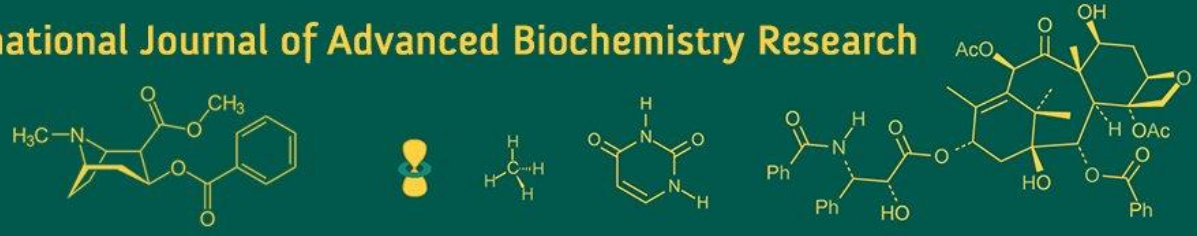
International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(9): 1945-1948
www.biochemjournal.com
Received: 17-08-2025
Accepted: 20-09-2025

Sanskar S Gadhave
M.Sc. Scholar, Department of Vegetable Science, Post Graduate Institute, Dr. PDKV, Akola, Maharashtra, India

RS Wankhade
Assistant Professor, Department of Horticulture, Agriculture Research Station, Dr. PDKV, Achalpur, Maharashtra, India

VS Kale
Professor, Department of Vegetable Science, Dr. PDKV, Akola, Maharashtra, India

Priti A Sonkamble
Associate Professor, Department of Genetics and Plant Breeding, Dr. PDKV, Akola, Maharashtra, India

AM Sonkamble
Head, Department of Vegetable Science, Dr. PDKV, Akola, Maharashtra, India

SO Bawkar
Assistant Professor, College of Horticulture, Dr. PDKV Akola, Maharashtra, India

Corresponding Author:
Sanskar S Gadhave
M.Sc. Scholar, Department of Vegetable Science, Post Graduate Institute, Dr. PDKV, Akola, Maharashtra, India

Genetic variability and heritability studies in okra

Sanskar S Gadhave, RS Wankhade, VS Kale, Priti A Sonkamble, AM Sonkamble and SO Bawkar

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i9Sy.5792

Abstract
A field trial was conducted to examine genetic variability and heritability in okra germplasm using 21 genotypes arranged in a Randomized Block Design (RBD) with two replications at the Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the summer season of 2024–25. Analysis of variance revealed significant differences among genotypes for all traits under study. Substantial diversity was observed in key yield-related attributes. For each trait, the phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV). High values of both PCV and GCV were recorded for leaf chlorophyll content, fruit width, number of branches per plant, and fruit yield per plant. Traits including fruit yield per plant, fruit weight, number of fruits per plant, fruit length, fruit width, number of branches per plant, and chlorophyll content exhibited high heritability coupled with high genetic advance over the mean, indicating the predominance of additive gene action. This suggests that these traits can be effectively improved through selection.

Keywords: Okra, genotypes, genetic variability, PCV, GCV

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench], a member of the family Malvaceae with a chromosome number of 2n = 130, is a major vegetable crop of global importance. It is widely cultivated in tropical, subtropical, and warm regions, including India, Africa, Turkey, and neighboring countries. In India, it is valued as one of the leading vegetable crops, primarily grown for its tender green fruits during summer and monsoon seasons.

Genetic variability plays a central role in okra breeding programs by supporting yield improvement, disease resistance, and nutritional quality. It aids in developing varieties adapted to diverse environments and market demands, while also providing resilience against pests and diseases for sustainable production. Intensive breeding efforts utilizing this variability have already resulted in several improved cultivars. However, genetic drift and rising susceptibility to pests and pathogens often reduce the long-term effectiveness of such varieties, making continuous development of new lines essential.

