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Variability and genetic parameters for agronomic traits in the heterotic gene pools of pearl millet

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Abstract
The present investigation was carried out to analyze the genetic variability parameters such as genotypic coefficient of variation, phenotypic coefficient of variation, heritability, expected genetic advance and genetic advance as percent of mean for ten agronomic traits among ninety heterotic gene pools of pearl millet. Analysis of variance revealed highly significant differences among the genotypes for all the traits. The phenotypic coefficient of variation was higher than the genotypic coefficient of variation. Low, medium and high estimates of broad sense heritability were found in different characters under the study. High heritability coupled with low expected genetic advance as percentage of mean was observed for trait test weight is the evidence that this plant trait was under the control of non-additive genetic effects for inheritance of this trait. Therefore, this trait can utilize for hybrid development in pearl millet.

Keywords: Non-additive gene action, pearl millet, GCV, PCV and heritability

Introduction
Pearl millet (*Pennisetum glaucum* (L) R. Br.) is gaining importance as a climate-resilient and health-promoting nutritious millets crop which belongs to family Poaceae, accounting for approximately half the total worldwide production of millets. It is mainly cultivated in Africa and semi-arid tropics of Asia and is unambiguously tolerant of hot and dry conditions. It is a diploid species with having 14 chromosome complements. It is a highly cross-pollinated crop because of the protogynous (female inflorescence matures before male) nature of its hermaphrodite flowers. It believed that the center of origin of Pearl millet is West Africa particularly from northern–central Sahel region and from there introduced in India (Oumar *et al*. 2008) [13]. Pearl millet is India's fourth important cereal crop after rice, wheat and sorghum which occupied 6.98 million hectare area with productivity being 1154 kg/ha in India (Anonymous 2015-16) and has a good source of protein (5.80-20.90%), fat (4.10-6.40%), carbohydrate (59.80-78.20%) and also has good amount of minerals, particularly phosphorus and iron (2.80%) (Krishnan and Meera 2018) [10]. Use of hybrids in pearl millet has saved a way of great success since the inception of idea using hybrids as commercial varieties, particularly in field-crops (Tripp and Pal 1998). In India started to produce pearl millet hybrids as early as 1951 (Rao *et al*. 1951) [15] and commercialized to farmers in year 1965 using cytoplasmic male sterile line Tift 23A (Yadav and Rai 2013) [20]. The variability in plant population is the first requirement for crop improvement Programme. The amount of variability in the germlasms or hybrids of any crops set the limits of progress that can achieve through selection (Sanadya *et al*. 2018) [16].

Materials and Methods
The experimental material for the present study consisted of 87 hybrids with three checks of pearl millet [*Pennisetum glaucum* (L.) R.Br.] which were obtained from AICRP on Pearl millet, ARS, Bikaner. The experiment materials were grown in RBD with two replications during *Kharif* season 2017-18 with row to row spacing of 60 cm and 15 cm between plants and all the recommended package of practices were followed to raise good and healthy crop stand. Data were recorded on ten agronomic traits *viz.*, days to 50 per cent flowering (DF), days to maturity (DM), plant height (PH), number of effective tillers per plant (NOT), ear head length (EL), ear head diameter (EHD), test weight (TW), harvest index (HI), biological yield per plant (BYP) and Seed yield per plant (SYP). Observations of characters namely DF and DM were recorded on plot basis whether remaining traits were recorded on the five plant basis for

each trait. The data were subjected to analysis of variance adopting standard statistical methods (Panse and Sukhatme, 1985). The PCV and PCV were calculated by using the formula suggested by Burton (1952) [3]. Heritability in broad sense (H_b) was analyzed according to the following formula suggested by Burton and De Vane (1953) [4]. Expected Genetic advance and expected genetic advance as percentage mean was estimated as per the formula suggested by Johnson *et al.* (1955) [9].

Results and Discussion

a) Analysis of Variance (ANOVA)

ANOVA is a statistical tool that has applications to experiments in which want to assess whether there is a difference in a continuous variable between genotypes (Dumitrascu *et al.* 2019) [5]. Analysis of variance revealed significant differences among the hybrids for all the characters indicating presence of good amount of variability in the hybrids of pearl millet. The mean square values for the characters studied presented in Table 1. Replications were non- significant for all the characters indicating good homogeneity among replications (Fisher and Yates, 1963) [6]. A wide range of variability for various traits has been observed earlier by Bhoite *et al*., (2008) [2], Sumathi *et al*., (2010) [18], Govindaraj *et al*., (2011) [7]. The significant variation for these yield and its related traits observed in the base population could be utilized to improve this crop by using simple breeding methods.

