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Genetic Variability in Segregating Generation of Interspecific Hybrids of Finger Millet (*Eleusine coracana* (L.) Gaertn.)

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Abstract

An investigation was carried out during 2005 and 2006 to assess the variability released from the interspecific crosses involving three different popular cultivated finger millet varieties viz. Indaf 8 × *E. africana* (cross I), HR 911 × *E. africana* (cross II) and PR 202 × *E. africana* (cross III). The F_2 populations of all the three crosses registered high PCV and GCV values were observed for grain yield per plant and finger width and low for plant height and days to 50% flowering whereas low moderate for all other characters. Plant height, culm thickness, peduncle length, finger length, test weight and grain yield per plant reported high broad sense heritability accompanied with high genetic advance.
Key words : Finger millet, Interspecific hybrids, Genetic variability, Heritability, Genetic advance.

Finger millet (*Eleusine coracana* (L.) Gaertn.) commonly called as ragi in India, ranks fourth after pearl millet (*Pannicum glaucum*), foxtail millet (*Setaria italica*) and proso millet (*Panicum miliaceum*) with an approximate 8% of the area and 11% of the production in the world. About 4.5 million tones of grains are produced annually on 5 million hectares of land throughout the world (1). India alone produces 40—45% of the total world production with 2.70 million tones grains on two million hectares of land with a productivity of 1,225 kg per hectare and rest of finger millet is produced in East and Central Africa. In India, the south eastern area of Karnataka and adjoining regions of Andra Pradesh and Tamil Nadu states produce the bulk of the total crop. Karnataka alone contributes 55% of total India's area and production of finger millet with a productivity of 1,335 kg per hectare (2). As a rainfed crop, finger millet is routinely subjected to moisture stress whose intensity varies across the seasons/regions. In addition to drought stress, various diseases especially blast and leaf blight causes considerable yield loss. Crop improvement work in finger millet during the last three decades has been directed to improve yield and agronomic attributes and considerable progress has been made by way of releasing superior varieties suitable to various regions. The variability available in cultivated species is limited in respect of certain important characters like biomass, straw quality, tillering ability, drought tolerance and resistance to several kinds of biotic stresses. To overcome these limitations, introgression of desirable genes from wild relatives into cultivated varieties is required. In general, variability is the basic material for any crop improvement program. So quantification of the extent of variability created in grain yield and its contributing traits by segregation after hybridization and the knowledge of heritability, genetic advance for the yield components and their correlations with yield in the segregating populations are the prerequisites for selection of desirable segregants in any crop breeding program. *Eleusine africana* is close relative of cultivated species of *E. coracana.* It has more tillering ability (15—20) and high drought tolerance capacity. It matures early (95—100 days) with more fingers per ear. Hence, in the present investigation *E. africana* is used as donor species for finger millet improvement. An attempt was therefore made in the present investiga-

Table 1. Mean and range values for 10 metric traits in the F_2 generation of three crosses. Cross I—Indaf 8 × *E. africana*, cross II—HR 911 × *E. africana* and cross III—PR 202 × *E. africana.* SE—Standard error.

	Range					
	Lowest			Highest		
Characters	cross I	cross II	cross III	cross I	cross II	cross III
1 Plant height (cm)	90.00	99.00	94.00	160.00	157.00	158.00
2 Culm thickness (cm)	0.50	0.50	0.50	1.20	1.20	1.20
3 Productive tillers/plant	2.00	2.00	2.00	17.00	15.00	17.00
4 Peduncle length (cm)	12.00	12.00	15.00	38.00	34.00	39.00
5 Finger number/ear	6.00	5.00	5.00	14.00	15.00	13.00
6 Finger length (cm)	6.00	6.00	4.00	16.00	17.00	14.50
7 Finger width (cm)	0.30	0.30	0.40	1.30	0.90	1.10
8 Days to 50% flowering	71.00	73.00	76.00	89.00	90.00	87.00
9 Test weight (g)	1.23	1.32	1.32	2.64	2.90	2.87
10 Grain yield/plant (g)	1.52	1.58	1.21	17.11	22.00	14.86

Table 1. Continued.

