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ESTIMATION OF GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR VARIOUS QUANTITATIVE TRAITS IN OKRA (*ABELMOSCHUS ESCULENTUS* L. MONECH)

Pramod Singh, Anil Kumar*, C.N. Ram, Aastik Jha, Aashish Kumar Singh, Virendra Kumar, Pravesh Kumar, Yogesh Kumar and Vikas Babu
Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229, Uttar Pradesh, India
*Corresponding author E-mail: akkakori@gmail.com
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ABSTRACT

The present investigation was conducted during the summer season of 2024 at the Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) - 224229. The experiment was laid out in a Randomized Block Design with three replications, comprising twenty-three genotypes of okra. Significant variability was observed among the genotypes for pod yield per plant. The pod yield ranged from 78.12 g (NDO-23-37) to 258.67 g (Kashi Pragati), with an overall mean of 148.31 g. Among the genotypes evaluated, the lowest pod yield per plant was recorded in NDO-23-37 (78.12 g) followed by NDO-23-34 (104.78 g) and NDO-23-40 (105.81 g). In contrast, the highest pod yield was observed in Kashi Pragati (258.67 g) followed by NDO-23-47 (220.11 g) and NDO-23-53 (184.11 g).
Keywords**:** Genetic variability, heritability, genetic advance, yield and quality

Introduction

Okra [*Abelmoschus esculentus* L. (Moench)] is a widely cultivated vegetable crop belonging to the Malvaceae family, commonly known by names such as lady's finger, bhindi and gumbo. Indigenous to northern Africa particularly Ethiopia and Sudan it flourishes in tropical and subtropical regions. Cytogenetically, okra is considered an amphidiploid species, most likely derived from interspecific hybridization between *A. tuberculatus* (2n = 58) and *A. ficulneus* (2n = 72) another related amphidiploid, *A. caillei*, occurs in West and Central Africa and is thought to involve *A. esculentus* in its lineage. The genus *Abelmoschus* exhibits considerable chromosomal diversity, with chromosome numbers ranging from 2n = 56 in *A. angulosus* to 2n = 196 in *A. manihot* var. *caillei* (Singh & Bhatnagar, 1975).

Okra is prized for its tender green pods, which are consumed fresh, dried or processed. Additionally, the seeds serve as a caffeine-free coffee substitute. Nutritionally, a 100g edible portion provides approximately 36 kcal and contributes essential proteins, vitamins and minerals (Aykroyd, 1941). Medicinally, okra is traditionally used to treat urinary ailments and goitre. Despite its significance, okra production is hindered by suboptimal cultivars, biotic stresses (such as pests) and abiotic factors. To meet growing consumption demands, breeding programs should prioritize the selection of genetically diverse, heritable traits that enhance yield and quality.

Material and Method

The present investigation was carried out to evaluate genetic variability, heritability and genetic advance for yield and quality traits in okra. The study was conducted at the Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) 224229, during the summer season of 2024. The experiment was laid out in a Randomized Block Design with three replications to assess the performance of twenty-three okra genotypes. Each genotype was sown in three rows, with a row-to-row spacing of 45 cm and plant-to-plant spacing of 30 cm in each replication. The sowing was carried out on 21st April 2024. All recommended agronomic practices and plant protection measures were followed to ensure the proper growth and development of the crop. Observation was recorded traits like days to first flower appearance, days to 50% flowering, days to first pod harvest, first pod-producing node, pod length (cm), pod diameter (mm), average pod weight (g), number of pods per plant, internodal length (cm), stem diameter (mm), plant hight (cm), pod yield per plant (g), number of seeds per pod, total pod yield (q/ha), total soluble solid (˚Brix) and ascorbic acid (mg/100g).

