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Research Article

An assessment of variability generated in F_2 generation of four crosses of finger millet (*Eleusine coracana* (Gaertn))

B. Nandini, C.R. Ravishanker, B. Mahesha, M.B. Boranayaka and T.V.Shadakshari

Abstract :

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. The results of this investigation carried out in F_2 generation of four crosses of finger millet to quantify the variability created along with heritability and genetic advances for important yield and attributing characters. In general moderate to high broad sense heritability was observed for days to fifty per cent flowering, finger length, 1000 seed weight, whereas high broad sense heritability was observed for plant height, total tillers per plant and number of productive tillers per plant. A very high genetic advance was observed for total tillers per plant, productive tillers per plant, finger number per main ear, finger length and weight of main ear. Moderate to low genetic advance for plant height, days to fifty per cent flowering and 1000 seed weight were observed.

Key words:
*Eleusine coracana***,** variability, heritability and genetic advance.

Introduction

Finger millet (*Eleusine coracana* (L.) Gaertn.) is an important food crop in Africa and South Asia. It is a hardy crop that can be grown in diverse environments from almost at sea level in South India to high lands of Himalayas. It has dual importance as a source of food grain as well as straw. The major finger millet growing states are Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Orissa, Jharkhand, Chhattisgarh and Uttarakhand. The crop has dual importance as source of food grain as well as straw. Finger millet is very nutritious with good quality protein, plentiful minerals, dietary fibers, phytochemicals and vitamins. It is the richest source of calcium providing 8 – 10 times more than that of rice or wheat. Finger millet carbohydrate has unique property of slower digestibility and regarded as food for long sustenance. The grain has very good malting qualities providing opportunities in expanding its utility range in food processing and value addition. It is used in the production of beer, porridge, soup, bread, cake and puddling. Despite all these merits, this crop has been neglected from the main stream of crop improvement programme. One of the means to boost its production and productivity is to enhance utilization of finger millet germplasm to breed superior varieties. Even with advantages like good nutritional quality and long storability of grains, ragi is not exempted from biotic and abiotic stresses. This creates imbalance in food economy of poor and marginal farmers along with unstability to overall production. The major factors impending the grain yield in ragi are moisture stress and specifically diseases. The result of investigation carried out in F2 generation of four finger millet to quantify the variability created along with heritability and genetic advance for important yield and its attributing characters have been presented in this paper.

Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences (UAS), GKVK, Bengaluru-560065, Karnataka

Materials and methods

The experimental material for the present investigation comprised of F_2 generation of four crosses of finger millet *viz*., cross I (Indaf5 X L264) cross II (GPU26X GE1409) cross III (Indaf5XIE1409) and cross IV (GPU26 X IE2712) obtained from ragi breeder (AICSMIP), V.C. Farm, Mandya. The F_2 seeds of all the four crosses of ragi were first sown in nursery bed and 21 days old healthy seedlings were used for transplantation in the main field under irrigated condition during *kharif* 2008 with single seedling per hill at a spacing of 22.5 cm between rows and 10 cm between plants within the row. The experiment in the main field was laid out in randomized complete block design with two blocks. Crop was raised as per the recommended package of practices. Plants in each plot of all crosses were randomly selected and tagged excluding the border plants in each row. Observations were recorded on grain yield and its attributing character the phenotypic and genotypic variance for these traits.

