➔DOI : 10.15740/HAS/AJBS/10.2/143-147
e ISSN-0976-8343 | ■ Visit us : *www.researchjournal.co.in*
ASIAN JOURNAL OF BIO SCIENCE
Volume **10** | Issue 2 | October, 2015 | 143-147

RESEARCH **P**APER

Inter-characters associations in pearl millet (*Pennisetum glaucum* L.R.Br.) germplasm in hot-arid climate

OM VIR SINGH AND A.K. SINGH

National Bureau of Plant Genetic Resources, Regional Station, CAZRI Campus, JODHPUR (RAJASTHAN) INDIA

Article Info : Received : 06.07.2015; Revised : 23.08.2015; Accepted : 09.09.2015

The forty six accessions of pearl millet germplasm collected from different places were studied during *Kharif* 2012 and 2013 in a Randomized Complete Block Design in the hot arid climate of Rajasthan. The study was conducted to assess the magnitude of presence of genetic variability and inter-characters associations of the characters namely, number of tillers per plant, plant height (cm), panicle length (cm), panicle diameter (cm), number of leaves per plant, days to 50 per cent flowering and test weight (cm). The result showed that genetic variability was present among the accessions for all studied characters. The estimated PCV (%) and GCV (%) were moderate to high for all characters. The broad sense heritability (%) and genetic advance (% of mean) estimates were moderate to high for all studied characters. The number of tillers per plant, plant height (cm), panicle length (cm), panicle diameter (cm), number of leaves per plant, days to 50 per cent flowering and test weight (cm) had positive and significant genotypic, phenotypic and environmental correlation co-efficients with grain yield per plant. The presence of genetic variability, high heritability and genetic advance and association with grain yield of all studied characters amenable them for selection and enhancement of grain yield.

Key words : Pearl millet, Germplasm, Correlation, Variability, Hot-arid

How to cite this paper : Singh, Om Vir and Singh, A.K. (2015). Inter-characters associations in pearl millet (*Pennisetum glaucum* L.R.Br.) germplasm in hot-arid climate. *Asian J. Bio. Sci.*, **10** (2) : 143-147.

INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.R.Br.), the world's hardiest crop, is an important food and fodder crop in Africa and Asia and forage in America. India is the largest' producer of pearl millet in Asia, both in terms of area (about 8.1 million ha) and production (9.6 million tons) with an average productivity of 1186 kg/ha (Yadav, 2015). Its grain is a staple food of people living in arid regions of India and also has a high feed value for livestock, poultry and fish (Yadav, 2015). The low grain yield of pearl millet invites attention for systematic and concerted efforts to develop cultivars having high yield potential. The pearl millet germplasm is the store house of useful genes and it has been used in breeding programme worldwide (Andrews and Anand Kumar, 1996). Any germplasm collection is of little value in crop improvement until it is characterized and evaluated. Germplasm are obviously rich sources of resistance genes of biotic and abiotic stresses (Yadav and Weltzein, 2000) as well as traits for improving grain and fodder quality (Kelley *et al.*, 1996). The ultimate aim of plant breeding programme is the improvement of productivity of grains as measured in terms of the yield per unit area. The grain yield character in all crop plant and as in the pearl millet is governed by polygenes under the influence of macro and micro- environmental conditions of crop plant growing location.Thus, selection for yield in crop plants including pearl millet is usually not very effective. However, selection based on yield component characters could be more effective and efficient. Therefore, generating

information on association of yield with yield contributing characters and inter-characters associations among yield contributing characters themselves can improve the efficiency of selection in plant breeding (Izge *et al*., 2006). This study was conducted to assess the magnitude of presence of genetic variability and to estimate the correlation co-efficients among the yield and yield contributing characters in pearl millet accessions of germplasm. The outcome of experiment will help us to determine criteria for selection that could be effectively used to develop the desirable genotype(s) with high yield potential.

RESEARCH METHODOLOGY

The research materials, comprised of 46 accessions of pearl millet germplasm collected from different places was planted in a Randomized Complete Block Design with three replications at research farm of National Bureau of Plant Genetic Resources, Regional Station, Jodhpur during *Kharif* 2012 and *Kharif* 2013. Each plot consisted of 4 rows of 3 meter length at 45 cm spacing. The plant to plant distance within the row was kept 15 cm. All standard recommended packages of practices were followed to raise good experiments. The observations were recorded on five randomly taken plants per replication. The data were recorded on days to 50 per cent flowering, plant height (cm.), number of tillers per plant, number of leaves per plant, panicle length (cm), panicle diameter (cm.), test weight (g), and grain yield per plant (g). Phenotypic, and genotypic co-efficient of variation were calculated as per formula suggested by Burton (1952) Heritability (broad sense) estimates were made as per Hanson *et al*. (1956). The expected genetic advance was estimated by the formula suggested by Johnson *et al*. (1955). Phenotypic, genotypic and environmental correlation co-efficients were computed using the formula suggested by Al-Jibouri *et al*. (1958).

