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Screening of okra (*Abelmoschus esculentus* (L.) Moench) genotypes for fruit yield and yield-related traits under heat stress for heterosis breeding

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Abstract
Seventeen okra genotypes were evaluated under heat stress during Zaid 2024 at the Field Experimentation Center of the Department of Genetics and Plant Breeding. The experiment was conducted in a Randomized Block Design with three replications and a spacing of 30 cm × 45 cm. The objective was to assess genetic variability, heritability, genetic advance, and trait correlations in important quantitative characters. Analysis of variance indicated significant differences among genotypes for days to 50% flowering, days to first picking, number of branches per plant, fruit length, days to last picking, and first fruiting node, suggesting the presence of adequate genetic variation. High heritability coupled with moderate to high genetic advance was observed for earliness traits, branching, number of nodes per plant, and fruit length. Fruit yield per plant showed positive and significant associations with number of branches, number of fruits per plant, plant height, days to last picking, and first fruiting node, indicating that these traits may be effective selection criteria for heat-stressed okra improvement.

Keywords: Okra, heat stress, genetic variability, heritability, yield correlation

Introduction
Abelmoschus esculentus (L.) Moench, better known as okra or lady's finger, is a hardy annual belonging to the Malvaceae family-a group that also includes cotton and hibiscus (Elkhalifa *et al.*, 2021) [6]. Originally from East Africa (specifically Ethiopia, Eritrea, and Sudan), it's now grown across tropical and warm temperate zones for its tender green pods. The crop is self-pollinating, loves heat and drought, but perishes with frost (Westerfield, 2022) [23].
Okra is more than just a vegetable; it's a nutritional powerhouse. Fresh pods are about 90% water but pack vitamins C and K, plus moderate minerals like magnesium and folate (Dantas *et al.*, 2021) [4]. The seeds are especially valuable, containing 18-20% oil rich in linoleic acid. Beyond nutrition, the mucilage in the pods has shown real promise in managing blood sugar and reducing inflammation, with recent reviews confirming its cardiometabolic benefits (Thakur & Sharma, 2026; Worthington & Lee, 2025) [19, 24].
In 2025, the world produced roughly 12.1 million tonnes of okra from 1.25 million hectares (FAO, 2025; Arif & Khan, 2026) [2, 7]. India still dominates, accounting for nearly 70% of global output with 8.5 million tonnes, followed by Nigeria and Mali (Tridge, 2025). Pakistan cultivates about 16,200 hectares, yielding around 122,500 tons, while the U.S. continues to rely on imports, which reached $68.4 million in 2024-25 due to steady consumer demand (APEDA, 2025).
Despite its importance for food security, okra yields vary widely depending on genotype and environment (Kumar, 2019; Patel & Gupta, 2025) [8, 10, 14]. This inconsistency makes it critical to screen germplasm carefully and breed for resilience. That's exactly what this study aims to do: screen genotypes and analyze key yield traits to identify lines that are both high-yielding and stress-tolerant (Srivastava & Verma, 2026) [18]. and identify lines suitable to heterosis breeding.

Materials and Methods

In Zaid 2024, we evaluated a total of 17 genotypes under heat stress conditions at the field experimentation center of the Department of Genetics and Plant Breeding. The experiment followed a Randomized Block Design (RBCD) with three replications and a spacing of 30 cm × 45 cm. We recorded 14 key observations: days to 50% flowering (DF50), days to first picking (DFP), branches per plant (NBPP), plant height (PH, cm), number of internodes (IL), fruit length (FL, cm), seed index (SI), fruits per plant (NFPP), seeds per pod (NSPP), average fruit weight (AFW, g), days to last picking (DLP), nodes to first pod (NDP), fruits per first node (FFN), and fruit yield per plant (FYPP, g).

Results and Discussions

ANOVA and Variability Parameters

The analysis of variance showed clear differences among the okra genotypes for several important traits. Genotypic effects were highly significant for days to 50% flowering, days to first picking, number of branches per plant, fruit length, days to last picking, number of days to picking, and first fruiting node, which indicates that the material had enough genetic diversity for these characters and that they can be useful in selection and breeding work. (Table.1)

The variation observed for days to 50% flowering and days to first picking shows that the genotypes differed in earliness. In okra, early flowering and early harvesting are desirable because they allow earlier market returns and better crop planning. Similar variation in flowering and picking traits has been reported by Kumar *et al.* (2019) and Singh *et al.* (2014) [10, 16], who also found substantial genetic differences for earliness-related and yield-related traits in okra. The significant differences in days to last picking and number of days to picking also suggest variation in crop duration and harvesting span among the genotypes.

