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Genetic variability for morpho-physio traits in parental lines of pearl millet [*Pennisetum glaucum* (L.) R. Br.]

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SUMMARY

In present investigation attempt is being made to study genetic variability at both morpho - physiological level so as to access traits of parental lines of bajra to develop varieties and hybrids suitable for rainfed condition. Morphologically good parental lines should also be equally good in respect of physiological components of yield to achieve better stability/reliability in the performance of hybrid produced by them. If it is so, small fluctuation in morphological expression will not much affect the reliability in performance. Therefore, in addition to the A, B, R lines and inbreds were also subjected to test of variability.

Key words : Genetic variability, Morpho-physiological traits and *Pennisetum glaucum* (L.) R.

Pearl millet [*Pennisetum glaucum* (L.)R. Br.] is one of the most drought tolerant cereal crop grown in arid and semi-arid regions of the world. Crop is utilized as staple food, source of feed, fodder, fuel and for construction of huts in semi-arid and arid regions, where rainfed agriculture is primarily practiced. However, very few attempts have been made to study genetic variability jointly at physiological and morphological level and important physiological attributes such as chlorophyll stability index (CSI), stomata density, leaf area etc. needs to be involved to breed for rainfed condition both by selection and by exploitation of hybrid vigor because bajra is mostly grown in rainfed condition and it frequently suffers from intermittent droughts. Therefore, it becomes necessary to breed for rainfed bajra hybrids/composites having desirable physiological background which is represented by CSI, stomata density, leaf area etc.

MATERIALS AND METHODS

The present experiment was conducted with 35 genotypes including inbreds, maintainers, restorers and male sterile lines of bajra received from AICRP on bajra, Centre Dhule and were sown in randomized block design with three replications at Post Graduate Institute Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Kharif*, 2007. Two rows of 4.5 meter length were grown for each genotype in each replication, at the spacing of 45 x 15 cm.The analysis of variance was done as suggested by Panse and Sukhatme (1985). The phenotypic and genotypic variances were calculated by utilizing respective mean square value (Johnson *et al*., 1955). The genotypic and phenotypic coefficient of variation was calculated by the formula suggested by Burton and Devane (1953). Heritability in broad sense was estimated for each character as per the formula suggested by Hanson *et al.* (1956). Genetic advance was calculated by the formula suggested by Johnson *et al.* (1955).

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RESULTS AND DISCUSSION

Lower CSI indicates stable performance of genotypes under water stress and high temperature. The parental lines *viz*., DHBL-720, DHBL-726, DHBL-731, inbred DHBL-731 having lower CSI coupled with higher grain yield will certainly be useful to develop stress tolerant hybrids. These same lines also possessed low adaxial and abaxial stomata density indicating the possibility of good contribution of this inbred and parental lines to develop composite variety and hybrids for rainfed condition coupled with high level of grain yield. Two parental DHBL-724 and DHBL-731 shown judicious combination of stomata density (both adaxial and abaxial) lower than general mean but yield higher than the general mean. Male sterile counterpart of B line DHBL-724 can be used to develop hybrids with high grain yield and low stomata density. Inbred DHBL-731 can be used to develop composite/ synthetic with high grain yield and low stomata density. Significantly higher harvest index than general mean was noticed in two B-lines *viz*., DHBL-724 and DHBL-728 indicating that their male sterile counterparts will be useful to develop hybrids having higher harvest index. The present results are in confirmation with the finding of Mahajan (1998) and Sagare (2001).Lower leaf area

indicates low surface available for transpiration. Among 35 genotypes, 10 A-lines and 2 R-lines exhibited significantly lower leaf area than general mean. Old concept of having genotypes with higher leaf area to get high rate of photosynthesis may not be always useful. Bichkar (2005) was also to isolated *Rabi* sorghum hybrids with significantly low leaf area still with high grain yield level. On the similar lines, it was observed that only MS line DHBL-718 had such excellent and rare combination of leaf area (1324.66) and grain yield significantly higher (48.98) than mean.

