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Genetic variability for Morphological and Biochemical Parameters for Yield and its Components during Summer in Finger Millet (*Eleusine coracana* (L.) Gaertn.)

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ABSTRACT: Finger millet is a small cereal in global food grain production but an important food crop for poor marginal farmers, particularly in India's tribal communities. In this experiment, thirty genotypes (23+7 checks) of finger millet were evaluated for quality traits to study the genetic variability parameters. These genotypes were collected from Zonal Agricultural Research Station Kolhapur. These genotypes were evaluated during summer season in a randomized block design with three replications. Observations were recorded on days to 50 per cent flowering, days to physiological maturity, plant height (cm), earhead length (cm), number of fingers per earhead, number of productive tillers, 1000 grain weight (g), zinc content (mg/100g), calcium content (mg/100gm) and grain yield per earhead. The treatment differences were statistically highly significant for all the characters. The magnitude of genotypic and phenotypic coefficient of variation indicated the presence of good amount of variability. The GCV were lower than the PCV for all the characters, indicating the influence of environment on the expression of these traits. The highest heritability (b.s) was found for zinc content (0.99) and calcium content (0.97) indicate that the variation observed was mainly under genetic control and less influenced by environment. The character zinc content exhibited highest genetic advance as per cent of mean (32.01) which was followed by number of fingers per earhead (22.50). Calcium content, zinc content, number of fingers per earhead, earhead length, days to 50 per cent flowering showed high genetic advance as well as high heritability which shows that additive gene effects and selection may be effective.

Keywords: Finger millet, GCV, PCV, Heritability, Genetic advance.

INTRODUCTION

Finger millet, also known as 'nagali' or 'ragi,' is a small cereal in global food grain production but an important food crop for poor marginal farmers, particularly in India's tribal communities. African millet, Koracan, Wimbi (Swahili), Bulo (Uganda), and Telebun are some of the other names for this plant with chromosome number 2n=36 and belongs to the Poaceae family, subfamily Chloridoideae. *Eleusine coracana* Gaertn is the scientific name of finger millet. Eleusine gets its name from the Greek goddess of grains, Finger millet gets its name from the panical branching, which looks like fingers. It is thought to have originated in Ethiopia and then been during transported to India pre-aryan times. Finger millet is a very nutritious, non-glutinous grain that like buckwheat and quinoa, is acid-free and easy to digest. It is nutritionally superior to many cereals and is well known for its higher nutrients of calcium (344 mg/100 g), protein (7-10%), iron and other minerals (Divya *et al*., 2022). It is one of the least allergenic and digestible grains accessible and it is a warming grain that will assist to warm up the body. It can tolerate adverse environmental conditions like tolerance to moisture stress, resistance to water logging (Panda *et al.,* 2021; Patel *et al.,* 2022). It is extremely beneficial to diabetic patients. In India, finger millet is a popular staple meal. It may be dormant for weeks, hence it's a great crop for dry places. The grain is resistant to decay and insects and stores well, making it a valuable food source when other options are limited. It can be stored for up to five years if kept dry. This crop has shown a lot of variety in terms of height, flowering, maturity, tillering, finger characteristics and irrigation response. But it hasn't been properly explored in breeding efforts (Upadhyaya *et al*., 2006). As a result, improving yield by genetic enhancement of yield components would be more effective. The degree and

direction of relationship between distinct component, morphological features and yield should be known while doing so. The value of estimations of genetic variance components as a foundation for the prediction of the response of quantitative characters for selection in breeding programmes Burton (1952); Panse (1958). In plant breeding programme, understanding about genetic parameters such as genetic variability, heritability and genetic advance is essential for effective selection of desirable genotypes for genetic improvement.

The experiment was carried out during Summer, 2021 at Post graduate Research Farm, Rajarshi Chhatrapati Shahu Maharaj College of Agriculture Kolhapur. The Thirty diverse genotypes (23+7 checks) of finger millet were collected from All India Co-ordinated Research Project on Small millets, Zonal Agricultural Research Station, shenda park, Kolhapur. The experiment was laid out in Randomized Block Design. The field was divided into three homogeneous replication blocks. Thirty genotypes were planted randomly in three replications. Each entry was represented by single row of 4 m length spaced at 30 cm between the rows and 10 cm between the plants within the rows.

