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Genetic Component Analysis for Yield and Morphological Traits in Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) Genotypes

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Abstract. The main objectives of present investigation were to find out the extent of genetic variability, heritability (bs), component of variance and genetic advance for yield and yield related traits of pearl millet, *Pennisetum glaucum* (L.) R. Br. For this purpose twenty five (25) pearl millet (local and exotic) germplasm accessions were evaluated in a Randomized Complete Block Design having three replications at Arid Zone Research Institute, PARC, D.I. Khan, Pakistan during 2013. Highly significant ($P<0.01$) differences were observed for all the traits except days to maturity which was mere significant ($P<0.05$). A substantial amount of genetic variability among the genotypes revealed that accessions under studies belonged to diversified sources indicating the expediency of genotypes for future breeding of millet varieties. The line MS-3 proved its superiority through producing the highest grain yield of 132.70 g/plant. High genotypic (68.06) as well as phenotypic co-efficient of variation (71.50) were recorded for grain yield. Moderate to high heritability was recorded for number of leaves per plant (47.11), leaf area index (46.75), days to heading (69.34) and days to maturity (68.58). A very high heritability (89.54%) was recorded for 1000-grain weight and grain yield. The high heritability amalgamated with high genetic advance (171.04) as percent of mean was recorded for grain yield indicating the least environmental effect and presence of more additive gene effect leading to crop improvement through simple selection.

Keywords: pearl millet, genetic variability, heritability, genetic advance

Introduction

Among various kinds of millet (finger millet, foxtail millet, kodo millet, little millet, pearl millet and proso millet), the pearl millet (*Pennisetum glaucum* (L.) R. Br.) is the most popular one in Pakistan. It is mostly grown in rainfed ecologies across the country. Its stalk is used for fodder while grains are used for poultry feed however, very rarely consumed by people directly. Unlike some African countries for instance, in Ethiopia millet utilization is deep rooted in culture and its grain is used for making a native bread, injera, porridge and genfo (thick portridge) alone or mixed with teff (Eragrostic teft) maize and barley (Kebere *et al*., 2006). In Pakistan millet stalk as well as grain yields are quite low due to lack of improved varieties, drought stress and unimproved production technology. Furthermore, millets are mostly relegated to marginal land making more complications in getting the higher yield. Among all the factors responsible for low yield, the use of local land races is the most important problem to be addressed by the breeders. Old varieties must be replaced by new high yielding pure line varieties.

Germplasm is considered as raw material in many crop breeding programmes. For effective utilization of genetic variability in available germplasm, it is important prerequisite to evaluate and characterise the individual genotype. The progress in any crop improvement programme depends mainly upon the variability existing in the base population (Salini *et al*. 2010). Various genetic parameters like, genetic variability, genotypic co-efficient of variation, phenotypic co-efficient of variation, heritability and genetic advance are the important tools leading to choose the breeding approaches and methodology (either through simple selection or use of heterosis etc.). Shinde *et al*. (2010) suggested that use of broad sense heritability is apt for prediction of selection response to the entire genotypic value transmitted to progeny when selection is advanced through selfing. Johnson (1955) suggested that heritability values alone may not provide clear predictability of selection made. Therefore, heritability values along with estimates of genetic advance would be more reliable than heritability alone. Gupta and Mushonga (1992) studied grain yield and nine morphological traits and reported significant variation for all the traits. Heritability was high for days to flowering whereas low for finger length and 1000 grain weight. John (2006) observed high genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for number of productive

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tillers, number of fingers per ear and total dry matter production. Shanmuganathan *et al*. (2006) studied 104 pearl millet (*P. glaucum* (L.) R.Br.) lines, and recorded maximum variation for all the traits. High heritability coupled with high genetic advance was observed for all characters except days to 50% flowering suggesting that these traits are governed by additive gene action and possibility of improving these characters through selection. Lakshmana *et al*. (2009) reported that the mean sum of squares were highly significant for most of the yield components indicating greater diversity among the 105 millet germplasm lines. Nandini (2010) indicated the need for partition of overall variability into heritable and non-heritable components with the help of appropriate statistical techniques. They noted high broad sense heritability for plant height, total tillers and productive tillers per plant.

