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Studies on extent of variability, heritability and genetic advance in okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
The experiment was conducted at Main Experimental Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya during *Kharif*, 2016 in Randomized Complete Block Design with three replications using thirty 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-33 (212.16) followed by NDO-31 (199.03), NDO-24 (195.50), NDO- 35 (190.20) and NDO-17 (189.23) were found as five most promising genotypes for fruits yield per plant. High magnitude PCV were observed in case of unmarketable fruit yield per plant (31.34) followed by marketable fruit yield per plant (21.46), number of fruits per plant (20.78), total fruit yield per plant (19.70) and branches per plant (14.60). Moderate PCV along with GCV were recorded for number of branches per plant (14.60, 9.57) followed by fruit circumference (12.86, 8.11), fruit length (12.26, 8.34), average fruit weight (10.23, 9.42) and plant height (10.88, 9.00). High heritability were estimated for total fruit yield per plant (93.82) followed by unmarketable fruit yield per plant (87.68), average fruit weight (84.86), days to 50% flowering (84.54) and marketable fruit yield per plant (81.13). High heritability coupled with high genetic advance were estimated for total fruit yield per plant (93.82, 38.08) followed by unmarketable fruit yield per plant (87.68, 56.60) and marketable fruit yield per plant (81.13, 35.87) which indicating opportunity for high selection response.

Keywords: Variability, PCV, GCV, heritability, genetic advance, okra (*Abelmoschus esculentus* (L.) Moench)

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 Giu Kui 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. Another edible okra species are *Abelmoschus caillei* (A. Chev.).Stevels occurs in the humid parts of West and Central Africa. There are strong indications that *Abelmoschus caillei* is amphidiploids with *Abelmoschus esculentus* being one of the parental species. The lowest chromosome number 2n=56 reported in *Abelmoschus angulosus* (Ford, 1938) whereas, the highest chromosome number 2n=196 reported in *Abelmoschus manihot* var. *Caillei* (Singh and Bhatnagar, 1975 Siemonsma, 1982a, 1982b) [14, 15].

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) [6]. Okra was earlier included in the genus *Hibiscus*, section *Abelmoschus* in the family malvaceae (Linnaeus, 1753) [9]. The section *Abelmoschus* was subsequently proposed to be raised to the rank of distinct genus by Medikus, 1787. 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) **[8].**

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, Narendra Deva University of Agriculture and Technology Narendra Nagar (Kumarganj), Ayodhya (U.P.) during the *Kharif*, 2016. 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) [12], genotypic and phenotypic coefficient of variance by Burton and de Vane (1953) [1], heritability and genetic advance as per method suggested by Hanson *et al.* (1963) [3] and Johnson *et al*. (1955) [5], 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 performance 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 performance 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-33, NDO-31, NDO-24, NDO-35 and NDO-17 these genotypes may further evaluated 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 unmarketable fruit yield per plant followed by marketable fruit yield per plant, number of fruits per plant and total fruit yield per plant. The high estimates of PCV and GCV for these characters were also reported by Kerure *et al.* (2017) [7], and Chandramauli *et al.* (2016) [2]. Moderate PCV along with GCV were recorded for number of branches per plant followed by fruit circumference, fruit length, average fruit weight and plant height. While, low GCV and PCV were observed for days to 50% flowering followed by days to first fruit harvest, node to first flower appearance and crop duration. Moderate and low variability were also reported by Hazra and Basu (2000) [4] and Narayan *et al.* (2006) [11].

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 23.58 to 93.82 per cent. High estimate of heritability were recorded for characters total fruit yield per plant, unmarketable fruit yield per plant, average fruit weight, days to 50% flowering, marketable fruit yield per plant and days to first fruit harvest. High estimate of heritability were also reported by Naidu *et al.*(2007) [10].

The maximum genetic advance in per cent of mean showed in unmarketable fruit yield per plant followed by total fruits yield per plant, marketable fruit yield per plant, number of fruits per plant, average fruit weight and plant height. Similar results have been reported by Kerure *et al.* (2017) [7].

High heritability coupled with high genetic advance was observed for the traits *viz.* total fruit yield per plant, unmarketable fruit yield per plant and marketable fruit yield per plant 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) [2] and Patel *et al.* (2014) [13].

