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Genetic variability, heritability and genetic advance in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

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SUMMARY

A set of 64 genotypes comprising of eight parents and 56 F_1s generated through diallel were studied for genetic variability, heritability and genetic advance of grain yield and its nine components in pearl millet at Jamnagar (Gujarat) during *Kharif* season of 2009-10. The analysis of variance revealed highly significant genotypic differences for all the ten characters studied. The characters, namely, days to 50 % flowering, days to maturity, ear head length, ear head weight, plant height, 1000-grain weight, fodder yield per plant and grain yield per plant were less affected by environment showing close correspondence between genotypic co-efficient of variation and phenotypic co-efficient of variation. It was observed that the characters ear head weight, 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, which revealed role of fixable type of gene effects. Hence, these characters can be improved through simple selection process.

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

Pearl millet [*Pennisetum glaucum* (L.)] is the fourth most food grain crop after rice, wheat and sorghum in India, and grown mainly in Rajasthan, U. P., Maharashtra, Gujarat and Haryana which account for 95 % of the area under this crop. The critical assessment of nature and magnitude of genetic variability, heritability and genetic advance is one of the important prerequisites of plant breeding. The estimates of variability parameters for grain yield and its components in pearl millet could help in planning successful breeding programme. 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 thorough 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 nine components in pearl millet during *Kharif* season of 2009-10.

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MATERIALS AND METHODS

Eight genetically diverse inbreds of pearl millet *viz.,* J-2290, J-2340, J-2405, J-2454, J-2467, J-2480, J-2511 and H-77/833-2 were crossed in all possible combinations to generate a diallel set at the Pearl millet Research Station, Junagadh Agricultural University, Jamnagar (Gujarat) during summer-2009. Eight parents along with their 56 F_1s were evaluated for grain yield and nine yield components in a Randomized Block Design with three replications at Pearl millet Research Station, Junagadh Agricultural University, Jamnagar (Gujarat) during *Kharif*-2009. Each entry was sown in single row of 5.0 m length having 60 x 15 cm crop geometry. All the recommended cultural practices were adopted to raise good crop of pearl millet. Observations were recorded on ten randomly selected competitive plants for each entry, in each replication for 10 characters (Table 1). Days to 50 per cent flowering and days to maturity were noted on the basis of whole plot. Mean values were subjected to standard statistical analysis of variance (Panse and Sukhatme, 1967), genotypic and phenotypic co-efficient of variations (Burton, 1952) and heritability and genetic

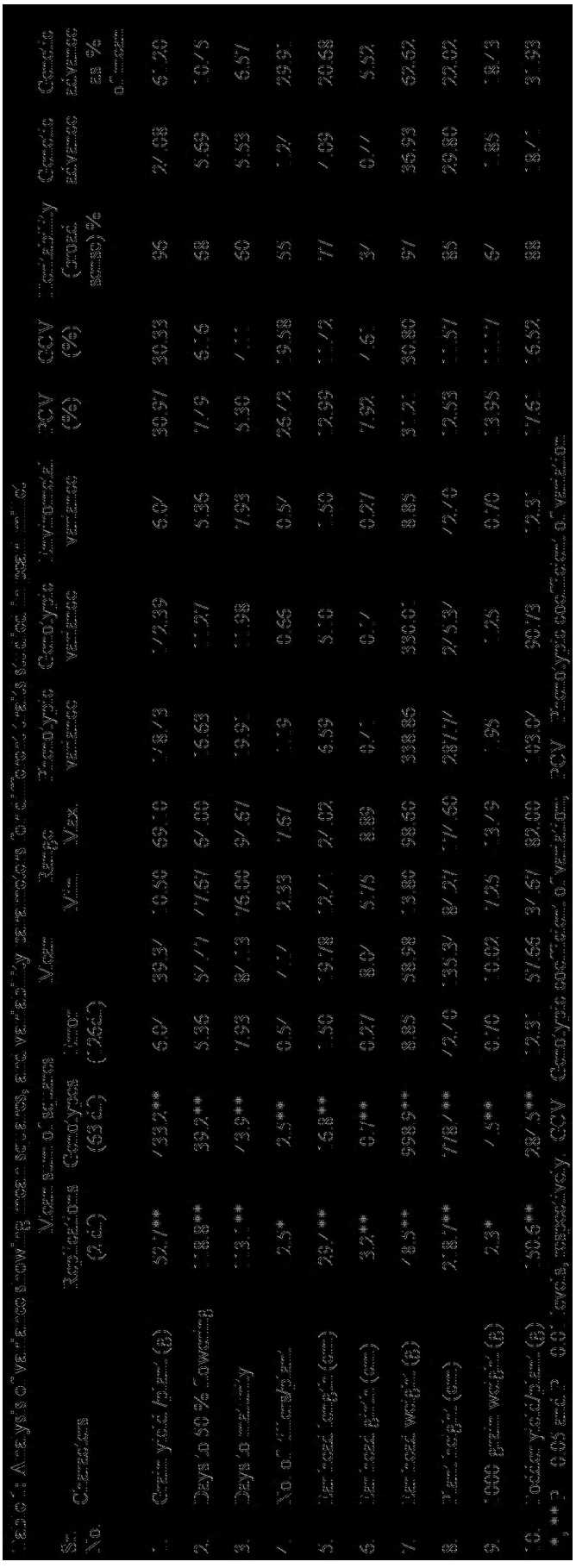
advance (Johnson *et al*., 1955).

