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RESEARCH ARTICLE

Genetic variability, heritability and genetic advance in okra biparental progenies

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Abstract

Four biparental and F_2, F_3 populations of okra were evaluated to ascertain genetic parameters of variability for growth and yield parameters. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters studied. Among the progenies during 2013, less difference between GCV and PCV was observed for plant height, number of branches, number of fruits, fruit length, fruit diameter, fruit weight, fruit yield per plant and seed yield per plant suggesting the major contribution of genetic variability towards the total variance, indicating ample scope for improvement for all the populations. All the characters exhibited high heritability with high GAM indicating the predominance of additive gene components. Thus, there is an ample scope for improving the characters through direct selection.

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INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench.] is a fast growing annual which has captured a prominent position among the vegetables and is commonly known as okra or lady's finger in India. Being a native of Tropical Africa it is grown for its tender fruits in tropics, sub-tropics and warmer seasons of the temperate areas in the world and is to be an amphidiploid. Variability in a population with respect to characters, for which improvement is sought, is an indispensable pre-requisite for a successful breeding programme. Therefore, the present investigation was undertaken to estimate the magnitude and nature of variation in okra population with respect to different vegetative, yield and yield attributing traits can be used in improvement programme.

Material and Methods

The present investigation was carried out at the Kittur Rani Channamma college of Horticulture Arabhavi, during 2013 involving four biparental progenies, F_2 and F_3 populations of okra to find the nature and extent of genetic variability for vegetative and yield parameters. Four biparentals, F_2 and F_3 populations were chosen from the okra, are planted as plant to progeny rows with ten plants per row with three replication and these were evaluated. Observations were recorded on these populations during 2013. The experiment was laid out in randomized block design with three replications. The data were collected on various parameters at vegetative and harvesting periods of crop duration. Data were put to statistical analysis as per Panse and Sukhatme (1967). Genetic parameters like genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV) were estimated according to Burton (1952), heritability as suggested by Falconer (1981) and genetic advance as per cent over mean by Johnson *et al.* (1955)

Results and Discussion

For above mentioned characters the results are discussed below.

Growth and yield parameters

For growth parameters the estimates of phenotypic variance (PV) was higher compared to genotypic variance (GV) for all characters, indicating the role of environmental factors for the expression of these characters. Less difference were observed for genotypic and phenotypic variance for number of branches, fruit yield per plant and seed yield per plant indicating the fact that these characters are not much influenced by environmental factors. This also suggests the presence of sufficient variability, which can be exploited by practicing selection based on phenotype for growth parameters (Tables 1, 3 and 5). The PCV values were higher than the GCV value for most of the characters. Similar results were obtained by Rangaiah *et al*. (1999), Vaid and Singh (1983), Mehta and Zaveri (1999), Kalia, A. and Padda (1963), Kadlera (1997) and Akinyele and Osekita (2008).

The coefficients of variations for both the genotypic and phenotypic for growth parameters revealed that the low differences were observed for number of fruits per plant, fruit diameter and seed yield per plant thus suggesting the major contribution of genetic variability towards the total variance indicating ample scope for improvement. Similar trend was reported by Arora (1991), Tharware *et al*. (1991), Akinyele and Osekita (2008) in okra and Singh and Sahu (1981) in chickpea for the above traits respectively, reported narrow difference between genotypic coefficient of variation for plant height and plant spread. Whereas, for plant height, number of branches, fruit length, fruit weight and fruit yield per plant had large differences were observed for PCV and GCV. This indicates there is role of environment in expression of these traits. So, careful selection may be practiced for improvement of populations.

Heritability (h^2) and genetic advance (GA) were varied greatly for growth parameters. High heritability associated with high GA proves more useful for efficient improvement of a character through simple selection (Panse and Sukhatme, 1967).

In the present study, estimates of high heritability with high genetic advance as per cent over mean (GAM) were observed for most of the characters *viz.*, number of branches par plant, fruit length, number of fruits per plant and seed yield per plant thus indicating the possible role of additive gene action. The results are in conformity to those observed by Rangaiah *et al*. (1999), Singh and Balyan (1988), Randhawa and Gill (1978), Parameshwarappa *et al*. (2009), Suma Biradar (2001), Tharware *et al*. (1991), Narendra singh, (2004) in chickpea and Akinyele and Osekita (2008) in okra.

It can be concluded that, wide variability was available for population and progenies for different character indicating validity of these experiments for conducting variability. Overall growth and yield contributing characters have exhibited high genetic variability coupled with high h^2 and high GAM, indicating the scope of further improvement either through selection or through hybridization followed by selection.

