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Genetic Variability, Heritability and Genetic Advance Studies in Finger Millet (*Eleusine coracana* (L.) Geartn.)

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ABSTRACT

The present stud aims to reveal the importance of some quantitative traits and genetic variability existing in the 55 finger millet genotypes. The coefficient of variation at phenotypic (PCV) and genotypic (GCV) levels were high for number of basal tillers, peduncle length, inflorescence exertion, inflorescence length, inflorescence width, length of finger, grain yield plant^{-1} and moderate for the traits *viz*., days to 50% flowering, plant height, flag leaf length, flag leaf width, width of finger number fingers ear^{-1}. Low PCV and GCV were observed in the trait flag leaf width. From these results, high heritability coupled with high genetic advance were observed in days to 50% flowering, plant height, number of basal tillers, peduncle length, inflorescence exertion, inflorescence length, inflorescence width, length of finger, number of fingers ear^{-1}, grain yield plant^{-1} which indicates the predominance of additive gene effects, in controlling these traits and hence early and simple selection could be exercised for these traits.

Key words : Finger millet, Variability, Heritability, Genetic advance

Finger millet (Eleusine coracana (L.) Geartn.) ranks first both in area and production among the small millets grown in India. It is grown under diverse situations of soil, temperature and rainfall which made it an indispensable component of dry land farming.

The genetic improvement of plant population depends on the presence of genetic variability and the extent to which the desirable traits are transmissible. Besides genetic variability, knowledge on heritability and genetic advance plays a predictive role in breeding, expressing the reliability of phenotype as a guide to its breeding value (Burton, 1952). Since many quantitative characters are highly influenced by environment, there is a need to partition the overall variability into its heritable and non-heritable components with the help of suitable genetic parameters such as genetic coefficient of variation, heritability estimates and genetic advance.

MATERIAL AND METHODS

The experimental material consists of 55 finger millet genotypes obtained from Agricultural Research Station, Vizianagaram (A.P.,). The material was grown in randomized block design with three replications at Agricultural college farm, Naira (A.P.,). Each entry was grown in two rows of three meter length with a spacing of 30X10 cm. The data were recorded on five randomly selected plants for 14 quantitative traits *viz.,* days to 50% flowering (Plot basis), plant height (cm), number of basal tillers, flag leaf blade length (mm), flag leaf blade width (mm), flag leaf sheath length (mm), peduncle length (mm), inflorescence exertion (mm), inflorescence length (mm), inflorescence width (mm), length of longest finger (mm), width of longest finger (mm), number of fingers ear^{-1} and grain yield plant^{-1}.

Standard statistical procedures were used for the analysis of variance, genotypic and phenotypic coefficients of variation (GCV and PCV) (Burton, 1952), heritability (Lush, 1940) and Genetic advance (Johnson *et al.,* 1955).

RESULTS AND DISCUSSION

The analysis of variance showed a wide range of variation and significant differences for all the 14 characters under study (Table 1), indicating the presence of adequate variability. The recordings of the means, range, co-efficient of variation, heritability and genetic advance as percent of means are presented in Table 2. Phenotypic coefficient of variation ranged from 9.26 to 35.22%. Highest PCV was recorded by number of basal tillers, whereas lowest was recorded by flag leaf width. Genotypic co-efficient of variation (GCV) followed the similar trend as that of PCV. The co-efficient of variation at phenotypic (PCV) and Genotypic (GCV) levels were high for the traits number of basal tillers, peduncle length, inflorescence length, inflorescence width, length of finger, grain yield plant^{-1} and moderate for the traits days to 50% flowering, plant height, flag leaf length, flag leaf sheath length, width of finger and number of fingers ear^{-1}. Low PCV and GCV were observed in the trait flag leaf width (Table 2). The similar results of high PCV and GCV were also reported by Kadam *et al.* (2009) for basal tillers, peduncle length, inflorescence length, inflorescence width, length of finger and grain yield plant^{-1}. The differences in magnitude of PCV and GCV were more for quantitative characters indicating more influence of environment in their governance, where as it was low for days to 50% flowering, plant height indicating less influence of environment on these traits.

In the present study, heritability was high for all the characters *viz*., days to 50% flowering, plant height, number of basal tillers, flag leaf length, flag leaf width, flag leaf sheath length, peduncle length, inflorescence exertion, inflorescence length, length of finger, number of fingers ear^{-1} and grain yield plant^{-1}. The maximum value was recorded by days to 50% flowering (98%) and the minimum was recorded by the trait width of finger (57%). Heritability is the heritable portion of phenotypic variance. It is a good index of the transmission of characters from parents to their offspring (Folconar, 1981). The estimates of heritability help the plant breeder in selection of elite genotypes from divergent population. But heritability itself does not provide any indication towards the amount of genetic progress that would result in selecting best individual; rather it depends upon the amount of genetic advance.