RESEARCH FINDINGS AND ANALYSIS

Analysis of variance was performed (Steel and Torrie, 1980) that showed mean square due to genotypes was significant for all studied characters in both years indicating that considerable amount of genetic variation existed among the accessions (Brunken, 1977). Large range in the value of characters was observed in both years (Table 1). This observed wide range of variation (Wilson *et al*., 1990 and Ovendeba *et al*., 1995) for recorded characters would offer scope of selection for for improvement of characters and development of desired genotypes (Govindaraj *et al*., 2009). The observed significant difference may be attributed to the composition of the evaluated germplasm of different accessionswhich were collected from different places.In general phenotypic coefficient of variation (PCV %) was higher than genotypic coefficient of variation (GCV %) for all the characters indicating the influence of environment on the expression of characters. The higher co-efficient of variations is indicative of the possibilities of improving these characters through phenotypic selection.

Heritability estimates for studied characters were moderate to high being range from 26.81 (grain yield per plant) to 62.14 (plant height). The characters like plant height and number of leaves per plant showed high heritability with high genetic advance that indicates the predominance of additive type of gene action for these characters (Vidyadhar *et al*., 2006). Such type of characters can be improved through simple phenotypic selection. However, most of the studied characters exhibited moderate heritability and moderate genetic advance in such type of situations also characters can be improved through simple selection since these characters are also being controlled by additive gene effects (Vidyadhar *et al*., 2006). However, Kempanna (1975) reported lower values of heritability for tillers per plant and grain yield.

Yield is a complex characters and its expression depends upon its contributing characters. Therefore, a study on correlation of yield with its contributing characters and among yield contributing characters themselves will be useful in designing the plant ideotype.Selection on the basis of grain yield character alone is not usually very effective and efficient. However, selection based on yield component characters could be more efficient and reliable. In both years grain yield per plant was significantly and positively correlated (Table 2) with number of tillers per plant, panicle length, panicle diameter, number of leaves per plant, days to 50 per cent flowering in both years at genotypic, phenotypic and environmental levels (Tolok *et al*., 1998; Balakrishnan and Das, 1995; Singh, 1995). However, test weight exhibited positive and significant phenotypic and genotypic associations with seed yield in 2013 only. Plant height at genotypic and phenotypic levels was also positively associated with grain

Table 1 : Estimates of variability parameters for different characters in pearl millet

Traits	Year	Range	Mean ± SE	PCV (%)	GCV (%)	Heritability (%)	GA(% of mean)
No. of tillers/plant	2012	1.20 -14.80	5.86±0.41	56.86	55.35	46.41	52.54
	2013	1.40 - 15.20	5.40±0.29	61.45	60.82	36.74	48.65
Plant Height (cm)	2012	81.40 - 294.10	139.96±6.25	47.03	46.11	58.05	62.17
	2013	78.60 - 288.40	146.25±5.86	51.90	51.34	62.14	63.25
Panicle length (cm)	2012	12.58-48.26	26.43±0.98	39.28	38.47	32.24	29.66
	2013	13.46 – 46.52	26.86±1.08	51.85	51.04	33.85	45.48
Panicle diameter	2012	1.86-9.56	2.21±0.19	26.37	25.62	40.55	46.96
(cm.)	2013	2.45 – 10.21	2.15±0.24	42.91	42.54	39.15	42.47
Number of	2012	8.60 - 39.40	18.65±0.57	24.76	24.08	50.32	59.04
leaves/plant	2013	6.20 – 40.00	21.36±0.57	35.80	35.20	51.48	48.36
Test weight (g)	2012	4.34 - 13.72	8.49±0.16	40.29	39.15	41.77	42.29
	2013	3.98 – 14.56	9.23±0.13	26.58	26.22	41.08	40.48
Days to 50%	2012	39 - 110	60.50±0.84	38.14	37.42	57.16	60.80
flowering	2013	40 - 106	64.50±0.84	30.88	30.10	50.35	52.75
Grain yield/plant (g)	2012	4.58 - 494.11	129.47±4.22	78.55	77.96	29.99	36.35
	2013	3.26 - 426.85	136.19±4.87	67.24	66.81	26.81	31.08

Table 2 : Phenotypic, genotypic and environmental correlation co-efficients among eight characters of pearl millet in 2012(diagonal) and 2013 (below diagonal)