Table 1: Genetic variability for plant height and number of branches at 60 DAS of F_2, F_3 and biparental populations in okra

Parameters	Plant height at 60 DAS						Number of branches at 60 DAS					
	F_2	F_3	F_2				F_2	F_3	Biparental populations			
			P_1	P_2	P_3	P_4			P_1	P_2	P_3	P_4
GV	55.00	39.00	52.20	106.50	24.64	102.70	0.45	0.48	0.50	0.47	0.21	0.56
PV	92.00	65.00	83.26	153.40	44.14	187.10	0.74	0.77	0.93	0.76	0.31	0.75
GCV (%)	8.21	5.82	7.80	11.50	4.26	11.86	7.82	8.20	8.00	7.98	5.77	9.31
PCV (%)	10.89	7.69	9.86	14.24	5.71	15.52	10.12	10.25	10.9	10.19	7.01	10.79
h^2 (%)	59.00	60.00	63.00	69.00	56.00	55.00	60.00	62.00	53.00	61.00	68.00	75.00
GA	11.81	9.96	11.79	17.72	7.64	15.47	1.07	1.12	1.07	1.10	0.78	1.33
GAM (%)	12.75	10.75	12.73	20.36	6.56	17.55	12.49	10.38	12.10	12.86	9.78	16.56

GV: Genotypic Variance
PV: Phenotypic Variance
GCV: Genotypic Coefficient of Variation
PCV: Phenotypic Coefficient of Variation
h^2: Heritability
GA: Genetic Advance
GAM: Genetic Advance over Mean

Table 2: Genetic variability for fruit length and fruit diameter of F_2, F_3 and biparental populations in okra

Parameters	Fruit length						Fruit diameter					
	F_2	F_3	Biparental populations				F_2	F_3	Biparental populations			
			P_1	P_2	P_3	P_4			P_1	P_2	P_3	P_4
GV	0.71	1.07	1.59	0.70	0.38	2.03	0.012	0.014	0.010	0.002	0.013	0.02
PV	1.12	1.90	2.91	1.10	0.81	3.48	0.021	0.024	0.019	0.004	0.018	0.03
GCV (%)	4.30	5.28	6.67	4.28	3.14	7.69	5.12	5.34	5.08	2.35	5.23	7.63
PCV (%)	5.60	8.43	9.00	5.35	3.14	10.55	6.10	6.34	6.97	3.16	6.26	9.58
h^2 (%)	63.00	56.00	54.00	63.00	46.00	58.00	57.00	58.00	53.00	55.00	69.00	63.00
GA	1.38	1.59	1.92	1.38	0.85	2.24	0.17	0.18	0.15	0.07	0.19	0.25
GAM (%)	7.03	8.09	10.17	7.05	6.47	11.55	7.93	8.67	7.64	3.60	9.01	12.51

GV: Genotypic Variance
PV: Phenotypic Variance
GCV: Genotypic Coefficient of Variation
PCV: Phenotypic Coefficient of Variation
h^2: Heritability
GA: Genetic Advance
GAM: Genetic Advance over Mean

Table 3: Genetic variability for fruit weight and number of fruits per plant of F_2, F_3 and biparental populations in okra

Parameters	Fruit weight						Number of fruits per plant					
	F_2	F_3	Biparental populations				F_2	F_3	Biparental populations			
			P_1	P_2	P_3	P_4			P_1	P_2	P_3	P_4
GV	3.92	4.52	2.37	2.45	5.63	11.83	0.24	0.32	0.17	0.10	0.45	0.50
PV	7.24	8.34	4.48	4.65	10.22	18.08	0.42	0.62	0.25	0.20	0.85	0.78
GCV (%)	6.40	7.43	4.95	4.63	8.19	10.96	1.75	2.34	2.04	1.61	3.30	3.36
PCV (%)	8.12	10.21	6.81	6.38	11.04	13.56	2.14	3.22	2.46	2.20	4.55	4.20
h^2 (%)	54.00	54.00	52.00	52.00	55.00	65.00	57.00	51.00	69.00	53.00	52.00	63.00
GA	3.00	3.22	2.30	2.34	3.62	5.73	0.76	0.83	0.71	0.49	1.00	1.16
GAM (%)	8.43	10.54	7.43	6.94	12.53	18.27	3.10	4.08	3.49	2.42	4.94	5.53

GV: Genotypic Variance
PV: Phenotypic Variance
GCV: Genotypic Coefficient of Variation
PCV: Phenotypic Coefficient of Variation
h^2: Heritability
GA: Genetic Advance
GAM: Genetic Advance over Mean

Table 4: Genetic variability for seed yield and fruit yield per plant of F_2, F_3 and biparental populations in okra

Parameters	Seeds yield per plant						Fruit yield per plant					
	F_2	F_3	Biparental populations				F_2	F_3	Biparental populations			
			P_1	P_2	P_3	P_4			P_1	P_2	P_3	P_4
GV	20.00	22.00	19.83	24.85	12.22	29.18	14.00	16.00	13.52	16.30	14.42	20.30
PV	22.00	22.14	20.66	25.01	13.47	30.19	25.87	29.60	26.32	30.13	27.80	38.40
GCV (%)	7.17	7.89	7.28	8.92	6.53	11.10	14.00	17.00	25.33	17.32	15.33	31.46
PCV (%)	7.88	7.92	7.34	8.95	6.59	11.18	27.73	31.70	31.06	32.43	28.68	32.66
h^2 (%)	90.00	97.00	95.00	99.00	90.00	96.00	54.00	54.00	51.00	54.00	51.00	52.00
GA	8.78	9.40	8.89	10.23	6.85	10.94	5.67	6.05	5.42	6.11	5.63	6.74
GAM (%)	22.65	24.26	23.18	26.40	16.53	28.21	15.26	16.29	14.60	15.77	14.53	17.40

GV: Genotypic Variance
PV: Phenotypic Variance
GCV: Genotypic Coefficient of Variation
PCV: Phenotypic Coefficient of Variation
h^2: Heritability
GA: Genetic Advance
GAM: Genetic Advance over Mean

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