Thus it may be concluded that considerable variability exists within the genotypes of okra. Thus, genotype NDO-33 followed by NDO-31, NDO-24, NDO-35 and NDO-17 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.* marketable fruit yield per plant, number of fruits per plant and average fruit weight indicated greater chance of selection response.

Table 1: Analysis of variance for thirteen characters in okra germplasm

S. No.	Characters	Source of variation		
		Replication	Treatments	Error
	d.f.	2	29	58
1	Days to 50% flowering	4.22	34.47**	1.98
2	Node to first flower appearance	0.11	0.49**	0.14
3	Plant height(cm)	19.53	381.77**	50.94
4	Crop duration	0.74	57.19*	29.70
5	Number of branches per plant	0.06	0.62**	0.19
6	Days to first fruit harvest	2.43	37.71**	2.91
7	Fruit length(cm)	3.29	4.14**	1.15
8	Fruit circumference(cm)	0.94	0.89**	0.29
9	Average fruit weight(g)	0.45	11.78**	0.68
10	Number of fruits per plant	0.06	10.64**	1.50
11	Marketable fruit yield per plant(g)	26.06	1488.67**	107.10
12	Unmarketable fruit yield per plant(g)	4.25	734.73**	32.87
13	Total fruit yield per plant(g)	84.58	2952.91**	63.43

* - Significant at 5 per cent probability level
**- Significant at 1 per cent probability level

Table 2: Mean performance of thirty genotypes for thirteen characters in okra germplasm

