ANALYSISOF GENETIC VARIABILITY AND CORRELATION STUDIES ON FRUIT YIELD AND ITS COMPONENT CHARACTERS IN OKRA (*Abelmoschus esculentus* L.)

ABSTRACT

A field experiment was carried out with 20 Okra genotypes with one check for analysis of genetic variability and correlation studies on fruit yield and its component characters inOkra (*Abelmoschus esculentus* L.) in a randomized block design with three replications. The material was planted 30 x 45cm, and genotype to genotype 45 cm on July 20, 2023. The experiment was carried out during the *Kharif* season of 2023-2024 at research farm, College of Agriculture Saralgaon, Murbad,Thane. The observations were recorded on thirteen traits *viz.*, days to first flowering, plant height (cm), number of branches per plant, number of internodes, internodal length (cm), fruit length (cm), fruit diameter (cm), average fruit weight (cm), number of fruits per plant, number of seeds per fruit, seed index (%), and fruit yield per plant (g). The estimation of analysis of variance revealed mean sum of square due to genotypes were significant for all the characters indicating sufficient genetic variability among the genotypes. The present study revealed that the phenotypic coefficient of variation was higher than the corresponding genotypic coefficient of variation for all the traits which might be due to the interaction of the genotypes with the environment to some degree or other explaining environmental factors influencing the expression of these characters. Moderate phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) wererecorded in plant height (cm), number of branches per plant, average fruit weight (cm), number of fruits per plant, and fruit yield per plant (g). High estimation genetic advance as a percentage of the meanwas recorded for average fruit weight (cm), and number of fruits per plant. Moderate genetic advance as a percentage of the mean was recorded for plant height (cm), number of branches per plant, internodal length (cm) and fruit yield per plant (g).Low genetic advance as a percentage of the mean was recorded for days to first flowering, number of internodes, fruit length (cm), fruit diameter (cm), and number of seeds per fruit.

Keywords: Coefficient of variation, Heritability, Genetic advance, Correlation, and Okra

1. INTRODUCTION

"Okra [*Abelmoschus esculentus* (L.) Monech] is a polyploid, belonging to the family Malvaceae with 2n = 2x =72 or 144 chromosome. It is the only vegetable crop in the Malvaceae family. It is a self-pollinated crop; occurrence of out crossing to an extent of 4 to 19% with the maximum of 42.2% is noticed with the insect assisted pollination. This self-pollinating crop is an example that requires a separation between varieties to maintain purity. It is an important vegetable crop grown in the tropical and sub-tropical parts of the world and commonly known as lady finger" [1,2]. "It has been cultivated for ages, and extensively disseminated from Africa to Asia, Southern Europe and America and currently grown in many countries. It is extensively cultivated for its tender immature fruits, which are largely used as fresh vegetables. Fruit has various medicinal properties too. It is useful in fever, chronic dysentery, and irritable states of genitero" [3]. "It is good for people suffering from renal colic, leucorrhoea, spermatorrhoea, chronic dysentery and general weakness. Nowadays many commercial cultivars including F1 hybrids of okra is available in the market, but all these are not adapted and suited to all the regions of the country. Further, no specific recommendation about the suitability of genotypes for a particular area is available. Farmers face problems in selecting genotypes/cultivars for commercial cultivation in a particular area. Considering the above-mentioned facts, there is a need to compare some of the available genotypes/cultivars to select high yielding, better adaptable genotypes/cultivars for commercial cultivation in Bangladesh. Knowledge of genetic diversity among okra germplasm will play significant role in breeding program as it helps to develop varieties with desired traits" [4,5]. "It is a prerequisite to develop high yielding okra varieties like in all other crop improvement. This is important for selecting parents in combination breeding and to obtain transgressive segregants. The knowledge of pattern of inheritance of various characters are important consideration while, determining the most approximate breeding procedures applicable to any particular crop. The phenotype is often not true indicator of its genotype. The phenotypic variability is the result of the effect of environment and genotype interaction. Path coefficient analysis is also very useful in formulating breeding strategy to develop elite genotypes through selection in advanced generations. In that perspective, attempts need to be made to determine the magnitude of heritable and non-heritable components and genetic parameters such as genotypic and phenotypic coefficient of variation, heritability and genetic advance as percentage of mean in some of the quantitative characters of Okra" [6,7]. Since the pattern of inheritance of quantitative characters is highly complex, therefore the present investigation was undertaken to determine the genetic divergence, heritability, genetic genetic advance, variability, character association in different