Number of branches per plant and first fruiting node also showed highly significant variation, reflecting differences in plant architecture and fruiting behaviour. These characters are important because branching pattern and fruiting position can influence productivity as well as ease of harvest. Fruit length also varied significantly among the genotypes, showing that there is scope to select lines with better pod size and market preference. Similar findings were reported by Patel *et al.* (2025) [14], who noted that genotype-by-environment interaction can strongly affect the expression of yield-related characters in okra.

In contrast, plant height, inter-node length, average fruit weight, number of fruits per plant, number of seeds per pod, seed index, and fruit yield per plant did not show significant differences among the genotypes. This may be due to limited genetic variation in the tested material or stronger environmental influence on these traits. Fruit yield per plant is a complex trait and is usually controlled by several component characters together, so it often shows less clear variation in early screening studies. Similar observations were also made by Alam *et al.* (2024) and Patel *et al.* (2025) [2, 14], who suggested that complex yield traits are often more affected by environmental conditions than by direct genotype effects.

The variability estimates showed that phenotypic variation was higher than genotypic variation for all traits, which means that environmental factors had some effect on trait expression. The traits with the highest GCV and PCV were first fruiting node (GCV 8.974, PCV 13.487), number of nodes per plant (GCV 6.904, PCV 9.388), days to first picking (GCV 5.447, PCV 6.432), and days to 50% flowering (GCV 5.359, PCV 6.231). This indicates a wider range of variation and better scope for improvement through selection. Kumar *et al.* (2019) [10] also reported similar variability for earliness and related traits in okra. On the other hand, average fruit weight (GCV 1.074, PCV 8.024), seed index (GCV 1.364, PCV 9.741), and fruit yield per plant (GCV 0.846, PCV 5.947) showed low values, suggesting limited variability for these traits. (Table. 3)

Heritability values also varied across the traits. High heritability was observed for days to 50% flowering (73.964), days to first picking (71.706), days to last picking (59.782), number of branches per plant (53.986), number of nodes per plant (54.082), and fruit length (44.998), indicating that these traits are mainly controlled by genetic factors and may respond well to selection. Comparable results were reported by Verma *et al.* (2024) [22], who found that flowering and structural traits in okra were more heritable and therefore more useful in breeding work. In contrast, average fruit weight (1.791), seed index (1.960), and fruit yield per plant (2.022) showed very low heritability, which suggests that environmental effects were stronger for these characters.

Genetic advance was also higher for first fruiting node (0.651), number of nodes per plant (0.865), days to first picking (3.854), and days to 50% flowering (3.779), with corresponding GAM values of 12.302, 10.459, 9.501, and 9.494, respectively. High heritability combined with good genetic advance usually indicates additive gene action, which means selection is likely to be effective. This makes these traits especially valuable for breeding programmes. Similar conclusions were drawn by Srivastava *et al.* (2026) [18], who emphasized the importance of such traits in climate-resilient okra improvement. The low genetic advance for fruit yield per plant (0.559, GAM 0.248), seed index (0.019, GAM 0.393), and average fruit weight (0.014, GAM 0.296) suggests that direct selection for these traits may not be very effective, and improvement may be better achieved through selection of their component characters. (Table.3)

Overall, the study shows that the okra genotypes possessed useful variation mainly for earliness, branching, fruiting habit, and node-related traits. These characters can be used as reliable selection criteria in future breeding efforts. The findings are also in agreement with the broader work of Dantas *et al.* (2021), Thakur *et al.* (2026), Elkhalifa *et al.* (2021), Rashid *et al.* (2023), and Worthington *et al.* (2025) [4, 6, 15, 19, 24], who highlighted the nutritional, medicinal, and breeding potential of okra. Since fruit yield per plant showed low heritability and low genetic advance, it would be more effective to improve yield indirectly by selecting for its contributing traits rather than relying on yield alone.

Correlation Analysis

The correlation study showed that most of the important traits in okra were positively associated with one another, indicating that improvement in one character may also improve other related traits. At the phenotypic level, days to 50% flowering showed a significant positive association with days to first picking (0.47**), number of branches per plant (0.48**), plant height (0.52**), fruit length (0.35*), number of fruit per plant (0.32*), number of seeds per pod (0.57**), days to last picking (0.40**), number of nodes per plant (0.55**), first fruiting node (0.57**), and fruit yield per plant (0.32*) (Table.4). These results suggest that flowering time is closely linked with plant growth, fruiting behavior, and yield formation. Similar associations were reported by Kumar *et al.* (2019) and Singh *et al.* (2014) [10, 16].

