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Studies on Extent of Variability, Heritability and Genetic Advance in Okra [*Abelmoschus esculentus* (L.) Moench]

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A B S T R A C T

The experiment was conducted at Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya during *Kharif*, 2019 in Randomized Complete Block Design with three replications using thirty -six genotypes of okra collected from different sources to study the extent of variability, heritability and genetic advance in per cent of mean for different quantitative traits. The analysis of variance for the design of experiment indicated highly significant differences among the genotypes for all the characters. Based on mean performance of genotypes NDO-37 (210.79) followed by NDO-26 (209.33), NDO-27 (199.41), NDO- 31 (208.97) and NDO-36 (209.12) were found as five most promising genotypes for fruits yield per plant. High magnitude PCV were observed in case of number of branches per plant (16.23) followed by fruit length (9.91), total fruit yield per plant (9.36). High heritability was estimated for total fruit yield per plant (99.3) followed by average fruit weight (93.86), petiole length (92.80) number of branches per plant (84.54). High heritability coupled with high genetic advance were estimated for number of branches per plant (84.54,28.27) followed by total fruit yield per plant (99.13, 19.11) and average fruit weight (93.86, 14.29) which indicating opportunity for high selection response.

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench 2n = 2x=130] is one of the important member of the family malvaceae and is well known by many regional names as lady's finger in England, Gumbo in USA, Dherosh in Bangladesh, Huang GiuKui in China, Quingombo in Spanish, Bhindi in Pakistan and India. Okra is an African word and is native to northern Africa including the area of Ethiopia and Sudan. It is a summer and rainy season crop and is widely cultivated from tropics to sub tropics. Okra (*Abelmoschus esculentus* L.) is probably an amphidiploids (allotetraploid) derived from *Abelmoschus tuberculatus* (2n = 58), a wild species from India, and a species (*Abelmoschus ficulneus* (L.) Wight and Arn. ex Wight) with 2n = 72 chromosomes. According to Vavilov, it was probably domesticated in the Ethiopian region but, according to Murdock, it is originated in

West Africa (Joshi *et al.,* 1974). Okra was earlier included in the genus *Hibiscus,* section *Abelmoschus* in the family malvaceae (Linnaeus, 1753). The wider use of *Abelmoschus* was subsequently accepted in the taxonomic and contemporary literature. This genus is distinguished from the genus *Hibiscus* by the characteristics of the calyx, spathulate, with five short teeth, connate to the corolla and caducous after flowering (Kundu and Biswas, 1973 and Terrell and Winters, 1974).The future and prospect of any breeding programme depend on the extent of variability present in the population. Hence, assessment of genetic variability in the base population is the foremost step in any breeding programme. In present investigation attempt has been made to assess the variability of important yield and yield attributing traits, along with the indices of variability *i.e.* GCV, PCV, heritability (broad sense) and genetic advance.

Materials and Methods

The research work was undertaken at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology Narendra Nagar (Kumarganj), Ayodhya (U.P.) during the *Kharif,* 2019. Geographically the experimental site (Kumarganj, Ayodhya) falls under humid sub-tropical climate and is located at 26.47° N latitude and 82.12° E longitude at an altitude of 113 meter above the mean sea level. The experiment was conducted in Randomized Complete Block Design with three replications to assess the performance of thirty genotypes. Observations were recorded on thirteen quantitative characters *viz.* days to 50% flowering, node to first flower appearance, plant height (cm), crop duration, number of branches per plant, days to first fruit harvest, fruit length (cm), fruit circumference (cm), average fruit weight, number of fruits per plant, marketable fruit yield per plant (g), unmarketable fruit yield per plant (g). The analysis of variance was carried out as per Panse and Sukhatme (1984), genotypic and phenotypic coefficient of variance by Burton and de Vane (1953), heritability and genetic advance as per method suggested by Hanson *et al.,* (1963) and Johnson *et al.*, (1955), respectively.

