SHORT COMMUNICATION

Genetic Variation in Pearl Millet Germplasm

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A study was conducted during 2005, among 105 pearl millet germplasm lines to assess the genetic variability present among the genotypes for different quantitative traits in relation to yield. High phenotypic coefficient of variation and genotypic coefficient of variation was observed high for ear length, ear girth, plant height, grain yield/plant and productive tillers/plant. High estimate of broad sense heritability coupled with high genetic advance as per cent of mean was registered for grain yield/plant, plant height, ear length and ear girth. The genetic variances for these traits are probably indicates better scope for improvement of these traits through direct selection.

Key Words: Genetic advance, Germplasm, Heritability, Phenotypic coefficient variation

Pearl millet is an important staple food crop of millions of people living in harsh environment and predominantly grown in arid and drier semi-arid regions of the world. Genetic reconstruction of a plant type is required for developing high yielding varieties by incorporating and improving yield components characters. Therefore, evaluation of germplasm for genetic variability is essential for present as well as for future crop improvement programmes. Moreover, proper utilization of germplasm requires testing of genetic potential under local conditions under targeted environment for which the breeding programme is aimed. Hence, the present study was taken up during 2005 to assess genetic variability in pearl millet germplasm to identify genetically diverse and agronomically superior genotypes.

The experimental material comprised of 105 diverse pearl millet germplasm lines collected from different geographical regions of India and abroad and were grown during *kharif* season of 2005 in a Randomized Block Design with three replications at Regional Agricultural Research Station, Bijapur, Karnataka. Each germplasm entry was sown in two rows of 4 meter length with a spacing of 50 cm between rows and 15 cm between plants with in the row. The recommended packages of practices were followed to raise the crop. Five plants were taken at random from each replication for all the entries to recorded observations on 12 characters *viz.*, days to 50% flowering, days to maturity, plant height, ear length, ear girth, flag leaf area, peduncle length, ear weight, grain yield/ear, grain yield/plant and 1000-seed weight. The phenotypic and genotypic coefficients of variations were computed as suggested by Burton (1952). Heritability estimates were computed as suggested by Hanson *et al.* (1956) and expected genetic advance as per the formulae given by Johnson *et al.* (1955).

Analysis of variance for 105 pearl millet germplasm lines for 12 quantitative characters revealed that the mean squares were highly significant for all the characters under study, indicating greater diversity among the germplasm lines (Table 1). Some of the genotypes were identified as desirable genotypes like IP-12901, 10085, 9140 and 6460 for early maturing, IP-10945, 10914, 15273, 7440 for ear length, IP-8389, 15899, 9246 and 9140 for more number of productive tillers/plant and genotype IP-13875, 10839, 12768, 5275, 4779, 13875 and IP-18742 for more ear weight/ear. Genotypes like IP-5275, 10839, 14778, 4779, 16690, 13875, 18742, 7468 and IP-7838 were identified as high yielding genotypes. IP-11211, 10839, 16690, 13875, 19388, 18742 and 13154 were recognized as more than 1000-seed weight genotypes (Table 2).

Significant variance due to genotypes and wide range of variability for all the characters were observed among the germplasm, suggesting ample scope for improvement through selection. The phenotypic coefficient of variation (PCV) though was higher than genotypic coefficient of variation (GCV) for all the characters under study (Table 3) but the narrow difference between PCV and

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Table 1. Analysis of variance for 12 quantitative characters in 105 pearl millet germplasm lines