In the present set of materials, all the characters except flag leaf length, flag leaf width and finger width expressed high genetic advance as percent of mean. Similar trend was also obtained by Ganapathy *et al.* (2011). The highest genetic advance as per cent of mean was expressed by the trait number of basal tillers (64.25 %) and the lowest (12.11 %) was expressed by the trait width of finger.

Relationship of heritability and genetic advance also give an idea about the type of gene action. From the present results, high heritability

Table 1. Analysis of variance for14 characters in 55 five finger millet genotypes.

S. No.	Character	Replications (df: 2)	Treatments (df: 54)	Error (df:108)
1	Days to 50% flowering	9.3818	580.9039**	4.1534
2	Plant height (cm)	12.3141	892.1801**	41.0148
3	No. of basal tillers	0.1220	1.8469**	0.0763
4	Flag leaf length (mm)	407.0488	4748.6226**	526.5939
5	Flag leaf width (mm)	0.2262	2.2281**	0.2614
6	Flag leaf sheath length (mm)	142.3072	332.7956**	59.3048
7	Inflorescence exertion (mm)	107.4872	1563.8640**	82.5425
8	Peduncle length (mm)	162.0868	1820.4681**	153.4687
9	Inflorescence length (mm)	20.3964	1393.2054**	31.4208
10	Inflorescence width (mm)	16.7711	537.6038**	32.2339
11	Length of finger (mm)	28.3817	1257.1549**	29.7837
12	Width of finger (mm)	0.2129	2.4505**	0.4859
13	No. of fingers ear^{-1}	0.0598	2.6023**	0.3421
14	Grain yield plant^{-1} (g)	1.9432	23.7389**	0.5873

Table 2. Range, mean, coefficient of variation, heritability (broad sense), genetic advance and genetic advance as per cent of mean for 14 characters in 55 finger millet (*Eleusine coracana* (L.) Gaertn.) genotypes.

S. No.	Character	Range		Mean	Coefficient of variation		Variance		h^2 (b) (%)	Genetic advance	Genetic advance as per cent of mean (%)
		Lowest	Highest		Genotypic (%)	Phenotypic (%)	Genotypic	Phenotypic			
1	Days to 50% flowering	52.67	102.67	82.22	16.86	17.05	192.25	196.40	98	28.26	34.37
2	Plant height	71.21	142.77	113.30	14.87	15.90	283.72	324.74	87	32.43	28.62
3	Number of basal tillers	1.13	4.93	2.32	33.14	35.22	0.59	0.67	89	1.49	64.25
4	Flag leaf length	265.33	428.20	336.60	11.15	13.06	1407.34	1933.94	73	65.92	19.59
5	Flag leaf width	8.53	13.80	10.34	7.83	9.26	0.66	0.92	71	1.41	13.64
6	Flag leaf sheath length	88.33	128.18	108.40	8.81	11.32	91.16	150.47	61	15.31	14.12
7	Inflorescence exertion	49.78	148.83	107.70	20.63	22.28	493.77	576.32	86	42.37	39.33
8	Peduncle length	144.22	266.44	203.20	11.60	13.11	555.67	709.14	78	42.98	21.16
9	Inflorescence length	45.22	189.67	72.90	29.23	30.22	453.93	485.35	94	42.45	58.22
10	Inflorescence width	41.27	129.33	55.55	23.36	25.50	168.46	200.69	84	24.50	44.10
11	Length of finger	47.97	186.67	74.69	27.08	28.05	409.12	438.91	93	40.23	53.86
12	Width of finger	8.23	13.27	10.43	7.76	10.24	0.65	1.14	57	1.26	12.11
13	Number of fingers ear^{-1}	4.84	8.73	6.76	12.85	15.49	0.75	1.10	69	1.48	21.95
14	Grain yield plant^{-1}	4.05	18.04	8.17	31.93	33.12	7.72	8.30	93	5.52	63.40

coupled with high genetic advance were observed in days to 50% flowering, plant height, number of basal tillers, peduncle length, inflorescence exertion, inflorescence length, in florescence width, length of finger, number of finger ear^{-1}, and grain yield plant^{-1}, which indicate the predominance of additive gene effects in controlling these traits and hense early and simple selection could be exercised for improvement of these traits. Similar results regarding heritability and genetic advance for number of basal tillers, finger length, number of fingers ear^{-1} and grain yield plant^{-1} were also reported by Anantharaja and Meenakshiganesan (2006). The traits flag leaf length, flag leaf width and flag leaf sheath length expressed high heritability coupled with moderate genetic advance which could be attributed to greater role of additive and non-additive gene effects and selection might be postponed to later generations to harness the non-additive gene action (Jayaprakash, 1991) for these traits. High level of heritability provides a good promise to plant breeders for the direct selection of quantitative traits on the phenotypic performance. Therefore, these characters can be improved and a high genetic gain from phenotypic selection will be effective for future breeding programs in finger millet.

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