	Correlation	No. of tillers/ plant	Plant height (cm)	Panicle length (cm)	Panicle diameter (cm)	No. of leaves/ plant	Days to 50 flowering	Test weight (g)	Grain yield/ plant (g)
No. of	P	**	-0.045	-0.337*	-0.215	0.508*	-0.142	0.196	0.404*
Tillers/plant	G		-0.028	-0.482*	-0.194	0.683*	-0.058	0.387*	0.560*
	E		0.308	-0.263	0.189	0.396*	0.241	-0.124	0.324*
Plant	P	0.245	**	0.333*	0.118	0.222	0.241	-0.114	0.547*
height(cm)	G	0.261		0.427*	0.248	0.286	0.295	-0.086	0.353*
	E	0.284		0.229	-0.217	0.210	0.114	-0.219	0.333*
Panicle	P	-0.219	0.409*	**	0.087	0.196	0.085	-0.057	0.348*
length (cm.)	G	-0.201	0.617*		0.143	0.257	0.124	-0.032	0.364*
	E	0.275	0.540*		-0.004	-0.148	0.265	-0.152	0.338*
Panicle	P	0.192	0.101	-0.358*	**	0.482*	-0.212	0.213	0.411*
diameter	G	0.247	0.262	-0.336*		0.553*	-0.186	0.224	0.451*
(cm.)	E	-0.005	0.007	0.288		0.467*	0.007	0.308	0.427*
No. Leaves/	P	0.384*	0.394*	-0.221	0.229	**	0.101	-0.209	0.214
plant	G	0.501*	0.527*	-0.047	0.270		0.109	-0.142	0.358*
	E	0.318*	0.358*	-0.111	0.251		0.200	-0.265	0.245
Days to	P	-0.105	0.227	0.127	-0.140	0.206	**	0.314*	0.314*
50%	G	-0.014	0.247	0.154	-0.151	0.215		0.371*	0.318*
flowering	E	0.135	0.104	0.158	0.142	0.187		0.361*	0.325*
Test weight	P	0.081	0.029	-0.261	0.419*	0.271	0.258	**	0.237
(g)	G	0.147	0.107	-0.092	0.599*	0.275	0.317*		0.233
	E	-0.284	0.006	-0.007	0.483*	0.269	0.427*		0.214
Grain	P	0.328*	0.241	0.635*	0.328*	0.398*	0.586*	0.315*	***
yield/plant	G	0.588*	0.267	0.780*	0.341*	0.480*	0.664*	0.341*	
(g)	E	0.222	0.455*	0.554*	0.303*	0.444*	0.428*	0.252	

yield in the year 2012 and in 2013 it was insignificantly associated with seed yield. Thus, selecting for increased number of tillers per plant, high plant height, long panicle, increased panicle diameter, higher number of leaves per plant, increased number of days to 50 per cent flowering and increased test weight shall result in higher yield (Chaudhry *et al*., 2003; Harer and Karad, 1998 and Kulkarni *et al*., 2000). Number of tillers per plant had positive and significant correlation with number of leaves per plant at genotypic, phenotypic and environmental levels in both years. However, number of tillers per plant exhibited positive and significant association at genotypic level with test weight in 2012 only. The negative association at genotypic and phenotypic level of number of tillers per plant was estimated with panicle length in the year 2012 only. Plant height had positive and significant association with panicle length at genotypic and phenotypic levels in both years however, it had positive and significant correlation with number of leaves perplant at genotypic, phenotypic and environmental levels in 2012 only.The panicle length exhibited significant negative genotypic and phenotypic association with panicle diameter in 2013. Panicle diameter showed positive and significant correlation with number of leaves per plant in 2012 and test weight in 2013. Days to 50 per cent flowering had positive and significant association with test weight in 2012 at genotypic, phenotypic and environmental levels however, in 2013, it exhibited positive correlation with test weight at genotypic and environment level only. The difference between the two years in estimates of the association between two characters could be attributed to the fact that estimates of genetic correlation are affected by the environmental factors and sampling errors, so they are seldom very precise (Falconer, 1980). In some cases the difference in the sign of genotypic and phenotypic correlations between two characters was also observed, this could be due to, as stated by Falconer (1980), the fact that genetic and environmental sources of variation affect these characters through different physiological mechanism.

Thus, the evaluated accessions of pearlmillet germplasm had exhibited good genetic variability that is amenable to the improvement of pearl millet yield by using trait specific accessions in breeding programme. The inter-characters associations study revealed that improving the characters through selection like number of tillers per plant, plant height, panicle length, panicle width, number of leaves per plant, days to 50 per cent flowering and test weight will enhance the grain yield in pearl millet.

