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Genetic parameters for yield and yield attributing traits in Finger Millet (*Eleusine coracana* L. Gaertn.) genotypes

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Abstract
As finger millet is nutritionally superior to many cereals, it is commonly referred to as "nutritious millet". The present study aims to uncover whether genetic variation exists and which traits are significantly important to unravel the genetic gain. Nine yield and yield components characters were assessed in 105 finger millet genotypes for their variability, heritability and genetic advance. Results from analysis of variance showed significant differences among all the characters studied indicating that there was sufficient variability to improve these traits. The result of genetic parameters revealed that high genotypic (30.4, 26.7 and 20.9) and phenotypic (34.1, 28.9 and 25) coefficients of variation along with high heritability (80, 85 and 67) and high genetic advance as per cent of mean (55.9, 50.9 and 35.2) indicated that variation among the genotypes is high for grain yield per plant followed by productive tillers per plant and ear weight respectively showing the predominance of additive gene action is anticipated in the inheritance of these traits.

Keywords: Grain yield, PCV, GCV, Heritability, genetic advance & response to selection

Introduction
Eleusine coracana (L.) Gaertn. Is one of the important small millets that are cultivated for food and fodder. It is predicted that additive gene action plays a dominant role in inheritance of grain yield per plant, productive tillers per plant and ear weight respectively. Across the world, it is widely cultivated in semi-arid and arid regions, primarily eastern and southern Africa, India and some Asian countries like Sri Lanka and China (Anuradha *et al.* 2013) [2]. Traditional low input farming systems in Africa make use of it as a food crop. It is important upland areas of eastern Africa, where its market price is higher than other cereals. Expression of grain yield is complex and relies upon the interplay of wide variety of aspect attributes.
Availability of tremendous divergent germplasm with extensive variability will directly effect the genetic enhancement through conventional breeding strategies. The knowledge in the nature and magnitude of genetic variability present in the gene pool plays a very significant role for starting any systematic breeding programme due to the fact the presence of large potential genetic variability in the base population which ensures best chance of genetic gain in crop improvement. Hence, the attempt was made to estimate the yield and contributing traits in one zero five finger millet genotypes by understanding the genetic parameters like phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance, which may contribute to formulation of suitable decision indices for enhancement in this crop.

Materials and Methods
In the present study nine yield and its contributing characters were taken for consideration of variation, heritability and genetic advance for 105 finger millet entries consisting of both germplasm collection, advanced breeding lines and released varieties. The study was done at RARS, Lam, ANGRAU during *kharif*, 2018. These genotypes are experimentized using completely randomized block design with two replications. The data pertaining to all the contributes constituting plant height (cm), days to 50% flowering, productive tillers per plant, fingers per ear, earhead length (cm), finger weight (g), days to maturity, thousand grain weight (g) and grain yield per plant (g) were recorded from five randomly selected competitive plants Phenotypic and genotypic variances were estimated according to Lush (1940) [6].

Phenotypic and genotypic variability coefficients (GCV & PCV) were computed as per Burton (1952) [5]. Heritability in broad sense was calculated as per Allard (1960) [1]. Range of heritability was sorted as suggested by Johnson *et al.* (1955) [10]. Genetic advance as per cent of mean was classified as formulated by Johnson *et al.* (1955) [10]. Traits were grouped as high, moderate or low genetic advance as per the method given by Johnson *et al.* (1955) [10].

Results and Discussion

The analysis of variance with genotypic mean square values were remarkably significant for all nine quantitative trait, indicating immense variation in the genotypes tested (Table 1).The phenotypic and genotypic coefficient of variation were highest for grain yield per plant (30.46 and 34.1) followed by productive tillers per plant (26.7 and 28.9) and ear weight (25.5 and 20.9). High GCV and PCV for grain yield per plant and productive tillers per plant were also reported by Ulaganathan and Nirmalakumari (2014) [16], Mahanthesha *et al.* (2017) [13] and Keerthana *et al.* (2019) [11]. 1000 grain weight (16.1 and 18.1) followed by ear length (15.9 and 13.5) and then finger per panicle (17.9 and 15.1) and plant height (11.2 and 11.1) were recorded moderate PCV and GCV and these results are in accordance with Ulaganathan and Nirmalakumari (2014) [16] and Keerthana *et al.* (2019) [11], while the characters *viz.*, days to 50% flowering (7.9 and 7.6) and days to maturity (6 and 5.2) manifested low phenotypic and genotypic coefficient of variation which were also reported by Prashantha *et al.* (2018) [14]. Improvement in the base population is essential for the characters with moderate to low variability. However, lower estimates of environmental coefficients of variation (ECV) estimates were lower than both genotypic and phenotypic coefficients of variations for most of the traits under study implies that the environmental role was minimal for control of such characters (Singh and Narayana, 1993) [15]. Heritability, being a measure of transmissibility of characters over generations and also its estimates, a tool for breeders for selecting superior individuals and successful utilization of them in breeding programme. Heritability in broad sense (h^2) which manifested for plant height (98%), days to 50% flowering (93%), productive tillers per plant (85%), 1000 grain weight and grain yield per plant having (80%), days to maturity (76%), earhead length (73%) followed by fingers per ear (70%) and then by ear weight (67%). Accordingly high heritability for all the characters studied was reported by Ganapathy *et al.* (2011) [9] and Ulaganathan and Nirmalakumari (2014) [16].