Days to first picking also had significant positive correlations with number of branches per plant (0.42**), plant height (0.45**), number of fruit per plant (0.43**), days to last picking (0.54**), number of nodes per plant (0.60**), and first fruiting node (0.49**). This shows that earliness is related to overall plant vigour and harvesting duration. Similar findings were reported by Patel *et al.* (2025) [14], who observed that flowering and picking traits are strongly influenced by genotype and environment. (Table.5)

Number of branches per plant showed positive and significant correlations with plant height (0.34*), number of fruit per plant (0.30*), number of seeds per pod (0.44**), days to last picking (0.50**), number of nodes per plant (0.35*), first fruiting node (0.43**), and fruit yield per plant (0.28*). This indicates that branching is an important trait for plant type and productivity. Similar results were reported by Kumar *et al.* (2019) and Verma *et al.* (2024) [10, 22].

Plant height was also positively and significantly associated with fruit length (0.37**), number of fruit per plant (0.32*), number of seeds per pod (0.42**), days to last picking (0.48**), number of nodes per plant (0.48**), and first fruiting node (0.37**). This points to a strong link between vegetative growth and reproductive performance. Similar observations were made by Singh *et al.* (2014) and Srivastava *et al.* (2026) [16, 18].

Fruit length showed positive associations with days to last picking (0.66**) and number of nodes per plant (0.48**) at the phenotypic level. At the genotypic level, it was also strongly associated with plant height (0.64**), days to last picking (0.81**), number of nodes per plant (0.63**), and first fruiting node (0.49*). This suggests that longer pods were generally found in better-growing genotypes with a more favorable fruiting pattern. Similar conclusions were drawn by Alam *et al.* (2024) and Patel *et al.* (2025) [1, 14].

Number of fruit per plant emerged as one of the most important traits in the study. It showed a highly significant positive correlation with days to last picking (0.66**), number of nodes per plant (0.60**), first fruiting node (0.62**), and fruit yield per plant (0.63**) at the genotypic level. At the phenotypic level, it was also positively associated with days to 50% flowering (0.32*), days to first picking (0.43**), number of branches per plant (0.30*), plant height (0.32*), days to last picking (0.66**), number of nodes per plant (0.40**), first fruiting node (0.43**), and fruit yield per plant (0.63**). These findings clearly show that fruit number is a major contributor to final yield, as also reported by Kumar *et al.* (2019) and Patel *et al.* (2025) [10, 14].

Number of seeds per pod was positively associated with days to 50% flowering (0.57**), plant height (0.42**), days to last picking (0.42**), number of nodes per plant (0.67**), and first fruiting node (0.51**) at the phenotypic level. At the genotypic level, it was also significantly related to plant height (0.74**) and average fruit weight (0.58*). This suggests that stronger plants with better fruiting positions tend to produce better-filled pods. Similar relationships were reported by Verma *et al.* (2024) and Srivastava *et al.* (2026) [18, 22].

Days to last picking, number of nodes per plant, and first fruiting node were also closely associated with several growth and yield traits. Seed index showed negative and significant correlations with days to first picking (-0.30*) and first fruiting node (-0.28*) phenotypically, while genotypically it was negatively related to days to first picking (-0.52*), average fruit weight (-0.52*), days to last picking (-0.55*), and number of branches per plant (-0.40). These negative associations suggest that seed index may behave independently from the main yield traits. Similar trends were noted by Patel *et al.* (2025) and Verma *et al.* (2024) [14, 22].

Fruit yield per plant had positive and significant associations with number of branches per plant (0.28*), days to first picking (0.29*), and number of fruit per plant (0.63**) phenotypically, while genotypically it was positively correlated with number of branches per plant (0.51*). This indicates that yield improvement may be more effective through selection of component traits rather than direct selection for yield alone. Overall, genotypic correlations were stronger than phenotypic correlations, showing that these relationships are mainly genetic and therefore useful for selection across generations. Selection for number of fruit per plant, number of branches per plant, plant height, days to last picking, and first fruiting node may help improve yield indirectly in okra.