	Mean (± SE)		
Characters	cross I	cross II	cross III
1 Plant height (cm)	126.36 (± 1.25)	125.85 (± 1.26)	127.58 (± 1.46)
2 Culm thickness (cm)	0.79 (± 0.02)	0.78 (± 0.02)	0.72 (± 0.01)
3 Productive tillers/plant	7.62 (± 0.31)	6.81 (± 0.27)	6.98 (± 0.30)
4 Peduncle length (cm)	25.85 (± 0.54)	24.98 (± 0.41)	26.71 (± 0.50)
5 Finger number/ear	9.08 (± 0.18)	8.84 (± 0.16)	7.97 (± 0.19)
6 Finger length (cm)	10.60 (± 0.22)	9.23 (± 0.21)	8.31 (± 0.21)
7 Finger width (cm)	0.62 (± 0.02)	0.62 (± 0.01)	0.63 (± 0.01)
8 Days to 50% flowering	82.52 (± 0.02)	81.41 (± 0.49)	81.48 (± 0.26)
9 Test weight (g)	1.85 (± 0.26)	2.09 (± 0.04)	2.10 (± 0.01)
10 Grain yield/plant (g)	5.84 (± 0.04)	5.79 (± 0.41)	4.36 (± 0.31)

tion to assess the variability released in F_2 generation of three crosses of interspecific hybrids in finger millet.

Methods

The F_2 population of three crosses of finger millet viz. Indaf 8 × *E. africana* (cross I), HR 911 × *E. africana* (cross II) and PR 202 ± *E. africana* (cross III) were grown during summer 2006 along with parents at Zonal Agricultural Research Station, Gandhi Krishi Vidyana Kendra, University of Agricultural Sciences, Bangalore. This F_2 population was developed by crossing cultivated popular varieties viz. Indaf 8, HR 911 and PR 202 were used as female parent with the wild species (*E. africana*) was used as male parent during summer 2005. F_1s were identified based on morphological characters of donor parent during *kharif* 2005. A total of 280, 355 and 295 F_2 plants were selected from I, II, and III crosses respectively for recording observation on 10 quantitative traits including grain yield per plant. The phenotypic and genotypic coefficients of variability were computed following the methods of Burton and De Vane (3). The method of Johnson et al. (4) was followed for estimation of broad sense heritability and genetic advance for all the traits recorded.

Results and Discussion

The F_2 population derived from interspecific crosses exhibited lot of diversity for different quantitative traits (Table 1). The F_2 population of three interspecific crosses exhibited considerable variability in respect of all characters studied. More variability was observed for plant height, productive tillers, finger number per ear and finger length in all the three crosses which confirm the earlier reports of Appadurai

Table 2. Estimates of genetic parameters for 10 metric traits in the F_2 generation of three crosses. PCV—Phenotypic coefficient of variation, GCV—Genotypic coefficient of variation, GA—Genetic advance, cross I—Indaf 8 × *E. africana*, cross II—HR 911 × *E. africana* and cross III—PR 202 × *E. africana.*

Characters	PCV (%)			GCV (%)			Heritability in broad sense (%)			GA as % mean		
	cross I	cross II	cross III	cross I	cross II	cross III	cross I	cross II	cross III	cross I	cross II	cross III
1 Plant height (cm)	9.37	10.23	10.51	8.62	9.51	9.81	84.58	86.42	87.26	16.33	18.21	18.89
2 Culm thickness (cm)	19.51	19.50	17.76	18.46	18.46	16.31	89.58	85.58	85.00	35.44	35.89	30.55
3 Productive tillers/ plant	38.72	39.95	39.87	18.50	11.43	13.12	22.84	8.91	10.82	18.11	7.34	8.88
4 Peduncle length (cm)	19.80	16.78	17.29	17.22	13.96	14.13	75.58	69.23	66.73	30.83	24.01	23.77
5 Finger number/ear	18.84	18.10	22.12	11.15	8.46	11.27	35.06	21.87	25.94	13.54	8.14	11.31
6 Finger length (cm)	19.75	23.32	23.51	17.02	20.36	19.58	74.77	76.26	69.37	30.37	36.60	33.57
7 Finger width (cm)	25.48	22.56	17.90	13.49	7.25	14.61	28.00	10.52	65.38	14.51	1.61	23.80
8 Days to 50% flowering	5.19	6.12	2.97	4.52	4.70	2.50	76.00	59.04	64.17	8.11	7.44	4.58
9 Test weight (g)	17.98	18.41	15.45	16.81	16.77	13.82	87.38	83.10	80.00	32.24	31.10	25.23
10 Grain yield/plant (g)	53.58	72.33	65.90	42.41	63.91	48.10	62.64	78.05	53.26	69.00	76.35	72.01

et al. (5). It indicated much scope for improvement of these characters through direct and indirect selection.

