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GENETIC EVALUATION FOR YIELD AND ITS ATTRIBUTING TRAITS IN FINGER MILLET [*Eleusine coracana* (L.) Gaertn.]

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ABSTRACT

This study was done to reveal the genetic variability, heritability and genetic advance in thirty–six genotypes for 12 quantitative traits including seed yield per plant. Moderate genotypic and phenotypic coefficient of variation found for the traits *viz*., number of fingers per earhead, number of productive tillers per plant, straw yield per plant, grain yield per plant, finger length, harvest index and main earhead indicating ample scope of variation for these traits, allowing further improvement by selection of these traits. Low value of genotypic coefficient of variation and phenotypic coefficient of variation was found for the traits *viz*., days to 50% flowering, finger width, days to maturity, plant height and 1000 grain weight indicating low variability for these traits. High heritability estimates were observed for days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, number of fingers per earhead, main earhead length, finger length, 1000 grain weight, grain yield per plant, straw yield per plant and harvest index showing low environmental influence on these traits and presence of additive gene action for these traits. Hence, priority can be given to these traits during selection to get more genetic gains. Genotypes WN 559 and GNN-6 were high yielding among all thirty–six genotypes so they can be considered for varietal development and release following further selection.

Key words : *Genetic evaluation, yield and its attributing traits, gcv, pcv, finger millet*

Finger millet [*Eleusine coracana* (L.) Gaertn.] sub species coracana belongs to family Poaceae. The cultivated *Eleusine coracana* is a tetraploid (2n=4X=36) having morphological similarities to both *Eleusine indica* (L.) Gaertn. (2n=18) and *Eleusine africana* (O.) Byrne (2n=36). It is an important cereal crop amongst the small millets and ranks third in importance among millets in the country in area and production after sorghum and pearl millet. Finger millet is very adaptable and thrives at higher elevations than other tropical cereals and adapted for its valued food grains (1). Its adaptability to wide range of geographical areas and agro-ecological diversity makes it more versatile.

Finger millet is an important 'nutricereal' because of its excellent nutritive value of the grains and the storage properties. Finger millet is a good source of micronutrients and dietary fibres and consumed both in native and processed form (2). Finger millet grains contain higher levels of minerals like Ca, Mg, and K (3). It also has high levels of amino acids like methionine, lysine and tryptophan (4), and polyphenols (3). With high fiber and protein content, millets are preferred as dietary foods for people with diabetes and cardiovascular diseases (5). Finger millet straw makes good fodder and contains up to 61 per cent total digestible nutrients.

Genetic variability is important for improvement of any crop through selection. More variability leads to more genetic gain through selection. 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. Due to these reasons this study was done to assess variability by taking different parameters *viz*., Phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance.

MATERIALS AND METHODS

This research was conducted during the *Kharif*, 2017 at Hill Millet Research Station, Navsari Agricultural University, Waghai, The Dangs. The experimental material comprised of thirty-six diverse genotypes of finger millet. These genotypes were laid out in Randomized Block Design along with respective checks in three replications. The seedlings were planted at 22.5 × 7.5 cm^2 spacing. The observations were recorded from ten randomly selected plants. Genetic variability analysis of each quantitative trait was carried out using different variability parameters. Phenotypic, genotypic and environmental variances were estimated according to the methods suggested by (6) and Phenotypic and genotypic coefficient of variation were calculated using formulae suggested by (7), whereas estimation of heritability and expected genetic advance were computed using the formula according to (6, 8) respectively.

RESULTS AND DISCUSSION

Analysis of variance : The analysis of variance indicating the mean sum of squares for all the twelve characters studied, are summarised in Table-1. The genotypic differences were highly significant for all the twelve characters indicating considerable amount of genetic variability among the genotypes tested in the present

Table-1 : Analysis of variance for twelve traits in thirty-six genotypes of Finger millet [Eleusine coracana (L.) Gaertn..