Besides high genetic variation in most of the traits, PCV was greater than GCV for most of the characters. High value of heritability coupled with high genetic advance as percent of means were recorded for most of the characters indicating the important role of additive gene action for the expression of these characters (Govindaraj, 2011). Deshmukh *et al*. (1986) proposed that PCV and GCV values roughly more than 20% are regarded as higher and less than 10% considered to be lower and the values between 10% and 20% are medium. Ishaq *et al*. (2013) and Musa *et al*. (2013) estimated higher variation in most of the yield components while studying 15 pearl millet accessions. PCV estimates were higher than GCV estimates for all the studied characters displaying the influence of environmental effect. The characters like days to 50% flowering and days to maturity were under the control of additive genetic effects as they had shown high estimates of heritability and genetic advance.

Singh *et al*. (2013) reported highly significant differences among the specific hybrids of pearl millet and also noted high PCV and GCV for most of the traits. High values of heritability coupled with high genetic advance as percent of mean for some important traits indicate lesser influence of environment on these characters and prevalence of more additive gene action in their inheritance, hence, are amenable for simple selection. High heritability with moderate genetic advance as percent of mean was observed for plant height; main stem diameter and harvest index (Vagadiya *et al*. 2013). Wolie *et al*. (2013) in their studies of 88 finger millet (*Eleusine coracana* (L.) Gaertn.) germplasm noted significant ($P<0.01$) differences among the genotypes tested for yield and yield related agronomic characters. They recorded high GCV and PCV for number of tillers, number of ears, number of fingers per ear, finger length and biomass yield. High heritability coupled with high expected genetic advance as percent of mean was obtained for number of ears per plant, number of finger per ear, finger length and days to heading, biomass yield, 1000 kernel weight, lodging susceptibility and blast severity.

The main objective of the present studies was to work out the extent of genetic variability in various plant traits in millet and to estimate the PCV, GCV, heritability and genetic advance that can be helpful in designing future breeding strategy for yield and other important traits in pearl millet.

Materials and Methods

The experiment was conducted on 25 millet germplasm accessions at Arid Zone Research Institute, PARC, D.I. Khan, Pakistan during 2013. The trial was arranged in a Randomized Complete Block Design (RCBD) replicated three times. Each genotype was maintained in plot size of 4 rows, 50 cm apart, 5 m long (10 m^2) for gross area, while middle two rows were taken into consideration for recording the actual data. All the recommended agronomic practices including seed rate, irrigation, and weeding etc. were carried out uniformly during the crop season. The crop was kept weed free and also protected from insect pests. The data were recorded on various plant traits including days to 50% flowering, plant height, number of leaves/plant, leaf area index, days to maturity, 1000-grain weight and grain yield/plant.

Analysis of variance into its various components was carried out for all traits using computer's software STATISTIX 9.1. The means of all the variables were separated through LSD at 0.05% level of probability to establish the level of significance (Steel and Torrie, 1997). The genetic parameters *viz*. genotypic co-efficient of variation, (GCV), phenotypic co-efficient of variation, (PCV), heritability (h^2) broad sense (bs), genetic advance and genetic advance as percent of means (GAM) at 1% standardized selection differential were calculated as proposed by Singh and Chaudhary (1985); Honson *et al*. (1956); Johnson *et al*. (1955) and Burton (1952), respectively.

Results and Discussion

Days to 50% heading. Analysis of variance revealed highly significant differences among the millet genotypes for days to heading ranging from 57 to 77 days (Table 1). The lines SEL-2 No. 8781 and SL- GP 2013 were found early in heading initiation availing 57 days and remained distinguished to all the lines (Table 2). The lines ACC No. 8781, SEL-3 No. 8283 and SL ACC No. 8784 were also among early heading lines with 58, 59 and 60 days, respectively. All these lines were statistically different from one another and also from rest of the genotypes. The line SEL-1 NO. 8802 took maximum days (77) and was statistically late among all the genotypes. These results are in accordance with the earlier workers including Wolie *et al*. (2013); Subi and Idris (2013); Govindaraj *et al*. (2011); Salini *et al*. (2010); Shanmuganathan *et al*. (2006); Kebere *et al*. (2006); John (2006); Gupta and Mushonga (1992). Wolie *et al*. (2013) also noted significant variation in days to heading in various millet germplasm.