S. No.	Genotypes	Days to 50% flowering	Node to first flower appearence	Plant height (cm)	Crop duration	Number of branches per plant	Days to first fruit harvest	Fruit length (cm)	Fruit circumference (cm)	Average fruit weight (g)	Number of fruit per plant	Marketable fruit yield per plant (g)	Unmarketable fruit yield per plant (g)	Total fruit yield per plant (g)
1	NDO-11	42.66	6.89	114.46	109.00	4.44	48.00	11.66	6.00	20.50	7.80	86.03	58.50	144.53
2	NDO-12	42.00	7.51	109.27	105.33	3.55	46.66	12.50	5.36	19.50	7.61	110.86	38.36	149.20
3	NDO-13	40.00	7.45	106.41	105.00	4.32	45.33	11.33	5.93	19.83	8.64	85.63	48.76	134.20
4	NDO-14	38.00	7.10	129.10	106.33	4.18	43.33	9.73	5.70	21.33	11.44	130.70	45.20	175.90
5	NDO-15	40.66	7.24	102.35	102.66	3.42	46.33	11.13	5.23	19.33	7.86	82.56	33.16	115.40
6	NDO-16	41.00	7.39	107.39	105.33	4.02	47.00	11.30	5.26	19.00	9.50	104.46	51.56	156.03
7	NDO-17	39.33	7.24	130.22	109.33	3.11	44.66	11.03	5.00	19.50	11.84	144.96	51.03	189.23
8	NDO-18	39.66	6.87	110.44	101.33	3.94	44.66	11.26	5.50	20.16	8.09	86.06	46.63	132.73
9	NDO-19	39.66	6.62	97.69	104.00	3.22	45.00	10.23	4.76	16.66	7.42	66.90	27.83	94.10
10	NDO-20	40.33	6.78	106.51	103.33	3.08	45.66	11.30	5.13	18.33	7.69	94.03	34.00	128.23
11	NDO-21	40.00	7.81	126.58	111.33	3.96	44.33	10.80	5.20	21.00	11.41	142.00	43.56	185.56
12	NDO-22	40.33	7.32	107.64	106.33	3.40	45.00	11.13	4.86	18.00	7.84	101.63	25.93	127.46
13	NDO-23	39.66	7.93	107.91	105.00	3.64	45.33	9.86	5.03	18.33	8.23	73.73	32.53	106.23
14	NDO-24	46.33	7.10	135.44	115.66	3.50	52.00	11.66	6.20	18.33	12.73	117.00	78.5	195.50
15	NDO-25	46.33	6.80	124.87	111.66	4.21	50.33	12.20	5.10	19.16	10.62	101.76	85.96	183.76
16	NDO-26	47.00	7.45	108.75	102.33	4.21	52.33	13.43	4.46	17.33	9.60	114.86	68.36	174.86
17	NDO-27	47.00	7.77	114.80	107.00	3.97	52.33	12.23	4.90	20.16	10.39	119.90	60.30	175.76
18	NDO-28	47.33	6.98	121.38	109.66	4.08	53.33	12.40	5.93	20.16	10.83	127.80	60.06	187.86
19	NDO-29	47.33	7.38	117.78	111.00	4.17	53.66	13.53	6.13	18.66	10.69	132.36	54.30	186.46
20	NDO-30	46.66	8.30	104.81	105.66	4.08	53.00	13.93	5.93	20.33	11.13	112.36	57.33	170.33
21	NDO-31	45.33	6.90	137.45	113.33	4.59	51.00	13.63	5.30	19.83	12.85	114.70	82.96	199.03
22	NDO-32	46.00	7.48	107.05	108.66	4.51	52.33	13.03	5.20	20.33	10.40	109.80	62.66	172.46
23	NDO-33	46.66	7.23	140.73	117.00	3.85	51.67	13.80	4.93	20.16	14.26	148.0	64.80	212.16
24	NDO-34	47.66	7.19	120.15	111.66	4.29	54.00	13.63	6.00	18.83	10.94	128.10	60.73	188.10
25	NDO-35	46.33	6.39	123.97	113.33	3.57	51.67	11.66	5.80	20.66	11.66	134.10	56.70	190.20
26	NDO-36	47.33	7.42	129.73	117.33	3.86	52.67	12.16	6.40	18.83	11.69	128.36	61.70	190.06
27	NDO-37	46.00	7.06	108.57	110.33	4.27	51.33	12.53	6.86	18.83	9.86	120.76	47.03	167.47
28	Arka Anamika (C)	40.33	6.98	114.17	104.33	5.04	46.33	10.66	5.33	18.66	10.06	75.23	38.36	123.03
29	Arka abhay (C)	42.00	6.80	110.88	111.00	4.02	47.67	12.80	5.36	17.83	11.41	102.16	30.83	132.83
30	Kashi kranti(C)	38.66	7.17	123.19	111.00	4.05	45.00	12.30	5.43	17.33	13.35	133.76	56.10	189.53
	Mean	43.25	7.22	116.66	108.51	3.95	48.73	11.96	5.47	19.23	10.26	111.02	52.12	162.61
	C.V.	3.25	5.18	6.11	5.02	11.05	3.50	8.99	9.98	8.37	11.94	9.32	10.99	4.89
	S.E.	0.81	0.21	4.12	3.14	0.25	0.98	0.62	0.31	0.93	0.70	5.97	3.31	4.59
	C. D. 1%	3.06	0.81	15.50	11.85	0.94	3.71	2.33	1.18	3.50	2.66	22.50	12.46	17.30
	C.D. 5%	2.30	0.61	11.66	8.90	0.71	2.79	1.75	0.89	2.63	2.00	16.92	9.37	13.07
	Range Lowest	38.00	6.39	97.69	101.33	3.08	43.33	9.73	4.46	16.66	7.42	66.90	25.93	94.10
	Range Highest	47.66	8.30	140.73	117.33	5.04	54.00	13.93	6.86	21.33	14.26	148.00	85.96	212.16

Table 3: Estimates of range, grand mean, phenotypic (PCV), genotypic (GCV) and environmental (ECV) coefficient of variation, heritability in broad sense and genetic advance in per cent of mean for thirteen characters in okra.

