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Genetic variability created through biparental mating in bhendi (*Abelmoschus esculentus* (L.) Moench).

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Abstract: *The study was also aimed to know the relative efficiency of BIPs over F_3 in turns of release of genetic variability and to know the shift in the association pattern of components of traits with fruit yield in okra (Abelmoschus esculentus (L) Monech)., an important vegetable crop grown in the tropical and sub-tropical parts of the world. The present investigation was carried out during kharif and summer seasons of 2007-08 to study the nature and magnitude of variability generated in the case of different quantitative traits in the population obtained by attempting crosses in the F_2 generation of 4 commercial single cross private bhendi hybrids namely safal, rasi, seminis and ph101. Biparental mating design was attempted. The plants involved in the cross were also selfed simultaneously to obtain F_3 progenies. The effectiveness of biparental mating was compared with conventional breeding method. The range, variance, heritability and genetic advance were higher in BIPs for all the characters studied except hundred seed weight. The utility of biparental matings in early segregating generations in okra is emphasized.*

Keywords: Biparental, okra, heritability, genetic advance

INTRODUCTION

Okra (*Abelmoschus esculentus* (L) Monech) is an important vegetable crop grown in the tropical and sub-tropical parts of the world. India is the largest producer of okra covering an area of 3.58 lakh ha with an annual production of 35.24 lakh tonnes (Anon., 2006). Okra belongs to family Malvaceae with 2n =130 chromosomes and amphidiploid nature. The tender fruits are used as vegetable, eaten boiled or in culinary preparations as sliced and fried pieces. It has good nutritional value, particularly high content of vitamin-C (30 mg/100 g), calcium (90 mg/100 g) and iron (1.5 mg/100 g) (Pal *et al.*, 1952). Pedigree method of breeding is the most common in the improvement of self-pollinated crops. However, this method has certain limitations. The rate of homozygosity is very high, which reduces chances of recombination. This also retains tight and undesirable linkages and utilizes only fixable effects. Since, the routine pedigree method of breeding was considered inadequate to exploit the useful genetic variability for complex characters like yield (Humphery *et al.*, 1969), intermating in early segregating generations was suggested to pool the desirable genes from the selected plants in self-pollinated crops (Jensen, 1970). The present study aims to evaluate the efficiency of intermating in F_2 generation of a cross in effecting improvement and to compare it with the pedigree method of breeding.

MATERIALS AND METHOD

The experimental material for the present investigation comprised of F_2 generation of four commercial single cross private hybrids *safal*, *rasi*, *seminis* and ph101. About 25 plants were selected in each F_2 populations on visual basis keeping in view the vigour for selective intermating. The F_2 plants used in biparental mating were also selfed to yield F_3 progenies. The experiment was conducted at Agricultural Research Station, Hanumanmatti, Karnataka during *kharif* 2007-08. The BIP population and their corresponding F_3 population were sown in the field with a row length of 5m. The rows and plants were spaced at 60 cm and 30 cm respectively. The data were recorded on five plants in BIP and F_3 for 11 characters *viz.,* days to first flowering, fruit length, fruit diameter, average fruit weight, number of fruits per plant, plant height, internodal length, number of branches per plant, 100 seed weight, stem diameter and fruit yield per plant. The means and ranges in respect to each character were worked out in the biparental as well as F_3 progenies. The phenotypic and genotypic variances, phenotypic and genotypic coefficients of variation, heritability in broad sense and genetic advance were computed following the method of Burton and Devane (1953).

RESULTS AND DISCUSSION

The comparison of mean and range of expression of different characters (Table 1) between BIP and F_3 indicated that F_3 populations showed high mean values than BIPs for the characters like plant height, internodal length, number of branches per plant, days to first flowering and fruit yield per plant. It was due to wide range observed in BIPs for the character under study. The present findings are in agreement with the findings of Singh and

Sahu (1981), Kadlera (1997) and Parameshwarappa *et al.* (1997) in safflower for plant height and number of branches. BIP populations recorded the highest mean values for characters such as 100 seed weight and number of fruits per plant than the selfing generations. High mean values of BIPs compared to selfing generations were reported by Yunus and Paroda (1983) for traits like 100 grain weight and grain yield in wheat and by Singh and Sahu (1981) for 100 seed weight and grain yield in safflower. The range of expression of characters in biparnetal progenies was wider. It is noteworthy that especially the lower limit of range was lower in BIP for all the characters. At the same time, the lower limit was higher compared to that of F_3 progenies for most of the characters suggesting that intermating has helped in releasing more variability than selfing. The higher variability in the BIP population could have resulted from the additional opportunity for genetic recombination. General shifts in the values of range of expression of characters by biparental approach were also reported by Nematullah and Jha (1993) in wheat and Parameshwarappa *et al.* (1997) in safflower.

