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Studies on genetic variability parameters in maintainer lines of pearl millet [*Pennisetum glaucum* (L.) R. Br.]

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Abstract
The present investigation was carried out to estimate magnitude of genetic variability in thirty maintainer lines of pearl millet for ten morphological characters. These maintainer lines were planted in randomized block design with three replications during *Kharif* 2019 at Research Farm, S.K.N. College of Agriculture, SKNAU, Jobner (Rajasthan). Analysis of variance indicated presence of significant genetic variability among the maintainer lines for all ten characters. The estimates of phenotypic coefficient of variation (PCV) exceeded genotypic coefficient of variation (GCV) for each of the ten characters studied indicating influence of environment on character expression, thereby, selection may be misleading seldom. High estimates of heritability coupled with high genetic advance (as per cent of mean) were recorded for days to 50% flowering, plant height, ear head length, ear head girth, 1000-grain weight, biological yield per plant and grain yield per plant.

Keywords: genetic variability, genetic advance, heritability, maintainer line

Introduction
Pearl millet [*Pennisetum glaucum* (L.) R. Br.] Popularly known as bajra is an important coarse grain cereal, most widely grown staple food crop of majority of poor and small land holders in arid and semi-arid tropical regions of Africa and Asia with 200-800 mm annual rainfall, where no other cereal crop can be grown successfully. It is chromosome number 2n=14 belong to the family Poaceae (Graminae) and genus *Pennisetum*. It is believed to have originated in West Africa (Vavilov, 1950) [18]. It is highly cross-pollinated crop with protogynous flowering and wind-borne pollination mechanism, which fulfils the essential biological requirement for hybrid development. In India, pearl millet is the fourth most widely cultivated food crop after rice, wheat and maize. It occupies 7.4 million hectares with an average production of 9.13 million tonnes and the productivity of 1237 kg/ha (Anonymous, 2019). It is consumed as both feed and fodder for livestock. Pearl millet is very rich in calories, proteins (6-15%), fat (5-6%), carbohydrates (60-72%), fibre (1-1.8%) and minerals with less amount of HCN, which makes it highly nutritive and palatable crop in comparison with other crops (Fleck, 1981). The knowledge of nature and magnitude of genetic variance controlling yield and yield components is a prerequisite for improvement of yield in any crop.

Material and Methods
The experiment was laid down in randomized block design (RBD) with three replications during *Kharif*, 2019. Each genotype was planted in a plot of 4.0 m x 1.0 m size accommodating two rows spaced 50 cm apart. The plant to plant spacing of 15 cm was maintained. The observations were recorded on five randomly selected competitive plants from each maintainer line in each replication for all the characters except days to 50% flowering and days to maturity which were recorded on plot basis. Analysis of variance was carried out by using standard statistical methods (Panse and Sukhatme, 1985) [14]. Variability parameters were determined as per methods described by Burton (1952) [6]. Broad sense heritability was estimated as per the formula given by Hanson *et al.* (1956) [10] and the expected genetic advance under selection was estimated as per the formula described by Johnson *et al.* (1955) [11].

Results and Discussion
The analysis of variance revealed that mean sum of square due to genotypes were significant for all the ten characters that indicated presence of adequate genetic variability among the pearl millet maintainer lines and response to selection may be accepted for grain yield per plant and its contributing traits (Table 1). Presence of significant variability for grain yield and its related characters in pearl millet has also been reported by earlier workers Subi and Idris

(2013) [16] and Kumar *et al.* (2014) [13]. The phenotypic coefficient of variation (PCV) exceeded genotypic coefficient of variation (GCV) for each of the ten characters studied during present investigation. It indicated that the apparent variation was not only due to the genotypes but also involved influence of environment and selection for such characters occasionally might be misleading. Moderate to high coefficient of variation in terms of both genotypic and phenotypic values exhibited by grain yield per plant, plant height, biological yield per plant, ear head length, harvest index, 1000 grain weight, ear head girth, effective tillers per plant, days to 50% flowering, thus, selection may be more effective for these characters because the response to selection is directly proportional to the variability present in the experimental material. Low GCV and PCV were observed for days to maturity which indicated that the clear variation among lines was not only due to their genotypes but also involved apparent role of environment and selection might not be effective for this character. Basavaraj *et al.* (2017) [2] have also reported higher estimates of PCV than GCV; and high magnitude of PCV and GCV for traits like panicle weight, stover weight per plot and grain yield per plot, respectively, suggesting the existence of wide range of genetic variability in the germplasm for these traits and thus the scope for improvement of these characters through simple selection would be better. Bika and Shekhawat (2015) [4], Bhasker *et al.* (2017) [3], Sharma *et al.* (2018) [15] and Kumar *et al.* (2020) [12] have reported similar findings in pearl millet, displaying the influence of environment on the expression of different quantitative characters.

