Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5785

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 1007-1011 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Genetic Variability Studies in Finger Millet (*Eleusine coracana* (L.) Gaertn.

Sarjan D. Devaliya*, Manju Singh, C. G. Intawala and Ranjit N. Bhagora

Department of Genetics and Plant Breeding, N. M. College of Agriculture,

Navsari Agricultural University, Navsari- 396 450, Gujarat, India

*Corresponding Author E-mail: sarjan17@gmail.com

Received: 25.09.2017 | Revised: 30.10.2017 | Accepted: 6.11.2017

ABSTRACT

The experimental material comprised 68 diverse genotypes of finger millet (Eleusine coracana (L.) Gaertn). The data on 13 quantitative traits were recorded to assess the magnitude of genetic variability, heritability and genetic advance for yield and yield contributing traits. In the present investigation, values of phenotypic coefficients of variability were greater than genotypic coefficients of variability for all the traits studied. Highest PCV and GCV were recorded for grain yield per plant. The characters viz., straw yield per plant, number of productive tillers per plant, main ear head length and number of fingers per ear were expressed the moderate amount of variation indicated large extent of genetic variability for these traits in the material. High heritability along with high genetic advance (% of mean) observed for for grain yield per plant, number of productive tillers per plant, straw yield per plant and main ear head length, indicating involvement of additive gene action for these traits and phenotypic selection based on these traits in the segregating generations would likely to be more effective.

Key words: *Finger millet, Genetic variability, Heritability, Genetic advance.*

INTRODUCTION

Finger millet (*Eleusine coracana* L.) ranks third among millets after sorghum and pearl millet. Finger millet is crop of antiquity and known for their suitability to dry lands, hill and tribal agriculture. It is cultivated mostly as a rainfed crop in India for its valued food grains and its adaptability to wide range of geographical areas and agro-ecological diversity, mostly continent in Africa and Asia. India is a major producer of finger millet in Asia with an area of 1193.70 thousand hectares with production of 1982.90 thousand tonnes and productivity of 1661.00 kg per hectare[3]. The major finger millet growing states include Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Maharashtra, Uttarakhand, West Bengal and Gujarat.

The basic information on the existence of genetic variability and diversity in a population and the relationship between different traits is essential for any successful plant breeding programme.

Cite this article: Devaliya, S.D., Singh, M., Intawala, C.G. and Bhagora, R.N., Genetic Variability Studies in Finger Millet (*Eleusine coracana* (L.) Gaertn., *Int. J. Pure App. Biosci.* **6(1):** 1007-1011 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5785

Genetic improvement through conventional breeding approaches depends mainly on the availability of diverse germplasm and presence of enormous genetic variability. The characterization and evaluation are the important pre-requisites for effective utilization of germplasm and also to identify sources of useful genes and superior genotypes.

MATERIAL AND METHODS

Thirteen yield contributing characteristics were taken to assess the magnitude of variability, heritability, genetic advance and genetic divergence for 68 genotypes of finger millet. The experimental material consisted 68 finger millet genotypes grown in randomized block design with three replications at Hill Millet Research Station, Waghai (Gujarat) during *Kharif*, 2015. Each entry was grown in 1.5 meter row with spacing of 30 cm between the rows and 10 cm within the plants. Five randomly selected plants from each genotypes in each replications were used to record observations on plant height, number of productive tillers per plant, numbers of fingers per ear, main ear head length, test weight, grain yield per plant, straw yield per plant and harvest index except 50 per cent flowering and days to maturity. Days to 50 per cent flowering and days to maturity was noted on single row basis. The mean of five plants was subjected to statistical analysis, data were statistical analyzed to estimate analysis of variance as suggested by Panse and Sukhatme[16]. Genotypic and phenotypic coefficient of variability were computed according to the method suggested by Burton[4]. Heritability in broad sense was calculated as per the formula given by Allard[2]. Range of heritability was categorized as suggested by Robinson *et al.*[19]. Genetic advance was expressed as per cent of mean by using the formula expounded by Johnson *et al.*[12]. Traits were classified as having high, moderate or low genetic advance as per the method suggested by Johnson *et al*[12].

RESULTS AND DISCUSSION

Genetic variability studies provide basic information regarding the genetic parameters of the genotypes based on which breeding methods are constituted for further crop improvement. These studies are also helpful to know about the nature and extent of variability that can be attributed to different causes, sensitivity of crop to environment, heritability of the character, genetic advance and genetic divergence. The analysis of variance showed a wide range of variation and significant differences for all the characters under study, indicating the presence of adequate variability for further improvement. The genotypic mean square values were highly significant for all quantitative traits, implying that the genotypes tested were highly variable (Table 1). The estimates of mean, range, phenotypic variance, genotypic variance, phenotypic coefficient of variation, genotypic coefficient of variation, heritability, genetic advance and genetic advance as percent of mean are presented in table 2.