Results and Discussion

The genetic divergence among twenty-three diverse genotypes of okra (*Abelmoschus esculentus* L. Moench) was meticulously evaluated employing robust statistical parameters, including the range, grand mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad-sense heritability and genetic advance as a percentage of the mean (Table-1). These measurements were used to understand the genetic makeup and to figure out how much variation exists in the collection of plants. Across all the quantitative traits assessed, PCV estimates consistently surpassed the corresponding GCV values, thereby highlighting the appreciable influence of environmental factors on phenotypic expression. The disparity between PCV and GCV further underscores the necessity of accounting for environmental variance when interpreting trait performance. This comparative analysis of genotypic and phenotypic variability provides critical insights into the heritable potential of traits under selection. The findings demonstrated a broad spectrum of genetic variability among the studied genotypes, encompassing traits with high, moderate and low estimates of both GCV and PCV. Traits exhibiting elevated values for both coefficients, such as pod yield per plant and average pod weight are indicative of predominant additive gene effects and offer considerable scope for improvement through direct phenotypic selection. These results underscore the potential for genetic enhancement and serve as a foundation for strategic breeding interventions aimed at yield augmentation and trait improvement in okra.

The highest PCV was observed in pod yield per plant (27.12%), followed by total pod yield (24.84%) and average pod weight (17.42%), indicating high phenotypic variability among these yield-related traits. This suggests a significant scope for selection and genetic improvement. Moderate PCV values were noted in traits such as number of pods per plant (14.93%), plant height (13.98%), and stem diameter (12.83%), reflecting a reasonable degree of variability and potential for enhancement through selection. Quality-related traits, including ascorbic acid content (10.70%), total soluble solids TSS (10.09%), internodal length (10.22%) and pod diameter (10.55%), also exhibited moderate PCV values, indicating their suitability for nutritional quality improvement. In contrast, low PCV was recorded in traits like number of seeds per pod (8.53%), pod length (7.58%), first pod-producing node (8.32%), days to first flowering (6.48%), days to 50% flowering (6.23%) and days to first pod harvest (5.89%). This suggests greater phenotypic stability and lower environmental influence on these traits. Among these, days to first pod harvest had the lowest PCV, highlighting its phenotypic consistency across different environments. Additionally, node to first flower appearance (10.04%), crop duration (7.03%), and days to first fruit harvest (4.38%) also showed moderate to low PCV values. These findings align with previous reports by Hazra and Basu (2000), Alam and Hussain (2008), Magar *et al*. (2009), Adeoluwa *et al*. (2011), and Chaukhande *et al*. (2011), who also documented moderate to low PCV in similar traits.

The genetic coefficient of variation (GCV) presented in Table-1 is as follows; the highest GCV was recorded for pod yield per plant (26.57%), followed by total pod yield (24.16%), average pod weight (16.41%) and number of pods per plant (13.32%). Moderately high GCV values were observed for plant height (11.07%), stem diameter (10.94%) and ascorbic acid content (10.07%). Other traits such as internodal length (7.27%), T.S.S. (7.40%), pod diameter (6.62%) and number of seeds per pod (5.61%) displayed moderate levels of GCV. In contrast, relatively lower GCV values were recorded for pod length (5.22%), first pod producing node (4.71%), days to first flowering (4.07%), days to first pod harvesting (4.01%) and days to 50% flowering (3.70%). In general, the phenotypic coefficient of variation (PCV) was found to be higher than the genotypic coefficient of variation (GCV) for all the traits studied, indicating that environmental factors played a significant role in the expression of these traits. The greater difference between PCV and GCV suggests that the expression of these traits is influenced by additive gene action along with environmental interaction.

Similar, results have been reported by Awasthi *et al*., (2022) they observed, Phenotypic variances range between days to first flowering (4.67) and plant height at 45 days (20.08). The phenotypic coefficient of variations was highest for characters *viz.*, plant height at 45 days (20.08%), number of fruits per plant (17.37%), number of seeds per fruit (17.34%), genotypic variances ranging between days to first flowering (4.63) and plant height at 45 days (19.79). High genotypic coefficient of variation was noted for plant height at 45 days (19.79%), number of seeds per fruit (17.38), number of fruits per plant (17.24%) and plant height at 90 days (15.56%).