Table 1. Mean squares of various pearl millet genotypes at Arid Zone Research Institute, D.I. Khan

Source of variation	D.F	Days to heading	Plant height (cm)	No. of leaves/plant	Leaf area index	Days to maturity	1000- grain weight	Grain yield/plant (g)
Replications	2	249.64	3782.52	12.75	3700	625.00	1.973	150.06
Genotypes	24	78.93**	2437.75**	3.97**	2578.09**	11.58*	517.08*	3456.1**
Error	48	10.14	112.19	1.081	927.18	1.66	0.64	115.41
CV%		0.57	0.60	10.26	11.93	13.65	5.77	3.45

* = significant at 0.05% level of probability; ** = significant at 0.01% level of probability.

Table 2. Mean performance of various pearl millet genotypes at Arid Zone Research Institute, D.I. Khan

Millet genotypes*	Days to heading	Plant height (cm)	No. of leaves/ plant	Leaf area index	Days to maturity	1000- grain weight (g)	Grain yield/ plant (g)
MS-3	68 E	240 I	9.60 DEF	293.67 ABC	100 BCD	15.67 B	132.70 A
SEL-4 No. 8802	69 D	245 H	9.20 F	284.67 A-E	102 AB	15.67 B	113.30 B
SEL- No. 1 NARC POP- 1	66 F	240 I	10.10 CDEF	235.33 E-J	98 BCDE	12.33 CD	108.80 C
SEL-2 No. 8778	69 D	215.33 M	9.10 F	218.00 HIJ	102 AB	10.00 E	84.40 D
SEL-1 No. 8802	73 B	220 L	9.53 DEF	257.67 B-I	103 A	15.67 B	83.03 D
SEL-1 No. 8778	63 J	218 L	9.23 F	237.00 D-J	97 CDEF	12.00 D	73.90 E
SEL-2 C-47	72 C	240 I	9.50 EF	290.33 ABC	101 ABC	15.33 B	71.80 E
NARC POP-1	73 B	238 I	10.00 CDEF	260.00 A-H	102 AB	12.00 D	54.50 E
SEL- No. 2 NARC POP- 1	65 H	205 O	10.40 B-F	224.33 GHIJ	100 BCD	12.67 CD	48.80 G
SL N-K MILLET	64 I	310.33 A	11.10 A-E	229.00 F-J	96 CDEF	13.33 C	47.80 G
SL No.8783	64 I	300 B	11.93 AB	308.33 A	98 BCDE	16.33 B	46.30 GH
SL- GP 2013	57 N	218 L	7.17 G	296.33 AB	100 BCD	12.67 CD	44.50 H
C-47	63 J	275 D	10.27 B-F	286.33 ABCD	101 ABC	12.33 CD	43.80 H
SL AC No. 8778	63 J	225 L	9.10 F	272.67 A-G	99 BCDE	9.67 E	37.80 I
ACC No. 8781	58 M	230.33 J	9.53 DEF	229.33 F-J	97 CDEF	19.67 A	35.30 IJ
SEL-2 No. 8781	57 N	245 H	10.00 CDEF	249.67 B-J	99 BCDE	12.33 CD	33.80 J
SL ACC No. 8783	65 H	270.33 E	11.60 ABC	202.33 J	100 BCD	16.00 B	25.70 K
GP- 2013 SL	66 G	252 G	11.60 ABC	287.00 ABCD	102 AB	15.67 B	24.20 K
SL ACC No. 8784	60 J	260 F	10.77 A-F	209.67 IJ	99 BCDE	12.67 CD	21.40 L
SEL-3 No. 8283	59 K	295 C	11.23 ABCD	246.33 C-J	101 ABC	1267 CD	20.20 L
NARC SEL-21	64 I	270.33 E	12.17 A	248.33 B-J	99 BCDE	12.67 CD	20.00 L
GP- 2013 SL	63 J	250.33 G	11.60 ABC	276.00 A-F	97 CDEF	16.00 B	19.80 L
SEL-3 No. 8778	73 B	250.33 D	9.23 F	240.33 D-J	100 BCE	15.67 B	18.90 M
SL ACC No.8786	68 E	230.33 J	9.97 CDEF	244.33 C-J	101 ABC	16.00 B	15.50 N
SEL-1 No. 8807	77 A	210.33 N	9.50 EF	252.00 B-J	103 A	12.67 CD	12.50 O

* = the millet genotypes have been arranged in descending order in merit of their grain yield.

