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GENETIC VARIABILITY AND CORRELATION OF YIELD AND ITS COMPONENTS IN FINGER MILLET [*ELEUSINE CORACANA* (L.) GAERTN.]

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ABSTRACT

In the present investigation the genetic variability and interrelationships of 11 quantitative characters were studied in 40 diverse genotypes of finger millet. Out of 11 characters, magnitude of GCV ranged from 9.24 to 27.21%, PCV ranged from 9.51 to 32.75%, heritability (in broad sense) ranged from 64.70% to 99.80% and genetic gain ranged from 23.73 to 59.72%. High genetic gain was observed for seed yield per plant (59.72) followed by seed protein content (53.29) and ear weight per plant (52.02) indicating the prevalence of additive gene action for inheritance of these traits. Character association studies revealed that, traits like 1000-seed weight (0.9021 and 0.7640), number of fingers per year (0.8534 and 0.6838), ear weight per plant (0.7850 and 0.6450), finger length (0.7573 and 0.5103), days to maturity (0.6245 and 0.5137), productive tillers per plant (0.5669 and 0.4148), days to 50% flowering (0.5079 and 0.4249) and plant height (0.2665 and 0.2006) were found to possess significant positive association with seed yield per plant at both genotypic and phenotypic levels respectively. So this concluded that this is the genetic reason for these character association.

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INTRODUCTION

Finger millet (*Eleusine coracana* Gaertn.) is one of the important food crops and largely grown in southern states of India.In India, it is cultivated on 1.3 M ha, with a production of 1.59 Mt and a productivity of 1.7 t ha^{-1}(Ministry of Agriculture, 2013). It is commonly famous as "Nutritious millet" as the grains are nutritionally superior to many cereals. It contains protein (7-10%), calcium (344 mg/100 g), iron and other minerals. The carbohydrates present in finger millet have the unique property of slower digestibility. It is also rich in phosphorus (283 mg/100 g) and potassium (408 mg/100 g).Now a days this minor millet became very popular for consumption as it fulfills all nutritional requirements. So the demand for it is increasing day by day. But due to its low yielding ability very less farmers used to sown it.

So to overcome this, it is very necessary to make such genetically stable genotypes having high yield potential. It is therefore, necessary to estimate relative amounts of genetic and non- gentic variability exhibited by different characters using suitable parameters like genotypic coefficient of variability (GCV), heritability (H) and genetic gain. Genetic variability related to presence of differences among the individuals of a population due to differences in their genetic constitution or the environment in which they are grown.

The success of any breeding programme depends upon the quantum of genetic variability present in the population. Wider range of genetic variability helps in selecting desired genotypes. In addition to the genetic variability, knowledge on heritability and expected genetic advance helps the breeder to employ the suitable breeding strategy. Genetic variability together with the heritability estimates would give a better idea on the amount of genetic gain expected out of selection (Burton, 1952 and Swarup and Chaugle, 1962). Similar studies were carried out by Ganapathy *et al.* (2011), Priyadharshini *et al.* (2011), Reddy *et al.* (2012), Nishit (2013) and Srilakshmi (2013).

Yield is a complex and polygenically inherited character resulting from multiplicative interaction of its component traits. The cumulative effect of such traits determines the yield. The change in one character brings about a series of changes in the other characters, since they are interrelated. Therefore, the correlation studies are of considerable importance in any selection programme as they provide degree and direction of relationship between two or more component traits.So the genetic variability and correlation tools are very important for the breeder to enhance the grain yield of finger millet.

So the present study was conducted to assess genetic variability, heritability and correlation to provide necessary information that could be useful in finger millet improvement programme aimed at improving grain yield.