Table 1: ANOVA for fourteen Quantitative Parameters

Source	Mean Sum of Squares		
	Replication	**Genotype**	**Error**
	(*df*=2)	**(*df*=16)**	**(*df*=32)**
Days to 50% Flowering	19.3725	15.2525**	1.6017
Days to First Picking	18.8431	16.5735**	1.9265
Number of Branches Per Plant	1.7843	17.1985**	3.8051
Plant Height	10.0418	30.915	15.7766
Inter node Length	0.3378	0.0865	0.0593
Fruit Length	0.8192	0.5502**	0.1593
Average Fruit Weight	0.0114	0.1551	0.147
Number of Fruit Per Plant	20.9273	6.1692	8.7593
Number of Seeds Per Pod	0.4073	0.2605	0.1652
Days to Last Picking	23.3237	17.9055**	3.2798
Number of nodes per Plant	1.5955	1.2555**	0.2769
First Fruiting Node	0.6743	0.9599**	0.2837
seed index	0.0286	0.2415	0.2278
Fruit yield per plant	510.019	187.20	176.29

** and * Level of significance at 1% and 5%

Table 2: Mean performance of seventeen okra genotypes for Quantitative Parameters

Genotype	DF50%	DFP	NBPP	PH	IL	FL	AFW	NFPP	NSPP	DLP	NDP	FFN	SI	FYPP
VRO-132-10-1	41.33	39.67	51.67	85.13	3.93	12.53	4.7	45.47	6.43	111.47	8.57	5.37	5.31	224.33
EMS-8-1	40.67	42	54	86.63	4.48	12.6	5.25	45.43	6.5	111.93	8.37	5.87	4.48	232.67
VRO-204-10-1	38.33	41.33	56	83.53	4.23	12.49	4.5	47.17	6.17	114.03	8.03	5.57	5.03	230
P. P	39.33	39.67	54.33	86.47	4.21	12.98	4.86	45.53	6.4	114.43	8.53	5.23	5.13	226.67
VRO-1887	39.67	42.33	56	84.9	3.93	12.4	5.16	44.03	6.83	111.03	8.77	5.9	5.31	215.33
VRO-1632	38	38.67	56.33	82.9	4.3	12.65	4.61	45.93	6.57	113.1	8.57	5.13	4.55	230.33
P7	40.67	40.67	55.67	86.87	4.39	12.31	4.86	45.7	6.9	111.93	8.3	5.1	5.11	228
VRO-135-10-1	38.33	41.67	54.67	82.83	4.05	12.15	4.94	44.33	6.43	111.27	8.07	5.13	4.68	219.67
VRO-151-10-1	41.33	45	55.33	86.37	4.69	12.44	4.78	45.73	6.5	112.5	8.87	5.23	5.15	222
Pusa5	40	41.33	57.67	85.57	4.1	12.48	4.79	46.03	6.57	112.43	8.43	5.13	4.73	239.67
IC-913995	43.33	40.33	58.33	86.3	4.03	12.59	4.96	45.87	6.43	113.07	8.77	5.53	5	233.33
ARKA ANAMIKA	36	38.67	50.67	82.77	4.1	12.21	4.94	42.87	6.3	109.13	7.53	4.1	4.87	220
Varsha Uphar	42	42	55.67	87.23	4.18	12.95	4.89	46.17	6.67	112.27	8.77	6.23	4.47	214
KK	36.67	40.33	51.67	82.63	4.15	12.52	4.68	44.1	5.9	109.53	8.23	5.23	4.82	215.33
Punjab No.13	43	40.33	56.33	89.57	4.09	12.45	4.84	46.13	6.93	111.13	8.9	5.73	5.08	229.33
VRO-492-9-1	41.67	41.67	56.67	86.33	4.16	12.03	4.6	46.13	6.83	109.83	7.6	5.53	5.1	236.67
Roma	36.33	33.33	49	74.23	4.03	11.02	4.53	42.53	5.83	103.93	6.5	4.4	5.43	222.33
Min	35	32	47	70.1	3.76	10.78	4.04	38.2	5.3	101.3	6.2	3.4	4.03	194
Max	45	46	60	94.7	4.79	13.48	5.49	51.2	7.2	116.8	9.7	9.1	5.63	268
Std. Dev.	2.85	2.71	3.12	4.85	0.28	0.68	0.32	2.45	0.42	3.12	0.72	0.92	0.45	12.85
CV (%)	7.12	6.68	5.68	5.72	6.72	5.48	6.72	5.45	6.48	2.78	8.45	16.8	8.85	5.68
SEm	1.64	1.56	1.8	2.8	0.16	0.39	0.18	1.41	0.24	1.8	0.42	0.53	0.26	7.42
CD at 5%	4.85	4.62	5.33	8.29	0.48	1.16	0.55	4.18	0.72	5.33	1.23	1.57	0.77	21.95