Heritability is a crucial genetic parameter that measures the proportion of phenotypic variation in a trait that can be attributed to genetic factors. It reflects the degree to which offspring resemble their parents and is fundamental in predicting the effectiveness of selection in crop improvement programs. On the other hand, genetic advance refers to the expected improvement in a trait resulting from selection and serves as an indicator of how much a character can be improved in subsequent generations. It also helps in understanding the direction and intensity of selection pressure needed for trait enhancement. When heritability is high but genetic advance is low, it often indicates the influence of non-additive gene action or environmental effects. However, high heritability combined with high genetic advance as a percentage of the mean suggests the predominance of additive gene action and minimal environmental interference, making such traits more amenable to direct selection. Therefore, traits exhibiting both high heritability and genetic advance are considered ideal for genetic improvement and should be emphasized in advanced breeding programs aiming to develop superior crop varieties with desirable traits.

In the present study, heritability estimates varied widely, indicating differing levels of genetic control across traits (Table 1). The highest heritability was observed for pod yield per plant (95.99%), followed by total pod yield per hectare (94.60%), average pod weight (88.76%) and ascorbic acid content (88.53%). These traits also exhibited high genetic advance as a percentage of the mean—53.63%, 48.40%, 31.85%, and 19.52%, respectively suggesting they are primarily governed by additive gene action. Consequently, these traits can be effectively improved through direct phenotypic selection. Moderately high heritability was recorded for number of pods per plant (79.60%), stem diameter (72.78%), total soluble solids (T.S.S) (53.76%), and internodal length (50.64%), each accompanied by moderate to high genetic advance. This indicates that both genetic factors and environmental influences contribute to the expression of these traits, offering substantial potential for improvement through selection-based breeding. In contrast, traits such as days to first flowering (39.37%), days to 50% flowering (35.29%) and first pod-producing node (32.04%) showed low to moderate heritability, along with low genetic advance as a percentage of mean (ranging from 4.53% to 5.49%). These results suggest limited response to selection, likely due to a greater influence of environmental factors or non-additive gene action. Additionally, pod diameter (39.43%) and number of seeds per pod (43.28%) also recorded relatively low heritability and genetic advance, indicating that selection for these traits may not be effective unless supplemented with other breeding approaches such as hybridization or marker-assisted selection. Similar findings of high heritability for key yield-related traits have also been reported by Saifullah *et al.* (2009), Magar *et al.* (2009), Dakahe *et al.* (2007), and Jindal *et al.* (2010).

Genetic advance as a percentage of the mean, also referred to as genetic gain, is an important indicator to assess the expected improvement in a trait through selection, assuming high heritability and additive gene action. It combines information from genetic variability, heritability and selection intensity and thus provides a more realistic estimate of the potential for genetic improvement in a breeding program.

In the present study (Table-1), pod yield per plant recorded the highest genetic advance as percent of mean (53.63%), followed by total pod yield per hectare (48.40%), average pod weight (31.85%) and number of pods per plant (24.48%). These traits also had high heritability, indicating that additive genetic effects predominate and substantial improvement through direct phenotypic selection is possible. Such traits are considered ideal for improvement through simple selection methods, especially in early generations. Traits like plant height (18.05%), followed by ascorbic acid content (19.52%), stem diameter (19.23%), TSS (11.18%) and internodal length (10.66%) showed moderate genetic advance, reflecting that while selection may still be effective, both additive and non-additive gene actions, along with environmental interactions, could be influencing trait expression.

On the other hand, lower genetic advance as a percent of mean was recorded for number of seeds per pod (7.61%) followed by pod diameter (8.57%), pod length (7.40%), first pod producing node (5.49%) and days to first flowering (5.26%). These traits had lower heritability values and lower genetic advance present of mean (GAM), suggesting a limited response to selection and complex inheritance patterns, possibly involving dominance and epistasis. The lowest genetic gain was observed in days to 50% flowering (4.53%) and days to first pod harvesting (5.62%), indicating less potential for genetic improvement through selection due to higher environmental influence and low additive variance.