okra genotypes and their direct and indirect contribution to fruit yield in okra with the ultimate goal of identifying the most diverse and high yielding genotypes for fruit yield.

2. MATERIALS AND METHODS

The experiment was carried out during the*Kharif* season of 2023-2024 at Research Farm, College of Agriculture Saralgaon, Murbad, Thane. This place is situated at 19°16'53.9"N 73°29'41.3"E. This region has a humid subtropical climate with cool winters and long, hot summers. Summers last from April to June and winters from November to February. Temperatures in the summer vary from average highs of around 48 °C (118 °F) to average lows of around 25 °C (77 °F). Winter temperatures have highs of 19 °Cto lows of 10°C. The climate is dry overall, except during the brief southwest monsoon season during July and August. The average annual rainfall is about 120 cm.

The experimental material comprised of 20 Okra genotypes grown in randomized block design with three replications during, *Kharif* 2023. The material was planted 30 x 45cm on July 20, 2023. Data were recorded on five random and competitive plants of each genotype from each replication for various characters *viz.* days to first flowering, plant height (cm), number of branches per plant, number of internodes, internodal length (cm), fruit length (cm), fruit diameter (cm), average fruit weight (cm), number of fruits per plant, number of seeds per fruit, seed index (%), and fruit yield per plant (g) which were recorded. An analysis of variance was performed on mean values in order to determine the importance for each character, using Panse and Sukhatme's (1967) recommended technique. The formulas provided by Burton (1952) and De Vane (1953) were used to determine GCV and PCV, whereas Johnson et al. (1955)'s method was used to calculate genetic advance, or the projected genetic gain, and heritability in the broad sense (h2). Correlation coefficients were calculated using Singh and Chaudhary's (1985) recommended methodology.

3. STATISTICAL ANALYSIS

Thedataonvariouscropcharacterswеresubjectedtostatisticalanalysisbyusingappropriatemethod ofanalysisofvarianceandcovarianceasdescribedbyPanse and Sukhatme (1962) [1].The range and estimates of mean, phenotypic, genotypic,andenvironmentalvarianceandcovariance,standarderror,coefficient ofvariationand critical difference were obtained for all thethirteentraits.Thesignificance ofdifferencebetweengenotypesfor variouscharacterswastested. Thesignificancewas tested byreferring tothe tablegiven bySnedecor(1946)

[2].Thephenotypicandgenotypiccoefficientsofvariationinpercentwerecomputedbythe followingformulaegiven byBurton (1952) [3]. ThePCVandGCVvalueareranked aslow,medium,and high[4]and arementionedbelow. Heritabilityinpercentin a broadsensewasestimatedbythemethodgivenbyHanson*et al.,* (1956) [5]. Heritabilityvaluesarecategorizedaslow,moderate,andhigh [6].Improvement in the mean genotypic value of selected plants over the parental population is known as genetic advance. Expected genetic advance (GA)wascalculatedbythe methodsuggestedbyJohnson*et al*.,(1955) [7]. The Phenotypic,genotypic,andenvironmental correlation coefficients between characters were computed utilizingrespectivecomponentsofvarianceandco-variance,byfollowingformulasuggestedby AI Jibouri*et al.* (1958) [8]. Totestthesignificanceofphenotypicandenvironmentalcorrelationcoefficients,the estimated values were compared with the tabulated values of Fisher and Yates(1938)at n-2 d.f.attwo levels of probability, *viz*.,5%and 1%.