Table 1: Analysis of variance for yield and yield components among 105 genotypes of finger millet.

S. No	Source	Replications	Treatments	Error
	Degrees of freedom	1	104	104
	Mean Sum of Squares			
1.	Days to 50% Flowering	7.205762	7816.709**	283.5092
2.	Plant height (cm)	0.04144	26862.51**	312.0173
3.	Productive tillers/ plant	5.618679s	434.8178**	34.19257
4.	Ear length (cm)	0.054724	330.3048**	51.40213
5.	1000 grain Weight (g)	0.281015	32.80233**	3.714707
6.	Grain yield/plant	110.5989	8473.125**	961.6411
7	Ear weight (g)	5.602333	876.6327**	172.6327
8.	Fingers/panicle	1.00119	320.015**	55.37381
9.	Days to maturity	39.43333	7818.924**	1082.067

**Significant at 1% level

Heritability measures the transmission of heritable portion of phenotypic variance of characters from parents to offspring (Falconer, 1960) [8]. All the yield attributing traits under study resulting high heritability showing the least effect of environmental factors on these traits depicting that phenotypic selection would be rewarding for the improving these traits. (Ulaganathan and Nirmalakumari, 2014) [16].

The characters grain yield per plant (55.9), productive tillers per plant (50.9), ear weight (35), 1000 grain weight (29.7), fingers per ear (26.1), earhead length (23.9) and plant height (22.5) recorded high genetic advance as per cent over mean. High genetic advance indicated that these characters are likely to be governed by additive genes. The trait days to 50% flowering (15.2) recorded moderate genetic advance as like previous report of Prashantha *et al.* (2018) [14] and Lule *et al.* (2012) [12] pointing that these characters are governed by preponderance of non additive genes. While days to maturity manifested low values for genetic advance similar to Devaliya *et al.* (2018) [7]. Overall, high heritability supported with high genetic advance was observed for grain yield per plant, productive tillers per plant, thousand grain weight, ear weight, earhead length, plant height and fingers per ear in confirmation as per reports of Keerthana *et al.* (2019) [11] and Ulaganathan and Nirmalakumari (2014) [16]. Based on these results, simple selection may be sufficient to achieve genetic improvement in the population in the desired direction.

To summarize, high coefficient of variation for grain yield per plant implies much variability in the present population for this trait, providing great width for improvement of the character among the genotypes. High heritability mixing with high genetic advance was noted for per plant grain yield suggesting that this character may be used as a selection criterion for successful improvement in the trait. The amount of genetic variability in the present population can be utilized for varietal improvement in finger millet breeding programmes. Based on the results of variability parameters, other agronomic traits like productive tillers per plant and ear weight which recorded high genotypic (30.4, 26.7 and 20.9) and phenotypic (34.1, 28.9 and 25) coefficients of variation along with high heritability (80, 85 and 67) and high genetic advance as per cent of mean (55.9, 50.9 and 35.2) respectively indicated that variation among the genotypes is high and more over the predominance of additive gene action is anticipated in the inheritance of these traits. Hence, simple selection may be advantageous for amending these characters. The remaining characters under study *viz.*, days to 50% flowering, days to maturity, plant height, ear head length, 1000 grain weight and fingers per ear exhibited low to moderate assessments for PCV, GCV, genetic advance coupled to high heritability suggesting that both additive and non-additive gene effects in the expression of the traits.

Table 2: Mean, variability, heritability and genetic advance as per cent of mean for yield, yield components and grain quality parameters in finger millet

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (%) (broad sense)	Genetic advance as per cent of mean (5% level)
			Minimum	Maximum	GCV %	PCV %		
1	Days to 50% Flowering	78.31	62	91.5	7.6	7.9	93	15.2
2	Plant height (cm)	101.82	64.4	126.8	11.1	11.2	98	22.5
3	Productive tillers per plant	5.18	2.7	10.2	26.7	28.9	85	50.9
4	Ear length (cm)	8.52	6.2	12	13.5	15.9	73	23.9
5	1000 grain Weight (g)	2.31	1.4	3.1	18.1	16.1	80	29.7
6	Grain yield/plant	19.73	8.3	34.6	30.4	34.1	80	55.9
7	Ear weight (g)	8.80	5.3	14.3	20.9	25.5	67	35.2
8	Fingers/panicle	7.47	4.5	10.7	15.1	17.9	70	26.1
9	Days to maturity	107.48	87	120	5.2	6	76	9.48

PCV = Phenotypic coefficient of variation
GCV = Genotypic coefficient of variation

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