Assessing the extent of variability is therefore crucial, as it underpins effective selection in breeding. The success of any crop improvement program largely depends on the availability of useful variability and the heritability of desirable traits. Estimates of the genotypic coefficient of variation (GCV), combined with heritability, are reliable indicators of the genetic gain expected from selection (Burton, 1952) [4]. With this perspective, the present study was conducted to evaluate genetic variability and heritability in okra for supporting future breeding strategies.

Materials and Methods
The present study, entitled *"Genetic variability and heritability studies in okra"*, was carried out during the summer of 2024–2025 at the Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experimental material included 21 okra genotypes sourced from various institutes and evaluated under a Randomized Block Design (RBD) with two replications. The main aim was to assess the magnitude of genetic variability, heritability, and genetic advance for yield and its component traits.

Five randomly chosen plants per genotype were tagged to record data on: plant height at 90 DAS, days to 50% flowering, number of internodes on the main stem, number of branches per plant at 90 DAS, days to first picking, fruit length (cm), fruit width (mm), fruit weight (g), number of fruits per plant, fruit yield per plant (g), chlorophyll content of leaves (mg/g), and fruit moisture content (%). Meteorological information was collected from the Meteorological Observatory, Department of Agronomy, Dr. PDKV, Akola. Standard practices for manuring, fertilization, plant protection, irrigation, and other cultural operations were followed.

Treatments (genotypes) were randomly allotted within blocks. The phenotypic and genotypic coefficients of variation (PCV and GCV) were calculated following Burton (1952) [4]. Broad-sense heritability, genetic advance (GA), and genetic advance as a percentage of mean (GAM) were estimated as per Robinson *et al*. (1949) [15].

Results and Discussion

Variability across okra genotypes was assessed using mean values, GCV, and GAM. Substantial variation in mean performance was noted for all characters studied (Table 1), including plant height at 90 DAS, days to 50% flowering, number of internodes, number of branches per plant, days to first picking, fruit length, fruit width, fruit weight, number of fruits per plant, fruit yield per plant, chlorophyll content, and fruit moisture content. The highly significant differences observed confirm the existence of a broad genetic base, highlighting good prospects for crop improvement through selection.

Wide variability was particularly evident in yield-related traits. Fruit yield per plant ranged from 80.90 to 236.60 g with an average of 155.99 g, followed by plant height at 90 DAS (66.35–84.24 cm; mean 74.63 cm), number of internodes (8.60–11.45; mean 10.44), number of fruits per plant (8.10–20.50; mean 15.30), fruit width (10.89–22.67 mm; mean 14.79 mm), days to 50% flowering (41.50–52.50 days; mean 47.19 days), and days to first picking (47.50–58.50 days; mean 53.07 days). Such variability reflects the scope for selection and yield enhancement. Similar results were earlier reported by Burse (2012) [3], Priyanka *et al*. (2018) [10], Patil (2020) [9], and Shravanthi *et al*. (2021) [16].

In all traits studied, PCV values exceeded GCV values, indicating environmental influence on trait expression. However, the relatively narrow gaps between PCV and GCV suggested that most of the observed variability was genetic rather than environmental. These findings agree with Koundinya *et al*. (2013) [6] and Reddy *et al*. (2012) [14].

The PCV ranged from 4.062% to 35.726%, with the highest recorded for chlorophyll content (35.726%), followed by fruit width (29.688%), number of branches per plant (24.782%), fruit yield per plant (24.707%), and number of fruits per plant (20.096%). These results are in line with Thulasiam *et al*. (2017) for number of branches per plant and Patil *et al*. (2020) [9] for fruit yield per plant.