4. RESULTS AND DISCUSSION

"Analysisofvarianceindicatedthatthemeansumofsquaresduetogenotypeswere highly significantforallthecharactersrevealingthattherewasconsiderable genetic variability amongst the material under study. There issignificant variation for replication which shows that error due to a high environment. The results from the analysis of the variance of all characters under the studyhavebeengivenintable1" [9,10,11,12]. The mean performance and range also showed larger variation for all 12 traits studied in the present investigation has been presented in table 2.

The phenotypic coefficient of variation was greater thangenotypic coefficient of variation for all the traits (Table 3). It means the observedvariationisnotonly due tothe genotypes,butalsodue tosuitable influence ofenvironment. The highest estimates of PCV and GCVindicate that these characters have quantitative inheritance and are considerably more orlessinfluencedbyenvironmentalfactors. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was recorded as moderate for plant height (cm), number of branches per plant,average fruit weight (cm), number of fruits per plant, and fruit yield per plant (g). Similarkindof results were foundby [13,14,15,16]."High heritability estimates were observed byin days to first flowering, plant height (cm), number of branches per plant, internodal length (cm), fruit diameter (cm), average fruit weight (cm), number of fruits per plant, seed index (%), and fruit yield per plant (g). Moderate heritability was found

in number of internodes, fruit length (cm), and number of seeds per fruit. Very high heritability coupled with high genetic advance observed in traits *viz.*, forseed index (%) thusthesecharactersshowadditivegeneactionintheir expression.High estimationgenetic advance as a percentage of the meanwas recorded foraverage fruit weight (cm), and number of fruits per plant.Moderate genetic advance as a percentage of the mean was recorded forplant height (cm), number of branches per plant, internodal length (cm) and fruit yield per plant (g). Low genetic advance as a percentage of the mean was recorded for days to first flowering, number of internodes, fruit length (cm), fruit diameter (cm), and number of seeds per fruit".Similarkindof results were foundby[17,18,19,16,20].

Inthepresentfindings,themagnitudesof the phenotypiccorrelationcoefficient table 4 (a) were greater than the corresponding genotypic correlation coefficient table 4 (b). Similarfindingsby[21,22,23,24,25]. Asignificantphenotypicandgenotypiccorrelationwith the fruit yield per plant exhibited highly significant and positive at phenotypic level followed by internodal length (cm), average fruit weight (cm), and number of fruits per plant.

S. No.	Characters	Source of variation		
		Replications	Treatments	Error
	Degree of freedom	2	19	38
1	Days to first flowering	2.33	10.83**	1.30
2	Plant height (cm)	1.31	178.5**	13.21
3	Number of branches per plant	0.38	0.71**	0.84
4	Number of internodes	0.25	0.52*	0.20
5	Internodal length (cm)	0.10	0.81**	0.07
6	Fruit length (cm)	1.52	4.71**	1.81
7	Fruit diameter (cm)	0.08	0.29**	0.07
8	Average fruit weight (cm)	0.39	5.10**	0.51
9	Number of fruits per plant	1.33	5.99**	0.84
10	Number of seeds per fruit	280.67	10.8*	6.29
11	Seed index (%)	0.07	4.18**	0.7
12	Fruit yield per plant (g)	2170.7	1670.4**	223.2

Table 1. Analysis of variance for twelve characters in Okra

*** Significant at 5 % probability level,** Significant at 1 % probability level.**

Table 2: Adjusted mean of genotypes and checks, range and least significant differences for ten characters in Okra.