Conclusion

The present study revealed significant genetic variability among twenty-three okra genotypes for key yield and quality traits, highlighting strong potential for genetic improvement through selection. Traits such as pod yield per plant, total pod yield per hectare, average pod weight, and number of pods per plant exhibited high genotypic and phenotypic coefficients of variation (GCV and PCV), high heritability, and high genetic advance, suggesting the predominance of additive gene action and suitability for direct phenotypic selection. Moderate variability was observed for traits such as plant height, stem diameter and ascorbic acid content, indicating a moderate scope for improvement. In contrast, traits like days to flowering and pod diameter showed low heritability and genetic gain, implying limited response to selection. Overall, traits demonstrating high heritability coupled with high genetic advance should be prioritized in breeding programs aimed at developing high-yielding and superior-quality okra cultivars.

Table 1 : Analysis of variance (mean squares) for sixteen characters in okra

S. No.	Traits	Source of variation		
	d.f.	Replication	Treatments	Error
		2	22	44
1.	Days to first flowering	0.7101	11.3834**	3.8617
2.	Days to 50% flowering	78.318	13.5402**	5.137
3.	Days to first pod harvesting	10.4928	13.7945*	7.6897
4.	First pod producing node	0.0628	0.2268**	0.094
5.	Pod fruit length (cm)	0.5687	0.6056*	0.3099
6.	Pod diameter (mm)	0.3538	4.0803**	1.3819
7.	Average pod weight (gm)	0.6232	10.8506**	0.4393
8.	No. of pod per plant	0.8013	9.4122**	0.7409
9.	Internodal length (cm)	0.0795	0.4366**	0.107
10.	Stem diameter (mm)	0.6998	7.1309*	3.1352
11.	Plant height (cm)	6.4571	114.6152**	18.9891
12	Pod yield per plant (gm)	173.018	4730.2528**	644.195
13.	No. of seed per pod	2.4945	20.9245**	6.3618
14.	Total pod yield (q/ha)	76.8954	2102.2925**	286.3031
15.	T.S.S (°Brix)	0.1097	0.6994*	0.3712
16.	Ascorbic acid (mg/100gm)	0.2739	4.2499**	0.1761

Table 2: Estimates of range, grand mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense, genetic advance (Ga) and genetic advance in per cent of mean for 16 characters in okra germplasm

Characters	Min	Max	Grand Mean	GCV (%)	PCV (%)	Heritability (%)	Genetic Advance	Genetic Advance % mean
Days to first flowering	37.00	46.67	38.94	4.07	6.48	39.37	2.05	5.26
Days to 50% flowering	42.33	51.00	45.19	3.70	6.23	35.29	2.05	4.53
Days to first pod harvesting	45.33	55.33	49.54	4.01	5.89	46.28	2.78	5.62
Plant height (cm)	44.11	75.44	51.01	11.07	13.98	62.67	9.21	18.05
Internodal length (cm)	3.18	4.95	4.56	7.27	10.22	50.64	0.49	10.66
Stem diameter (mm)	11.69	18.50	14.55	10.94	12.83	72.78	2.80	19.23
First pod producing node	4.00	5.17	4.47	4.71	8.32	32.04	0.25	5.49
Pod length (cm)	7.20	8.97	7.89	5.22	7.58	47.36	0.58	7.40
Pod diameter (mm)	12.38	17.30	14.32	6.62	10.55	39.43	1.23	8.57
Average pod weight (g)	8.36	13.97	11.35	16.41	17.42	88.76	3.62	31.85
No. of pod per plant	8.77	15.87	12.76	13.32	14.93	79.60	3.12	24.48
T.S.S (^{0}Brix)	5.17	6.93	6.11	7.40	10.09	53.76	0.68	11.18
Ascorbic acid (mg/100g)	10.30	13.97	11.57	10.07	10.70	88.53	2.26	19.52
No.. of seed per pod	32.67	46.47	39.24	5.61	8.53	43.28	2.99	7.61
Pod yield per plant (g)	78.12	258.67	148.31	26.57	27.12	95.99	79.54	53.63
Total pod yield (q/ha)	52.08	146.74	98.04	24.16	24.84	94.60	47.46	48.40

