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RESEARCH ARTICLE

Genetic variability studies in F_2 generation of okra [*Abelmoschus esculentus* (L.) Moench]

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SUMMARY

Studies were conducted on genetic variability for ten quantitative characters in F_2 generation of three crosses in okra. The genotypic and phenotypic co-efficients of variations were moderate to high for all the characters except ridges per plant with reference to F_2 generation of the crosses C-II and C-III; whereas the F_2 of C-I showed moderate to high PCV and GCV for all the traits except fruit diameter and fruits per plant High broad sense heritability coupled with high genetic advance as per cent of mean was recorded for fruit length and primary branches in C-II and C-III and for fruit length followed by nodes per plant in C-I which indicated lower environmental influence on these traits and the prevalence of additive genes. Simple and early selection schemes would be effective for the improvement of these traits.

Key Words : Okra, Genetic variability, Genetic advance, Heritability

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Okra [*Abelmoschus esculentus* (L.) Moench.] 2n=130 which is also known as gumbo, lady's finger and bhendi is an annual, often cross pollinated crop of the family Malvaceae. Okra is normally cultivated during summer and rainy seasons and is specially valued for its tender and delicious fruits. It is an important vegetable crop of the tropics and subtropics of the world and has found its place in India since time immemorial.. Its average nutritive value is higher than tomato, egg plant and most of the cucurbits. It is an excellent source of iodine besides other minerals and vitamins. All forms of plant improvement activities through breeding contemplate an eventual boost in genetic potential for yield. Since yield is polygenically controlled and highly influenced by environment, selection based on yield alone is not effective. The breeder while selecting for high yield has to select indirectly through yield associated and highly heritable characters after eliminating Environmental components of phenotypic variance. An attempt to improve a character by selection would be futile unless a major portion of variation is of genotypic and quantitative assessment of the population for yield and its contributing characters is necessary. Study of different variability parameter provides a strong basis for selection of desirable genotype for augmentation of yield and other agronomical attributes. Such study estimates the feasibility of using available genetic resources for effective improvement. The present study was therefore undertaken to determine the genetic variability for fruit yield and its attributes.

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MATERIALS AND METHODS

The experimental material in the present study consisted five contrasting parents lines *viz.,* Pusa sawani, Arka Anamika

, Pusa A-4, Sel -7 and Sel -10. Three crosses were developed by mating the contrasting parents *viz.*, Pusa sawani × Arka anamika (C-I), Sel-7 × Pusa A-4 (C-II) and Sel-7 x Sel-10 (C-III). The F_1 progeny of these three crosses was raised during kharif 2010 to generate F_2 population. The parents and their respective F_1's were sown in separate blocks with three replications and the F_2 population sown without replication. The parents and hybrids were evaluated following Randomized Complete Block Design with three replications and the F_2 population was unreplicated. The experiment was laid out at fields of Department of the genetics and plant breeding, University of Agricultural Sciences, GKVK, Bangalore during summer season 2011. The observation recorded from five competitive plants per parent and hybrid cross were randomly selected from each replication and tagged. The mean of these five plants was considered for statistical analysis. With respect to F_2, observations were recorded on 120 plants in C-I, 109 plants in C-II and 130 plants in C-III on the eleven characters *viz.*, days to first flowering, days to 50 per cent flowering, fruit weight (g), plant height (cm), number of branches per plant, internodal length (cm), fruit weight (g), fruit length (cm), fruit diameter (cm), ridges per plant, number of fruits per plant and fruit yield per plant (g).

Genotypic and phenotypic co-efficients of variation were calculated according to the method suggested by Burton and De-Vane (1953). Heritability in broad sense and the genetic advance as percent of mean to visualize the relative utility of genetic gain were worked out as suggested by Johnson *et al*. (1955). Correlation co-efficient was calculated as per Al-Jibouri *et al*. (1958).

RESULTS AND DISCUSSION

The genotypic and phenotypic co-efficient of variability, heritability and genetic advance, character-wise are presented in Table1. In the present study, PCV was higher than GCV for all the characters with close correspondence between them. This indicated the fact that the environmental influence is very low and hence, selection for these characters could be made based on their phenotypic performance. High GCV values for most of the characters reveal the presence of high magnitude of genetic variability in the three F_2 population studied.

Variability observed in the three F_2 population are discussed below :

F_2 generation of cross C-I :

The characters fruit diameter and plant height registered low to moderate PCV and GCV coupled with moderate heritability along with moderate to low genetic advance as per cent of mean with these trait. These finding are in agreement with the results reported by Panda and Singh (1977) and Vijay and Manohar (1990). Improvement in these characters can be brought by hybridization to widen the genetic base and followed by selection in advanced generation. The characters days to flowering, ridges per fruit, fruits per plant, nodes per plant registered moderate GCV and PCV coupled with moderate to higher heritability and moderate to high magnitude of genetic advance as per cent mean. This is in conformity with the findings of Patil *et al.* (1996), Rajani and Manju (1997) and Hazra and Basu (2000). Greater magnitude of PCV and GCV was observed for yield per plant and its attributes like fruit weight, fruit length and mean internodal length. Similar finding were reported by Magar and Madrap (2009) for yield per plant and fruit weight and Patil *et al.* (1996) for mean internodal length. High magnitude of PCV and GCV for these characters indicated the presence of high degree of variability and better scope for improvement.