S.N.	Genotypes	Days to first flowering	Plant height (cm)	Number of branches per plant	Number of internodes	Internodal length (cm)	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (cm)	Number of fruits per plant	Number of seeds per fruit	Seed index (%)	Fruit yield per plant (g)
1	IC- 22283	39.67	92.97	6.37	11.39	5.83	18.79	4.13	8.20	8.62	46.37	5.55	215.69
2	IC- 22285	45.33	84.23	5.37	11.39	4.77	17.36	4.13	7.19	7.23	48.12	5.05	165.80
3	IC- 23594	39.67	77.00	6.71	11.77	5.67	18.96	4.50	9.27	11.87	47.02	7.70	275.91
4	IC- 27831	39.33	63.10	5.71	11.01	5.47	14.97	4.10	8.29	11.57	50.72	7.10	230.31
5	IC- 27874	42.00	63.37	5.71	11.39	4.80	16.72	4.53	7.49	8.58	46.41	8.55	210.25
6	IC- 27875	40.00	71.27	5.71	11.01	4.03	17.20	3.83	11.20	8.98	48.08	7.50	209.49
7	IC- 27877	43.67	66.60	4.71	11.01	4.60	19.44	4.10	7.99	9.34	48.99	8.05	206.57
8	IC- 27878	40.00	60.23	6.04	11.01	5.60	16.88	4.60	11.79	8.39	46.23	7.90	203.55
9	IC- 27879	39.33	64.63	5.71	11.01	5.63	18.00	4.40	10.59	11.40	50.13	6.90	221.87
10	IC- 27881	42.00	78.07	5.37	11.01	4.87	16.88	4.33	8.49	8.10	47.01	4.90	197.84
11	IC- 27898	39.67	64.07	5.71	11.39	5.53	18.64	4.20	9.65	11.49	53.18	6.40	232.37
12	IC- 28359	44.33	68.57	4.71	11.01	4.43	18.16	4.50	9.15	9.66	46.09	6.55	217.91
13	IC- 29117	40.00	80.67	5.71	10.62	5.73	18.96	4.40	11.40	11.69	46.12	5.10	253.61
14	EC-112112	40.00	71.60	5.71	11.77	5.43	17.20	4.20	9.57	11.47	48.85	7.50	238.06
15	EC- 112241	40.33	68.80	5.04	11.01	5.63	18.64	4.53	9.64	11.82	47.05	8.45	228.14
16	EC- 169355	39.33	65.40	5.71	10.24	5.67	16.40	4.40	9.32	11.32	47.17	7.50	221.88
17	EC- 169364	44.33	62.97	6.37	11.39	4.90	15.92	4.10	8.13	10.01	52.16	7.60	183.38
18	EC- 169468	40.00	74.83	6.37	11.77	5.40	15.92	4.37	9.89	11.40	48.65	8.45	242.78
19	EC- 169481	40.00	71.53	5.04	11.01	5.20	16.72	4.73	11.00	11.87	48.63	6.50	258.08
20	EC- 169499	43.67	70.10	5.71	10.62	4.33	17.52	4.53	9.59	9.49	50.00	4.51	198.82
Mean		41.13	71.00	5.67	11.14	5.18	17.46	4.33	9.39	10.22	48.35	6.89	220.61
Range	**Max**	45.33	92.97	6.71	11.77	5.83	19.44	4.73	11.79	11.87	53.18	8.55	275.91
	Min	39.33	60.23	4.71	10.24	4.03	14.97	3.83	7.19	7.23	46.09	4.51	165.80

****=significantat5% and1%levelofprobability, NS = non-significant.**

Table 3: Estimate of coefficient of variation, h^2 (broad sense), and genetic advance in percent of mean in Okra

S. No.	Characters	Range		Mean	Coefficient of variation		Heritability in broad sense (%)	Genetic advance in percent of mean
		Max	Min		PCV	GCV		
1	Days to first flowering	45.33	39.33	41.13	5.72	3.31	81.43	7.12
2	Plant height (cm)	92.97	60.23	71	12	9.58	90.5	19.96
3	Number of branches per plant	6.71	4.71	5.67	12.02	10.12	87.42	19.29
4	Number of internodes	11.77	10.24	11.14	5.94	2.61	51.53	4.44
5	Internodal length (cm)	5.83	4.03	5.18	10.03	8.03	92.51	16.58
6	Fruit length (cm)	19.44	14.97	17.46	9.09	5.45	61.71	-0.36
7	Fruit diameter (cm)	4.73	3.83	4.33	5.21	2.83	80.76	6.18
8	Average fruit weight (cm)	11.79	7.19	9.39	12.33	10.16	89.84	20.43
9	Number of fruits per plant	11.87	7.23	10.22	17.59	14.41	84.24	28.48
10	Number of seeds per fruit	53.18	46.09	48.35	5.28	2.19	53.49	3.9
11	Seed index (%)	8.55	4.51	6.89	5.72	3.31	96.36	30.19
12	Fruit yield per plant (g)	275.91	165.8	220.61	12	11.18	81.43	18.85