High estimates of genotypic and phenotypic variance were observed for days to maturity, plant height, days to 50 per cent flowering, iron content and straw yield per plant. Similar findings were also reported by Kebere *et al*.[13], Suryanarayana *et al.*[22] for plant height and days to maturity, John[11] for days to 50 per cent flowering, plant height, days to maturity and straw yield per plant and John[11] for days to 50 per cent flowering, plant height and straw yield per plant.

Low estimates of genotypic and phenotypic variance were observed for number of productive tillers per plant, number of fingers per ear, main ear head length, test weight, grain yield per plant, harvest index, protein content and calcium content. Similar results for most of the characters were also obtained by Kebere *et al.*[13] for test weight, John[11] for test weight, main ear head length, number of productive tillers per plant and grain yield per plant, John[11] for number of productive tillers per plant, number of fingers per ear, main ear head length, test weight and grain yield per plant.

Grain yield per plant had highest genotypic and phenotypic coefficient of variation. The characters *viz.*, straw yield per

plant, number of productive tillers per plant, main ear head length and number of fingers per ear were expressed the moderate amount of variation. While the traits iron content, test weight, days to 50 per cent flowering, plant height, days to maturity, harvest index, protein content and calcium content had the lower coefficient of variation.

Similar results were also obtained by Abraham *et al*.[1], Chunilal *et al*.[6] Karad and Patil , Chaudhari[5] and Suryanarayana *et al.*[22] for grain yield per plant.

The moderate value of genotypic coefficient of variation and phenotypic coefficient of variation were reported by Ganapathy *et al.*[7] for number of fingers per ear and grain yield per plant, John[11] for main ear head length, Reddy *et al.*[18] for main ear head length and straw yield per plant, Lule *et al.*[14] for productive tiller number and finger number per ear.

All the characters except calcium content and harvest index exhibited high heritability estimates which, indicated that these characters are largely governed by additive genes and selection for improvement of such characters could be rewarding. Moderate heritability estimates were observed for calcium content while on the other hand the trait harvest index had lower heritability values.

Similar reports were earlier reported by Abraham *et al*.[1] for test weight, days to maturity, number of fingers per ear and plant height, John[11], Shet *et al.*[21] for test weight, John[11], Ganapathy *et al.*[7] , Priyadharshini *et al.*[17] for number of productive tillers per plant and number of fingers per ear, Shet *et al.*[21] Suryanarayana *et al.*[22], Ulaganathan and Nirmalakumari[23], Priyadharshini *et al.*[17], Ganapathy *et al.*[7] for grain yield per plant and plant height, Nandini *et al.*[15] for plant height and number of productive tillers per plant, Ulaganathan and Nirmalakumari[23] for test weight and number of productive tillers per plant, Ganapathy *et al.*[7] for days to 50 per cent flowering, Haradari *et al.*[8], Jayshree and Nagarajaiah[9] for plant height and days to 50 per cent flowering, Karad and Patil for test weight, days to maturity, iron content and protein content, Reddy *et al.*[18] Suryanarayana *et al.*[22] for main ear head length and number of fingers per ear, Saundaryakumari and Singh[20] for test weight, grain yield per plant and days to 50 per cent flowering.

Genetic advance as per cent of mean ranged from 3.69 to 29.30 per cent. Grain yield per plant (29.30 per cent) recorded the highest genetic advance followed by straw yield per plant (28.86 per cent), number of productive tillers per plant (28.34 per cent), and main earhead length (26.64 per cent). High genetic advance indicated that these characters are governed by additive genes and selection will be rewarding for improvement of these traits. Moderate genetic advance as per cent of mean was recorded for iron content (19.72 per cent) followed by number of fingers per ear (17.54 per cent), test weight (12.23 per cent) and days to 50 per cent flowering (10.77 per cent), while the remaining characters had shown low genetic advance as expressed as percentage of mean.

High heritability coupled with high genetic advance was observed for grain yield per plant, number of productive tillers per plant, straw yield per plant and main ear head length. It forces to conclude that these characters are governed by additive gene action. Similar results were also obtained by John[10], Karad and Patil for number of productive tillers per plant and straw yield per plant, Shet *et al.*[21], Saundaryakumari and Singh[20] for grain yield per plant, Ganapathy *et al.*[7], Ulaganathan and Nirmalakumari[23] Priyadharshini *et al.*[17], Haradari *et al.*[8], Suryanarayana *et al.*[22] for grain yield per plant and number of productive tillers per plant, Reddy *et al.*[18], Suryanarayana *et al.*[22] for main ear head length.