Result and discussion

Variability parameters *viz,* mean, range, phenotypic variance, genotypic variance, PCV, GCV, broad sense heritability and genetic advance expressed as per cent of mean with respect to all nine characters in F_2 population of all the seven crosses are presented from Table 1 and briefly out lined below. The range of variability was quite high for all the characters studied except days to fifty per cent flowering, finger number per main ear and finger length which exhibited low to moderate amount of variability across all the seven crosses (Table, 1) This indicates high scope for improvement of the highly variable characters, which were created by segregation and recombination whereas, it may not be equally effective for a character, which exhibited narrow range of variability. In general phenotypic coefficient of variance (PCV) values were higher than genotypic coefficient of variance (GCV) for all the characters studied in F_2 generation of all the seven crosses coupled with considerable difference between them, which indicates the substantial influence of environment in the expression of these traits and the same result was observed by Mohan Prem Anand(2003). Days to fifty per cent flowering registered low values of GCV and PCV in all the crosses and this result is similar with the reports of Chunilal *et al.* (1996) and Malali Gowda (1996). Heritability in broad sense for this trait was moderate to low in cross I whereas, in cross III, cross IV and cross V shows high heritability coupled with genetic advance expressed as percent of mean. This indicates its role in further selection. Plant height exhibited low values of GCV and PCV in cross I and cross III. This was in conformity with the reports of Patnaik, (1968), Setty et al. (1974), Appadurai et al. (1977), Goswami and Asthana (1984), Venkatesh Bhat (1974), and Ravikumar and Seetharam (1994). Heritability in broad sense for this trait was high in all the four crosses owing to least difference between the GCV and PCV, which indicates high genetic determination for this trait. Computed genetic advance as per cent of mean, which was based on broad sense heritability combined with favorable genetic advance exhibited by this trait indicates its prominent role in selection of desirable segregants. Total tillers per plant exhibited high values of PCV and GCV in all the four crosses. In general considerable difference exists between both PCV and GCV, which indicate greater influence of environment in shaping this trait. Result obtained in present study supported with earlier reports of Setty et al.(1974) and Ravikumar and Seetharam (1994) whereas, it contradicts with the observation made by Narsimha Rao and Pardhasardhi (1968b), who reported very low level of variability at both genotypic and phenotypic level. All the crosses in F_2 generation registered high broad sense heritability coupled with high amount of genetic advance expressed as per cent of mean except cross I. Ravikumar and Seetharam (1994) obtained similar result for this trait whereas cross I registered moderately high broad sense heritability coupled with moderate to high genetic advance expressed as per cent of mean. This type of result was reported by Narsimha Rao and Pardhasardhi (1968b) and Setty et al. (1974). Thus high broad sense heritability coupled with high genetic advance expressed as per cent of mean of this trait can be utilized as an index for its improvement. Productive tillers per plant registered moderate to high level of variability at both the levels. Difference between PCV and GCV were moderate to wide in all the four crosses, which indicates the major effect of environment on this character. Broad sense heritability as comparatively moderate to high, while genetic advance expressed as per cent of mean was invariably high in all four crosses studied. Shanthappa (1979), Prabhakar and Prasad (1984), Venkatesh Bhat (1991), Ravikumar and Seetharam(1994), Ramaswamy *et al* . (1994), Krishan Reddy (1994), and Byre Gowda (1917) reported moderate to high phenotypic and genotypic variability, heritability and genetic advance for this trait in segregating generation. Reliability can be placed on this important trait for selection of segregants owing to its high broad sense heritability coupled with high genetic advance. Number of finger on main ear exhibited moderate PCV and GCV values across all four crosses. Narrow difference between PCV and GCV in all the four crosses indicates low magnitude of environmental influence on the expression of this trait. This was in accordance with earlier observation made by Setty *et al*. (1974) and Appadurai *et al.* (1977) who reported moderate values of variability for this trait but contradicts with the reports of Shanthakumar (1988), Byre Gowda (1997) and Debelo(1998) who reported high variability for this trait. The broad sense heritability was moderate to high in all remaining crosses. Genetic advance expressed as percentage of mean was also high in all the crosses studied. High values for this trait were earlier reported by Setty *et al*., (1974) and Appadurai *et al*. (1977). However Narsimha Rao and Pardhasardhi (1968b) reported moderate values for both broad sense heritability and Genetic advance expressed as percentage of mean. Hence this trait can be used effectively for selection of desirable segregants owing to its high broad sense heritability combined with high genetic advance. Finger length of main ear exhibited moderate PCV and GCV values in all the crosses studied but, the difference between them were moderate to wide indicating the variable influence of environment on the expression of this trait in different crosses. However broad sense heritability was moderate to high with high genetic advance in all the crosses except in crosses I, it was low value for both these parameter. These results of present study were in total agreement with earlier reports of Chaudhari and Acharya (1969) Setty *et al*. (1974) and Appadurai *et al*. (1977). However moderate to wider difference between the GCV and PCV values of this trait make itself less preferred for improvement of yield owing to its les genetic determination. However it can be considered as a candidate for improvement due to its broad sense heritability and genetic advance. Yield of main ear exhibited high variability in terms of both PCV and GCV in all the crosses studied. Wide difference observed between PCV and GCV values indicated more environmental influence on expression of this trait. However Chaudhari and Acharya (1969) have reported moderate values for both PCV and GCV. Broad sense heritability was moderate to high in all the crosses. However, genetic advance expressed as per cent of mean was high across all the crosses. Similar results were reported by Chaudhari and Acharya (1969) which they attributed to additive gene action. Thus present situation gives scope for further improvement of this trait. Weight of main ear exhibited moderately high to very high GCV and PCV in F_2 generation of all the crosses. Wide difference is observed between PCV and GCV values indicating more environmental influence on expression of this trait. However, broad sense heritability was high coupled with high genetic advance in all four crosses. The results of present study were in agreement with earlier reports of Venkatesh Bhat (1991) and Debelo (1998). Test weight exhibited moderate to high variability in terms of PCV and GCV in all crosses. In general there exists narrow range of difference between PCV and GCV, which reflects less influence of environment on the expression of this trait compared to other quantitative traits. Patnaik (1968) reported parallel result, showing moderate values of PCV with low amount of GCV coupled with narrow difference between them. However Prabhakar and Prasad (1984) noticed moderate to high variability for this character coupled with narrow difference between them. All the crosses registered moderate to high Broad sense heritability except in cross I where it shows low heritability coupled with genetic advance. Same result was observed by Shanthappa (1979).