Source of variation	Degree of freedom	DF	DM	PH	PTP	FPE	MEL	FL	FW	TW	GY	SY	HI
Replication	2	6.40	30.73	32.21	0.05	0.27	0.32	0.91	0.003	0.001	1.32	4.22	7.47
Genotypes	35	258.03**	301.37**	185.44**	0.85**	5.85**	3.57**	2.95**	0.02**	0.07**	5.32**	45.42**	40.87**
Error	70	22.23	40.39	29.48	0.16	0.41	0.19	0.32	0.01	0.004	0.68	4.10	6.48
S.Em.±	-	2.72	3.67	3.13	0.24	0.37	0.25	0.33	0.05	0.04	0.48	1.17	1.47
C.D at 5%	-	7.68	10.35	8.84	0.66	1.04	0.71	0.92	0.14	0.11	1.35	3.30	4.15
C.D at 1%	-	10.19	13.74	11.74	0.88	1.38	0.95	1.23	0.18	0.14	1.79	4.38	5.50
C.V%	-	5.12	5.02	4.52	14.40	9.41	4.85	7.88	10.12	2.44	9.98	8.64	9.66

*significant at 5% level, **significant at 1% level

DF Days to 50 % flowering PTP No. of productive tillers per plant FL Finger length (cm) GY/P Grain yield per plant (g)
DM Days to maturity FPE Number of fingers per earhead FW Finger width (cm) SY/P Straw yield per plant (g)
PH Plant height (cm) MEL Main ear head length (cm) TW 1000-Grain weight (g) HI Harvest index (%)

Table-2 : Range, mean and components of variance for twelve traits in thirty-six genotypes of Finger millet.

Sr. No.	Characters	Range	Mean	Component of variance		
				Genotypic	Phenotypic	Environmental
1.	Days to 50% flowering	67.67-112	92.04	78.60	100.83	22.23
2.	Days to maturity	105.33-145	126.55	87.00	127.38	40.39
3.	Plant height (cm)	92-136.4	120.13	51.99	81.47	29.48
4.	Number of productive tillers per plant	1.83-3.8	2.83	0.23	0.39	0.16
5.	Number of fingers per earhead	5.1-11	6.79	1.81	2.22	0.41
6.	Main earhead length (cm)	6.77-11.43	9.03	1.13	1.32	0.19
7.	Finger length (cm)	5.4-10.27	7.19	0.88	1.20	0.32
8.	Finger width (cm)	0.67-1.03	0.84	0.005	0.012	0.007
9.	1000-Grain weight (g)	2.37-3.06	2.69	0.023	0.027	0.004
10.	Grain yield per plant (g)	5.20-10.85	8.29	1.54	2.23	0.68
11.	Straw yield per plant (g)	14.82-33.22	23.43	13.77	17.87	4.10
12.	Harvest index (%)	19.64-34.20	26.35	11.46	17.94	6.48

study, suggesting ample scope for improvement of yield and various yield attributing characters.

Mean performance of genotypes : The mean performance of all thirty-six genotypes for twelve characters is shown in table-4. The variability parameters like mean, range, genotypic, phenotypic and environmental variances for twelve characters are presented in table-2. Similarly, phenotypic coefficient of variation and genotypic coefficients of variation for all the characters are presented in table-3. From the mean table it can be concluded that among thirty-six genotypes WN 550 is high yielding followed by GNN-6.

PCV and GCV estimates : The values of phenotypic coefficient of variation were higher than genotypic coefficient of variation for most of the characters indicating the influence of environmental factors. Moderate genotypic and phenotypic coefficient of variation found for the traits *viz*., number of fingers per earhead, number of productive tillers per plant, straw yield per plant, grain yield per plant, finger length, harvest index and main earhead length. These results indicated the presence of wide variation for these characters under study to allow further improvement by selection of the individual traits. Moderate genotypic and phenotypic coefficient of variation for such traits were also observed by (9) for finger length, number of fingers per earhead and (10) for number of fingers per earhead, number of productive tillers per plant, main earhead length, grain yield per plant and straw yield per plant in finger millet while (1) for panicle length in little millet. The lower value of genotypic coefficient of variation and phenotypic coefficient of variation observed for the traits *viz.,* days to 50% flowering, finger width, days to maturity, plant height and 1000 grain weight indicating the presence of low variability for these traits. Similar results were also obtained by (11) for days to 50% flowering and days to maturity and (10) for days to 50% flowering, days to maturity, plant height and 1000 grain weight in finger millet while (12) for plant height and days to maturity and (1) for plant height in little millet. In the present study, the difference between PCV and GCV were lower for the characters *viz.,* days to 50%flowering, days to maturity, plant height, number of fingers per earhead, main earhead length, finger length and 1000 grain weight suggesting negligible role of environment in the expression of traits,

Table-3 : Genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean for twelve traits in thirty-six genotypes of Finger millet.

