

Original Research Article

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## Evaluation of Genetic Variability for Quantitative and Qualitative Characters in Finger Millet (*Eleusine coracana* (L.) Gaertn.) Local Germplasm

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### ABSTRACT

A study was undertaken to determine the extent of genetic variability for grain yield and eight other quantitative characters and two qualitative characters in 40 genotypes of finger millet. The analysis of variance revealed significant differences among genotypes for all the characters. High genotypic coefficient and phenotypic coefficient of variation was recorded for grain iron content followed by grain yield per plant, number of tillers per plant, number of productive tillers per plant, main earhead length, number of fingers per earhead, grain calcium content, 100 ml volume weight of grain. The lower magnitude of GCV was observed plant height, days to 50 per cent flowering and days to maturity. The high estimates of heritability in broad sense was observed for grain iron content followed by grain yield per plant, 100 ml volume weight, main earhead length, number of tillers per plant, grain calcium content, number of fingers per earhead, days to 50 per cent flowering, days to maturity and plant height. Highest estimate of GA was noticed for grain calcium content. While, medium to low estimates of GA observed for 100 ml volume weight, days to maturity, plant height, days to 50 per cent flowering, grain yield per plant, grain iron content, main earhead length, number of tillers per plant and number of productive tillers per plant. High heritability coupled with high genetic advance was recorded in grain yield per plant, 100 ml volume, which indicated the predominance of additive gene effects. Improvement in these characters could be exercised by simple selection due to fixable additive gene effects.

#### Keywords

Finger millet,  
Genetic variability,  
Heritability,  
Genetic advance

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### Introduction

Millet is a collective term referring to a number of small seeded annuals grasses that are cultivated as grain crops, primarily on marginal lands in dry areas in temperate, subtropical and tropical regions. Finger millet, (*Eleusine coracana*), is also known as African

millet, ragi, nachani, nagali. It is important staple food in parts of eastern and Central Africa and India. Finger millet is very adaptable to a wide range of environmental and climatic conditions, thrives at higher elevations than most other tropical cereals and tolerates salinity better than moist cereals. It is important cereal in Karnataka. It is intensively

grown in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Gujarat, Maharashtra and in the hilly regions of Uttar Pradesh, Himachal Pradesh with a total area of 2.5 million hectares and 2.2 million tones of production.

Finger millet (*Eleusine coracana* (L.) Gaertn.), is one among highly utilized belong to family Poaceae and it ranks 4<sup>th</sup> in the importance of world. Finger millet is originated from Ethiopia. It is allopolyploid with chromosome number  $2n=4x=36$  and evolved from a cross between two diploid species *Eleusine indica* (AA) and *Eleusine floccifolia* or *Eleusine tristachya* (BB) as genome contributors (Hiremat and Salimath, 1992). Finger millet is mostly self pollinating with some amount of cross pollination (1%) mediated by wind (Jansen and Ong 1996, Purseglove 1972).

In India, the total area under finger millet was 1.9 million hectares with production of 1.9 million tonne and productivity 1661 kg/ha (2017). Out of these it is cultivated in Maharashtra is 966 ha and the production is 1008 tonne and productivity under Maharashtra state was 1043 kg/ha. (2014-2015).

Nutritive value of ragi per 100 g is Protein 7.3g, Fat 1.3g, Carbohydrate 72g, Calcium 3.44g, Iron 9.9g, Minerals 2.7g, Fibre 3.6g, Energy 328 kCal, Ash 2.6g, Vitamin A 6 RE, Thiamin 0.24 mg, Riboflavin 0.11 mg, Niacin 1.0 mg, Vitamin C 1 mg, Chloride 84 mg, Copper 0.5 mg, Iodine 10 µg, Magnesium 140 mg, Manganese 1.9 mg, Molybdenum 2 µg, Phosphorous 250 mg, Potassium 314 mg. And essential amino acids are Cystine 1.7, Isoleucine 4.0, Leucine 7.8, Lysine 2.5, Methionine 5.0, Phenylalanine 4.1, Tryptophan 1.3, Threonine 4.1, Tyrosine 4.1, Valine 6.4. This is versatile grain that can probably be used in dozens of types of foods,

including many that are quite unlike its traditional ones. Its several major uses are porridge, bread, malt, beverage, fodder, popped Products.

## Materials and Methods

The experimental materials consisting forty germplasm of finger millet collected from Nashik, Dhule, Ahmednagar, Satara Pune, Jalgaon and Nandurbar districts of Maharashtra (Table 2). The experiment was laid out in RBD with three replications at Department of Botany, College of Agriculture, Dhule (M.S.) during Kharif 2017. By adopting a spacing of 22.5 cm between rows and 10 cm between plants respectively, at recommended package of practices were followed to raise good and healthy crop stand. Data were collected on eleven yield and yield contributing characters viz., days to 50% flowering, days to maturity, plant height, number of tillers per plant, number of productive tillers per plant, main earhead length, number of fingers per earhead, 100 ml volume weight, grain yield per plant, grain iron content, grain calcium content.