Table 3 : Mean performance of 23 genotypes for twenty characters in okra

S. NO	Genotypes	Days to first flowering	Days to 50% flowering	Days to first pod harv-esting	Plant height (cm)	Internodal length (cm)	Stem diameter (mm)	First pod prod-ucing node	Pod length (cm)	Pod diameter (mm)	Average pod weight (g)	No. of pod per plant	T.S.S (°Brix)	Ascorbic acid (mg /100g)	No. of seed per pod	Pod yield per plant (g)	Total pod yield (q/ha)
1	NDO-23-31	38.67	43.00	51.00	44.69	4.69	11.69	4.00	7.47	13.23	12.40	12.53	5.60	10.63	38.73	151.68	103.55
2	NDO-23-32	39.67	43.67	55.33	44.11	4.71	15.80	4.60	7.27	15.43	12.70	13.80	5.93	10.50	42.13	175.43	116.71
3	NDO-23-33	39.00	44.67	49.67	47.23	4.81	18.50	4.40	8.17	14.30	10.99	12.87	6.20	10.43	39.20	144.76	94.26
4	NDO-23-34	37.00	42.33	49.00	46.81	3.18	14.11	4.20	8.97	13.94	12.02	8.77	6.37	10.70	38.13	104.78	70.38
5	NDO-23-35	37.67	43.00	49.00	49.29	4.75	14.99	4.67	8.17	15.55	8.55	13.87	5.20	12.30	41.20	118.40	78.93
6	NDO-23-36	39.33	44.00	45.67	44.29	4.87	16.26	4.27	8.07	15.17	11.02	14.20	6.93	10.43	32.67	156.26	104.17
7	NDO-23-37	38.00	43.33	49.67	52.67	4.69	14.58	4.80	7.97	14.48	8.92	8.77	6.90	13.07	36.93	78.12	52.08
8	NDO-23-38	37.33	43.00	48.67	46.67	4.43	13.25	4.20	8.17	15.52	13.93	12.47	6.30	10.80	38.00	173.71	115.81
9	MDO-23-39	38.00	44.67	51.33	51.74	4.44	16.60	4.67	8.33	12.85	12.50	12.73	5.73	11.50	38.40	159.06	106.04
10	NDO-23-40	39.00	46.33	49.67	50.03	3.97	12.77	4.33	7.93	14.96	8.82	12.00	5.67	11.33	41.87	105.81	70.54
11	NDO-23-41	39.67	46.33	47.00	52.78	4.03	14.08	4.40	8.33	14.56	10.39	15.30	6.03	12.53	36.87	158.88	105.92
12	NDO-23-44	37.00	45.67	45.67	52.41	4.69	15.00	4.27	8.07	13.89	9.09	12.10	6.40	10.47	40.87	109.93	73.29
13	NDO-23-45	39.67	44.33	49.67	53.96	4.69	12.28	4.20	7.87	14.38	8.87	14.80	6.50	11.17	37.60	130.77	87.18
14	NDO-23-46	38.00	44.67	47.00	48.55	4.58	14.95	4.47	7.67	13.97	12.02	13.10	5.83	10.30	38.60	157.74	105.16
15	NDO-23-47	39.00	45.00	45.33	52.09	4.53	12.34	4.60	7.20	15.37	13.86	15.87	6.77	12.80	39.67	220.11	146.74
16	NDO-23-48	37.33	45.33	50.67	52.20	4.75	17.65	4.40	7.53	12.67	13.31	11.33	5.70	11.53	38.20	150.77	100.51
17	NDO-23-49	39.33	45.67	50.33	49.21	4.47	13.64	4.47	8.27	12.38	10.49	12.97	6.80	12.37	41.20	136.02	90.68
18	NDO-23-50	38.67	45.33	49.67	50.38	4.71	16.00	4.93	7.97	13.34	8.36	12.67	5.47	11.28	40.67	105.85	70.57
19	NDO-23-51	40.00	45.67	50.33	51.76	4.83	13.81	4.60	7.47	13.30	11.51	12.47	6.50	10.50	41.40	143.39	95.59
20	NDO-23-52	40.33	46.00	50.00	55.02	4.58	13.99	4.67	7.37	14.29	10.70	11.40	5.17	13.33	37.40	122.13	81.42
21	NDO-23-53	38.67	45.67	50.00	48.70	4.78	14.68	4.13	7.27	13.23	13.97	11.80	6.23	10.40	37.47	184.10	129.13
22	NDO-23-54	37.67	50.67	51.67	53.21	4.69	13.69	4.33	7.27	15.34	13.21	12.47	5.97	13.77	38.87	164.82	109.88
23	Kashi Pragati (C)	46.67	51.00	53.00	75.44	4.95	14.07	5.17	8.70	17.30	13.50	15.27	6.27	13.97	46.47	258.67	146.49
	Mean	38.94	45.19	49.54	51.01	4.56	14.55	4.47	7.89	14.32	11.35	12.76	6.11	11.57	39.24	148.31	98.04
	Min	37.00	42.33	45.33	44.11	3.18	11.69	4.00	7.20	12.38	8.36	8.77	5.17	10.30	32.67	78.12	52.08
	Max	46.67	51.00	55.33	75.44	4.95	18.50	5.17	8.97	17.30	13.97	15.87	6.93	13.97	46.47	258.67	146.74
	SE(d)	1.61	1.85	1.75	3.56	0.27	0.80	0.25	0.35	0.96	0.54	0.70	0.34	0.34	2.06	6.58	4.62
	C.D.	3.25	3.74	3.53	7.20	0.54	1.61	0.51	0.72	1.94	1.09	1.42	0.69	0.69	4.16	13.31	9.34
	C.V.	5.05	5.02	4.32	8.54	7.18	6.69	6.86	5.50	8.21	5.84	6.74	6.86	3.63	6.43	5.43	5.77