DF50: Days to 50% Flowering, DFP: Days to First Picking, NBPP: Number of Branches Per Plant, PH: Plant Height, IL: Inter-node Length, FL: Fruit Length, AFW: Average Fruit Weight, NFPP: Number of Fruit Per Plant, NSPP: Number of Seeds Per Pod, DLP: Days to Last Picking, NDP: Number of nodes per Plant, FFN: First Fruiting Node, SI: Seed Index, and FYPP: Fruit Yield Per Plant.

Table 3: Genetic variability parameters among Fourteen quantitative traits of okra

Traits	GCV	PCV	Heritability	GA	GAM at 5%
Days to 50% Flowering	5.359	6.231	73.964	3.779	9.494
Days to First Picking	5.447	6.432	71.706	3.854	9.501
Number of Branches Per Plant	3.849	5.238	53.986	3.198	5.825
Plant Height	2.643	5.369	24.234	2.278	2.68
Inter node Length	2.298	6.306	13.278	0.072	1.725
Fruit Length	2.933	4.372	44.998	0.499	4.052
Average Fruit Weight	1.074	8.024	1.791	0.014	0.296
Number of Fruit Per Plant	2.2	6.517	15.53	1.844	4.04
Number of Seeds Per Pod	2.749	6.844	16.129	0.147	2.274
Days to Last Picking	1.979	2.559	59.782	3.517	3.152
Number of nodes per Plant	6.904	9.388	54.082	0.865	10.459
First Fruiting Node	8.974	13.487	44.276	0.651	12.302
seed index	1.364	9.741	1.96	0.019	0.393
Fruit yield per plant	0.846	5.947	2.022	0.559	0.248

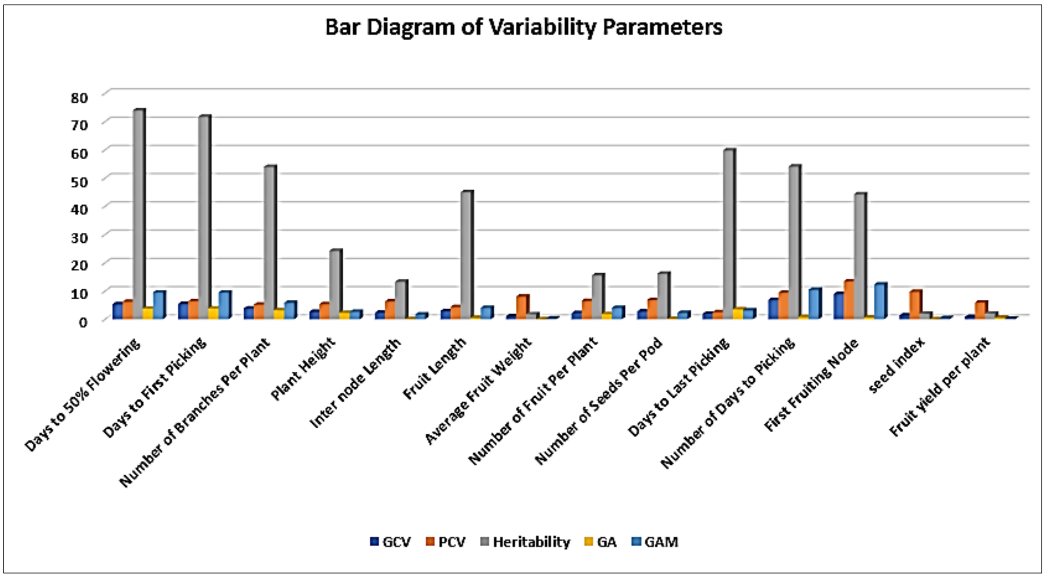

Fig 1: Bar diagram representing the relationship among GCV, PCV, Heritability, Genetic Advance and GA as Percent of Mean in Okra