Sources of variation	df	Days to 50% flowering	Days to maturity	Plant height (cm)	Prod. tillers/ plant	Ear girth (cm)	Ear length (cm)	Flag leaf area (cm^2)	Peduncle length (cm)	Ear weight/ ear (g)	Grain yield/ ear (g)	Grain yield/ plant (g)	1000-grain weight (g)
Replication	2	0.37	4.91	51.00	0.14	0.02	3.60	1.96	14.47	25.40	22.06	47.20	1.59
Treatment	104	17.72**	18.55**	464.46**	0.31**	3.47**	41.00**	430.00**	22.15**	8**	65.23**	623.99**	10.01**
Error	208	5.84	4.25	114.68	0.03	0.08	1.34	7.92	1.36	7.23	2.68	16.81	0.17
S.E.(diff.)		1.70	0.79	7.57	0.12	0.20	0.82	1.99	1.99	11.90	1.15	2.89	0.29
C.D. @ 5%		3.36	1.56	14.92	0.24	0.39	1.61	3.92	1.63	3.75	2.28	5.71	0.58
C.D @ 1%		4.44	2.05	19.68	0.32	0.52	2.13	5.17	2.14	4.94	3.01	7.53	0.77

** Significant at 1 % level

GCV indicated that environmental effect was slightly less for most of the characters. High values of GCV and PCV were obtained for the characters like ear length, ear head girth, plant height, grain yield per plant and productive tillers per plant, indicating variation for these characters contributed markedly to the total variability. Further, narrow range of difference between PCV and GCV indicated that any selection pressure operated on these characters may help to realize improvement at early generation (Table 3). High PCV and GCV values were reported in pearl millet by Kunjir and Patil (1986a) for plant height, productive tillers/plant and ear length, Lakshmana *et al.* (2003) for grain yield/plant and Borkhataria *et al.* (2005) for ear girth and grain yield/ plant.

Heritability in conjunction with genetic advance is more effective and reliable in predicting resultant effect of selection and based on which, selection procedures can be evaluated. The results of present study on heritability (%) in broad sense for 12 characters revealed that all traits except days to flowering and days to maturity are highly heritable whereas days to 50% flowering and days to maturity showed moderate heritability. Burton (1952) suggested that genetic variation along with the heritabity estimates would give a better idea about the expected efficiency of selection, characters possessing high GCV along with the high heritability will be evaluated in a selection programme. The results of present study on heritability (%) in broad sense for 12 characters revealed that all traits except days to flowering and days to maturity are highly heritable. Ear length, ear head girth, and plant height, grain yield/plant and productive tillers/plant recorded high estimates of GCV coupled with high heritability. However, the values of genetic advance suggested that real progress could be made only for a few characters such as ear head length, ear head girth and grain yield/plant. Similar observation were reported by earlier workers *viz.*, Berwar *et al.* (2001) for plant height; Solanki *et al.* (2002) and Lakshmana *et al.* (2003) for grain yield per plant. Moderate heritability accompanied with low or medium to low genetic advance for the days to 50% flowering and days to maturity indicated the involvement of non-additive gene action in the expression of these characters and moderate heritability is expressed due to favourable influence of the environment rather than genotypes. These results

Table 2. Potential genotypes identified for most important yield attributing parameters in pearl millet germplasm

Characters	Potential genotypes
Days to maturity (80-85 days)	IP-12901, 10085, 9140, 6460, 10394, 13154, 8429, 9416, 17144, 7449, 13840, 9301, 12091, 6445
Ear length (cm) >5 cm	IP-17028, 15257, 14038, 17979, 17978, 10945, 15710, 11503, 10914, 10839, 15364, 15273, 14497, 16196, 7440, 14644, 15364, 18621, 186251, 16197, 16690, 13875, 17144, 12682, 19246, 18800, 8069
Ear weight/ear (g) 30 g	IP-10394, 10820, 15256, 17493, 10811, 10085, 15681, 15257, 14942, 17690, 8229, 8429, 5275, 15710, 11211, 11503, 10914, 10839, 14778, 4779, 18621, 18625, 16197, 16690, 13875, 12779, 12768, 10339, 19388, 18742, 13154
Grain yield/ear (g) >70 g	IP-5256, 9416, 10811, 15681, 17690, 17978, 5275, 11211, 10914, 10839, 4779, 18625, 16690, 13875, 10339, 18742, 13154
Grain yield/plant (g) 70 g	IP-9140, 9286, 3799, 10394, 10811, 15681, 17978, 5275, 112411, 10839, 14778, 16196, 9301, 4779, 18625, 16690, 13875, 12779, 18742, 18657, 13154, 12901, 4169, 7468, 6545, 6451, 7838
1000-seed weight (g) >12 g	IP-9140, 9286, 15857, 15899, 9149, 15817, 10085, 17753, 8229, 6417, 5275, 14026, 11211, 10839, 9301, 4779, 16690, 13875, 12779, 19388, 18742, 13154, 16449, 13137, 12474, 6545, 4511