Table 1: Analysis of variance for different characters of pearl millet hybrids

Characters	df	DF	DM	PH	NOT	EHL	EHD	TW	HI	BYP	SYP
Replications	1	2.22	0.27	53.36	0.17	2.40	0.01	0.11	0.04	0.20	9.60
Treatments	89	4.15**	18.38**	407.27**	0.21**	7.29**	0.09**	5.47**	73.59*	920.52**	68.32**
Error	89	1.60	2.67	117.05	0.08	2.06	0.01	0.03	19.13	304.90	8.91

DF= days to 50 per cent flowering, DM= days to maturity, PH= plant height, NOT= number of effective tillers per plant, EHL= ear head length, EHD= ear head diameter, TW= test weight, HI= harvest index, BYP= biological yield per plant, SYP= Seed yield per plant

b) Genetic parameters

The phenotypic variation is not a precise criterion for judging the amount of genotypic variation present in population. Therefore, the genetic parameters were worked out in the present study because these give a better picture and amount of genetic variability present for each trait. In present study, the estimates of PCV were slightly higher than GCV. Among all the characters high GCV and PCV were observed for NOT, HI and SYP in comparison to other characters indicating the presence of high amount of genetic variability for these characters. Selection for these characters would be effective. Low GCV and PCV were observed for DF, DM, PH, EHL and EHD. High PCV and GCV for NOT and SYP was reported by Sharma *et al*., (2018) [17].

Heritability indicates the effectiveness with which selection for genotypes can do based on its phenotypic variation. It expresses the extent to which individual phenotypes are determined by their genotypes. Burton (1952) [3] suggested that GCV along with heritability would give a better idea about the efficiency of selection. In the present investigation, the heritability in general was high (>90%) for a character i.e. TW, While moderate heritability was recorded for most of the characters i.e. DM, PH, EHL, HI, EHD, BYP and SYP whereas, low heritability was observed for DF and Not. Kulkarni *et al*. (2000) [11] and Nagar *et al*. (2006) [12] have reported similar estimation of heritability for various characters.

Heritability estimates alone do not provide reliable information about the gene governing the expression of a particular character and this do not provide the information of the amount of genetic progress that would result from the selection of best individuals. So that the heritability estimates along with genetic advance as percentage over mean were more useful than heritability estimates alone in predicting the response to selection. Genetic advance was the highest for BYP whereas; it was moderate for PH and low for remains traits. In the present investigation, high heritability along with low genetic advance was observed for TW. It indicates that the character is governed by non-additive gene action and heterosis breeding may be useful. Govindaraj *et al*. (2011) [7] has reported similar estimation of heritability coupled expected genetic advance as percentage over mean for TW. The genetic parameters were presented character-wise in Table 2.

Table 2: Estimates of variability parameters of different characters of pearl millet hybrids

Characters	DF	DM	PH	NOT	EHL	EHD	TW	HI	BYP	SYP
Mean	46.28	72.58	185.8	1.79	21.8	2.57	9.27	22.22	96.67	20.78
Range	43.00 - 50.00	68.50-80.50	154.0-223.6	1.10-3.00	17.80-27.30	2.01-3.26	6.05-13.65	8.28-32.68	57.08 - 153.83	7.51 - 29.84
GCV (%)	2.43	3.86	6.48	13.82	7.41	8.02	17.78	20.48	18.15	26.23
PCV (%)	3.66	4.47	8.71	21.33	9.91	8.51	17.89	30.64	25.6	29.91
Heritability (%)	44.22	74.68	55.35	41.98	55.93	88.71	98.75	58.74	50.24	76.93
Genetic advance	1.54	4.99	18.46	0.33	2.49	0.4	3.37	8.23	25.61	9.84
Genetic advance as per cent of mean	3.33	6.87	9.93	18.45	11.42	15.56	36.4	37.08	26.5	47.4

DF= days to 50 per cent flowering, DM= days to maturity, PH= plant height, NOT= number of effective tillers per plant, EHL= ear head length, EHD= ear head diameter, TW= test weight, HI= harvest index, BYP= biological yield per plant, SYP= Seed yield per plant

Conclusion

This study revealed that significant differences among the gene pools in this crop for all the characters indicating presence of good amount of variability in the hybrids of pearl millet. BYP and SYP had high estimates of GCV and PCV. These observations indicated that the variability could be exploited for successful isolation of desirable genotypes for the traits concerned. High heritability coupled with low

genetic advance as percentage of mean was observed for trait TW. Hence, this character needs to be given more importance for heterosis breeding programme.