It is concluded that genetic variability present in the population is mainly used for varietal improvement of further breeding programme. High genotypic and phenotypic coefficient of variation were observed for grain yield per plant indicating that this character is more variable in the genotypes. There is a great scope for improvement of this

character by direct selection among the genotypes. High heritability coupled with high genetic advance as per cent of mean was observed for grain yield per plant, number of productive tillers per plant, straw yield per plant and main ear head length suggested that these characters may be successfully used as selection criteria in improving grain yield.

Table. 1: Analysis of variance for thirteen traits in 68 genotypes of Finger millet [*Eleusine coracana* (L.)]

Source of variation	D.F.	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of productive tillers per plant	Number of fingers per ear	Main earhead length (cm)	Test weight (g)	Grain yield per plant (g)	Straw yield per plant (g)	Harvest index (%)	Protein content (%)	Iron content (ppm)	Calcium content (%)
Replication	2	1.53	6.01	0.75	0.004	0.48	0.03	0.03	0.08	0.92	0.95	0.005	1.76	0.0002
Genotypes	67	88.65**	116.18**	98.26**	0.41**	2.80**	5.47**	0.11**	5.13**	62.27**	3.14**	0.29**	81.55**	0.0005**
Error	134	11.40	16.67	17.47	0.05	0.41	0.38	0.01	0.57	7.29	1.43	0.04	2.17	0.0001
S.Em±	-	1.93	2.34	2.39	0.12	0.37	0.35	0.06	0.43	1.55	0.68	0.11	0.84	0.007
C.D at 5 %	-	5.45	6.59	6.75	0.35	1.04	1.00	0.18	1.22	4.36	1.93	0.34	2.38	0.02
C.D at 1 %	-	7.20	8.71	8.91	0.46	1.37	1.32	0.23	1.62	5.76	2.55	0.44	3.14	0.03
C.V %	-	4.18	3.45	4.05	9.91	7.58	6.78	4.09	10.27	10.45	5.31	3.02	2.85	4.06

***significant at 0.05 **significant at 0.01**

Table 2: Range, mean, components of variance, genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean for thirteen traits in 68 genotypes of Finger millet

Sr. No	Characters	Range		Mean	Variance		Coefficient of variation		Heritability (b)(%)	Genetic advance	Genetic advance % of mean
		Min	Max		Genotypic	Phenotypic	GCV%	PCV%			
1.	Days to 50% flowering	70.67	92.66	80.80	25.75	37.16	6.28	7.54	69.30	8.70	10.77
2.	Days to maturity	107.00	131.33	118.23	33.17	49.81	4.87	5.97	66.60	9.68	8.19
3.	Plant height (cm)	88.80	115.27	103.27	26.93	44.40	5.02	6.45	60.60	8.32	8.06
4.	Number of productive tillers per plant	1.20	3.13	2.16	0.12	0.17	16.14	18.95	72.60	0.61	28.34
5.	Number of fingers per ear	5.53	10.87	8.50	0.79	1.21	10.50	12.95	65.80	1.49	17.54
6.	Main earhead length (cm)	5.47	11.83	9.10	1.70	2.08	14.30	15.83	81.70	2.42	26.64
7.	Test weight (g)	2.29	3.11	2.69	0.03	0.05	6.90	8.02	74.00	0.33	12.23
8.	Grain yield per plant (g)	5.49	10.89	7.38	1.52	2.09	16.70	19.61	72.50	2.16	29.30
9.	Straw yield per plant (g)	15.56	37.63	25.85	18.33	25.61	16.56	19.58	71.50	7.46	28.86
10.	Harvest index (%)	20.49	26.03	22.53	0.57	2.00	3.35	6.28	28.50	0.83	3.69
11.	Protein content (%)	6.22	7.39	6.90	0.08	0.13	4.16	5.14	65.50	0.48	6.94
12.	Iron content (ppm)	41.00	60.07	51.65	26.46	28.62	9.96	10.36	92.40	10.19	19.72
13.	Calcium content (%)	0.30	0.37	0.33	0.0001	0.0003	3.48	5.35	42.40	0.01	4.67