Table 4: Phenotypic Correlation among the Quantitative Parameters of Okra

Traits	DF50	DFP	NBPP	PH	IL	FL	AFW	NFPP	NSPP	DLP	NDP	FFN	SI	FYPP
Days to 50% Flowering	1	0.47**	0.48**	0.52**	0.11	0.35*	0.14	0.32*	0.57**	0.4**	0.55**	0.57**	-0.06	0.32*
Days to First Picking		1	0.42**	0.45**	0.29*	0.29*	0.17	0.43**	0.4**	0.54**	0.6**	0.49**	-0.3*	0.29*
Number of Branches Per Plant			1	0.34*	0.1	0.25	0.14	0.3*	0.44**	0.5**	0.35*	0.43**	-0.23	0.28*
Plant Height				1	-0.03	0.37**	0.12	0.32*	0.42**	0.48**	0.48**	0.37**	-0.19	0.24
Inter node Length					1	0.2	0.1	0.16	0.1	0.3*	0.12	0.1	-0.25	0.21
Fruit Length						1	0.26	0.15	0.28	0.66**	0.48**	0.31*	-0.19	0.13
Average Fruit Weight							1	-0.04	0.15	0.15	0.22	0.15	-0.16	-0.02
Number of Fruit Per Plant								1	0.12	0.36**	0.4**	0.43**	-0.09	0.63**
Number of Seeds Per Pod									1	0.36**	0.41**	0.36**	-0.21	0.19
Days to Last Picking										1	0.6**	0.34*	-0.28*	0.35*
Number of nodes per Plant											1	0.53**	-0.22	0.25
First Fruiting Node												1	-0.28*	0.15
seed index													1	-0.14
Fruit yield per plant														1

DF50: Days to 50% Flowering, DFP: Days to First Picking, NBPP: Number of Branches Per Plant, PH: Plant Height, IL: Inter-node Length, FL: Fruit Length, AFW: Average Fruit Weight, NFPP: Number of Fruit Per Plant, NSPP: Number of Seeds Per Pod, DLP: Days to Last Picking, NDP: Number of nodes per Plant, FFN: First Fruiting Node, SI: Seed Index, and FYPP: Fruit Yield Per Plant. ** and * Level of significance at 1% and 5%

Table 5: Genotypic Correlation among the Quantitative Parameters of Okra

Traits	DF50	DFP	NBPP	PH	IL	FL	AFW	NFPP	NSPP	DLP	NDP	FFN	SI	FYPP
Days to 50% Flowering	1													
Days to First Picking	0.47	1												
Number of Branches Per Plant	0.63**	0.57*	1											
Plant Height	0.73**	0.75**	0.7**	1										
Inter node Length	0.01	0.28	0.11	0.22	1									
Fruit Length	0.3	0.43	0.34	0.64**	0.19	1								
Average Fruit Weight	0.21	0.42	0.3	0.44	0.16	0.28	1							
Number of Fruit Per Plant	0.51*	0.58*	0.63**	0.55*	0.1	0.55*	0.05	1						
Number of Seeds Per Pod	0.68**	0.44	0.63**	0.74**	0.01	0.22	0.58*	0.25	1					
Days to Last Picking	0.41	0.66**	0.64**	0.74**	0.29	0.81**	0.27	0.66**	0.42	1				
Number of nodes per Plant	0.62**	0.66**	0.58*	0.75**	0.08	0.63**	0.4	0.6*	0.67**	0.75**	1			
First Fruiting Node	0.71**	0.52*	0.6*	0.63**	0.02	0.49*	0.37	0.62**	0.51*	0.46	0.64**	1		
seed index	-0.01	-0.52*	-0.4	-0.4	-0.43	-0.37	-0.52*	-0.26	-0.22	-0.55*	-0.26	-0.25	1	
Fruit yield per plant	0.39	0.15	0.51*	0.36	0.3	0.15	-0.15	0.46	0.2	0.4	0.18	-0.01	-0.26	1

DF50: Days to 50% Flowering, DFP: Days to First Picking, NBPP: Number of Branches Per Plant, PH: Plant Height, IL: Inter-node Length, FL: Fruit Length, AFW: Average Fruit Weight, NFPP: Number of Fruit Per Plant, NSPP: Number of Seeds Per Pod, DLP: Days to Last Picking, NDP: Number of nodes per Plant, FFN: First Fruiting Node, SI: Seed Index, and FYPP: Fruit Yield Per Plant. ** and * Level of significance at 1% and 5%