The mean of five plants was subjected to statistical analysis. The data for different characters were statistically analyzed for significance by using analysis of variance technique described by Panse and Sukhatme (1985). The adapted design was Randomized Block Design (RBD) with three replications. The significance of mean sum of square for each character was tested against the corresponding error degrees of freedom using "F" Test (Fisher and Yates, 1967). The components of variances were used to estimate genetic parameters like phenotypic and genotypic coefficient of variation (PCV and GCV) as per the formula given by Burton and De Vane (1953). Heritability in broad sense was calculated according to the formula given by Allard (1960) and expressed in

percentage. Genetic advance was estimated by using Burton (1953). Statistical analysis was done by using WINDOSTAT program.

**Results and Discussion**

Analysis of variance revealed significant differences among genotypes for all the characters. Studies of genetic variability exhibited high phenotypic and genotypic coefficients of variation, heritability and genetic advance as percent of mean for the traits viz., Genetic advance as a per cent of mean was observed highest for grain iron content followed by grain yield per plant. Whereas, it was found medium for number of tillers per plant, number of productive tillers per plant, main earhead length, number of fingers per earhead, 100 ml volume weight, grain calcium content while low estimates of GA observed for plant height, days to 50 per cent flowering and days to maturity indicating simple selection can be practiced for improvement of these characters (Table 1). It shows that the presence of variability and choice of material is appropriate.

Improvement of economic characters like yield through selection is conditioned by the

nature and magnitude of variability existing in such populations. However, the phenotypic expression of complex character like yield is a combination of genotype, environment and their interaction. This indicates the need for partition of overall variability into heritable and non-heritable components with the help of appropriate statistical techniques.

Possibility of achieving improvement in any crop plants depends largely on the magnitude of genetic variability. Phenotypic variability expressed by a genotype or a group of genotypes in any species can be partitioned into genotypic and environmental components. The genotypic component being the heritable part of the total variability, its magnitude for yield and its component characters influence the selection strategies to be adopted by the breeders

Coefficients of variation studies indicated that the estimates of PCV were slightly higher than the corresponding GCV estimates for all the characters, indicating that the characters were less influenced by the environment. Therefore, selection for the improvement of these traits.

**Table.1** Analysis of variance for eleven characters in finger millet

Sr. No	Characters	Mean sum of square		
		Replication	Genotype	Error
1	Days to 50% flowering	33.908	279.59**	16.429
2	Days to maturity	33.033	393.21**	35.272
3	Plant height (cm)	41.308	415.080**	45.445
4	No. of tillers / plant	0.582	7.679**	0.308
5	No. of productive tillers / plant	0.410	6.308**	0.210
6	Main earhead length (cm)	0.290	11.546**	0.272
7	No. of fingers / earhead	0.614	6.986**	0.374
8	100 ml volume weight (gm)	16.808	662.402**	14.859
9	Grain yield / plant (gm)	8.258	210.99**	4.053
10	Grain iron content (mg/100 gm)	0.069	19.561**	0.069
11	Grain calcium content (mg/100 gm)	1210.40	11756.44**	554.75

\*, \*\* Indicates significance at 5% and 1% level, respectively.

**Table.2** List of finger millet genotypes with origin

Sr. No	Genotypes	Source
1	DHFM-01	Sinner (Nashik)
2	DHFM-02	Niphad (Nashik)
3	DHFM-03	Niphad (Nashik)
4	DHFM-04	Niphad (Nashik)
5	DHFM-05	Surgana (Nashik)
6	DHFM-06	Igatpuri (Nashik)
7	DHFM-07	Niphad (Nashik)
8	DHFM-08	Niphad (Nashik)
9	DHFM-09	Sinner (Nashik)
10	DHFM-10	Niphad (Nashik)
11	DHFM-11	Surgana (Nashik)
12	DHFM-12	Sakri (Dhule)
13	DHFM-13	Akole (Ahmednagar)
14	DHFM-14	Newasa (Ahmednagar)
15	DHFM-15	Akole (Ahmednagar)
16	DHFM-16	Akole (Ahmednagar)
17	DHFM-17	Satara (Satara)
18	DHFM-18	Bhor (Pune)
19	DHFM-19	Shirpur (Pune)
20	DHFM-20	Shirpur (Pune)
21	DHFM-21	Junnar (Pune)
22	DHFM-22	Junnar (Pune)
23	DHFM-23	Shirpur (Pune)
24	DHFM-24	Peth (Nashik)
25	DHFM-25	Jalgaon (Jalgaon)
26	DHFM-26	Sinner (Nashik)
27	DHFM-27	Nashik (Nashik)
28	DHFM-28	Nandurbar (Nandurbar)
29	DHFM-29	Nandurbar (Nandurbar)
30	DHFM-30	Nandurbar (Nandurbar)
31	DHFM-31 (Phule Nachani)	Kolhapur
32	DHFM-32	Nandurbar (Nandurbar)
33	DHFM-33	Akole (Ahmednagar)
34	DHFM-34	Akole (Ahmednagar)
35	DHFM-35	Akole (Ahmednagar)
36	DHFM-36	Akole (Ahmednagar)
37	DHFM-37	Akole (Ahmednagar)
38	DHFM-38	Akole (Ahmednagar)
39	DHFM-39	Akole (Ahmednagar)
40	DHFM-40	Akole (Ahmednagar)