REFERENCES

1. Abraham, M, J., Gupta, A. S. and Sharma, B. K., Genetic variability and character association of yield and its components in finger millet (*Eleusine coracana*) in an acidic soil of Meghalaya. *Indian Journal of Agricultural Sciences*, **59(9):** 579-581 (1989).
2. Allard, R.W., "Principles of plant breeding". John Willey and Sons, Inc., New York. (1960)
3. Anonymous., Annual report 2013-2014, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India Krishi Bhawan, New Delhi-110 001 March, 2015. (2014)
4. Burton G. W., Quantitative inheritance in grasses. Proc. 6th *Int. Grassland Cong.* **1:** 227-287 (1952).
5. Chaudhari, D. R., Genetic variability, correlation and path analysis in finger millet. M.Sc. *Thesis* submitted to Navsari Agricultural University, Navsari (2013).
6. Chunilal., Dawa, T., Plaha, P. and Sharma, S. K., Studies on genetic variability and component analysis in ragi (*Eleusine coracana* Gaertn). *Indian Journal of Genetics and Plant Breeding*, **56(2):** 162-168 (1996).
7. Ganapathy, S., Nirmalakumari, A. and Muthiah, A. R., Genetic variability and inter realationship analysis for economic

traits in finger millet germplasm. *World Journal of Agricultural Sciences,* **7(2):** 185-188 (2011).

8. Haradari, C., Ugalat, J. and Nagabhushan., A study on character association genetic variability and yield components of finger millet *(Eleusine* coracana (L.)Gaertn.). *Journal of Crop and Weed*, **8(2):** 32-35 (2012).
9. Jayshree, M. K. and Nagarajaiah, C., Genetic variability and character association studies in African and Indian finger millet (*Eleusine coracana* (L.) Gaertn). accessions. *Environment and Ecology*, **31(4A):** 1950-1953 (2013).
10. John, K., Variability and correlation studies in quantitative traits of Finger millet (*Eleusine coracana*). *Agricultural Sciences Digest*, **26(3):** 166-169 (2006).
11. John, K., Estimates of genetic parameters and character association in finger millet (*Eleusine coracana* Gaertin). *Agricultural Sciences Digest*, **27(2):** 95-98 (2007).
12. Johnson, H. W., Robinson, H. F. and Comstock, R. E., Estimates of genetic and environmental variability in soybean. *Agronomy Journal*, **47:** 314-318 (1955).
13. Kebere, B., Prapa, S., Wasana, W. and Vipa, H., Genetic variation, heritability and path-analysis in Ethiopian finger millet landraces. *Natural Sciences*, 40: 322-334 (2006).
14. Lule, D., Tesfaye, K., Fetene, M. and De, V. S., Inheritance and association of quantitative traits in finger millet (*Eleusine coracana* Subsp. *Coracana*) landraces collected from Eastern and South Eastern Africa. *International Journal of Genetics*, **2(2):** 12-21 (2012).
15. Nandini, B., Ravishanker, C. R., Mahesha, B., Boranayaka, M. B. and Shadakshari, T. V., An assessment of variability generated in F_2 generation of four crosses of finger millet (*Eleusine coracana* (L.) Gaertn). *Electronic Journal of Plant Breeding*, **1(4):** 747-751 (2010).
16. Panse, V. G. and Sukhatme, P. V., Statistical Methods for Agricultural Workers. ICAR Publication. New Delhi. (1967).
17. Priyadharshini, C., Nirmalakumari, A., John, Joel. and Raveendran, M., Genetic variability and trait relationships in finger millet *(Eleusine coracana* (L.) Gaertn.) Hybrids. *Madras Agricultural Journal*, **98(1-3):** 18-21 (2011).
18. Reddy, C. V. C. M., Reddy, P. V. R. M., Munirathnam, P. and Gowda, J., Studies of genetic variability in yield and yield attributing traits of finger millet *(Eleusine coracana* (L.) Gaertn.). *Indian Journal of Agricultural Research*, **47(6):** 549-552 (2013).
19. Robinson, H. F., Comstock, R. E. and Harvery, V. H., Estimates of heritability and degree of dominance in corn. *Agronomy Journal*, **41:** 353-359 (1949).
20. Saundaryakumari and Singh, S., Assesment of genetic diversity in promising finger millet (*Eleusine coracana* (L.) Gaertn) genotypes. *International Quarterly Journal of Environmental Sciences*, **10(2):** 825-830 (2015).
21. Shet, R. M., Jagadeesha, N., Lokesh, G. Y., Gireesh, C. and Gowda, J., Genetic variability, association and path coefficient studies in two interspecific crosses of finger millet (*Eleusine coracana* (L.) Gaertn). *International Journal of Plant Sciences* **5(1):** 24-29 (2010).
22. Suryanarayana, L., Sekhar, D. and Rao, N. V., Genetic variability and divergence studies in finger millet *(Eleusine coracana* (L.) Gaertn.*). International Journal of Current Microbiology and Applied Sciences*, **3(4):** 931-936 (2014).
23. Ulaganathan, V. and Nirmalakumari, A., Genetic variability for yield and yield related traits in finger millet *[Eleusine coracana* (L.) Gaertn] Genotypes. Department of Millets, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore, India. (2011).