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Research Article

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE STUDIES IN OKRA (*Abelmoschus esculentus* L. Moench)

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Abstract- The present experiment was conducted at Horticulture Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow (UP) to study the variability, heritability, expected genetic advance, inter characters association and direct and indirect effect of components on fruit yield per plant. The result of experiment showed that the analysis of variance of the designed experiment indicates that the mean square due to genotypes were highly significant for all the characters. The genotypes Parbhani Kranti recorded highest yield per plant followed by VRO-6, VRO-5 and Punjab-7. High magnitude of genotypic and phenotypic coefficient of variation was recorded for fruit yield per plant, number of fruits per branch, number of leaves per plant while, fruit diameter showed lowest genotypic and phenotypic coefficient of variation. The highest heritability (%) was noted in number of flower per plant followed by fruit yield per plant, number of leaves per plant, number of fruits per plant, fruit weight, number of fruit per branch and plant height where as the lowest heritability was observed in number of branches per plant, stem diameter and number of days taken to flower. The highest genetic advance was observed for number of fruits per plant followed by number of leaves per plant, number of flower per plant, plant height and number of days taken to flower while, lower genetic advance were recorded for fruit length, number of fruits per branch, fruit diameter, number of branches per plant and fruit yield per plant. Path coefficient analysis carried out of phenotypic level. Positive and direct effect on fruit yield per plant exerted by number of fruits per plant followed by stem diameter, fruit weight, number of days taken to flower, number of leaves per plant, number of fruits per branch and number of branch per plant. However, negative and indirect effect on fruit yield was observed

Keywords- Genetic variability, Heritability, Genetic advance, Okra & fruit yield

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Introduction

Okra [*Abelmoschus esculentus* (L) Moench] belongs to the family Malvaceaeis the most popular vegetable around the world in respect of area, production and availability. Okra is also known as Bhindi, Lady's fingers, Ochro, Okoro and Gumbo etc. in various part of the world. It has been an important crop from time unknown in Afghanistan, India, Iran, Pakistan, Turkey and Yugoslavia. Okra is originated to Ethiopia from where it proliferated in to Arabia down to Nile valley and was introduced in to Europe by moors and further in to Louisceana early 1700's by the French colonists. The plant of okra is a robust, erect, annual herb, stem green on tinged red. Okra is a hairy plant and leaves are heart shaped, the flower is yellow with crimson centre fruit is capsule. It is an often-cross pollinated crop when natural cross pollinated is about to the extent of 81.75-9.61% has been reported by Purewal [1].

Okra is a warm season vegetable and requires a long warm growing season. It is susceptible to frost and will not thrives even when there is a continuous cold spell. In plains, it is grown during summer (February to March) and rainy season (June to July), where on hills, it is grown during summer season (April to May) only. India is the largest producer of Okra followed by Nigeria, Pakistani, Ghana, Benin and Egypt. The major growing states in country are Andhra Pradesh, West Bengal, Bihar, Odisha, Gujarat, Jharkhand, Chhattisgarh, Maharashtra, Assam, Haryana and Uttar Pradesh. The area in India, under okra have 498.0 thousand hectare with the production and productivity of 5784.0 million tones and 11.6 million tons per hectare, respectively. It shares about 5.9% of area and 3.9% of total vegetable production under vegetable crops in our country [2].

Okra (Bhindi) is propagated from seeds, after harvesting the fruits can be easily transported in bulk and stored for few days without much loss of quality. 100 g consumable unripe bhindi fruit contain 10.4g dry matter, 3100-calorie energy, 1.8g protein, 90 mg calcium, 1.0mg iron, 0.1 mg carotene, 0.07 mg thiamine, 0.08 mg riboflavin, 0.08 mg niacin indand 18 mg vitamin C [3].

The tender green fruit of okra are cooked in curry are also use in soups. For year round consumption, sun dried and frozen and sterilized fruit of okra are also important market products. Okra has multiple uses the extract from bhindi and stem is use after cleaning cane juice in preparation of jaggery. The dry seeds of okra also contain 13-22% edible oil and 20-24% protein [3]. The refined oil may be used as substitute for common edible oils especially cotton seed oil. The seed cake is also used as an animal food. In some countries, the ripen seeds of okra are used as substitute of coffee particularly in Turkey. The dry fruit shell and stem containing crude fiber suitable for use in manufacture of paper and card board.