Plant height. Plant height in fodder crops is an important trait which is directly proportional to stalk yield. Highly significant variability was observed for plant height in 25 different millet lines. Due to high genotypic diversity, the plant height ranged from 205 to 310.33 cm. The maximum tallest plants were found in lines SL N-K MILLET with the height of 310.33 cm. This line was statistically superior to all the lines used in this study. It was, however, followed by some other statistically divergent lines like, SL No.8783, SEL-3 No. 8283, C-47 and SL ACC No. 8783 with height of 300, 295, 275, and 270 cm, respectively. Similarly, the lines SEL-No. 2 NARC POP-1, SEL-1 No. 8802, SEL-2 No. 8778 and SL- GP 2013 had produced dwarf plant with height of 205, 310.33, 215.33 and 218 cm, respectively. These lines were statistically distinct from one another. The results of Wolie *et al*. (2013); Subi and Idris (2013); Govindaraj *et al*. (2011); Shanmuganathan *et al*. (2006); Kebere *et al*. (2006) and Gupta and Mushonga (1992) and are in conformity with present observations regarding genetic variation in plant height in millet genotypes.

Number of leaves per plant. The number of leaves was found to be significantly different in various millet genotypes. The maximum leaves were counted from NARC SEL-21 (12.17/plant). This value was however statistically uniform to some other lines *viz*; SL No.8783, GP- 2013 SL, SL ACC No. 8783, SEL-3 No. 8283, SL N-K MILLET and SL ACC No. 8784 with 11.93, 11.60, 11.60, 11.60, 11.23, 11.10, and 10.77 leaves/plant, respectively. The least number of leaves/plant were calculated from line SL- GP 2013 with only 7.17 leaves per plant. Rest of the 17 lines remained statistically similar in producing the number of leaves/plant. Musa *et al*. (2013); Ishaq *et al*. (2013); Wolie *et al*. (2013); Lakshmana *et al*. (2009); Shanmuganathan *et al*. (2006) and John (2006) have also shown significant differences in number of leaves and other morphological traits in millet.

Leaf area index. Variation in leaf area index (LAI) was found to be significantly different due to diversified millet genotypes. The highest value was calculated for genotype SL No. 8783 with LAI of 308.33. It was, however, statistically at par with most of other lines namely, SL- GP 2013, MS-3, SEL-2 C-47, GP-2013 SL, C-47, SEL-4 No. 8802, GP-2013 SL-1, SL AC No. 8778 and NARC POP-1 with LAI value of 286.33, 293.67, 290.33, 287, 286.33, 284.67, 276, 272.67 and 260, respectively. The lowest value was shown by lines SL ACC No. 8783 and this line was also statistically at par with rest of the lines except SEL-1 No. 8802 which was statistically similar to other lines showing high value of LAI. These results are in accordance with findings of Subi and Idris (2013); Govindaraj *et al*. (2011); John (2006); Kebere *et al*.(2006); Shanmuganathan *et al*. (2006) and Gupta and Mushonga (1992).

Days to maturity. Days to maturity was significantly affected by various millet lines. The maturity period in present studies ranged from 96 to 103 days. The lines SEL-1 No. 8802 and SEL-1 No. 8807 were found late in maturity each availing 103 days. The lines SEL-1 No. 8807 was also late in days to heading and took maximum period (103 days) than all the genotypes used. The lines SEL-1 No. 8802 and E7 were, however, statistically similar to many other lines namely: SEL-2 No. 8778, SEL-4 No. 8802, NARC POP-1, GP- 2013 SL, C-47, SEL-2 C-47, SEL-3 No. 8283 and SL ACC No.8786 taking 101 to 102 days to maturity. The line SL N-K MILLET was found early as it took 96 days and was statistically at par with many other lines including GP-2013 SL, ACC No. 8781, SEL-1 No. 8778, SL No. 8783, SEL- No. 1 NARC POP-1, SL ACC No. 8784, NARC SEL-21 SEL-2 No. 8781 and SL AC No. 8778 which took less than 100 days to maturity.

It was generally noted that millet genotypes did not follow the same trend in maturity period as behaved in days to heading except line SEL-1 No. 8802 which remained early in both cases. Similar variation in phenology in millet genotypes have also been recorded by Subi and Idris (2013); Govindaraj *et al*. (2011); Salini *et al*. (2010); Kebere *et al*. (2006) and Gupta and Mushonga (1992).