References

Adeoluwa, O.O., Kehinde, O.B. (2011). Genetic variability studies in West African okra (*Abelmoschus caillei*). *Agric. Biol. J. N. Am.* **2**(10): 1326-1335

Alam, AKMA, Hossain, M. (2008). Variability of different growth contributing parameters of some okra [*Abelmoschus esculentus* (L.) Moench]. *J Agri. and Rural Dev.* **6**(1, 2): 25-35

Awasthi, S., Singh, D.P., Lal, B., Singh, P., Upadhyay, A., Singh, P.K., and Kumar, A. (2022). Assessment of Genetic Variability, Heritability and Genetic Advance of Okra Genotypes [*Abelmoschus esculentus* (L.) Moench]. *Assessment*, **53**(04): 7501-7512

Aykroyd (1941). Health Bulletin, No-3 Published by *Nutritional Res. Lab. Koonoor*, 21-26

Chauhan, D.V.S. (1972). Vegetable Production in India. 3rd ed. Ram Prasad and Sons. Agra

Chaukhande, P., Chaukhande, P.B, Dod, V.N. (2011). Genetic variability in okra. *The Asian J of Hort*, 6(1): 241246

Dakahe, K., Patil, H.E. and Patil, S.D. (2007). Genetic variability and correlation studies in okra [*Abelmoschus esculentus* (L.) Moench]. *Asian J of Hort*. **2**(1): 201-203

Duggi, S., Magadum, S.K., Srinivasraghavan, A., Kishor, D.S., Oommen, S.K. (2013). Genetic analysis of yield and yield attributing characters in okra [*Abelmoschus esculentus* (L.) Moench]. *Int. J of Agric. and Environ,* **6**(1): 45-50.

Jindal, S.K., Arora, D., Ghai, T.R. (2010). Variability studies for yield and its contributing traits in okra, [*Abelmoschus esculentus* (L.) Moench]. *El. J of Pl. Breed*, **1**(6): 1495-1499

Magar, R.G., Madrap, I.A. (2009). Genetic variability, correlation and path analysis in okra [*Abelmoschus esculentus* (L.) Moench]. *Int. J Pl. Sci.,* **4**(2): 498-501

Singh, H.B., Bhatnagar, A. (1975). Chromosome number in okra from Ghana. *Indian J. Gen. Pl. Breed*., **36**: 26-27

Saifullah, M., Rabbani, M.G. (2009). Evaluation and characterization of okra [*Abelmoschus esculentus* (L.) Moench]. genotypes. *SAARC J. of Agric*. **7**(1): 9198.

Hazra, P. and Basu, D. (2000). Genetic variability, correlation and path analysis in okra. *Ann. Agric. Res.* **21**(3): 452-453.