Table 1: Analysis of variance for twelve characters in okra

Sr. No	Mean sum of square			
	Name of characters/source	Replication	Treatment	Error
	Degree of freedom	1	20	20
1	Plant height at 90 DAS	0.981	28.522**	11.648
2	No of internodes on main stem	0.001	0.660**	0.299
3	Number of fruits per plant	0.644	18.720**	0.175
4	Fruit weight (g)	0.053	2.146**	0.069
5	Fruit width (mm)	5.899	34.068**	4.494
6	Fruit length (cm)	1.449	3.349**	0.109
7	Number of branches per plant at 90 DAS	0.174	1.012**	0.033
8	Chlorophyll content of leaves (mg/g)	0.009	0.349**	0.037
9	Days to 50 percent flowering	38.095	17.374**	1.845
10	Days to first picking	8.595	19.714**	2.895
11	Moisture content of fruit (%)	4.093	19.230**	3.679
12	Fruit yield per plant (g)	23.177	2931.982**	38.837

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

Low phenotypic coefficients of variation (PCV) were observed for traits such as fruit moisture content (4.062%), plant height (6.005%), days to 50% flowering (6.569%), days to first picking (6.335%), and number of internodes on the main stem (6.334%). Comparable results for PCV in plant height and days to 50% flowering were earlier reported by Patil (2020) [9]. Traits like fruit length (13.111%) and fruit weight (10.502%) exhibited moderate PCV values, which closely align with the findings of Kumari *et al*. (2019) [7], and for fruit length, with the observations of Thulasiram *et al*. (2017) [17].

The genotypic coefficient of variation (GCV) ranged between 3.347% and 32.090%. Maximum GCV values were recorded for leaf chlorophyll content (32.090%), fruit width (25.999%), fruit yield per plant (24.382%), and number of branches per plant (23.987%). These results are consistent with the findings of Patil (2020) [9] for fruit yield per plant and Thulasiram *et al*. (2017) [17] for number of branches per plant. Conversely, traits such as fruit moisture content (3.347%), plant height (3.892%), days to first picking (5.464%), days to 50% flowering (5.905%), and number of internodes on the main stem (4.069%) exhibited low GCV values. Similar observations were previously reported by Thulasiram *et al*. (2017) [17] for days to first picking and by Reddy *et al*. (2022) [13] for days to 50% flowering.

Moderate GCV values were noted for number of fruits per plant (19.909%), fruit length (12.691%), and fruit weight (10.170%). These results are in agreement with the reports of Thulasiram *et al*. (2017) [17] for fruit length and Shravanthi *et al*. (2021) [16] for number of fruits per plant.

Table 2: Genetic parameters in respect of twelve quantitative traits in okra genotypes

Sr. No	Character	Range		Mean	GCV%	PCV%	Heritability% (h^2)	GA	EGA in% of mean
		Min	Max						
1	Plant height at 90 DAS	66.35	84.24	74.63	3.892	6.005	42.005	3.878	5.197
2	No of internodes on main stem	8.60	11.45	10.44	4.069	6.334	37.619	0.537	5.141
3	Number of fruits per plant	8.10	20.50	15.30	19.909	20.096	98.150	6.215	40.631
4	Fruit weight (g)	8.40	12.20	10.02	10.170	10.502	93.778	2.033	20.287
5	Fruit width (mm)	10.89	22.67	14.79	25.999	29.688	76.693	6.937	46.903
6	Fruit length (cm)	8.20	12.70	10.03	12.691	13.111	93.691	2.538	25.306
7	Number of branches per plant at 90 DAS	1.68	3.92	2.92	23.987	24.782	93.688	1.395	47.829
8	Chlorophyll content of leaves (mg/g)	0.39	1.81	1.23	32.090	35.726	80.681	0.730	59.377
9	Days to 50 percent flowering	41.50	52.50	47.19	5.905	6.569	80.798	5.160	10.934
10	Days to first picking	47.50	58.50	53.07	5.464	6.335	74.389	5.152	9.708
11	Moisture content of fruit (%)	79.34	88.22	83.32	3.347	4.062	67.884	4.733	5.681
12	Fruit yield per plant (g)	80.90	236.60	155.99	24.382	24.707	97.385	77.319	49.566

Heritability refers to the proportion of genotypic variance in relation to phenotypic variance (total variance), reflecting the transmissible portion of variability and serving as a dependable predictor of the extent to which traits can be inherited across generations. Therefore, heritability estimates play a vital role in any crop improvement program.