It is most useful in fevers, catarrhal attacks and irritable states of the genitor urinary organs, such dysuria, gonorrhea, leucorrhoea and in all cases attended with scalding pain and difficulty in passing urine. In chronic dysentery the bland is most beneficial and generally given in the term of the soup. The mucilage is aphrodisiac in effect. Its tender pods are eaten in cases of spermatorrhoea. The mucilage from the fruit and seed or the fresh bruised capsule forms an efficient emollient poultice.

The okra crop offers several features, which have a great value to the breeders in

achieving quick genetic results. Among them, erect growing habit, short life span, large flower monodalphous and epipetalous nature of stamens are amenable to easy emasculation and its capsule bears large number of hybrid seeds. Its adaptability to a wide range of climatic conditions is quite useful. It produces a large number of seeds per fruit, which may be either cross or self and forms the primary asset to the breeders for making improvement. Being a short duration crop that is grown in two seasons in a year. Keeping these views the present experiment was aimed to see the better performance of collected germplasms for future breeding programme.

Materials and method

The present investigation entitled "Genetic Variability, Heritability and Genetic Advance Studies in Okra [*Abelmoscus esculentus* (L.) Moench]" was conducted at Horticulture Research Farm of the Department of Applied Plant Science, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) during the Rabi season of 2011-12. An area of 53.20m x 9.60m size was divided into 48 plots having the size of 1.8m x 1.8m and arranged in the three replications of 16 plots. The experiment was laid out in RBD under 16 treatments (Sixteen genotypes were grown namely- Prabhani Kranti, Punjab-7, DOV-1, DOV-2, Selection-1, Okra Tripura, Okra Manipur, B.O.2, Larm-1, K.S.-410, VRO-6, VRO-5, P-7, VRO-4, Selection-10 and DOV-1-07-5). The seeds of genotypes were collected from Indian Agricultural Research Institute, New Delhi. The observations were recorded for plant height (cm) , number of branches per plant, number of days taking to flowering, stem diameter (cm), number of leaves per plant, Number of flowers per plant, number of fruits per branches, number of fruits per plant, length of fruits (cm), weight of fruits (g), diameter of fruits (cm) and yield per plant (kg). The recorded data were subjected to analysis of variance appropriate to the design as given by Chandel [4].

Result and Discussion

The phenotypic coefficient of variability was observed were highest for fruit yield per plant (32.44), number of branches per plant (20.43), stem diameter (19.21) and number of fruits per plant (18.95). Similar findings were also recorded by Singh *et al.*[5]. The highest phenotypic and genotypic coefficient of variation for number of branches per plant, plant height, node at which first flower appears, number of nodes per plant, number of seed per fruit, fruit length and number of nodes per plant.

Table-1 *Mean performance of 16 genotypes for 12 characters of okra*

S. No.	Genotypes	Plant height (cm)	Number of branches per plant	Days taken to flower	Stem diameter (cm)	Number of leaves per plant	Number of flowers per plant
1.	Prabhani Kranti	92.91	9.50	65.66	2.85	71.66	72.83
2.	Punjab-7	88.21	7.35	54.33	1.85	54.41	58.41
3.	DOV-1	73.50	6.76	47.00	1.91	52.50	54.43
4.	DOV-2	67.41	8.29	61.83	2.26	66.25	68.33
5.	Selection-1	73.25	7.02	59.91	2.08	62.91	64.41
6.	Okra Tripura	63.84	5.68	50.34	1.66	46.66	48.75
7.	Okra Manipur	70.44	5.41	47.50	1.65	39.75	41.91
8.	B.O.2	82.79	4.43	44.52	1.66	39.08	41.25
9.	Larm-1	78.85	6.28	50.16	1.75	48.16	50.25
10.	K.S.-410	70.22	7.58	51.66	1.99	53.75	55.91
11.	VRO-6	70.10	8.34	61.80	2.38	68.83	70.58
12.	VRO-5	60.66	8.27	61.16	2.19	68.33	70.25
13.	P-7	89.34	6.59	48.75	1.85	44.16	46.41
14.	VRO-4	89.93	7.27	55.08	2.03	58.48	60.58
15.	Selection-10	89.08	8.15	57.30	2.00	67.96	69.83
16.	DOV-1-07-5	70.74	6.83	49.75	1.90	53.27	54.58
S.E. of Mean		0.64	0.20	1.52	0.06	0.44	0.41
CD (at P=0.05)		0.94	0.30	2.23	0.09	0.65	0.60