MATERIALS AND METHODS

The experimental material for the present investigation consisted of forty genotypes

of finger millet collected from Agricultural Research Station (ARS), Vizianagaram, Andhra Pradesh and All India Coordinated Small Millets Improvement Project (AICSMIP), Bangalore. These genotypes were evaluated during *kharif* 2013 at Agricultural College Farm, Bapatla in a Randomized Block Design with three replications. The seeds were directly sown by dibbling. Each entry was represented by four rows of 3m length. The spacing of 20 cm between rows and 10 cm between the plants was followed. Basal dose of 30 kg Nitrogen through Urea at the time of sowing and remaining 30 kg Nitrogen, 30 kg Phosporus and 20 kg Potash applied during crop growth period. Observations were recorded on ten randomly chosen plants for eleven quantitative characters *viz*., plant height, days to 50% flowering, days to maturity, number of productive tillers per plant, fingers per ear, finger length, ear weight per plant, 1000-seed weight, seed protein content, seed calcium content and seed yield per plant. The mean value of the recorded data was subjected to analysis of variance.The genotypic and phenotypic coefficients of variation were calculated using the formula by Burton (1952).The GCV and PCV values were classified as described by Sivasubramanian and Menon (1973) *i.e*. low, moderate and high.Heritability in broad sense was computed as the ratio of genetic variance to the total phenotypic variance and narrow sense heritability was the ratio of additive genetic variance to the total phenotypic varianceas suggested by Hanson *et al*. (1956) and expressed as percentage. Heritability in broad sense was categorized as per the classification given by Johnson *et al*. (1955) i.e low, moderate and high.Genetic advance and the range of genetic advance as per cent of mean was classified as suggested by Johnson *et al*. (1955) i.e low, moderate and high.The phenotypic and genotypic correlation coefficients were worked out to determine the degree of association of a character with yield and also among the yield components by using covariance technique as per Falconer (1964).

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among the genotypes for all 11 characters.

Variability

Out of 11 characters, magnitude of GCV ranged from 9.24 to 27.21%, PCV ranged from 9.51 to 32.75%, heritability (in broad sense) ranged from 64.70% to 99.80% and genetic gain ranged from 23.73 to 59.72%. High PCV and GCV were recorded for seed yield per plant, ear weight per plant, productive tillers per plant and seed protein content. Similar results were found by Dhamdhere *et al*. (2011), Jadhav *et al*. (2011), Karad and Patil (2013), Srilakshmi (2013),Ulaganathan and Nirmalakumari (2013)and Singh *et al*. (2013). While moderate PCV and GCV were recorded for seed calcium content, number of fingers per year, plant height, days to 50% flowering and days to maturity. Similar findings has been occurred by Sarala (2007), Ganapathy *et al*. (2011), Dhamdhere *et al*. (2011), Srilakshmi (2013) and Nishit (2013). Since GCV itself would not provide reliable measure of the heritable variations, heritability estimates were considered along with it. The estimates of heritability in broad sense ranged from 64.70% for finger length to 99.80% for seed protein content. The estimates of heritability were high for all the 11 characters under study. But, the estimates of heritability in broad sense has limitations because it includes both additive and epistatic gene effects. Therefore estimates of heritability in broad sense would be more meaningful if accompanied by the estimates of genetic advance.

Estimates of genetic advance expressed as percentage of mean, ranged from 23.73 for 1000-seed weight to 59.72 for seed yield per plant. The highest genetic advance was obtained for seed yield per plant, as also reported by Priyadharshini *et al*. (2011), Nishit (2013), Srilakshmi (2013) and Ulaganathan and Nirmalakumari (2013).The estimates of heritability and genetic advance as per cent of mean were high for all the eleven characters under study indicating the predominance of additive gene action and hence direct phenotypic selection is useful with respect to these traits.

Association of characters

The estimates of correlation coefficients between all possible pairs of characters are in Table 2. Genotypic correlation coefficients in general were higher than phenotypic correlation coefficients indicating that the apparent associations are largely due to genetic reasons. The traits, 1000-seed weight, number of fingers per ear, ear weight per plant, finger length, days to maturity, productive tillers per plant, days to 50% flowering

Table 1: Estimates of variability, heritability and genetic advance as per cent of mean for seed yield and yield components in finger millet [*Eleusine coracana* (L.) Gaertn.]