S.N.	Characters	Days to	Plant	Number	Number	Internod	Fruit	Fruit	Average	Number	Number	Seed	Fruit

Table4 (a): Estimates of Phenotypic correlation between different characters in Okra.

		first flowering	height (cm)	of branches per plant	of internodes	al length (cm)	length (cm)	diameter (cm)	fruit weight (cm)	of fruits per plant	of seeds per fruit	index (%)	yield per plant (g)
1	Days to first flowering	**1.0000**	0.1084	-0.1612	0.2315	-0.6261	0.1112	-0.0075	-0.2828	-0.4938	0.2436	-0.1548	-0.5653
2	Plant height (cm)		**1.0000**	0.2535	0.1959	0.2322	0.2909*	-0.1167	-0.1183	-0.0648	-0.2956	-0.4405	0.1831
3	Number of branches per plant			**1.0000**	0.4839**	0.2957*	-0.1488	0.0097	0.2339	0.119	0.2246	0.2322	0.2656
4	Number of internodes				**1.0000**	0.0659	-0.0546	0.0523	0.0683	-0.0847	0.2566	0.3198*	0.0811
5	Internodal length (cm)					**1.0000**	0.1360	0.2988*	0.0659	0.5944**	-0.1452	0.1364	0.5577**
6	Fruit length (cm)						**1.0000**	0.182	0.1564	0.2489	-0.0259	-0.0825	0.3114
7	Fruit diameter (cm)							**1.0000**	0.3421**	0.3039	-0.2254	0.203	0.3733*
8	Average fruit weight (cm)								**1.0000**	0.2831*	-0.0378	0.0665	0.3529**
9	Number of fruits per plant									**1.0000**	0.5403	0.2364	0.7703**
10	Number of seeds per fruit										**1.0000**	-0.0457	-0.1861
11	Seed index (%)											**1.0000**	0.2186
12	Fruit yield per plant (g)												**1.0000**

***, ** Significant at 5 % and 1 % probability levels, respectively.**

Table 4(b): Estimates of Genotypic correlation between different characters in Okra.

S.N.	Characters	Days to first flowering	Plant height (cm)	Number of branches per plant	Number of internodes	Internodal length (cm)	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (cm)	Number of fruits per plant	Number of seeds per fruit	Seed index (%)	Fruit yield per plant (g)
1	Days to first flowering	**1.0000**	0.0165	-0.2012	0.0647	-0.7321	-0.0030	-0.1228	-0.4390	-0.6001	0.2050	-0.2718	-0.7702
2	Plant height (cm)		**1.0000**	0.1617	0.1028	0.1336	0.3650**	-0.2548	-0.3186	-0.2123	-0.5070	-0.57668	0.0781
3	Number of branches per plant			**1.0000**	0.6111**	0.3237**	-0.3526	-0.1382	0.1113	0.0455	0.1353	0.1177	0.1771
4	Number of internodes				**1.0000**	-0.0404	-0.4069	-0.0291	-0.0056	-0.3210	0.2254*	0.4268**	0.0157
5	Internodal length (cm)					**1.0000**	0.1195	0.3004	0.0633	0.6272	-0.2089	0.1565	0.5449**
6	Fruit length (cm)						**1.0000**	0.0764	0.0680	0.1858	-0.2433	-0.2091	0.2291
7	Fruit diameter (cm)							**1.0000**	0.3226**	0.2516*	-0.5632	0.0992	0.3101
8	Average fruit weight (cm)								**1.0000**	0.3029*	-0.0639	0.0507	0.4335**
9	Number of fruits per plant									**1.0000**	0.3584**	0.2141	0.9004**
10	Number of seeds per fruit										**1.0000**	-0.0239	-0.1094
11	Seed index (%)											**1.0000**	0.2156
12	Fruit yield per plant (g)												**1.0000**