F_2 generation of cross C-II :

The characters like yield per plant, fruit weight, fruit length and primary branches plant registered high GCV and PCV coupled with moderate to high magnitude of heritability and higher magnitude of genetic advance as per cent of mean. Reports of Alam and Hossain (2008) *reported similar results for primary branches per plant and* Patil *et al.* (1996) for fruit length. The higher difference between GCV and PCV for yield per plant and fruit weight indicated higher influence of environment on these characters whereas low difference between GCV and PCV for primary branches coupled with high heritability and high genetic advance as mean per cent indicated the lower effect of environment on this trait which further indicating that this trait is amenable for selection. A moderate PCV and low to moderate GCV for days to flowering, nodes per plant, plant height, fruits per plant and mean internodel length but coupled with higher magnitude of both heritability and genetic advance as percent mean in respect to C-II for primary branches was evident. Similar finding were reported Vijay and Manohar (1990), for plant height and fruit per plant. Low PCV and low to moderate GCV values for fruit diameter and ridges per fruit indicated narrow genetic base for these traits. This is in conformity with the findings of Hazra and Basu (2000) for ridges per fruit and Gondane and Lal (1994) for fruit diameter. Improvement in these characters can be brought about by hybridization to widen genetic base followed by selection in advance generation.

F_2 generation of cross C-III :

Primary branches per plant expressed high amount of PCV and GCV along with high heritability and genetic advance. The difference between PCV and GCV was found to be narrow indicating lesser influence of environment on these characters and also predominance of higher additive genes. The results obtained on yield and yield related characters in the present study are in agreement with the reports of Mishra and Chhonkar (1979) and Gangashetty *et al.* (2010) for this trait. The trait fruit yield per plant and fruit weight manifested high

Table 1: Estimation of *per se* performance and components of genetic variability for fruit yield and its attributes in F_2 generation of C-I, C-II and C-III

Characters		Mean	Range		PCV	GCV	$h^2_{(BS)}$	GA as % mean
			lowest	Highest				
Days to flowering	C-I	45.13	35.00	56.00	11.98	10.63	0.78	19.42
	C-II	46.82	37.00	58.00	11.77	9.108	0.59	14.51
	C-III	47.39	36.00	59.00	13.51	10.80	0.63	17.80
Average fruit weight (g)	C-I	19.35	10.03	39.52	26.61	19.78	0.55	30.29
	C-II	18.09	8.95	41.34	31.90	19.37	0.36	24.22
	C-III	20.28	10.80	37.97	27.02	11.45	0.17	10.00
Fruit length (cm)	C-I	14.35	8.80	20.92	35.61	27.81	0.60	44.74
	C-II	13.28	7.24	18.60	22.23	17.98	0.65	29.96
	C-III	12.34	6.75	17.06	18.43	16.19	0.77	29.324
Fruit diameter (cm)	C-I	1.88	1.41	2.51	9.68	7.43	0.58	11.76
	C-II	1.85	1.46	2.67	12.40	7.83	0.39	10.20
	C-III	1.93	1.29	2.64	11.31	5.149	0.20	4.82
Ridges per fruit	C-I	5.87	5.00	7.30	12.15	11.04	0.82	20.68
	C-II	5.45	5.00	6.35	5.20	1.70	0.10	1.14
	C-III	5.74	5.10	7.50	7.62	5.79	0.57	9.06
Fruits per plant	C-I	25.63	17.20	34.60	12.15	8	0.43	10.84
	C-II	21.72	14.10	29.70	14.42	12.23	0.71	21.38
	C-III	21.32	15.20	29.60	15.28	8.84	0.33	10.54
Primary branches per plant	C-I	2.18	1.00	4.00	11.41	8.72	0.58	13.74
	C-II	1.82	0.00	3.00	30.59	26.56	0.75	47.50
	C-III	1.86	0.00	3.00	44.87	36.58	0.66	61.44
Plant height (cm)	C-I	128.17	86.00	173.00	10.54	7.18	0.46	2.46
	C-II	108.63	70.50	148.50	14.42	12.23	0.71	21.38
	C-III	106.62	76.00	148.00	15.28	10.65	0.48	15.29
Nodes per plant	C-I	26.71	19.20	36.00	16.72	13.29	0.63	21.76
	C-II	22.89	15.00	32.60	17.26	9.14	0.28	7.838
	C-III	22.35	16.30	31.90	19.11	11.86	0.38	11.20
Mean internodes length (cm)	C-I	4.80	4.47	5.00	38.64	28.7	0.55	13.74
	C-II	4.74	4.08	5.00	16.93	10.79	0.40	3.07
	C-III	4.76	4.06	5.19	15.76	12.26	0.60	4.47
Fruit yield per plant (g)	C-I	193.46	100.30	395.20	26.61	19.78	0.55	30.28
	C-II	180.71	89.50	413.40	32.09	19.63	0.37	24.74
	C-III	202.71	108.00	379.70	27.04	11.47	0.17	10.02

PCV, moderate GCV, and genetic advance as per cent of mean and low heritability indicating the role of environment. Studied conducted by Magar and Madrap (2009) were in conformity to these results. Moderate PCV and GCV, with moderate to high heritability and low to high genetic advance as per cent mean observed for fruit length, days to flowering, and nodes per plant, plant height and mean internodal length indicating the role of environment. Patil (1995) reported similar results for mean internodal length. The presence of low PCV and GCV for traits like ridges per fruit indicate presence of low variation similar to result reported by Hazra and Basu (2000).The traits such as fruit diameter and fruit per plant registered moderate PCV and low GCV Which indicated higher environmental effect and need to create variability for the traits.

Fruit length and fruit weight showed high amount of variability both at phenotypic and genotypic level in C-I and C-II but yield per plant recorded high variability across all the three crosses. Days to flowering, nodes per plant and fruit per plant reported moderate variability in all the three crosses. Ridges per fruit and fruit diameter showed lower variability in C-II and C-III but it was moderate nature in C-I.

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