Five random plants from each treatment in each replication were selected for recording observations. The selected plants were tagged at the age of 45 days. The different observations were recorded on the five plants from each genotype at different growth stages of crop and average values per plant were worked out. The mean values of five randomly selected observational plants for thirty genotypes for different traits were used for statistical analysis. The analysis of variance was done as suggested by Panse and Sukhatme (1967). Genotypic coefficient of variation (GCV), Phenotypic coefficient of variation (PCV) and Heritability percentage in broad sense was estimated as per the formula suggested by Burton (1952). Genetic advance was calculated by the formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The results of the analysis of variance for various quality characters for thirty one genotypes of groundnut is presented in the Table 1. The results indicated that there is highly significant differences among genotypes for all the characters. Mean performance of genotypes for these characters presented in Table 2.

1. GCV and PCV: The results of the genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance as per cent of mean for quality traits were estimated and computed in the Table 3. Genotypic coefficient of variation (GCV) was lower than phenotypic coefficient of variation (PCV) for all the characters under study. The gcv and pcv were highest for the traits *viz.,* zinc content (15.61 and 15.68), number of fingers per earhead (11.89 and 12.95), grain yield per earhead (11.82 and 13.57), earhead length (11.69 and 12.79). Similarly lowest gcv and pcv were reported for the character days to physiological maturity (1.30 and 2.06). These conclusions were supported by Patnaik (1968); Sarvaiya *et al.* (1982); Mishra (1980); Abraham *et al.* (1989). For grain yield per plant, Karad and Patil (2013); Kumari and Singh (2015); Devaliya *et al.* (2018).

The GCV and PCV were moderate for the traits *viz.*, number of productive tillers per plant (10.22 and 11.74) followed by calcium (10.23 and 10.37). For days to 50 per cent flowering, John (2007); Ganapathy *et al.* (2011) found comparable results. Sonnad (2005); Patil (1982) for 1000 grain weight. John (2007); Ganapathy *et al.* (2011) recorded similar results for finger length and the number of fingers per primary earhead.

2. Heritability: The heritability estimates were ranged from -0.39 (Days to physiological maturity) to 0.99 (zinc content). The highest heritability was found for zinc content (0.99) followed by calcium content (0.97), 1000 grain weight (0.93), no. of fingers per earhead (0.84), earhead length (0.83) indicating that variations observed was due to genetic control and less influenced by environment.

Similar findings were also recorded by Patnaik and Jana (1973); Dhagat *et al*. (1972); Mishra *et al.* (1980); Sarvaiya *et al.* (1982); Shankar (1986); Abraham *et al.* (1989); Tyagi and Koranne (1989); Sonnad (2005); Ganapathy (2011). For grain yield per plant Chaudhari and Acharya (1969); Mahudeswaran and Murugesan (1973), Shankar (1986), Tyagi and Koranne (1989); Sonnad (2005); Ganapathy *et al.* (2011); Karad (2013). They have all cited (1986) for days to maturity and days to 50 per cent blooming.

3. Genetic advance: The genetic advance was ranged between -1.59 to 56.47. The highest magnitude of genetic advance was recorded for the character calcium content (56.47). The average results were observed for the trait days to 50 per cent flowering (5.72) followed by plant height (4.93). The lowest advance estimated by days to physiological maturity (-1.59). Calcium content, zinc content, number of fingers per earhead, earhead length, days to 50 per cent flowering showed high genetic advance as well as high heritability, which shows that additive gene effects and selection may be effective. Patnaik and Jana (1973); Kulkarni (1980); Sonnad (2005); Ganapathy *et al.* (2011); Karad and Patil (2013); Suryanarayana *et al*. (2014); Karad (2013); Devaliya all produced similar findings.

4. Genetic advance as per cent of mean: The genetic advance as per cent of mean was ranged between -1.69 to 32.01. The highest per cent was observed in zinc content (32.01) followed by number of fingers per earhead (22.50), earhead length (22.01), grain yield per earhead (21.23), calcium content (20.81), number of productive tillers per plant (18.33) while the characters days to physiological maturity (-1.69), days to 50 per cent flowering (8.66), plant height (5.65) were recorded lower genetic advance as per cent of mean.

Table 1: Analysis of variance for different characters of Finger millet.