S. No.	Characters	Range		General mean	Coefficient of variation			Heritability in broad sense% (h^2_{bs})	Genetic advance	Genetic advance in% of mean ($\overline{Ga}$)
		Lowest	Highest		PCV	GCV	ECV			
1	Days to 50% flowering	38.00	47.67	43.26	8.28	7.61	3.25	84.54	6.23	14.41
2	Node to first flower appearance	6.39	8.30	7.22	7.05	4.77	5.19	45.81	0.48	6.65
3	Plant height(cm)	97.69	140.73	116.66	10.88	9.00	6.12	68.40	17.89	15.34
4	Crop duration	101.34	117.34	108.51	5.74	2.79	5.02	23.58	3.03	2.79
5	Number of branches per plant	3.08	5.04	3.95	14.60	9.57	11.02	43.00	0.51	12.93
6	Days to first fruit harvest	43.34	54.00	48.73	7.82	6.99	3.50	79.91	6.27	12.87
7	Fruit length(cm)	9.74	13.93	11.96	12.26	8.34	8.99	46.25	1.40	11.68
8	Fruit circumference(cm)	4.46	6.86	5.48	12.86	8.11	9.98	39.76	0.58	10.53
9	Average fruit weight(g)	16.33	23.66	20.40	10.23	9.42	8.38	84.86	3.65	17.89
10	Number of fruits per plant	7.42	14.26	10.26	20.78	17.01	11.94	67.00	2.94	28.67
11	Marketable fruit yield per plant(g)	66.90	148.00	111.02	21.46	19.33	9.32	81.13	39.82	35.87
12	Unmarketable fruit yield per plant(g)	25.94	85.96	52.13	31.34	29.34	11.00	87.68	29.50	56.60
13	Total fruit yield per plant(g)	94.10	212.16	162.61	19.70	19.09	4.90	93.82	61.92	38.08

References

1. Burton GW, de Vane EH. Estimated heritability in tall replicated clonal material. Agron. J. 1953; 45:474-478.
2. Chandramouli B, Shrihari D, Rao AVD, Rao MP. Studies on genetic variability, heritability and genetic advance in okra [*Abelmoschus esculentus* (*L*.) Monech] genotypes. Plant Archives. 2016; 16(2):679-682.
3. Hanson GH, Robinson HF, Comstock RE. Biometrical studies of yield in segregating population of Korean Iespedeza. Agron. J. 1963; 48:47-90.
4. Hazra P, Basu D. Genetic variability, correlation and path analysis in okra. Annals of Agri. Res. 2000; 21(3):452-453.
5. Johnson HW, Robinson HF, Comstock RE. Genotypic and phenotypic correlation in soybean and their implications in selection. Agron. J. 1955; 47:477-483.
6. Joshi AB, Gadwal VR, Hardas MW. Evolutionary studies in world crops. In Diversity and Change in the Indian Sub-Continent. Hutchinson, J.B. (Ed.), London: Cambridge University. 1974, 90-105.
7. Kerure P, Pitchaimuthu M, Hosamani M. Studies on variability, correlation and path analysis of traits contributing to fruit yield and its components in okra (*Abelmoschus esculentus* L. Moench). El. J. Pl. Breed. 2017; 8(2):620-625.
8. Kundu BC, Biswas C. Anatomical characters for distinguishing *Abelmoschus* spp. and *Hibiscus* spp. Proceed. Indian Sci. Cong. 1973; 60:295-298.
9. Linnaeus C. *Species Plantarum*. Stockholm, 1753, I, II.
10. Naidu AK, Verma BK, Raut RL. Genetic variability studies of yield and its attributing traits in okra [*Abelmoschus esculentus* (L.) Moench]. International Conference on sustainable Agriculture for food, Bio-energy and livelihood security. 2007; 2:467.
11. Narayan JRP, Mulge R, Kotikal YK, Patil MP, Madalageri MB, Patil BR. Studies on genetic variability for growth and earliness character in okra (*Abelmoschus esculentus* (L.) Monech). Crop Res. (Hisar). 2006; 32(3):411-413
12. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, *ICAR Publication*, New Delhi, 1984, 359
13. Patel R, Sengupta SK, Verma AK. Studies on genetic parameters in okra [*Abelmoschus esculentus* (L.)], Trends in Biosciences. 2014; 7(14):1808-1811.
14. Siemonsma JS. La culture du gombo (*Abelmoschus* spp.) legume fruit. Thesis Univ. Wageningen, Netherlands, 1982a.
15. Siemonsma JS. West African okra morphological and cytological indications for the existence of a natural amphiploid of *Abelmoschus esculentus* (L.)Moench and *A. Manihot* (L.)Medikus. Euphytica, 1982b; 31(1):241-52.
16. Singh HB, Bhatnagar A. Chromosome number in okra from Ghana. Indian J Gen. Pl. Breed. 1975; 36:26-27.
17. Terell EE, Wintre HF. Change in scientific names for certain crop plants. Horticulture Science. 1974; 9:324-325.