***, ** Significant at 5 % and 1 % probability levels, respectively**

5. CONCLUSION

Our investigation revealed that genotypes possessed considerable genetic variability for different characters under study which makes them suitable for utilization in different breeding programmes. The mean sum of squares attributed to genotypes were significant for all features, according to the calculation of analysis of variance, suggesting that there was enough genetic diversity among the genotypes. The results of this study showed that for every trait, the phenotypic coefficient of variation was greater than the corresponding genotypic coefficient of variation. This finding may be the result of some interaction between the genotypes and the environment, which could explain environmental factors that affect how these characters express themselves. PCV and GCV are highly observed for was recorded as moderate for plant height (cm), number of branches per plant, average fruit weight (cm), number of fruits per plant, and fruit yield per plant (g). whichsuggestsgreaterphenotypicandgenotypicvariabilityamongthegenotypesandresponsivenes softheattributesformakingfurther improvementbyselection. High heritability estimates were observed by in days to first flowering, plant height (cm), number of branches per plant, internodal length (cm), fruit diameter (cm), average fruit weight (cm), number of fruits per plant, seed index (%), and fruit yield per plant (g). High estimation genetic advance as a percentage of the meanwas recorded for average fruit weight (cm), and number of fruits per plant. Thus,this characterrevealedthemostimportantassociationoffruityield per plant in Okra.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

REFERENCES

1. Panse VG, Shukhatme PV. Statistical Methods for Agricultural Workers (2nd Ed). ICAR, Publications, New Delhi. 1967.
2. Snedecor, G. W., and Haber, E. S. (1946). Statistical methods for an incomplete experiment on a perennial crop. *Biometrics Bulletin*, 2(4), 61-67.
3. Burton, G. W., and De Vane, D. E. (1953). Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material.

4. Sivasubramanian, S., and P. Madhava Menon, 1973: Genotypic and phenotypic variability in rice. *Madras Agric. J.* 60, 1093–1096.
5. Hanson, C. H., Robinson, H. F., and Comstock, R. E. (1956). Biometrical studies of yield in segregating populations of Korean lespedeza 1. *Agronomy journal*, *48*(6), 268-272.
6. Robinson, H. F., Comstock, R. E., and Harvey, P. H. (1949). Estimates of heritability and the degree of dominance in corn.
7. Johnson, H. W., Robinson, H. F., and Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybeans.
8. AI□Jibouri, H., Miller, P. A., and Robinson, H. F. (1958). Genotypic and environmental variances and covariances in an upland Cotton cross of interspecific origin 1. *Agronomy journal*, *50*(10), 633-636.
9. Akinyele, B. O., and Osekita, O. S. (2011). Genotype× environment interaction in NH47-4 variety of okra–*Abelmoschus esculentus* (Linn.) Moench. *Int. J. Genet. Mol. Biol*, *3*(4), 55-59.
10. Sharma, R., Barupal, S., Shukla, Y. R., Bharat, N. K., and Dilta, B. S. (2018). Effect of seed priming on field performance of okra. *International Journal of Farm Sciences*, 8(4), 144-149.
11. Kumar, A., Kumar, M., Sharma, V. R., Singh, M. K., Singh, B., and Chand, P. (2019). Genetic variability, heritability and genetic advance studies in genotypes of okra [(*Abelmoschus esculentus* (L.) Moench]. *Journal of Pharmacognosy and Phytochemistry*, 8(1), 1285-1290.
12. Ranga, A. D., Kumar, S., and Darvhankar, M. S. (2021). Variability among different yield and yield contributing traits of Okra (*Abelmoschus esculentus* L. Moench) genotypes. *Electronic Journal of Plant Breeding*, *12*(1), 74-81.
13. Kerure, P., Pitchaimuthu, M., and Hosamani, A. (2017). Studies on variability, correlation and path analysis of traits contributing to fruit yield and its components in okra (*Abelmoschus esculentus* L. Moench). *Electronic Journal of Plant Breeding*, *8*(1), 134-141.
14. Kumar, A., Singh, A. K., Singh, B. K., and Pal, A. K. (2021). Estimation of variability, heritability and genetic advance studies in Okra. *The Pharma Innovation Journal*, 10(9), 1279-1281.