In the present investigation, heritability values ranged from 37.619% to 98.150% across different traits, which aligns with the findings of Ramgiry *et al*. (2017) [12]. The highest heritability was recorded for number of fruits per plant (98.150%), followed by fruit yield per plant (97.385%), fruit weight (93.778%), fruit length (93.691%), number of branches per plant (93.688%), days to 50% flowering (80.798%), chlorophyll content of leaves (80.681%), fruit width (76.693%), days to first picking (74.389%), and fruit moisture content (67.884%). These results are consistent with reports by Chandramouli *et al*. (2016) [5] and Rambabu *et al*. (2019) [11] for fruit yield per plant, Alam *et al*. (2020) [2] for number of fruits per plant, Shravanthi *et al*. (2021) [16] for fruit weight, and Verma *et al*. (2018) [18] for fruit width. Moderate heritability was observed for plant height at 90 DAS (42.005%) and number of internodes on the main stem (37.619%), findings comparable with Acharya *et al*. (2015) [1] for plant height.

Genetic advance as a percentage of mean (GAM) ranged from 5.141% to 59.377%. The highest GAM was observed for leaf chlorophyll content and fruit yield per plant, which agrees with results of Chandramouli *et al*. (2016) [5] and Priyanka *et al*. (2018) [10]. High GAM was also obtained for number of fruits per plant, fruit length, fruit width, fruit weight, and number of branches per plant. These results corroborate the findings of Shravanthi *et al*. (2021) [16] for number of fruits per plant, Mohammed *et al*. (2022) [8] for fruit weight, and Ramgiry *et al*. (2017) [12] for number of branches per plant. Moderate GAM was recorded for days to 50% flowering, while days to first picking, fruit moisture content, plant height, and number of internodes per main stem showed low GAM. Similar trends were reported by Priyanka *et al*. (2018) [10] for days to 50% flowering and by Chandramouli *et al*. (2016) [5] for days to first picking.

The occurrence of high heritability coupled with high GAM, particularly for fruit yield per plant, indicates the predominance of additive gene action in the expression of these traits. Such traits are expected to respond well to phenotypic selection, offering promising opportunities for genetic improvement. These findings are in agreement with earlier studies by Chandramouli *et al*. (2016) [5] and Priyanka *et al*. (2018) [10].

Conclusion

The study identified the genotypes Korchi, PDKV Pragati, Varsha Uphar, Phule Vimukta, and IC-42464 as superior performers for fruit yield per plant. The analysis of variance revealed significant differences among genotypes for all traits studied, confirming the existence of substantial genetic variability in the material.

The highest genotypic and phenotypic coefficients of variation were recorded for leaf chlorophyll content, followed by fruit width, fruit yield per plant, and number of branches per plant. Furthermore, high heritability estimates combined with high genetic advance were noted for fruit yield per plant, number of fruits per plant, fruit weight, fruit length, fruit width, number of branches per plant, and chlorophyll content. This combination points to additive gene action, suggesting that these traits can be effectively improved through simple selection approaches.