RESULTS AND DISCUSSION

The analysis of variance (Table 1) revealed highly significant differences among the genotypes for all the ten characters studied; it indicated that vast genetic variability existed among the genotypes for different characters studied. The range of phenotypic variability was found to be wide phenotypic variation for plant height, ear head weight, fodder yield per plant and grain yield per plant. This indicated that possibility of effective selection for these traits. On the other hand, number of effective tillers per plant, ear head girth and 1000 grain weight exhibited narrow range of phenotypic variability. The remaining characters showed moderate magnitude of phenotypic variability. In the present study, the higher estimates of genotypic variance over environmental variance in all the characters except ear head girth revealed that the variation among the genotypes had a genetic basis. The estimates of phenotypic and genotypic variances were observed high for plant height, ear head weight, fodder yield per plant and grain yield per plant. The phenotypic and genotypic variances were moderate for days to 50 % flowering, days to maturity and ear head length; while, they were low for the remaining characters. Borkhataria *et al*. (2005) also reported high genotypic and phenotypic variances for plant height and grain yield.

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 moderate values of GCV and PCV were observed for plant height, ear head length and 1000 grain weight. The remaining characters showed low magnitude of GCV and PCV under studied. Results also revealed that the estimate of PCV value was slightly higher than their corresponding GCV value for days to 50 % flowering, days to maturity, ear head length, ear head weight, plant height, 1000-grain weight, fodder yield per plant and grain yield per plant, which showed that these traits were less affected by environment. The results are in conformity with the report of Hepziba *et al*. (1993), Saraswathi *et al*. (1995), Lakshmana and Guggari (2001) and Pawar *et al.* (2010).

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 34.00 (ear head girth) to 97.00 per cent (ear head weight). High heritability (broad sense) estimates were recorded for the traits *viz.*, ear head weight, plant height, fodder yield per plant and grain yield per plant thereby suggesting the usefulness of making 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 days to 50 % flowering, days to maturity, number of effective tillers per plant, ear head length and 1000 grain weight. While, ear head girth recorded low heritability. The results in the present study are in agreement with Vyas and Skrikant (1986), Hepziba *et al*. (1993), Aryana *et al*. (1996) and Borkhataria *et al*. (2005). 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, 1952). It was interesting to note that high GCV was accompanied with high heritability estimates for ear head weight, 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 0.44 (ear head girth) to 36.93 (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. Genetic gain gives an indication of expected genetic progress for a particular trait under suitable selection pressure. Therefore, the expected genetic gain as per cent of mean was computed. The highest genetic advance expressed as percentage of mean was observed for ear head weight (62.62) followed by grain yield per plant (61.20), fodder yield per plant (31.93) and number of effective tillers per plant (29.91), thereby indicating their usefulness in selection of breeding programme. Heritability in conjunction 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). The character that exhibited high heritability and genetic advance as per cent of mean indicated the dominance of additive gene action in its inheritance and such characters could be improved by selection. In the present study, the characters *viz.*, ear head weight, fodder yield per plant and grain yield per plant exhibited high heritability coupled with high genetic advance expressed as percentage of mean indicating 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) and Borkhataria *et al.* (2005). High to moderate heritability estimates with medium genetic gain was observed for number of effective tillers per plant, plant height, ear head length and 1000 grain weight indicating the involvement of both additive and non-additive gene action with more influence of environment. Hence, it could be suggested that improvement of these characters might be difficult through selection. Days to 50 % flowering, days to maturity and ear head girth showed low heritability and genetic advance as percentage of mean, which indicated the predominance of non-additive gene action in controlling these traits. Hence, direct selection for these traits is not rewarding. Thus, in the present study, the characters like ear head weight, 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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