From this study a high magnitude of variability was created for majority of the characters and cross I produced higher magnitude of favorable segregants followed by cross II, cross III and cross IV.

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Table 1: Estimates of range, mean, variability, heritability and genetic advance for nine quantitative traits of F_2 generation of the cross III (GPU26 X IE2712) of finger millet.

Character	cross	Range	Mean	Phenotypic variance	Genotypic variance	PCV (%)	GCV (%)	Heritability (broad sense) (%)	GA as% of mean
Days to 50% flowering	1	61-81	72.82	9.12	2.19	4.14	2.03	24.03	2.05
	2	63 -84	74.5	24.88	20.13	6.69	6.02	80.94	11.16
	3	60 - 88	72.7	26.92	18.97	6.95	5.83	70.46	10.09
	4	60 -88	75.1	38.21	28.87	8.23	7.15	75.56	12.81
Plant height(cm)	1	72.5-116.5	98.31	90.39	80.48	9.59	9.05	89.04	17.59
	2	80- 116.5	99.8	107.73	102.38	10.39	10.13	95.03	20.35
	3	82– 115.9	97.5	135.01	126.96	11.49	11.14	94.04	22.26
	4	66 -113.5	93.21	60.49	43.94	8.09	6.89	72.64	12.11
Total tillers/plant	1	2 -8	4.77	1.83	1.10	28.39	22.01	60.10	35.15
	2	2 - 9	4.9	3.22	2.55	36.64	32.61	79.20	59.79
	3	2- 10	5.4	3.42	2.76	34.26	30.79	80.73	56.99
	4	2 -8	4.88	2.56	1.89	32.83	28.19	73.77	49.89
Productive tillers/plant	1	1 -7	4.07	1.66	0.75	32.24	21.78	45.66	30.32
	2	1 -8	4.05	2.44	1.73	38.54	32.45	70.89	56.29
	3	1- 10	4.29	2.60	1.78	37.59	31.13	68.61	53.13
	4	1-8	4.06	2.09	1.41	35.59	29.22	67.43	49.44
Finger number/main ear	1	3 -13	7.98	2.92	2.22	21.42	18.71	76.28	33.67
	2	3 -11	7.62	2.27	1.72	19.79	17.22	75.76	30.88
	3	4-13	8.18	2.99	0.88	21.14	11.46	29.43	12.81
	4	4-11	7.56	1.84	0.96	17.94	12.95	52.10	19.25
Finger length (cm)	1	4.5 – 12.9	8.15	2.45	0.51	19.25	8.76	20.73	8.22
	2	4.5 -11.6	8.74	2.45	2.06	17.92	16.44	84.24	31.10
	3	4.3 -13.1	8.9	2.01	1.61	15.87	14.22	80.3	26.25
	4	3.9 -11.6	8.46	2.97	2.709	20.36	19.43	91.09	38.21
Weight of main ear(g)	1	3.3 – 14.8	9.70	5.54	4.02	22.79	20.65	82.12	38.56
	2	3.24 - 15.6	10.52	5.82	4.99	22.94	21.25	85.77	40.54
	3	2.91 -16.5	10.9	6.76	6.02	23.84	22.50	89.06	43.75
	4	2.91 -16.5	10.9	6.76	6.02	23.84	22.50	89.06	43.75
Grain yield /ear(g)	1	1.98 – 12.5	7.47	5.06	4.16	30.11	27.31	82.27	51.04
	2	1.73 -13.5	8.42	5.89	4.26	28.85	24.54	72.38	43.01
	3	1.5 – 14.3	9.04	6.9	6.245	29.12	27.63	90.07	54.03
	4	1.5 – 14.3	9.04	6.9	6.245	29.12	27.63	90.07	54.03
1000 seed weight(g)	1	1.39 -3.89	2.89	0.16	0.03	14.02	6.46	21.27	6.14
	2	1.65-3.96	3.11	0.15	0.15	12.48	12.47	99.81	25.66
	3	1.75 - 3.73	3.08	6.78	5.47	12.24	7.68	39.36	9.93
	4	1.63 – 3.8	3.09	0.16	0.02	13.07	5.15	15.54	4.18

Note: cross I - Indaf5 X L264; cross 2 - PU26X GE1409; cross 3 - Indaf5XIE1409 and cross 4 - GPU26 X IE2712