References

1. Acharya B. Studies on genetic variability, divergence and character association in hybrid okra (*Abelmoschus esculentus* (L.) Moench). [MSc thesis]. Odisha: Department of Vegetable Sciences, College of Agriculture, Orissa University of Agriculture and Technology; 2015.
2. Alam K, Singh MK, Kumar M, Singh A, Kumar V, Ahmad M, *et al*. Estimation of genetic variability, correlation and path coefficient in okra (*Abelmoschus esculentus* (L.) Moench). Journal of Pharmacognosy and Phytochemistry. 2020;9(5):1484-1487.
3. Burse NR. Genetic variability, correlation and path analysis in okra (*Abelmoschus esculentus* (L.) Moench). [MSc thesis]. Akola: Department of Agricultural Botany, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth; 2012. 109 p.
4. Burton GW. Quantitative inheritance in grasses. Proceedings of the 6th International Grassland Congress. 1952;1:273-283.
5. Chandramouli B, Shrihari D, Rao AD, Rao MP. Studies on genetic variability, heritability and genetic advance in okra (*Abelmoschus esculentus* (L.) Moench) genotypes. Plant Archives. 2016;16(2):679-682.
6. Koundinya AVV, Dhankhar SK, Yadav AC. Genetic variability and divergence in okra (*Abelmoschus esculentus*). The Indian Journal of Agricultural Sciences. 2013;83(6):680-684.
7. Kumari A, Singh VK, Kumari M, Kumar A. Genetic variability, correlation and path coefficient analysis for yield and quality traits in okra (*Abelmoschus esculentus*

(L.) Moench). International Journal of Current Microbiology and Applied Sciences. 2019;8(6):918-926.
8. Mohammed J, Mohammed W, Shiferaw E. Performance and genetic variability of okra (*Abelmoschus esculentus* (L.) Moench) genotypes in Ethiopia for agro-morphology and biochemical traits. Advances in Agriculture. 2022;2022:5521151.
9. Patil KR. Genetic variability and association analysis in quantitative traits of okra. [MSc thesis]. Akola: Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth; 2020. 70 p. Unpublished.
10. Priyanka DV, Reddy T, Begum H, Sunil N, Jayaprada M. Studies on genetic variability, heritability and genetic advance in genotypes of okra (*Abelmoschus esculentus* (L.) Moench). International Journal of Current Microbiology and Applied Sciences. 2018;7(5):401-411.
11. Rambabu B, Waskar DP, Khandare VS. Genetic variability, heritability and genetic advance in okra. International Journal of Pure and Applied Biosciences. 2019;7(1):374-382.
12. Ramgiry M, Barholia AK, Mishra P. Studies on genetic variability, heritability and genetic advance in okra (*Abelmoschus esculentus* (L.) Moench). Trends in Biosciences. 2017;10(2):941-944.
13. Reddy JP, Anbanandan V, Kumar BS. Genotypic, phenotypic variability and evaluation of okra (*Abelmoschus esculentus* (L.) Moench) genotypes for yield components. Journal of Applied and Natural Science. 2022;14(1):180-187.
14. Reddy MT, Hari Babu K, Ganesh M, Reddy Chandrasekhar K, Begum H, Reddy Purushothama B, *et al*. Genetic variability analysis for the selection of elite genotypes based on pod yield and quality from the 84 germplasm of okra (*Abelmoschus esculentus* (L.) Moench). Journal of Agriculture Technology. 2012;8(2):639-655.
15. Robinson HE, Comstock RE, Harvey PH. Estimates of heritability and degree of dominance in corn (*Zea mays* L.). Agronomy Journal. 1949;41:353-359.
16. Sravanthi U, Prabhakar BN, Saidaiah P, Rao AM, Narayana DL, Sathish G. Studies on genetic variability in okra (*Abelmoschus esculentus* (L.) Moench). The Pharma Innovation Journal. 2021;10(11):151-155.
17. Thulasiram LB, Bhople SR, Mekala Srikanth MS, Nayak BR. Genetic variability and heritability studies in okra (*Abelmoschus esculentus* (L.) Moench). Journal of Pharmacognosy and Phytochemistry. 2017;6(5):1830-1834.
18. Verma V, Singh B, Singh MK, Singh SK. Studies on genetic variability, heritability and genetic advance in okra (*Abelmoschus esculentus* (L.) Moench). Journal of Pharmacognosy and Phytochemistry. 2018;7(4):1114-1115.