Table-2 *Mean performance of 16 genotypes for 12 characters of okra*

S. No.	Genotypes	Number of fruits per branch	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield per plant (g)
1.	Prabhani Kranti	8.64	71.41	10.70	6.42	20.44	1.45
2.	Punjab-7	6.00	54.83	9.26	5.70	17.13	0.93
3.	DOV-1	5.58	52.25	8.16	4.93	15.70	0.81
4.	DOV-2	5.00	66.41	8.03	5.00	16.31	1.07
5.	Selection-1	6.41	62.76	7.95	5.49	17.99	1.12
6.	Okra Tripura	4.50	46.75	6.37	4.55	13.82	0.64
7.	Okra Manipur	5.25	39.83	5.48	4.82	12.91	0.50
8.	B.O.2	4.50	39.50	6.05	5.31	14.65	0.57
9.	Larm-1	5.25	48.25	7.38	5.42	13.73	0.65
10.	K.S.-410	7.64	53.91	8.60	5.29	14.97	0.80
11.	VRO-6	8.01	68.16	9.14	5.91	19.25	1.31
12.	VRO-5	7.50	68.25	9.12	5.73	18.57	1.26
13.	P-7	6.25	44.41	8.42	5.09	14.06	0.61
14.	VRO-4	7.28	58.58	8.07	5.31	14.86	0.86
15.	Selection-10	7.25	67.91	9.55	4.83	13.05	0.88
16.	DOV-1-07-5	6.25	52.66	8.30	4.37	12.60	0.66
S.E. of Mean		0.13	0.47	0.15	0.07	0.12	0.01
CD (at P=0.05)		0.20	0.69	0.22	0.11	0.17	0.01

Moderate genotypic coefficient of variance were observed in number of branches per plant (18.49), number of flower per plant (18.26), fruit length (16.74), stem diameter (16.25), where as the lowest phenotypic variation were observed for the characters fruit weight (15.51) followed by plant height (13.53), number of days taken to flower (12.53) and fruit diameter (10.20).

The genotypic coefficient of variability were observed highest for the characters of

fruit yield per plant (32.35) followed by number of fruit per branch (20.06), number of leaves per plant (19.15) and number of fruit per plant (18.89), similarly finding was also recorded by [6] the phenotypic variance was highest for yield per plant followed by plant height at final harvest. The moderate coefficient of variability were observed for the character number of flower per plant (18.21), number of branches per plant (17.75), fruit length (16.39) and fruit weight (15.45) [7-11] was found moderate variation for primary branches per plant (2.9) and fruit length (12.9cm).

Table-3 *Estimation of phenotypic and genotypic variation, heritability and genetic advance for 12 characters in okra*

Sl. No.	Characters	Phenotypic variation	Genotypic variation	Heritability (%)	Genetic Advance	Genetic advance % of mean
1.	Plant height (cm)	108.56	107.23	98.8	27.17	35.30
2.	Number of branches per plant	1.73	1.59	92.1	3.19	44.96
3.	Number of days taken to flower	46.08	35.61	83.8	15.01	27.72
4.	Stem diameter (cm)	0.10	0.09	86.9	0.74	37.31
5.	Number of leaves per plant	115.79	115.15	99.4	28.25	50.43
6.	Number of flower per plant	111.90	111.36	99.5	27.79	47.97
7.	Number of fruits per branch	1.67	1.61	96.4	3.29	52.01
8.	Number of fruits per plant	112.68	111.95	99.3	27.84	49.72
9.	Fruit length (cm)	1.87	1.79	95.8	3.46	42.38
10.	Fruit diameter (cm)	0.28	0.27	93.6	1.32	25.23
11.	Fruit weight (g)	5.88	5.83	99.2	6.35	40.62
12.	Fruit yield per plant (g)	0.08	0.08	99.4	0.75	85.19

The lowest genotypic coefficients of variance are observed for the characters of stem diameter (13.15), plant height (13.45), number of days taken to flower (11.47) and fruit diameter (9.87). High heritability with genetic advance over mean for fruit yield per plant, number of fruits per plants, number of locules per fruit was also seen by [12-14] who observed that the Path analysis revealed that internodal length had the highest positive direct effect whereas plant height had the highest negative direct effect on dry fruit yield. Path coefficient analysis with portioning of phenotypic correlation revealed that number of fruits per plant and fruit weight had found positive and high direct effect on fruit yield.

Conclusion

On the basis of present investigation, the analysis of variance of the designed experiment indicates that the mean square due to genotypes were highly significant for all the characters this revealed that treatment different for characters.

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