Sr. No.	Characters	Replication (2)	Treatment (29)	Error (58)
1.	Days to 50 percent flowering	7.07	36.91**	7.67
2.	Days to physiological maturity	173.33	11.27**	15.77
3.	Plant height(cm)	331.08	89.39**	50.18
4.	Earhead length(cm)	0.71	3.12**	0.51
5.	Number of fingers per earhead	0.28	3.43**	0.53
6.	Number of productive tillers per plant	0.125	0.7**	0.17
7.	1000grain weight(g)	0.09	0.11**	0.006
8.	Calcium(mg/100gm)	65.87	2379.1**	63.14
9.	Zinc (mg/100gm)	0.001	0.27**	0.0025
10.	Grain yield per earhead (g)	0.53	0.42**	0.1

(*, ** - significant at 5 and 1 per cent, respectively)

Table 2: Mean performance 31 genotypes of Finger millet for different characters.

Sr. No.	Genotypes	Days to 50 per cent flowering	Days to physiological Maturity	Plant height (cm)	Earhead length (cm)	No. of finger per earhead	No. of productive tillers per plant	1000 grain weight(g)	Calcium Content (mg/100gm)	Zinc Content (mg/100gm)	Grain yield per earhead (gm)
1.	**KFMG-2101**	71.67	94.00	86.00	8.14	6.50	3.87	3.00	229.33	2.11	2.07
2.	**KFMG-2102**	67.67	94.00	85.00	6.35	8.63	4.37	2.90	226.00	2.11	3.57
3.	**KFMG-2103**	71.00	91.33	91.07	9.02	6.97	5.70	3.30	246.33	1.96	3.00
4.	**KFMG-2104**	62.67	91.67	84.67	8.06	5.63	3.57	3.00	207.33	1.80	2.60
5.	**KFMG-2105**	62.33	93.00	72.90	7.17	7.43	3.93	2.61	307.33	2.32	3.00
6.	**KFMG-2106**	70.67	97.00	81.90	7.86	7.90	3.73	2.44	219.00	2.31	2.87
7.	**KFMG-2107**	61.33	93.00	90.67	8.33	6.63	3.63	2.69	292.33	1.96	2.63
8.	**KFMG-2108**	71.67	96.33	86.47	8.81	7.30	3.73	2.69	254.33	2.19	3.13
9.	**KFMG-2109**	66.67	95.00	91.20	7.78	8.87	4.40	2.85	299.67	1.77	2.40
10.	**KFMG-2110**	71.67	93.33	82.37	6.92	8.23	4.27	2.92	279.67	2.06	2.53
11.	**KFMG-2111**	64.00	96.00	81.17	5.59	8.67	3.83	2.65	287.67	1.80	2.53
12.	**KFMG-2113**	66.00	95.00	90.03	8.75	9.43	3.97	2.64	295.67	1.65	2.60
13.	**KFMG-2115**	70.00	94.00	87.57	8.84	10.60	4.17	2.78	305.33	2.26	2.70
14.	**KFMG-2116**	62.00	94.67	91.43	6.91	9.50	4.07	2.88	277.00	1.88	2.30
15.	**KFMG-2117**	66.33	91.00	90.07	6.86	7.50	4.37	2.88	262.00	2.21	3.20
16.	**KFMG-2118**	59.33	94.00	88.33	6.98	9.43	3.73	2.90	303.00	1.77	2.60
17.	**KFMG-2119**	65.67	96.00	79.07	7.49	8.10	4.13	3.03	281.67	1.95	2.97
18.	**KFMG-2120**	64.67	95.67	88.67	8.01	8.73	3.87	2.73	279.33	2.43	2.80
19.	**KFMG-2121**	69.00	95.00	85.43	9.51	8.30	3.73	2.52	257.67	2.12	2.92
20.	**KFMG-2122**	68.67	93.33	85.87	7.58	8.27	3.97	2.85	285.33	1.69	2.42
21.	**KFMG-2123**	63.67	90.33	87.90	8.92	9.33	5.17	2.42	263.67	1.58	2.57
22.	**KFMG-2124**	67.00	90.33	81.13	6.93	8.93	3.73	2.95	279.67	2.38	3.03
23.	**KFMG-2125**	65.67	94.67	98.57	8.96	9.90	5.17	2.85	250.00	1.66	2.23
24.	**GPU-28 (C)**	62.33	97.00	91.43	8.82	7.83	4.63	2.94	309.33	1.29	2.83
25.	**GPU-45 (C)**	64.67	97.00	80.67	7.39	8.20	4.10	2.80	241.67	2.05	3.13
26.	**GPU-67 (C)**	66.00	92.67	83.67	7.04	7.33	4.07	2.96	293.00	1.79	2.67
27.	**Dapoli -3 (C)**	69.00	91.67	91.40	8.68	8.07	4.13	2.94	290.67	1.29	2.77
28.	**VL-376 (C)**	66.33	93.67	95.70	8.63	8.23	3.83	3.09	259.00	1.87	2.27
29.	**P. Kasari(C)**	61.67	93.00	94.37	9.43	8.33	4.07	2.95	302.33	1.59	3.73
30.	**P. Nachani (C)**	62.00	92.33	92.30	9.63	8.97	4.23	2.96	255.00	2.36	2.97
	Mean	**66.04**	**93.87**	**87.23**	**7.98**	**8.26**	**4.14**	**2.84**	**271.34**	**1.94**	**2.77**
	S.E	**1.60**	**2.29**	**4.09**	**0.41**	**0.42**	**0.24**	**0.05**	**4.59**	**0.03**	**0.18**
	C.D 5 percent	**4.52**	**6.29**	**11.57**	**1.17**	**1.19**	**0.67**	**0.13**	**12.99**	**0.08**	**0.52**
	C.V	**4.19**	**4.23**	**8.12**	**9.00**	**8.88**	**10.00**	**2.91**	**2.92**	**2.58**	**11.52**