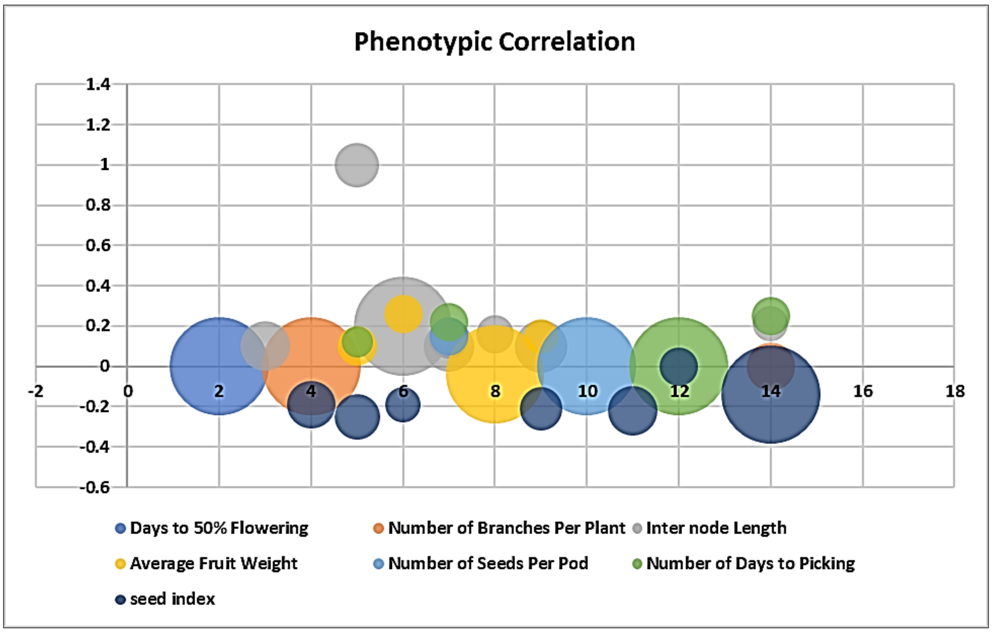

Fig 2: Scatter diagram of Phenotypic Correlation for quantitative traits of okra

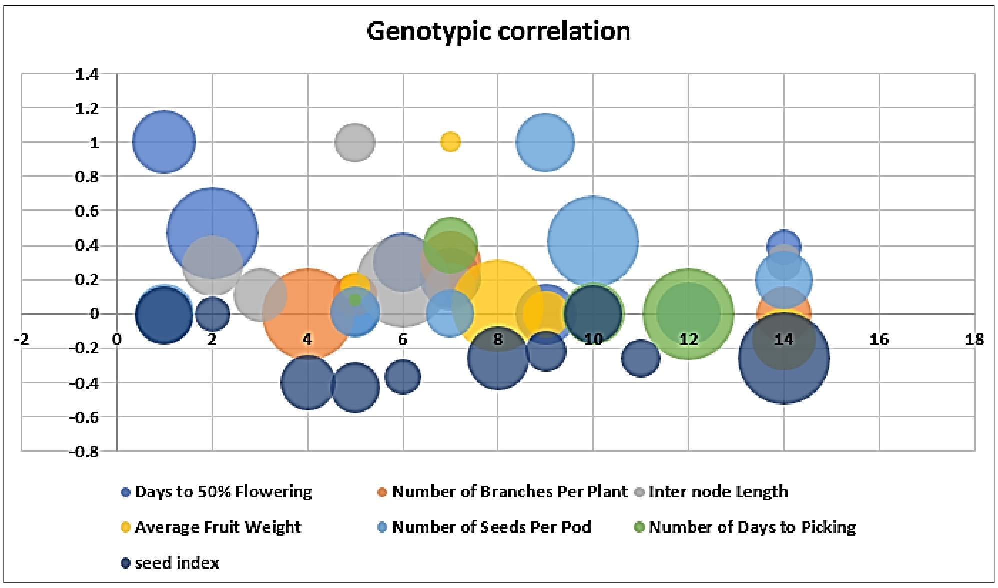

Fig 3: Scatter diagram of Genotypic Correlation for quantitative traits of okra

Conclusion

The present study clearly demonstrated that the okra genotypes possessed useful genetic variability for a number of important quantitative traits The highest fruit yield per plant was recorded in Pusa5 (239.67 g), followed by VRO-492-9-1 (236.67 g), IC-913995 (233.33 g). The analysis of variance confirmed significant differences among genotypes and Variability estimates further indicated that several traits had high heritability and favorable genetic advance, suggesting the predominance of additive gene action and good scope for genetic improvement. Correlation indicates yield in okra is mainly controlled by component traits. Number of branches, number of fruits per plant, plant height, days to last picking, and first fruiting node showed positive associations with yield, so indirect selection for these traits would be more effective than selecting yield alone. Overall, the study suggests These traits provide a strong foundation for developing early, high-yielding, and superior okra varieties with better agronomic performance and farmer acceptance