References

1. Anonymous. Area under fodder production in India. MoA & FW, Government of India, 2015-16.
2. Bhoite KD, Pardeshi SR, Mhaske BM, Wagh MP. Genetic variability in pearl millet. Agricultural Science Digest. 2008;28(2):115-117.
3. Burton GW. Quantitative inheritance in pearlmillet (*Pennisetum glaucum*). Agronomy Journal. 1952;43:409-417.
4. Burton GW, De Vane EM. Estimation of heritability in tall fescus (*Festuca arundinacea*) from replicated clonal material. Agronomy Journal. 1953;45:478-481.
5. Dumitrascu B, Darnell G, Ayroles J, Engelhardt BE. Statistical tests for detecting variance effects in quantitative trait studies. Bioinformatics. 2019;35(2):200-210.
6. Fisher RA, Yates F. Statistical Tables for Biological, Agricultural and Medical Research. 6th Ed. Oliver & Boyd, Edinburgh and London. 1963, 146p.
7. Govindaraj M, Selvi B, Rajarathinam S, Sumathi P. Genetic variability and heritability of grain yield components and grain mineral concentration in india's pearl millet (*Pennisetum glaucum* (L) R. Br.) accessions. African Journal of Food, Agriculture, Nutrition and Development. 2011;11(3):4758-4771.
8. Govindaraj M, Selvi B, Kumar I, Sudhir. Genetic diversity studies in indigenous pearl millet [*Pennisetum glauccum* (L.) R. Br.] Accessions based on biometrical and nutritional quality traits. Indian Journal of Plant Genetic Resources. 2011;24(2):186-193.
9. Johnson HW, Robinson HF, Comstock RE. Estimate of genetic and environmental variability in soyabean. Agronomy Journal. 1955;47:314-318.
10. Krishnan R, Meera MS. Pearl millet minerals: effect of processing on bioaccessibility. Journal of Food Science and Technology. 2018;55(9):3362-3372.
11. Kulkarni VM, Navale PA, Harinarayana G. Variability and path analysis in white grain pearl millet. Tropical Agriculture. 2000;77:130-132.
12. Nagar RP, Singh D, Jain RK. Genetic variability in fodder pearl millet. Range management and Agroforestry. 2006;27:55-57.
13. Oumar I, Mariac C, Pham J, Vigouroux V. Phylogeny and origin of pearl millet (*Pennisetum glaucum* (L.) R. Br) as revealed by microsatellite loci. Theoretical and Applied Genetics. 2008;117:489-497.
14. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. ICAR, New Delhi, 1961.
15. Rao PK, Nambiar AK, Madhav Menon P. Maximization of production by cultivation of hybrid strain with special reference to cumbu (pearl millet). Madras Agricultural Journal. 1951;38:95-100.
16. Sanadya SK, Shekhawat SS, Sahoo, Kumar A. Variability and inter-relationships of quantitative traits in sewan grass (*Lasiurus sindicus* Henr.) accessions. International Journal of Chemical Studies. 2018;6(6):1843-1846.
17. Sharma B, Chugh, LK, Sheoran, RK, Singh VK, Sood M. Study on genetic variability, heritability and correlation in pearl millets germplasm. Journal of Pharmacognosy and Phyto chemistry. 2018;7(6):1983-1987.
18. Sumathi P, Madineni S, Veerabadhiran P. Genetic variability for different biometrical traits in pearlmillet genotypes (*Pennisetum glaucum* (L.) R. Br.). Electronic Journal of Plant Breeding. 2010;1(4):437-440.
19. Tripp R, Pal S. Information exchange in commercial seed markets in Rajasthan. ODI Network Paper. 1998;83:1-11.
20. Yadav OP, Rai KN. Genetic improvement of pearl millet in India. Agricultural Research. 2013;2(4):274-292.