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Genetic Variability, Heritability and Genetic Advance for Yield and Yield Component traits in Pearl Millet [*Pennisetum glaucum* (L.) R. Br.]

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ABSTRACT

An investigation was carried out to study genetic variability, heritability and genetic advance among 122 genotypes comprised of 99 hybrids with three checks *viz.*, HHB 67 Imp, ICMH 356 and HHB 146-672 and 20 parents of pearl millet for twelve characters based on pooled data of three environments. The results revealed that the difference between PCV and GCV was high for head yield per plant, grain yield per plant, fresh stover yield per plant, dry matter yield per plant and grain harvest index indicating the significant role played by the genotype environment interaction in the phenotypic expression of these traits. High estimates of heritability and genetic advance as per cent of mean were observed for characters plant height, ear length, ear diameter, productive tillers per plant, fresh stover yield per plant and 1000 grain weight indicating that the selection for these traits would be more effective.

Key words: *Genetic Advance, Heritability, Pearl millet, Pooled data, Variability.*

The success of any breeding programme depends upon the quantum of genetic variability present in the population. Wider range of genetic variability helps in selecting desired genotypes. In addition to the genetic variability, knowledge on heritability and genetic advance helps the breeder to employ the suitable breeding strategy. Therefore, it is necessary to have knowledge of genetic variability, heritability and genetic advance present in the available genetic material. Hence, an attempt was made to study genetic variability, heritability and genetic advance present in the material used in the experiment.

MATERIAL AND METHODS

A total of 122 genotypes comprised of 99 hybrids with three checks *viz.*, HHB 67 Imp, ICMH 356 and HHB 146-672 and 20 parents (9 lines +11 testers) were evaluated during *kharif*, 2015 over two locations *viz.,* RP 01B field, ICRISAT, Patancheru and Agricultural Research Station, Vizianagaram, ANGRAU and at one location during *rabi*, 2015 at Agricultural College Farm, Naira, ANGRAU in randomized block design in two replications. The data on days to 50% flowering, productive tillers per plant, head yield, grain yield, fresh stover yield, dry matter yield and 1000-grain weight were recorded on plot basis. The data on remaining quantitative traits *viz*., plant height, ear length and ear diameter were recorded on five randomly selected representative plants in a plot in all the experimental trials at all locations. The planting was done on ridges which were 75 cm apart. Each entry was planted in single row of 2 m length with a spacing 15 cm between plant to plant, at a uniform depth. Standard agronomic management practices were followed throughout the entire growing period as required. The data were subjected to statistical analysis using SAS software and genetic parameters such as phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) as per Burton (1952), heritability in broad sense (h^2_b) and expected genetic advance as percent of mean (GAM) worked out as per Johnson *et al*. (1955) and Hanson (1963).

RESULTS AND DISCUSSION

The pooled analysis of variance for 122 genotypes of pearl millet for twelve quantitative traits are presented in Table 1 and revealed existence of significant differences among the genotypes for all the characters under study. Estimates of variability, heritability and genetic advance as per cent of mean for all the characters studied based on pooled data of three environments are presented in Table 2. All the characters under study showed wide range of values, revealing ample scope for exploitation of the traits through the process of selection. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters indicating the influence of environment on expression of these traits. Highest magnitude of PCV (30.07) and GCV (28.83) were observed for dry matter yield per plant and fresh stover yield per plant, while lowest PCV and GCV (7.57 and 4.13) were recorded by panicle harvest index. These results are in correspondence with the findings of Singh *et al.* (2014b) and Bika and Shekhawat (2015). High PCV and moderate GCV was recorded by productive tillers per plant, head yield per plant and grain yield per plant. Moderate PCV and GCV were observed for plant height, ear length, ear diameter and 1000 grain weight. These results are in correspondence with the findings of Chaudhary *et al*. (2012) for grain yield per plant, Singh *et al*. (2014a), Sharma *et al.* (2018) for productive tillers per plant, Singh *et al*. (2014a) for plant height, Kumar *et al*. (2015) for ear length and 1000 grain weight, Singh *et al*. (2014b), Sharma *et al.* (2018) for ear diameter.