15. Reddy, J. P., Anbanandan, V., and Kumar, B. S. (2022). Genotypic, phenotypic variability and evaluation of okra [*Abelmoschus esculentus* (L.) Moench] genotypes for yield components. *Journal of applied and natural science*, 14(1), 180-187.
16. Mohammed, J., Mohammed, W., and Shiferaw, E. (2022). Performance and genetic variability of okra (*Abelmoschus esculentus* (L.) Moench) genotypes in Ethiopia for agromorphology and biochemical traits. *Advances in Agriculture*, 2022(1), 5521151.
17. Phani Krishna, M., Hameedunnisa Begum, H. B., Rao, A. M., and Kumar, N. S. (2015). Estimation of heritability and genetic advance in okra [*Abelmoschus esculentus* (L.) Moench.].
18. Priyanka, V. M., Reddy, T., Begum, H., Sunil, N., and Jayaprada, M. (2018). Studies on genetic variability, heritability and genetic advance in genotypes of okra [*Abelmoschus esculentus* (L.) moench]. *International Journal of Current Microbiology and Applied Sciences*, *7*(5), 401-411.
19. Vani, V. M., Singh, B. K., Raju, S. V. S., and Singh, A. K. (2021). Studies on genetic variability, heritability and genetic advance for various quantitative traits in okra [*Abelmoschus esculentus* (L.) Monech] genotypes under north gangetic plains of Uttar Pradesh. *Journal of Pharmacognosy and Phytochemistry*, *10*(3), 272-274.
20. Kumar, Y., Singh, V. B., Gautam, S. K., Kumar, V., and Singh, V. (2020). Studies on genetic variability, heritability and genetic advance for fruit yield and its contributing traits in okra [*Abelmoschus esculentus* L. Moench]. *The Pharma Innovation Journal*, *9*(10), 351-354.
21. Syfullah, K., Sani, M. N. H., Nasif, S. O., Parvin, S., Rony, M. M. H., Islam, M. S., and Hossain, M. S. (2018). Genetic variability, heritability, character association and morphological diversity in okra (*Abelmoschus esculentus* L. Moench). *International Journal of Plant & Soil Science*, 25(6), 1-11.
22. Barman, A., and Marboh, R. (2022). Genetic variability and correlation analysis in indigenous germplasm of okra (*Ablemoschus esculentus* L. Moench). *Annals of Plant and Soil Research*, *24*(3), 452-457.
23. Awasthi, S., Singh, D. P., Singh, P., Upadhyay, A., and Lal, B. (2022). Estimation of correlation and path coefficient for morphological and quantitative traits in okra (*Abelmoschus esculentus* L. Moench). *Vegetable Science*, *49*(02), 176-182.
24. Lal, G. M. (2023). Estimation of Correlation and Path Coefficient Analysis for Quantitative Characters in Okra (*Abelmoschus esculentus* L. Moench)

Genotypes. *International Journal of Environment and Climate Change*, 13(10), 491-501.

25. Nbeaa, R. A., Abo-Trabi, B., and Ahmad, E. (2023). Phenotypic Correlation and Path Coefficient and Relative Importance Studies in Okra *Abelmoschus esculentus* (L.) Moench. *Basrah Journal of Agricultural Sciences*, *36*(1), 50-59.