Table 3: The estimates of genetic variability parameters for different characters in Finger millet.

Sr. No.	Characters	General mean	Range	GCV (%)	PCV (%)	Heritability (b.s.)	Genetic advance (%)	G.A as a per cent of mean
1.	Days to 50 percent flowering	66.04	59.33 -71.67	4.72	5.31	0.79	5.72	8.66
2.	Days to physiological Maturity	93.86	90.33 -97	1.30	2.06	0.39	1.59	1.69
3.	Plant height (cm)	87.23	72.90 -98.57	4.14	6.25	0.43	4.93	5.65
4.	Earhead length(cm)	7.98	5.59 -9.63	11.7	12.79	0.83	1.75	22.01
5.	Number of fingers per earhead	8.25	5.63 - 10.60	11.9	12.95	0.84	1.85	22.5
6.	Number of productive tillers/plant	4.13	3.57 - 5.70	10.2	11.74	0.75	0.75	18.33
7.	1000 grain weight(g)	2.83	2.42 -3.30	6.59	6.8	0.93	0.37	13.15
8.	Calcium(mg/100gm)	271.34	207.33 -309.33	10.2	10.37	0.97	56.47	20.81
9.	Zinc(mg/100gm)	1.94	1.29 -2.43	15.6	15.68	0.99	0.62	32.01
10.	Grain yield per earhead(g)	2.76	2.07 -3.73	11.8	13.57	0.75	0.58	21.23

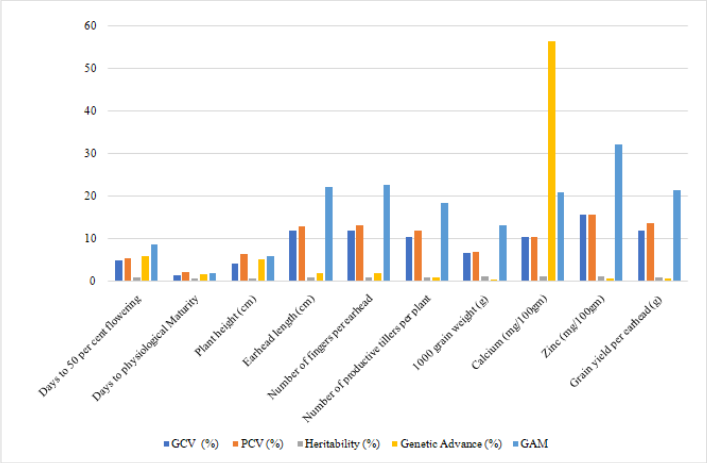

Fig. 1. Genetic variability parameters for different characters in Finger millet.

CONCLUSIONS

Based on the present study, wide range of variation was observed for all the ten characters under study. The analysis of variance exhibited significant difference among all the genotypes and all the characters. Estimates for the genotypic coefficients of variation (gcv) were lower than the phenotypic coefficients of variation (pcv) for all the characters. Heritability (b.s) of all the characters in present investigation was ranging from -0.39 to 0.99 per cent. The genetic advance was found ranging from -1.59 to 56.47.Calcium content, zinc content, number of fingers per earhead, earhead length and days to 50 per cent flowering showed high genetic advance as well as high heritability which shows that additive gene effects and selection may be effective.

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