Five A-lines *viz*., DHBL-711, DHBL-712, DHBL-714, DHBL-715 and DHBL-719; 3 B-lines *viz*., DHBL-720, DHBL-722 and DHBL-726; 1 R-line DHBL-702 and 2 inbreds *viz*., DHBL-735 and DHBL-736 had significantly lower number of grains/cm^2 of ear head indicating bold grains. The above A, B and R lines can be used to develop hybrids, so also inbreds can be used for developing composites/synthetics with bold grains. In pearl millet too small grains fetch poor market price. On the basis of eye observation, it is found that, if number of grains per cm^2 exceed 23, the grain size is so small that it would fetch poor market price. The very small grain size of male sterile lines or inbreds can be solved by selecting other components with bold grains so that they will be able to produce bold grains. Inbred DHBL-735 (24.06) had highest number of trichomes/cm^2 followed by inbred DHBL-730 (23.40), B-line DHBL-723 (19.56) and A-line DHBL-718 (14.76). Three A-lines, six B-lines, one R-line and 5 inbreds showed significantly more number of trichomes/cm^2 than general mean. Many workers in cotton indicated that higher trichome density in cotton is related to the tolerance against large number of insect pests having different types of feeding habit and life cycle. Trichomes were absent in A-line *viz*., DHBL-709, DHBL-711, DHBL-712, DHBL-714, DHBL-715, DHBL-716 and DHBL-717; B-lines *viz*., DHBL-722, DHBL-725, DHBL-726; R-lines *viz*., DHBL-702, DHBL-704, DHBL-705, DHBL-706 and inbreds *viz*., DHBL-736, DHBL-737, DHBL-739 and DHBL-740. It is interesting to note that none of these genotypes were superior in respect of drought tolerance trait like CSI and adaxial/ abaxial stomata density. Therefore, it appears that trichome density may also serve as indicator of the superiority in respect of other characters related to drought tolerance.

The high magnitude of PCV and GCV was recorded in most of the traits studied suggesting presence of good variability for these traits. GCV and PCV estimates were of lowest magnitude for harvest index suggesting narrow range of variation for these characters. High heritability (bs) was recorded for all the characters under study. High genetic advance was recorded for all the characters under study except CSI, harvest index and number of productive tillers/plant. High heritability with medium genetic advance was observed for characters like number of grains/cm^2 of earhead, stomata density (both adaxial and abaxial) and CSI.

Harvest index had low heritability with low genetic advance, because both PCV (3.61 %) and heritability

Table 2 : Components of genetic variation in 35 genotypes of pearl millet for various characters

Characters	Mean	Range	Genotypic variance	Phenotypic variance	PCV (%)	GCV (%)	h^2 (%)	GA	GA % of mean
Chlorophyll stability index CSI (nm)	0.2488	0.219-0.307	0.000567	0.000598	9.8310	9.577	94.91	0.047	19.22
Trichome density (No./mm^2)	5.307	0.0-24.06	49.65	49.70	132.82	132.76	99.91	14.51	273.38
Adaxial stomata density (No./mm^2)	81.27	69.36-94.43	28.86	31.77	6.93	6.61	90.82	10.54	12.97
Abaxial stomata density (No./mm^2)	92.96	81.5-107.83	43.47	47.12	7.38	7.09	92.25	13.04	14.03
Harvest index (%)	27.36	24.53-29.82	0.6050	0.9860	3.62	2.84	61.36	1.25	4.58
Leaf area (cm^2/plant)	1491.32	758.33-2236.0	99518.88	101206.65	21.33	21.15	98.33	644.41	43.21
Earhead length (cm)	18.98	11.25-28.91	15.69	18.18	22.81	21.20	86.35	7.58	40.58
No. of productive tillers/plant	2.32	1.8-5.0	0.5873	0.6475	34.58	32.92	90.71	1.50	64.42
No. of grains/cm^2 of earhead	22.97	16.33-29.1	9.13	9.63	13.51	13.15	94.78	6.06	26.35
Grain yield (g/plant)	45.45	28.9-68.63	56.57	63.64	17.55	16.54	88.90	14.60	32.14

(Note: Due to absence of trichomes in 19 genotypes, GCV, PCV and GA per cent of mean showed over estimated)

(61.36 %) were of low magnitude in this trait. The arithmetic mean for trichomes was closer to zero due to its total absence in 18 genotypes causing non-normal distribution. Therefore, GCV (132.76 %), PCV (132.82 %) and genetic advance (273 % of mean) showed overestimated values as expected.

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