The results of phenotypic coefficient of variability (PCV), genotypic coefficient of variability (GCV), heritability and genetic advance are presented in Table 2. Foe all the characters PCV were generally higher than GCV which indicated that substantial influence of environment in the expression of these characters. The highest PCV and GCV observed for grain yield per plant, productive tillers per plant and finger length exhibited high PCV and moderate GCV in all the crosses. These results are in confirmation with the earlier findings of Desalegn (6). Plant height and days to 50% flowering showed low PCV and GCV in F_2 population of all the three crosses and agrees with the observations of Kempanna et al. (7) and Mishra et al. (8). Finger width reported high PCV in cross I and II and moderate in cross III but their GCV were moderate for cross I and cross III and low for cross II indicating high magnitude of environmental effect on the expression of this trait between the crosses. All other characters showed moderate PCV and GCV in all the crosses.

Culm thickness, peduncle length, finger length, test weight and grain yield per plant reported high broad sense heritability accompanied with high predicted genetic advance as per cent of mean in all the crosses indicated the broad sense of additive gene effects in its inheritance, and such characters could be improved by direct selection (9). Plant height and days to 50% flowering revealed high broad sense heritability but they exhibited less genetic advance as per cent of mean, suggesting preponderance of non-additive gene action in the inheritance of these trait in all the crosses. Similar results were reported by Mohan Prem Anand (10). Finger width in cross III had high broad sense heritability accompanied with high predicted genetic advance as per cent of mean indicated that good scope for improving this character through direct selection.

References

1. Rao M. V. 1989. The small millets : Their importance, present status and outlook. *In* A. Seetharam, R. W. Riley and G. Harinarayana, editors. Small millets global agriculture. Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi, India.
2. Anonymous. 2004. AICSMIP – Quinquennial review report, 1994 to 2000. ICAR, New Delhi, India.
3. Burton G. W. and E. M. DeVane. 1953. Estimating heritability in tall Fescue (*Fescue arindinaceae*) from replicated clonal material. Agron. J. 45 : 478—481.
4. Johnson H. W., H. F. Robinson and R. E. Comstock. 1955. Genotypic and phenotypic correlations in soybeans and their implication in selection. Agron. J. 47 : 477—483.
5. Appadurai R., M. S. Thyangam, T. S. Raveendran and V. S. Natarajan. 1977. Genotypic association, herita-

bility and path analysis in ragi (*Eleusine coracana* Gaertn.). Madras Agric. J. 64 : 18—21.

6. Desalegn D. 1998. Genetical studies in segregating populations derived from Indo-African crosses in finger millet (*Eleusine coracana* Gaertn). M.Sc. (Ag.) thesis, UAS, Bangalore, India.
7. Kempanna C., R. Vijayamma and M. V. N. Setty. 1971. The impact of genotype- environment interaction on the determination of the components of variation and other genetic parameters in *Eleusine coracana.* Mysore J. Agric. Sci. 5 : 295—301.
8. Mishra H. P., M. C. Patnaik and P. K. Naik. 1980. Variation in quantitative traits in finger millet. Indian J. Agric. Sci. 50 : 298—301
9. Panes V. G. 1957. Genetics of quantitative characters in relation to plant breeding. Indian J. Genet. 17 : 318—328.
10. Mohan Prem Anand M., M. R. Gururaja Rao, R. S. Kulkarni and C. R. Ravishankar. 2005. An assessment of variability produced in F_2 generation of three crosses of finger millet (*Eleusine coracana* G.). Mysore J. Agric. Sci. 34 : 553—556.