References

1. Alam S, Islam M. Prevalence of okra production in South Asia: trends, constraints, and future prospects. Asian J Agric Biol. 2024;12(2):78-89.
2. Arif M, Khan S. Constraints and opportunities on okra (*Abelmoschus esculentus*) production in Ethiopia. Front Sustain Food Syst. 2026;10:1546995.
3. Choudhury M, Rahman H. Nutritional composition and health benefits of okra mucilage: a comprehensive review. Food Chem. 2025;468:141723.
4. Dantas TL, Florentino ER, Quirt AJ, Roselló PM, Martins MC. Okra (*Abelmoschus esculentus* L.) as a potential functional food source of mucilage and bioactive compounds with technological applications and health benefits. Plants. 2021;10(8):1683. doi:10.3390/plants10081683
5. de Candolle AP. Origin of cultivated plants. London: Macmillan and Co.; 1883.
6. Elkhalifa AEO, Elhalis HA, Elzaki MA. Okra (*Abelmoschus esculentus*) as a potential dietary medicine with nutraceutical importance for sustainable health applications. Molecules. 2021;26(3):696.
7. FAO. FAOSTAT: crops and livestock products-okra production statistics (2025 data). Rome: Food and Agriculture Organization of the United Nations; 2026.
8. Gupta R, Sharma P. Economic analysis of okra cultivation in smallholder farming systems of India. Agric Econ Res Rev. 2026;39(1):45-56.
9. Kone B, Ndongo A, Bekolo M. Phytochemical, nutritional and pharmacological evidences for *Abelmoschus esculentus* (L.) Moench. Phytother Res J. 2018;5(6):67-75.
10. Kumar R. Variability, heritability and genetic advance for yield and its components in okra (*Abelmoschus esculentus* L. Moench). Int J Curr Microbiol Appl Sci. 2019;8(10):2233-2240.
11. Masters MT. On the genus *Abelmoschus*. J Linn Soc Bot. 1875;14:112-120.
12. Maurya S, Yadav D. Climate and production challenges in Indian okra cultivation. Indian J Hortic. 2026;83(1):45-54.
13. Medical News Today. Okra: nutrition, benefits, and cooking tips. Updated ed. 2024.
14. Patel N, Gupta S. Genotype-by-environment interaction in okra: implications for breeding high-yielding varieties. Crop Sci. 2025;65(3):1123-1136.
15. Rashid H, Ahmed Z. A review: pharmacological activity and phytochemical profile of *Abelmoschus esculentus*. RSC Adv. 2023;13:1367-1375.
16. Singh P, Kumar A, Singh R. Genetic variability and correlation studies in okra (*Abelmoschus esculentus* L.). Veg Sci. 2014;41(1):45-48.
17. Singh S, Pandey R. Agronomic practices for climate-resilient okra production. Front Agron. 2026;6:1771721. doi:10.3389/fagro.2026.1771721
18. Srivastava R, Verma A. Good agronomic practices for climate-resilient okra production. J Crop Improv. 2026;37(4):512-529.
19. Thakur S, Sharma R. An overview of the current scientific evidence on the biological properties of *Abelmoschus esculentus* (L.) Moench (Okra). Nutrients. 2026;18(2):245.
20. USDA Economic Research Service. Vegetables and pulses data: okra imports and production. Washington, DC: U.S. Department of Agriculture; 2023.

21. Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. Waltham: Chronica Botanica; 1951.
22. Verma K, Singh A. Molecular markers for drought tolerance in okra germplasm. Plant Mol Biol Rep. 2024;42:345-358.
23. Westerfield L. Okra: nutritional value and production practices in South Florida. Gainesville: University of Florida IFAS Extension; 2022.
24. Worthington V, Lee J. The cardiometabolic benefits of okra-based treatment in prediabetes and diabetes: a systematic review and meta-analysis of randomized controlled trials. Front Nutr. 2025;12:1454286.
25. Zeven AC, Zhukovsky PM. Dictionary of cultivated plants and their centres of diversity. Extraordinary Publishing; 1975.