Table 3.Mean, range and other variability parameters for 12 quantitative characters in 105 pearl millet germplasm lines

Characters	Range	Mean	Variance		Coefficient of variation		h^2 (bs)	Genetic advance	Genetic advance (as % mean)
			ó² p	ó² g	PCV	GCV			
Days to flowering	44.33	50.32	9.80	3.96	6.22	3.96	40.40	2.60	5.61
Days to maturity	81.67-92.33	86.82	9.01	4.76	3.45	2.51	52.83	3.26	3.75
Plant height (cm)	147.97-206.27	174.98	231.27	116.59	8.69	6.17	50.41	15.79	9.02
Productive tillers/plant	1.47-2.90	2.16	0.12	0.09	16.43	14.27	75.40	0.54	25.00
Ear length (cm)	5.60-11.00	7.75	1.21	1.13	14.21	13.73	93.4	2.10	27.09
Ear girth (cm)	15.67-31.00	23.76	14.69	13.35	16.14	15.38	90.8	7.14	30.08
Flag leaf area (cm^2)	54.97-118.20	81.43	148.62	140.69	14.97	14.57	94.6	23.65	29.04
Peduncle length (cm)	17.33-28.37	21.97	8.29	6.93	13.11	11.98	83.5	4.93	22.43
Ear weight/ear	32.93-72.10	48.80	70.88	63.64	17.25	16.35	89.7	15.49	31.74
Grain yield/ear (g)	17.30-38.47	26.06	23.53	20.84	18.62	17.52	88.5	8.81	33.80
Grain yield/plant (g)	30.70-85.33	60.14	219.20	202.39	24.62	23.66	92.3	28.02	46.59
1000-seed weight (g)	6.37-13.70	9.44	3.45	3.29	19.69	19.18	94.9	3.61	38.24

ó²p-Phenotypic variance ó²g- Genotypic variance GAM-Genetic advance over mean
PCV-Phenotypic coefficient of variation GCV-Genotypic coefficient of variation h^2(bs)-Heritability in broad sense
GA-Genetic advance

were similar to the findings of Navale *et al.* (1991) for days to 50% flowering and Berwal *et al.* (2001) for days to maturity in pearl millet.

Heritability estimates along with genetic advance are more useful than heritability alone in predicting the effectiveness of selection. Further, the heritability estimates coupled with expected genetic advance as per cent of mean indicate the mode of gene action in choosing an appropriate breeding methodology. Some characters like grain yield per ear and 1000-grain weight had high heritability with moderate genetic advance and thus could serve as an index for selection, for high grain yield per plant. These results are in line with findings of Dang *et al.* (1985) and Kunjir *et al.* (1986) who reported high heritability for 1000-grain weight in pearl millet. High estimates of genetic advance as per cent of mean coupled with high estimates of heritability was observed for grain yield/ plant, 1000-seed weight, grain yield/ ear, ear weight and ear length. These characters are likely to provide high selection response, owing to their high transmissibility (Saxena and Singh, 2001). High estimates of genotypic coefficient of variation, heritability and genetic advance as per cent of mean indicate the predominance of additive gene action in controlling these characters and simple directional selection may be effective to improve these characters (Roopa Lavanya, 2006).The study revealed substantial genetic variability in the germplasm collection and a scope for improvement through selection.

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