LITERATURE CITED

Al-Jibouri, H.A, Miller, P.A. and Robinson, H.F. (1958). Genetic and environmental variances and covariances in upland cotton cross of inter-specific origin. *Agron. J.*, 50(**10**) : 633-637.

Andrews, D.J. and Anand Kumar, K. (1996). Use of the West African pearl millet landrace Iniadi in cultivar development. *Plant Genetic Resources Newsletter,* **105** : 15–22.

Balakrishnan, A. and Das, I.D.V. (1995). Character association in pearl millet. *Madras Agric. J.*, **82**(1), 59-60.

Brunken J.N. (1977). A systematic study *of Penizisetum* sect. *Pennisetum* (Gramineae). *Am J. Bot.,* **64**(2): 161 - 176

Burton, G.W. (1952). Quantitative inheritance in grasses. Proceedings of 6th International Grassland Congress, **1**, 277-283.

Chaudhry, M.H., Subhani, G.M., Shaheen, M.S., Saleem, U. (2003).Correlation and path analysis in pearl Millet (*Pennisetum americanum* L.). *Pakistan J. Biol. Sci.,* **6** (6) : 597-600.

Falconer, D.S. (1980). *Introduction to Quantitative Genetic*. 2nd. Ed. Longman, London, UNITED KINGDOM.

Govindaraj, M., Selvi, M. and Rajarathinam, S. (2009). Correlation studies for grain yield components and nutritional quality traits in pearl millet [*Pennisetum glaucum* (L.) R. Br.] germplasm. *World J. Agric. Sci.,* **5** : 686– 689.

Hanson, C.H., Robinson, H.F. and Comstock, R.E. (1956). Biometrical studies of yield in segregating populations of Korean lespedza. *Agron. J.*, **48**(6) : 268-272.

Harer, P.N. and Karad, S.R. (1998). Correlation and path coefficient analysis in pearl millet. CAB. Abstract, PC. SPIRS, 3-30, 1998-2000, No 2000/60-61-74.

Izge, A.U., Kadams, A.M. and Gungula, D.T. (2006). Studies on character association and path analysis of certain quantitative characters among parental lines of pearl millet (*Pennisetum glaucum)* and their F1 hybrids in a diallel cross. *Afr. J. Agric. Res.*, **1**(5): 194-198.

Johnson, H.W., Robinson, H.F. and Comstock, R.E. (1955). Estimation of genetic and environmental variability in soybeans. *Agron. J.*, **47** : 314–318.

Kelley, J.D., Parthasarathy, R.P., Weltzein, R.E. and Purohit, M.L. (1996). Adoption of improved cultivars of pearl millet in an arid environment: Straw yield and quality considerations in Western Rajasthan. *Environ. Agric.*, **32**:161–172.

Kempanna, C. (1975). Variability pattern and its impact on the structure of yield in ragi. Technical Bulletin Series No. 8 University of Agricultural Sciences, Banglore, KARNATAKA (INDIA).

Kulkarni, V.M., Navale, P.A. and Harinaragana, G. (2000). Variability and path analysis in white grain pearl millet (*Pennisetum glaucum* L.). *Tropical Agric*., **77** : 130 -132.

Ovendeba, B., Ejeta, G., Hanna, W.W. and Kumar, A.K. (1995). Diversity among African Pearl Millet Landraces Populations. *Crop Sci.*, **35** : 919-924.

Singh, S.P. (1995). Selection for water stress tolerance in interracial populations of common bean. *Crop Sci*., **35** : 118 – 124.

Steel, R.G.D. and Torrie, J.H. (1980). *Principles and Procedures of Statistics*. 2nd ed. New York: McGraw-Hill.

Tolok, A.D.H., Shon, T.K. and Yoshida. T. (1998). Effect of selection for yield components on grain yield of (*Pennisetum typhoideum*) CAB. Abstracts. Pc. SPIRS, 3-30, 1998– 2000.

Vidyadhar B, Chand, P. and Devi, I.S. (2006). Genetic variability and character association for yield trails in pearl millet (*Pennisetum sp.)* germplasm. *J. Res.*, ANGRAU, **34** : 114-117.

Wilson, J.P., Burton, G.W., Zongo, J.D. and Dicko, I.O. (1990). Diversity among pearl millet land races collected in Central Burkino Faso. *Crop Sci.*, **30** : 40-43.

Yadav, H. P. (2015). *Pearl Millet News*. All India Coordinated Research Project on Pearl Millet p. 1.

Yadav, O.P. and Weltzein, R.E. (2000). Differential response of pearl millet landrace based population and high yielding varieties in contrasting environments. *Ann. Arid Zone*, **39** : 39–45.