	313.11**	93.40	72.19	42.35	115.1	166.64	73.24	93.40	17.88	11.86	44.00	11.69	16.19

*, ** P = 0.05 and P = 0.01 levels, respectively. GCV = Genotypic coefficient of variation; PCV = Phenotypic coefficient of variation

of GCV and PCV, suggesting narrow range of variation. The moderate values of GCV and PCV were observed for rest of the characters. Results also revealed that the relative magnitude of phenotypic co-efficient of variation (PCV) was slightly higher than corresponding genotypic co-efficient of variation (GCV) for all the characters studied which indicated that these characters had interactions with environment to some extent. These results are in conformity with the report of Saraswathi *et al*. (1995), Lakshmana and Guggari (2001), Borkhataria *et al.* (2005), Pawar *et al.* (2010) and Bhadalia *et al.* (2011).

Partitioning of total phenotypic variation into heritable and non-heritable components is very useful because only heritable portion of variation is exploitable through selection. The estimates of heritability (broad sense) ranged from 44.00 to 91.30 per cent. High heritability estimates were recorded for the traits like ear head weight, ear head length, grain yield per plant, number of effective tillers per plant and fodder yield per plant, suggesting thereby the usefulness of selection based on phenotypic observations. The high heritability may be due to additive gene effects hence, these traits are likely to respond to direct selection. Moderate heritability estimates was observed for rest of all the characters. The results achieved in the present study are in akin with Vyas and Skrikant (1986), Hepziba *et al*. (1993), Aryana *et al*. (1996), Borkhataria *et al.* (2005), Pawar *et al.* (2010) and Bhadalia *et al.* (2011). Genotypic coefficient of variability along with heritability estimates provides a better picture for the amount of genetic gain expected to be obtained from phenotypic selection (Burton and Devane, 1953). It was interesting to note that high GCV was accompanied with high heritability estimates for ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant in the present material which further revealed that selection could be more effective for the improvement of these traits.

The estimates of genetic advance ranged from 1.02 (ear head girth) to 21.36 (ear head weight). The estimates of genetic advance did not project the actual genetic gain that has been attained in relation to the *per se* performance which obviously is not uniform in different populations and even in the same population under different environments. Therefore, the expected genetic gain as per cent of mean was computed. The estimate of genetic advance as percentage of mean ranged between 12.16 (ear head girth) to 41.71 (ear head weight). Heritability in coupled with genetic gain was more useful than the heritability values alone in the prediction of the resultant effect for selecting the best individual genotypes (Johnson *et al*., 1955). Genetic gain gives an indication of expected genetic progress for a particular trait under suitable selection pressure. In the present study, the characters like ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant exhibited high heritability coupled with high genetic advance expressed as percentage of mean. This indicated the predominance of additive gene action in governing the traits and their suitability of selection for further improvement among the genotypes studied. These results are in accordance with those of Saraswathi *et al*. (1995), Borkhataria *et al.* (2005) and Bhadalia *et al.* (2011). Moderate heritability estimates with medium to low genetic gain was manifested for number of nodes per plant, ear head length, ear head girth, harvest index and threshing index which might be due to preponderance of non-additive gene effects. Hence, it could be suggested that improvement of these characters might be difficult through simple selection. Thus, in the present study, the characters like ear head weight, number of effective tillers per plant, fodder yield per plant and grain yield per plant had high magnitude of phenotypic range, heritability, PCV, GCV, genetic advance and genetic advance expressed as percentage of mean indicated that selection for these traits could be effective.

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