Results and Discussion

The analysis of variance for different characters has been presented in Table 1. The mean sum of square due to genotypes were highly significant for all the characters. In other words, the performances of the genotypes with respect to these characters were statistically different, suggesting that, there exists ample scope for selection in the available genotypes of okra. The mean performances of genotypes under studies are presented in Table 2 which shows the extent of variation in average performance among the genotypes for the quantitative traits. The best five genotypes which significantly out yielded the check varieties on the basis of mean performance for fruit yield were NDO-37, NDO-26, NDO-27, NDO-35 and NDO-36. These genotypes may further evaluate for yield performance towards development of new improved varieties of okra in future.

The genotypic and phenotypic coefficients of variation were computed to assess the existing variability in available germplasm (Table 3). High magnitudes of phenotypic as well as genotypic coefficients of variation were observed in number of branches per plant followed by total fruit yields per plant, fruits length and number of fruits per plant. The high estimates of PCV and GCV for these characters were also reported by Kerure *et al.,* (2017) and Chandramauli *et al.,* (2016). Moderate PCV along with GCV were recorded for fruit circumference followed by

node to first flower appearance and node per plant. While, low GCV and PCV were observed for days to first fruit harvest followed by plant height, node per plant. Moderate and low variability were also reported by Hazra and Basu (2000) and Narayan *et al.,* (2006).

The result on heritability and genetic advance in per cent of mean of present investigation had been presented in Table 3. The heritability estimates for different characters ranged from 10.03 to 99.13 per cent. High estimate of heritability was recorded for characters total fruit yield per plant, average fruit weight, petiole length days to 50% flowering, fruit circumference number of branches per plant.

High estimate of heritability was also reported by Naidu *et al.,* (2007). The maximum genetic advance in per cent of mean showed in number of branches per plant fallowed by total fruit yields per plant, fruit length and fruit circumference. Similar results have been reported by Kerure *et al.,* (2017). High heritability coupled with high genetic advance was observed for the traits *viz.* total fruit yield per plant, average fruit weight and petiole length which indicates the opportunity for selection response in available germplasm of okra. High heritability along with high genetic advance have also been reported for most of the yield and yield attributing traits by Chandramauli *et al.,* (2016) and Patel *et al.,* (2014).

Thus, it may be concluded that considerable variability exists within the genotypes of okra. The, genotype NDO-37 followed by NDO-26, NDO-35, NDO-36 and NDO-27 were found promising for total fruit yield per plant and other traits and may further evaluated to develop as variety. High heritability along with high genetic advance for important traits *viz.* total fruit yield per plant, average fruit weight and petiole length indicated greater chance of selection response.

Table.1 Analysis of variance for thirteen characters in okra

S.No.	Characters	Source of variation		
		Replication	**Treatment**	**Error**
	d.f.	**2**	**35**	**70**
1.	Node to first flower appearance	0.28	32.58**	7.25
2.	Days to 50 % flowering	2.78	390.33**	48.59
3.	Days to first fruit harvest	7.41	323.88**	139.26
4.	Fruit length (cm)	4.09	178.97**	30.38
5.	Fruit circumference (cm)	0.03	27.20**	3.48
6.	Plant hight (cm)	216.00	2702.21**	2165.08
7.	Number of branches per plant	0.06	25.94**	2.98
8.	Crop duration (days)	88.91	1059.21**	3233.76
9.	Petiole length (cm)	0.01	67.09**	3.39
10.	Average fruit weight (g)	0.22	224.14**	9.54
11.	Node per plant	3.75	160.09**	239.49
12.	Number of fruits per plant	2.57	53.44**	80.09
13.	Total fruit yield per plant (g)	10.66	31692.86**	186.67