Sr. No.	Characters	GCV%	PCV%	Heritability (Broad sense %)	Genetic advance	Genetic advance (% of mean)
1.	Days to 50% flowering	9.633	10.91	77.956	16.125	17.521
2.	Days to maturity	7.371	8.919	68.294	15.878	12.547
3.	Plant height (cm)	6.002	7.513	63.813	11.865	9.877
4.	Number of productive tillers per plant	16.973	22.057	59.217	0.761	26.906
5.	Number of fingers per earhead	19.837	21.956	81.626	2.507	36.919
6.	Main earhead length (cm)	11.755	12.718	85.432	2.021	22.382
7.	Finger length (cm)	13.024	15.222	73.205	1.651	22.955
8.	Finger width (cm)	8.664	13.32	42.304	0.097	11.608
9.	1000-Grain weight (g)	5.607	6.115	84.093	0.285	10.593
10.	Grain yield per plant (g)	14.997	18.015	69.296	2.131	25.717
11.	Straw yield per plant (g)	15.839	18.042	77.068	6.712	28.644
12.	Harvest index (%)	12.848	16.073	63.902	5.576	21.158

Table-4 : Mean value for twelve characters of finger millet.

Sr. No	Genotypes	DF	DM	PH	PTP	FPE	MEL	FL	FW	TW	GY	SY	HI
1.	PR 1507	105.67	141.33	122.20	2.20	7.77	10.17	7.73	0.83	2.58	6.75	26.66	20.18
2.	WN 550	97.00	135.33	119.20	2.83	8.13	8.97	7.27	0.73	3.04	10.85	24.52	30.80
3.	WN 585	77.00	109.67	113.47	2.90	10.13	9.17	6.53	0.87	2.74	9.61	18.53	34.20
4.	OEB 601	89.00	119.67	129.93	2.77	6.53	9.33	6.60	0.80	2.73	7.42	22.40	24.98
5.	VR 1101	92.00	124.00	130.00	3.57	7.20	9.03	6.60	0.80	2.64	9.61	26.64	26.37
6.	PR 1511	91.00	123.67	111.53	2.33	5.53	9.47	7.00	0.73	2.55	6.75	21.04	24.32
7.	WN 559	92.33	127.33	127.07	1.97	6.63	10.47	8.73	0.93	2.60	7.74	26.01	22.91
8.	OEB 602	84.00	115.67	120.67	3.57	5.17	6.77	5.40	0.77	2.53	6.55	24.02	21.45
9.	RAuF 15	86.00	120.33	121.67	3.60	11.00	8.50	6.53	0.70	2.74	9.97	22.82	30.56
10.	ML 181	99.67	134.33	122.00	2.83	5.70	9.90	7.93	0.77	2.47	6.94	19.42	26.37
11.	VL 390	87.00	119.67	92.00	2.33	8.17	8.77	6.07	0.67	2.38	5.20	15.45	25.29
12.	IIMRFM-6655	86.33	118.67	111.87	1.83	9.23	8.67	7.20	0.77	2.79	8.16	18.17	31.05
13.	KMR 663	99.67	133.67	123.73	2.73	6.20	9.63	7.20	0.80	2.64	7.49	19.04	28.26
14.	KWFM 49	106.00	142.67	114.40	3.10	6.93	10.07	8.07	0.83	2.56	6.96	17.55	29.03
15.	RAuF 13	87.00	122.67	126.60	2.80	7.07	9.67	7.73	0.97	3.06	9.84	24.64	28.56
16.	ML 322	90.00	123.33	123.87	3.27	5.73	10.10	8.33	0.83	2.75	8.85	22.27	28.43
17.	VL 389	68.67	106.67	106.13	2.60	7.97	7.80	6.27	0.87	2.68	7.36	14.82	33.21
18.	PRS 38	84.00	117.00	136.40	2.07	8.40	9.13	7.13	0.87	2.50	8.84	24.16	26.80
19.	KMR 632	99.00	137.33	119.07	2.97	6.10	11.43	10.27	0.87	2.55	8.80	27.27	24.38
20.	KOPN 1059	102.33	145.00	123.47	2.43	5.93	9.93	8.27	0.83	2.67	8.89	28.15	24.01
21.	TNEC 1292	85.67	118.00	128.80	3.33	7.83	8.77	6.93	0.80	2.84	8.53	19.43	30.54
22.	GPU 97	99.00	132.00	126.47	2.13	5.47	10.43	8.80	0.90	2.51	8.21	28.40	22.44
23.	TNEC 1294	96.67	129.33	112.40	3.80	5.10	7.73	6.27	1.03	2.62	6.91	20.54	25.22
24.	GPU 96	100.00	140.33	117.87	2.27	5.77	7.63	6.87	0.87	2.73	8.19	25.66	24.10
25.	Gossigoan Marubadhan	112.00	145.00	120.73	2.87	6.47	6.90	6.13	0.93	2.75	8.87	33.22	21.15
26.	GPU 45	85.67	118.67	123.67	2.90	6.23	8.10	6.13	0.73	2.55	7.11	22.79	23.84
27.	VL 352	67.67	105.33	117.80	2.23	8.33	7.07	5.73	1.03	2.58	7.16	23.77	23.43
28.	GPU 67	90.00	122.67	118.40	2.23	5.90	8.13	6.67	0.77	2.76	8.73	25.52	25.44
29.	PR 202	88.33	121.00	131.73	3.33	5.60	7.33	6.13	0.80	2.71	9.29	24.27	27.73
30.	GN-1	94.00	127.67	120.40	2.57	5.63	8.93	7.13	0.77	2.64	6.76	27.69	19.64
31.	GN-2	96.33	130.33	116.87	2.73	5.80	9.17	7.33	0.73	2.78	7.34	26.37	21.78
32.	GN-3	95.00	131.33	117.33	3.07	5.87	9.73	8.53	0.93	2.70	8.40	26.10	24.34
33.	GN-4	93.00	129.00	118.80	3.27	6.33	9.40	7.33	0.83	2.75	9.84	25.45	27.91
34.	GN-5	93.67	130.33	119.33	3.40	6.07	9.27	7.47	0.87	2.78	9.86	24.19	28.97
35.	GNN-6	97.33	129.33	119.40	3.53	6.00	9.40	7.27	0.93	2.87	10.42	23.33	30.81
36.	GNN-7	95.33	127.33	119.40	3.47	6.53	10.07	7.33	0.90	3.03	10.07	23.22	30.24