**Table.3** Parameters of genetic variability for different characters in finger millet

Sr. No	Characters	General Mean	$\sigma^2_g$	$\sigma^2_p$	$\sigma^2_e$	GCV (%)	PCV (%)	ECV (%)	$h^2$ (BS %)	GA	GA as % of mean
1	Days to 50 per cent flowering	93.43	87.72	104.15	16.42	10.02	10.92	4.33	84.23	17.70	18.95
2	Days to maturity	134.04	119.31	154.58	35.27	8.14	9.27	4.43	77.18	19.76	14.74
3	Plant height (cm)	102.23	123.21	168.65	45.44	10.85	12.70	6.59	73.05	19.54	19.11
4	No. of tillers/plant	5.60	2.45	2.76	0.30	27.95	29.66	9.91	88.83	3.04	54.27
5	No. of productive tillers/plant	5.17	2.03	2.24	0.21	27.57	28.96	8.87	90.61	2.79	54.06
6	Main earhead length (cm)	8.78	3.75	4.03	0.27	22.06	22.84	5.94	93.24	3.85	43.88
7	No. of fingers/ earhead	7.03	2.20	2.57	0.37	21.10	22.82	8.69	85.48	2.82	40.18
8	100 ml volume weight	76.78	215.84	230.70	14.85	19.13	19.78	5.02	93.56	29.27	38.12
9	Grain yield/plant (gm)	20.16	68.98	73.03	4.05	41.18	42.37	9.98	94.45	16.62	82.44
10	Grain iron content (mg/100 gm)	4.65	6.49	6.56	0.06	54.71	55.00	5.64	98.95	5.22	112.12
11	Grain calcium content (mg/100 gm)	308.05	3733.89	4288.64	554.75	19.83	21.25	7.64	87.06	117.45	38.12

The difference between GCV and PCV values was more for grain calcium content, plant height indicating that selection based on phenotypic observation may not be very effective for these traits (Table 3). The GCV and PCV were high for number of tillers per plant, number of productive tillers per plant, main earhead length, number of fingers per earhead and grain yield per plant showing greater scope for selection for improvement of these characters. Similar results obtained to John *et al.*, (2006), Bedis *et al.*, (2006), Priyadharshini *et al.*, (2011), Lule *et al.*, (2012), Reddy *et al.*, (2013), Karad *et al.*, (2013) Wolie *et al.*, (2013), Suryanarayana *et al.*, (2014) Jyosthana *et al.*, (2016), and Mahanthesha *et al.*, (2017), Suryanarayana *et al.*, (2014) and Mahanthesha *et al.*, (2017).

High heritability coupled with high genetic advance reveals the presence of lesser environmental influence and prevalence of additive gene action in their expression (Panse, 1957). Lower values of genetic advance indicate the prevalence of narrow range of variability, high G X E interaction (non-additive gene action). In the present investigation high heritability coupled with high genetic advance as per cent of mean was observed for grain iron content, grain yield per plant, number of productive tillers per plant and main earhead length suggesting that these characters are govern by additive genes and phenotypic selection for these characters may be effective.

Previously similar results were reported by Ganapathy *et al.*, (2007). Prabhu *et al.*, (2008) Karad *et al.*, (2013). Auti *et al.*, (2017). High heritability with low genetic advance or low heritability with low genetic advance is observed for any given character, presence of non additive gene action may be suspected.

High heritability with low genetic advance was observed for number of pods per cluster,

100 seed weight, pod length and number of seeds per pod. This indicates non-additive gene action and selection in early genotypes for such traits may not be effective.

Genotypic coefficient of variation (GCV) along with heritable estimates would provide a better picture of the amount of genetic advance to be expected by phenotypic selection (Burton, 1953). It is suggested that genetic gain should be considered in conjunction with heritability estimates (Johnson *et al.*, 1955). Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone (Table 3).

In conclusion, the material chosen differed in their genotypic make up as evidenced by the significant differences among them in respect of all the quantitative characters studied. Phenotypic coefficients of variations estimate were slightly higher than the genotypic coefficients of variation for all the trait, indicating low environmental influence on the expression of all the traits.

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