** Significant at 1 percent probability level

Table.2 Mean performance of thirty-six genotype of okra

S. No.	Genotypes	Node to first flower appearance	Days to 50 % flowering	Days to first fruit harvest	Fruit length (cm)	Fruit circumference (cm)	Plant hight (cm)	Number of branches per plant	Crop duration (days)	Petiole length (cm)	Average fruit weight (g)	Node per plant	Number of fruits per plant	Total fruit yield per plant (g)
1	**NDO-21**	6.83	41.67	54.33	12.18	6.30	106.41	3.63	96.67	14.38	18.16	22.34	12.00	183.96
2	**NDO-22**	7.64	42.00	53.00	11.86	6.34	116.60	3.27	103.00	13.19	17.76	22.60	12.00	185.71
3	**NDO-23**	8.06	43.00	54.33	15.57	5.49	115.63	3.61	102.33	12.87	21.05	21.23	11.33	185.67
4	**NDO-24**	7.69	42.67	52.67	14.36	5.56	112.00	2.89	101.67	14.77	19.50	21.63	11.00	180.67
5	**NDO-25**	6.88	45.67	54.67	12.74	6.33	110.07	2.33	102.67	14.74	21.49	21.37	10.67	205.33
6	**NDO-26**	7.36	42.67	53.67	11.63	6.40	117.60	2.67	98.33	13.89	19.59	23.41	13.33	209.75
7	**NDO-27**	7.39	47.00	56.00	12.60	5.56	119.12	3.52	103.00	13.41	22.24	21.97	11.67	199.41
8	**NDO-28**	7.88	48.67	57.00	14.67	5.66	114.59	3.83	99.33	12.67	19.78	23.01	11.00	175.75
9	**NDO-29**	6.92	45.33	56.00	15.52	6.41	119.26	3.55	102.67	12.78	22.00	22.71	12.67	170.93
10	**NDO-30**	7.70	44.33	56.00	14.30	6.30	115.07	3.63	103.67	14.81	22.93	23.52	12.00	186.14
11	**NDO-31**	7.84	47.00	56.67	15.60	6.54	121.19	3.28	98.67	14.78	21.63	20.63	12.00	208.97
12	**NDO-32**	6.77	43.67	54.00	14.26	5.84	108.79	3.52	103.00	14.45	18.88	23.08	11.67	181.41
13	**NDO-33**	6.77	46.00	55.33	16.37	5.43	119.93	3.85	103.67	13.78	17.82	22.71	13.00	175.82
14	**NDO-34**	7.53	47.33	55.67	12.59	6.55	114.56	3.64	102.67	13.30	20.56	24.26	12.67	189.45
15	**NDO-35**	7.38	44.00	55.33	16.11	5.42	116.52	3.89	94.33	13.41	22.40	22.92	11.33	207.45
16	**NDO-36**	8.02	47.33	57.33	16.26	5.38	113.33	3.85	96.33	14.88	19.56	23.10	12.00	209.12
17	**NDO-37**	6.61	42.67	54.00	13.97	5.49	111.62	3.88	105.00	13.26	19.64	23.27	12.67	210.79
18	**NDO-38**	6.19	43.33	54.33	13.46	6.66	116.00	3.45	99.67	13.71	19.69	22.18	13.00	208.32
19	**NDO-39**	6.81	42.33	53.33	13.84	6.67	110.69	2.74	105.67	12.73	22.24	22.78	11.67	202.52
20	**NDO-40**	7.64	45.00	55.00	14.55	6.38	114.25	2.89	102.00	12.60	21.37	23.41	12.00	205.23
21	**NDO-41**	6.41	46.67	57.00	15.71	6.38	107.59	2.52	102.00	13.79	21.45	22.89	13.67	191.23
22	**NDO-42**	7.38	43.00	54.00	14.26	5.77	109.15	2.58	106.33	13.40	18.80	22.30	11.67	186.51
23	**NDO-43**	7.03	44.67	53.00	13.48	6.41	117.97	2.82	97.67	12.77	19.45	22.71	12.00	165.59
24	**NDO-44**	7.74	43.67	54.00	14.59	5.37	121.23	2.72	105.33	12.64	20.57	22.41	12.67	165.63
25	**NDO-45**	7.37	42.00	53.00	15.37	6.49	112.41	3.63	108.33	12.53	21.67	23.15	12.33	190.76
26	**NDO-46**	7.27	47.33	61.33	14.45	6.41	114.72	2.74	101.00	14.67	19.71	22.60	13.00	198.36
27	**NDO-47**	6.42	43.33	54.33	15.04	5.36	120.78	2.54	105.33	13.59	20.52	22.34	11.33	207.86
28	**NDO-48**	7.81	46.00	57.33	13.82	6.80	111.45	2.70	101.67	13.49	18.49	23.13	12.67	181.61
29	**NDO-49**	6.62	44.00	55.00	15.19	5.45	129.30	3.67	98.33	13.56	19.59	23.23	12.00	168.93