DF Days to 50 % flowering
DM Days to maturity
PH Plant height (cm)
PTP No. of productive tillers per plant
FPE Number of fingers per earhead
MEL Main ear head length (cm)
FL Finger length (cm)
FW Finger width (cm)
TW 1000-Grain weight (g)
GY/P Grain yield per plant (g)
SY/P Straw yield per plant (g)
HI Harvest index (%)

therefore improvement by phenotypic selection is possible.

Heritability and genetic advance estimates : High heritability estimates were noticed for days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, number of fingers per earhead, main earhead length, finger length, 1000 grain weight, grain yield per plant, straw yield per plant and harvest index indicating that these characters are less influenced by the environmental fluctuations and largely governed by additive genes, so selection could be rewarding for improvement of such yield attributes. Moderate heritability estimates were observed for finger width revealing higher environmental influence in the expression these traits. Genetic advance expressed as percentage of mean was observed high for number of number of fingers per earhead, productive tillers per plant, grain yield per plant, straw yield per plant, main earhead length, finger length and harvest index and was recorded moderate for characters *viz.,* days to 50% flowering, days to maturity and 1000 grain weight. However, plant height had recorded low genetic advance as expressed as percentage of mean.

In present investigation, high heritability coupled with high genetic advance was observed for the traits *viz.,* number of fingers per earhead, number of productive tillers per plant, main earhead length, finger length, grain yield per plant, straw yield per plant and harvest index indicating that these characters were governed by additive gene action, hence, there are good chances of improvement of these traits through direct selection. High value of heritability associated with low genetic advance as percentage of mean was found for plant height showed the predominance of non-additive gene action in the expression of this trait. Hence, breeder should use suitable methodology to use both additive and non-additive gene action simultaneously for significant improvement. The characters *viz.,* days to 50% flowering, days to maturity and 1000 grain weight showed high heritability coupled with moderate genetic advance as per cent of mean. High heritability accompanied with moderate genetic advance as per cent of mean indicated that the genotypes under study were diverse with immense genetic potential and further improvement in this trait is possible by adopting simple selection technique.

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