1000 grain weight. Weight of grain plays an important role in final grain yield production. In present investigations, 1000 grain weight was found to be significantly divergent among 25 millet germplasm ranging from 9.67 to 19.67 g. The heaviest seeds with 19.67 g/1000-grains were produced by line ACC No. 8781 and it remained statistically greater than rest of the pearl millet lines used in these studies. Statistically similar and second best lines with value of 16.33, 16, 16, 16, 15.67, 15.67, 15.67, 15.67, 15.67 and 13.33 were SL No.8783, GP- 2013 SL, SL ACC No. 8783, SL ACC No. 8786, SEL-3 No. 8778, SEL-4 No. 8802, SEL-1 No. 8802, MS-3, GP- 2013 SL, SEL-2 C-47 and SL N-K MILLET, respectively. The lines SL AC No. 8778 and SEL-2 No. 8778 remained poor among all with 9.67 and 10 g of 1000- grain weight. Rest of the 11 lines showed lower grain weight (from 12 to 12.67 g) and were statistically uniform with each other. The earlier workers including Subi and Idris (2013); Govindaraj *et al*. (2011); Salini *et al*. (2010); Lakshmana *et al*. (2009); Shanmuganathan *et al*. (2006); Kebere *et al*. (2006) and Gupta and Mushonga (1992) also recorded similar observation regarding grain weight in millet genotypes.

Grain yield. The grain yield, a multigenic trait, is considered as dependent variable as it is the ultimate result of various ongoing morpho-physiological activities of plant. Being quantitative trait, it is highly sensitive to environmental fluctuations. Grain yield may genetically be associated with all the plant traits in either direction (negative or positive). The characters having positive correlation with yield are believed to be yield components. Yield may vary from environment to environment and genotype to genotype depending upon the genetic makeup and its adaptability to given environment. In present studies, the variability in grain yield produced by different millet lines was found to be highly significantly different ranging from 12.50 to 132.70 g/plant. A high range of variability shows that, all millet genotypes belong to diversified genetic background. The highest grain yield was recorded by Line MS-3 (132.70 g) and it proved its superiority and remained statistically different from all the genotypes. It was followed by lines SEL-4 No. 8802 and SEL- No. 1 NARC POP-1 which produced 113.30 and 108.80 g yield/plant. These lines were statistically dissimilar to each other and all the remaining lines. Rest of the lines had produced less than 100 g yield/plant. The lines SEL-1 No. 8807, SL ACC No.8786, SEL-3 No. 8778 and GP-2013 SL remained substandard and produced less than 20 g/plant. The top three lines *viz*; MS-3, SEL-4 No. 8802 and SEL- No. 1 NARC POP-1 may further be utilized in experimentation and breeding programme. The variation in grain yield in different millet germ plasm have also been recorded by Subi and Idris (2013); Wolie *et al*. (2013); Govindaraj *et al*. (2011); Salini *et al*. (2010); John (2006); Shanmuganathan *et al*. (2006); Kebere *et al*. (2006) and Gupta and Mushonga (1992).

Genotypic and phenotypic co-efficient of variation. Genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) ranged from 1.82 (days to maturity) to 68.06 (grain yield) and 2.23 (days to maturity) to 71.50 (grain yield), respectively. Generally, PCV estimates were slightly higher than GCV estimates for all the traits. The PCV and GCV estimates were 7.33 and 8.80 for days to 50% heading, 11.32 and 12.12 for plant height, 8.79 and 14.10 for number of leaves per plant, 5.87 and 8.57 for leaf area index, 1.82 and 2.23 for days to maturity, 16.87 and 17.83 for 1000 grain weight and 68.06 and 71.50 for grain yield, respectively. The GCV and PCV estimates were found to be moderate for all the traits except grain yield suggesting that direct selection on yield basis may facilitate for breeding high yielding millet varieties. Deshmukh *et al*. (1986) proposed that PCV and GCV values roughly more than 20% are regarded as higher and less than 10% are considered to be lower and the values between 10% and 20% are medium. The estimates of GCA alone does not assess the amount of heritable variation; therefore, GCV computed in conjunction with heritability estimates would provide a better indication for selection on phenotypic performance basis (Burton, 1952). The higher PCV estimates than GCV have also been reported by many workers including Subi and Idris (2013); Wolie *et al*. (2013); Govindaraj *et al*. (2011) and Nandini (2010).