The estimates of variability, heritability and genetic advance for various characters in BIP and corresponding F_3 progenies are presented in Table 2. The BIP had greater GCV, PCV, heritability and genetic advance (% of mean) in respect of all the characters except 100-seed weight. The characters which showed wider range were also characterized by higher magnitudes of GCV and PCV. Generally, BIP population had higher GCV and PCV for all the characters except for 100 seed weight. Higher GCV and PCV in the BIP as compared to F_3 were also reported in wheat by Srivastava *et al.* (1989) and Kadlera (1997) in safflower. Among the characters GCV and PCV were high for number of branches per plant (20.93 and 30.34, respectively) and fruit yield per plant (23.62 and 28.08, respectively) in BIP. This suggests that, there is more scope for selecting better segregants in BIP population on the basis of number of branches per plant and fruit yield per plant.

In the case of BIP, heritability was higher in respect of yield and its component characters than in F_3s. This suggested that the variation due to environment played a relatively limited role in influencing the inheritance of these characters and thus the expected response to selection is higher in BIP. High heritability in the case of BIP over F_3 has also been reported by Yunus and Paroda (1983) in wheat and Kadlera (1997) in safflower. Like for heritability, BIP also showed relatively high expected genetic advance (as percentage of mean) estimates for all characters as compared to selfed progenies. Among the characters, fruit yield per plant and number of fruits per plant showed higher genetic advance. This suggested that, the gain from selection based on these two traits would be higher in BIP than in their corresponding selfed progenies.

The comparison of biparnetal mating and selfing shows that whatever additional variability realized with biparental mating in the early segregating generations has been the consequence of release of concealed variability in the segregating generation which is probably brought about by rare recombination between the tightly linked genes. In addition to this, it is also expected to help in maintaining a greater variability for selection to be effective for a longer period. Okra is an often cross pollinated crop where lack of variability has been implicated as one of the important causes for lack of desired progress in breeding. Hence, the present report on the use of biparental mating in an early segregating generation like F_2 of an appropriate cross, could be of much use in widening variability and consequently in making considerable gain in improving productivity.

Table 1. Mean and range of expression in respect of 11 quantitative traits in intermating (BIP) and selfed (F_3) populations of okra

Characters	Mean		Range	
	BIPs	F_3	BIPs	F_3
Days to first flowering	45.28	45.70	39.50-51.00	40.0-51.0
Fruit length (cm)	13.70	13.62	10.87-17.50	11.20-16.0
Fruit diameter (cm)	1.46	1.47	0.97-2.00	1.12-1.76
Average fruit weight (g)	17.27	18.00	12.50-21.80	14.25-21.75
Number of fruits per plant	24.94	24.74	12.75-38.25	14.0-42.75
Plant height (cm)	89.67	92.63	64.0-115.0	68.75-124.20
Internodal length (cm)	6.43	6.90	3.70-9.33	4.60-9.0
Number of branches per plant	2.32	2.56	1.0-3.68	1.5-3.52
100 seed weight (g)	5.77	5.88	4.53-7.10	4.57-3.52

Stem diameter (cm)	0.86	0.88	0.65-1.12	0.65-1.19
Fruit yield per plant (g)	428.70	448.50	181.20- 712.80	212.25-759.75

Table 2. Estimates of genetic variability parameters in respect of 11 quantitative traits in F_3 and BIP populations of okra

Sl. No.	Characters	Populations	GCV (%)	PCV (%)	h^2bs	GA	GAM (%)
1	Days to first flowering	BIP	4.91	5.52	79.44	3.10	6.87
		F_3	4.84	8.31	13.88	0.78	1.72
2	Fruit length (cm)	BIP	6.97	8.81	61.65	1.56	11.44
		F_3	4.49	7.16	39.38	0.79	5.80
3	Fruit diameter (cm)	BIP	12.42	16.51	56.38	0.28	19.05
		F_3	5.80	8.63	45.05	0.12	8.13
4	Average fruit weight (g)	BIP	9.28	11.79	62.17	2.58	14.89
		F_3	5.35	8.95	36.03	1.21	6.72
5	Number of fruits per plant	BIP	19.07	23.17	67.63	8.15	32.39
		F_3	14.19	21.63	45.88	4.80	19.46
6	Plant height (cm)	BIP	10.20	11.38	79.97	16.85	17.32
		F_3	9.05	12.35	54.23	12.71	13.70
7	Internodal length (cm)	BIP	15.65	19.74	61.19	1.62	25.70
		F_3	12.70	15.99	58.84	1.38	21.05
8	Number of branches per plant	BIP	20.93	30.34	47.89	0.71	30.13
		F_3	11.94	15.32	59.38	0.48	18.88
9	100 seed weight (g)	BIP	7.32	8.32	76.38	0.77	13.17
		F_3	11.62	12.98	77.10	1.22	22.31
10	Stem diameter (cm)	BIP	11.22	12.43	81.20	0.18	20.44
		F_3	8.23	11.42	52.28	0.11	12.15
11	Fruit yield per plant (g)	BIP	23.62	28.08	70.69	176.35	40.88
		F_3	18.96	25.81	54.70	128.93	28.82

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