Broad sense heritability estimates ranged from 29.77% (panicle harvest index) to 88.50% (days to 50% flowering). High estimates of heritability were observed for days to 50 % flowering, plant height, ear length, ear diameter, productive tillers per plant, fresh stover yield per plant and 1000 grain weight. These results are in consonance with the findings Kumar *et al*. (2015), Sharma *et al.* (2018) for days to 50% flowering for ear length, productive tillers per plant, Bika and Shekhawat (2015) for plant height, fresh stover yield per plant and Yahaya (2015) and Abdulhakeem *et al.* (2019). Moderate estimates of heritability were recorded by head yield per plant, grain yield per plant, dry matter yield per plant and grain harvest index. Similar results were given by Yahaya (2015) for grain yield per plant. Heritability values coupled with genetic advance would be more reliable than heritability estimates alone for selection of characters. The genetic advance expressed as percent of mean values ranged from 4.63 (panicle harvest index) to 40.07 (fresh stover yield per plant). Except days to 50% flowering, panicle harvest index and grain harvest index, remaining characters showed high estimates of genetic advance. The estimates of heritability and genetic advance as per cent of mean were high for traits *viz*., plant height, ear length, ear diameter, productive tillers per plant, fresh stover yield per plant and 1000 grain weight, which suggested the role of additive gene action in the inheritance of these traits and simple selection may be rewarding for their improvement. These findings were in agreement with Vinodhana *et al*. (2013), Singh *et al*. (2014a), Bika and Shekhawat (2015), Sharma *et al.* (2018) and Abdulhakeem *et al.* (2019) for plant height, ear length and ear diameter, Singh *et al*. (2014b), Kumar *et al*. (2015) for productive tillers per plant and 1000 grain weight. The traits *viz*., head yield per plant and grain yield per plant recorded moderate heritability coupled with high genetic advance indicating the role of both additive and non-additive gene actions in the inheritance of these characters and improvement can be brought about using breeding methods like diallel selective mating or biparental mating followed by selection in advanced generation. These findings were in accordance with that Yahaya *et al*. (2015) for grain yield per plant. High heritability combined with moderate genetic advance as per cent of mean was noticed for days to 50% flowering, while moderate heritability combined with moderate genetic advance as per cent of mean was recorded for grain harvest index. The estimates of heritability and genetic advance as per cent of mean were low for panicle harvest index and moderate for grain harvest index revealing that these traits are governed by non-additive gene action and can be improved by selection and intermating among selected ones in early generation followed by selection. In contrast to these findings, Singh *et al*. (2014a), Kumar *et al*. (2015) reported high heritability coupled with high genetic advance for harvest index. Therefore, it is suggested that selection should be based on plant height, ear length, ear diameter, productive tillers per plant, fresh stover yield per plant and 1000 grain weight towards the development of high yielding and dual purpose pearl millet hybrids.

Table 1. The analysis of variance of various quantitative traits among 122 genotypes (20 parents, 99 hybrids and three checks) based on pooled data of three environments in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

Source of variation	d.f.	TB	PH	EL	ED	Till	HYP	GYP	PHI	FSYP	DMYP	TGWT	GHI
Location	**2**	1387.06**	5020.61**	910.26**	336.38**	26.33**	115.82**	75.01**	2.32	189.45**	195.84**	5.12*	88.18**
Replication (Location)	**3**	6.11	7.18	0.46	1.72	3.60	5.61	4.57	0.23	7.33	13.98	1.83	14.94
Treatments	**121**	30.19**	65.05*	24.42**	24.17**	8.14**	4.88**	4.84**	3.90**	4.46**	3.31**	23.42**	2.32**
Location * Treatments	**242**	4.33**	11.20**	3.66**	3.86**	2.45**	2.42**	2.49**	2.61**	1.69**	1.83**	4.27**	1.60*
Error	**726**	0.86	3.11	2.69	2.07	3.42	2.14	2.11	0.26	1.67	0.02	2.12	2.65

d.f. – degrees of freedom; ** Significant at 1% level

TB – Days to 50% flowering; PH- Plant height (cm); EL- Ear length (cm); ED- Ear diameter (cm); Till- productive tillers per plant; HYP- Head yield per plant (g/plant); GYP- Grain yield per plant (g/plant); PHI- Panicle harvest index; FSYP- Fresh stover yield per plant (g/plant); DMYP- Dry matter yield per plant (g/plant); TGWT- 1000 grain weight (g) and GHI- Grain harvest index.

Table 2. Estimates of variability, heritability and genetic advance as per cent of mean for various quantitative characters based on pooled data of three environments in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

S. No.	Character	Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
		GCV (%)	PCV (%)		
1	Days to 50% flowering	8.62	9.16	88.5	16.67
2	Plant height	14.18	15.16	87.43	27.25
3	Ear length	14.22	15.28	86.63	27.21
4	Ear diameter	11.06	11.9	86.38	21.13
5	Productive tillers per plant	17.28	20.34	72.15	30.17
6	Head yield per plant	15.59	21.18	54.16	23.59
7	Grain yield per plant	16.97	23.38	52.69	25.33
8	Panicle harvest index	4.13	7.57	29.77	4.63
9	Fresh stover yield per plant	23.83	28.69	69	40.7
10	Dry matter yield per plant	23.09	30.07	58.95	36.45
11	1000 grain weight	16.53	18.09	83.53	31.07
12	Grain harvest index	8.18	12.56	42.45	10.96

PCV = Phenotypic coefficient of variation; GCV = Genotypic coefficient of variation

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