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)(%)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	Plant height (cm)	105.02	78.90	138.20	13.28	11.93	80.70	28.30
2.	Days to 50% flowering	70.03	54.00	84.00	11.30	11.12	96.80	28.91
3.	Days to maturity	103.05	88.00	122.33	10.08	10.02	98.80	26.30
4.	Productive tillers per plant	3.65	2.20	5.40	23.18	20.10	75.20	46.03
5.	Fingers per ear	5.73	3.73	7.60	15.27	14.86	94.70	38.20
6.	Finger length (cm)	6.87	4.89	9.44	20.72	16.67	64.70	35.41
7.	Ear weight per plant (g)	19.11	10.52	27.71	23.32	21.43	84.40	52.02
8.	1000-seed weight (g)	3.91	3.24	4.80	9.51	9.24	94.40	23.73
9.	Seed protein content (%)	8.36	5.70	13.65	20.22	20.20	99.80	53.29
10.	Seed calcium content (mg/100g)	331.31	234.00	478.66	17.39	17.36	99.60	45.75
11.	Seed yield per plant (g)	14.15	7.30	22.75	32.75	27.21	69.00	59.72

PCV = Phenotypic Coefficient of variation; GCV = Genotypic Coefficient of Variation

Table 2: Phenotypic and Genotypic correlations among seed yield and yield contributing characters in finger millet [*Eleusine coracana* (L.) Gaertn]

Character	Correlation	Days to 50% flowering	Days to maturity	Productive tillers per plant	Fingers per ear	Finger length	Ear weight per plant	1000-seed weight	Seed protein content	Seed calcium content	Seed yield per plant
Plant height	G	0.6730**	0.7207**	0.2156*	0.3965**	0.1898*	0.2342**	0.1805*	-0.3022**	0.045	0.2665**
	P	0.5896**	0.6537**	0.1121	0.3366**	0.1283	0.1859*	0.1497	-0.2741**	0.0432	0.2006*
Days to 50% flowering	G		0.8277**	0.3252**	0.5025**	0.4485**	0.3978**	0.3238**	-0.2241**	-0.0605	0.5079**
	P		0.8148**	0.2754**	0.4791**	0.3714**	0.3369**	0.3170**	-0.2196*	-0.0599	0.4249**
Days to maturity	G			0.2883**	0.4912**	0.5375**	0.5316**	0.4755**	-0.2392**	0.0635	0.6245**
	P			0.2458**	0.4771**	0.4271**	0.4799**	0.4600**	-0.2375**	0.0638	0.5137**
Productive tillers per plant	G				0.7332**	0.3625**	0.4388**	0.5353**	-0.2983**	-0.0387	0.5669**
	P				0.6178**	0.2211*	0.3236**	0.4648**	-0.2612**	-0.0334	0.4148**
Fingers per ear	G					0.5211**	0.6516**	0.7330**	-0.2406**	-0.1527	0.8534**
	P					0.4068**	0.5911**	0.6944**	-0.2341*	-0.1479	0.6838**
Finger length	G						0.6181**	0.6233**	-0.0711	-0.0127	0.7573**
	P						0.4416**	0.4950**	-0.0609	-0.0098	0.5103**
Ear weight per plant	G							0.5671**	0.0549	-0.1252	0.7850**
	P							0.5130**	0.0531	-0.1125	0.6450**
1000-seed weight	G								0.0068	0.0101	0.9021**
	P								0.0075	0.0099	0.7640**
Seed protein content	G									-0.1638	-0.0558
	P									-0.1634	-0.0467
Seed calcium content	G										-0.1139
	P										-0.0891

G: Genotypic correlation * Significant at 5% level; P: Phenotypic correlation ** Significant at 1% level

and plant height were found to possess significant positive association with seed yield per plant at both genotypic and phenotypic levels. These results were in accordance with findings of Srilakshmi (2013) for 1000-seed weight, number of finger per ear, finger length, days to maturity, productive tillers per plant and days to 50% flowering, Kumar *et al.* (2014) also found the same result for productive tillers per plant. Muduli *et al.* (2012) for ear weight per plant and Haradari *et al.* (2012) for plant height.

The trait protein and calcium content showed negative non-significant association with seed yield per plant at both genotypic and phenotypic levels. Similar results were found by Padmaja (2006) for both protein and calcium content.

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