Heritability and genetic advance. Low, moderate and high h^2 were observed for various traits studied in present investigation. It was interestingly noted that physiological traits *viz*; number of leaves (47.11%) and leaf area index (46.75%) exhibited low heritability, phonological traits like, days to 50% heading (69.34%) and days to maturity (66.58%) exhibited moderate heritability while yield traits including plant height (87.36%), 1000- grain weight (89.54%) and grain yield (90.61%) have shown higher heritability values (Table 3). The results given in Table 3 further revealed a high variation in genetic advance ranging from 1.78 for number of leaves per plant to 83.86 for grain yield. The characters including number of leaves per plant (1.78), 1000- grain weight (5.85) and days to 50% heading (10.53) exhibited low genetic advance whereas leaf area index showed medium value of genetic advance (27). The highest genetic advance was calculated for plant height (68.70) and grain yield (83.86). Heritability values alone may not provide clear predictability of selection made (Johnson *et al*., 1955). Therefore, heritability values along with estimates of genetic advance would be more reliable than heritability alone (Lakshmana, 2009) and mere estimates of heritability only give the indication about the magnitude of inheritance of quantitative characters while, genetic advance helps in devising the selection procedure to be adopted in

Table 3. Mean, range, GCV, PCV, heritability (h^2) and genetic advance estimates in various pearl millet genotypes at Arid Zone Research Institute, D.I. Khan

Characters	Mean	Range	Variance		Co-efficient of variability		Heritability (b.s.)	Genetic advance*	Genetic advance as % of means
			Geno-typic	Pheno-typic	Geno-typic	Pheno-typic			
Days to heading	65.32	57-77	4.788	5.75	7.33	8.80	69.34	10.53	16.11
Plant height (cm)	245.84	205-310.33	27.84	29.79	11.32	12.12	87.36	68.70	27.94
No. of leaves/plant	10.137	7.17-12.17	0.891	1.43	8.79	14.10	47.11	1.78	17.53
leaf area index	255.17	202.33-308.33	14.966	21.88	5.87	8.57	46.75	27.00	10.58
Days to maturity	99.88	92-108	1.818	2.23	1.82	2.23	66.58	3.92	3.92
1000- grain weight	13.867	9.67-19.67	2.34	2.47	16.87	17.83	89.54	5.85	42.16
Grain yield/plant(g)	49.029	12.50-132.70	33.37	35.06	68.06	71.50	90.61	83.86	171.04

* = at 1% standardized selection deferential.

field crops (Jahnson *et al*., 1957). In present studies, the higher heritability was found associated with high genetic advance for plant height and grain yield suggesting the reliable selection index values. These results are in conformity with those of Nandini (2010) and Shinde *et al*. (2010). Shanmuganathan *et al*. (2006) suggested that use of broad sense heritability is apt for prediction of selection response to the entire genotypic value transmitted to progeny when selection is advanced through selfing. They also reported that characters including plant height, leaf area index, days to maturity, 1000- grain weight and grain yield exhibited very high heritability suggesting that simple selection would be sufficient for these traits for genetic improvement of desirable traits. In present studies, the characters like 1000- grain weight and grain yield besides high heritability, possessed high genetic advance as percent of means (GAM) indicating the influence of additive gene action, suggesting that selection for these traits could be quite effective for improving the grain yield in millet genotypes.

Conclusion

It has been observed that the millet germplasm used in the present studies were highly diversified leading to significant variation in all the characters under investigations. This indicates that millet accessions in hand belong to diversified sources that can be very helpful in breeding millet varieties. The lines including MS-3, SEL-4 No. 8802 and SEL- No. 1 NARC POP-1due to their best performance may be focused for future studies and be involved in breeding programme. Moderate (number of leaves per plant and leaf area index) to high (days to heading and days to maturity) heritability and very high heritability (1000- grain weight and grain yield) further indicated that, these traits were genetically controlled and possessed the higher level of variation among genotypes. The high heritability allied with high genetic advance for plant height and grain yield further indicated that, these characters were least affected by environment and indicated the presence of more additive gene that could contribute effectively for millet germplasm improvement through simple selection.

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