In the present study, As per Table 2 all the characters recorded moderate to high magnitude of heritability. High magnitude (>60%) of heritability (broad sense) was observed for biological yield per plant, grain yield per plant, 1000 grain weight, plant height, ear head length and days to 50% flowering; whereas, ear head girth, days to maturity, harvest index and effective tillers per plant exhibited medium magnitude (30-60%) of heritability (broad sense); therefore these characters may respond to direct selection.. The estimates of heritability will help the plant breeder in selection of true breeding maintainer lines during planning of breeding strategies. High genetic advance as percentage of mean (>20%) was recorded for grain yield per plant followed by biological yield per plant, plant height, 1000 grain weight, ear head length, days to 50% flowering and ear head girth; moderate (10-20%) for harvest index and effective tillers per plant; and, low (<10%) for days to maturity in maintainer lines of pearl millet. As most of the characters indicating moderate to high magnitude of genetic advance, it showed that additive genes were controlling them and selection might be rewarding for improvement of such traits.

Relative comparison of heritability along with genetic advance (% of mean) over the characters indicated that characters *viz.*, days to 50% flowering, plant height, ear head length, ear head girth, 1000-grain weight, biological yield per plant and grain yield per plant had high heritability estimates coupled with high genetic advance (% of mean). Similar results were also reported by Chaudhary *et al.* (2003) [7] for grain yield and plant height; Varu *et al.* (2005) [17] for ear head girth, ear head length and plant height; Govindaraj *et al.* (2010) [9] for days to 50% flowering; Bind *et al.* (2015) [5] for grain yield per plant, panicle length and dry matter yield per plant; Sharma *et al.* (2018) [15] for ear head girth; and Kumar *et al.* (2020) [12] for the plant height, panicle length, panicle girth and grain yield per plant, indicated the prevalence of additive gene action in their inheritance and suggested that the phenotypic selection for these characters will be quite effective.

Table 1: ANOVA showing mean sum of squares for grain yield and yield components in maintainer lines (B-lines) of pearlmillet

S. No.	Characters	Source of variation		
		Replication (2)	Treatments (29)	Error (58)
1.	Days to 50% flowering	9.644	119.781**	15.035
2.	Days to maturity	1.011	89.166**	20.069
3.	Plant Height (cm)	54.67	2760.944**	179.524
4.	Effective tillers per plant	0.038	0.110**	0.043
5.	Ear head length (cm)	1.725	40.380**	4.627
6.	Ear head girth (cm)	1.183	5.988**	1.311
7.	1000-grain weight (g)	1.257	11.400**	0.675
8.	Biological yield per plant (g)	9.620	2424.411**	0.675
9.	Harvest index (%)	2.181	112.956**	43.495
10.	Grain yield per plant (g)	1.221	479.682**	25.523

Note: *&**Significant at 5% & 1% level of significance, respectively.
Figures in parenthesis are degrees of freedom.

Table 2: Variability parameters for yield and yield components in maintainer lines of pearl millet

S. No.	Characters	Range	GCV (%)	PCV (%)	Heritability (%)	GA	GA as percentage of Mean
1.	Days to 50% flowering	36.00-57.76	12.84	15.36	69.90	10.18	22.12
2.	Days to maturity	69.33-91.00	6.00	8.21	53.44	7.23	9.04
3.	Plant Height (cm)	54.60-165.93	28.50	31.33	82.74	54.97	53.40
4.	Effective tillers per plant	1.13-1.93	9.86	16.86	34.17	0.18	11.87
5.	Ear head length (cm)	12.63-24.12	18.63	21.95	72.03	6.04	32.57
6.	Ear head girth (cm)	6.10-11.90	13.47	18.28	54.32	1.90	20.45
7.	1000-grain weight (g)	7.40-13.43	19.05	20.77	84.12	3.57	35.99
8.	Biological yield/plant (g)	53.60-161.90	28.69	30.03	91.24	55.06	56.45
9.	Harvest index (%)	23.72-46.97	12.41	21.05	34.74	5.84	15.07
10.	Grain yield per plant (g)	20.77-70.43	32.90	35.56	85.57	23.45	62.69

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