30	**NDO-50**	7.25	44.33	55.33	11.48	6.49	106.17	3.65	96.33	12.77	21.51	22.97	12.33	155.78
31	**NDO-51**	6.50	43.00	54.33	14.12	6.41	104.54	2.85	102.67	12.69	22.25	24.03	12.67	150.71
32	**NDO-52**	7.63	47.00	58.00	14.23	5.42	113.43	2.82	101.00	14.71	19.49	23.23	13.00	160.56
33	**NDO-53**	8.02	42.67	54.00	13.74	5.53	112.70	2.52	104.00	14.82	18.52	24.37	13.00	170.33
34	**Arka Anamika (C)**	6.52	45.67	55.33	14.53	6.71	118.56	3.34	103.33	14.37	18.45	28.08	12.00	175.56
35	**Arka Abhay ©**	6.75	42.00	53.00	15.93	5.56	113.11	3.69	98.00	12.76	18.63	24.52	13.00	160.60
36	**VRO-6 (C)**	6.23	45.33	54.67	14.45	5.33	118.45	3.67	102.00	13.71	19.49	24.60	12.67	192.41
	Minimum	6.19	41.67	52.67	11.48	5.33	104.54	2.33	94.33	12.53	17.76	20.63	10.67	150.71
	Maximum	8.06	48.67	61.33	16.37	6.80	129.30	3.89	108.33	14.88	22.93	28.08	13.67	210.79
	Grand Mean	7.19	44.51	55.06	14.24	6.02	114.58	3.23	101.60	13.63	20.19	23.02	12.21	186.25
	C.D.at 5%	0.53	1.36	2.30	1.08	0.36	9.08	0.34	11.12	0.36	0.60	3.04	1.76	2.67
	SE(m)	0.19	0.48	0.81	0.38	0.13	3.21	0.12	3.92	0.13	0.21	1.07	0.62	0.94
	SE(d)	0.26	0.68	1.15	0.54	0.18	4.54	0.17	5.55	0.18	0.30	1.51	0.87	1.33
	C.V.	4.48	1.87	2.56	4.63	3.71	4.85	6.38	6.69	1.61	1.83	8.04	8.76	0.88

Table.3 Estimation of coefficient of variations (phenotypic and genotypic), heritability (in broad sense) and genetic advance in percent of mean for thirteen character in okra

S.no		GCV (%)	PCV (%)	GCV: PCV	Heritabilitybroad sense (h2bs) (%)	Genetic Advance in per cent of mean
1	**Node to first flower appearance**	7.30	8.57	85.25	72.68	12.82
2	**Days to 50 % flowering**	4.19	4.59	91.32	83.39	7.89
3	**Days to first fruit harvest**	2.83	3.81	74.09	54.89	4.31
4	**Fruit length (cm)**	8.77	9.91	88.45	78.24	15.98
5	**Fruit circumference (cm)**	8.18	8.98	91.09	82.97	15.36
6	**Plant hight (cm)**	3.43	5.94	57.69	33.28	4.07
7	**Number of branches per plant**	14.92	16.23	91.95	84.54	28.27
8	**Crop duration (days)**	2.27	6.29	36.04	12.99	1.68
9	**Petiole length (cm)**	5.79	6.01	96.33	92.80	11.49
10	**Average fruit weight (g)**	7.16	7.39	96.88	93.86	14.29
11	**Node per plant**	2.69	8.47	31.77	10.09	1.76
12	**Number of fruits per plant**	2.92	9.23	31.66	10.03	1.91
13	**Total fruit yield per plant (g)**	9.32	9.36	99.57	99.13	19.11

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