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(Original Article)

A Study of Combining Ability in Okra (*Abelmoschus esculentus* L. Moench) for Growth, Yield, and Quality characteristics

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Abstract

A half-diallel cross among seven okra cultivars and twenty-one hybrids was conducted to examine and analyze the general (G.C.A) and specific (S.C.A) combining ability effects and genetics related to multiple yield and yield-related characteristics. The analysis study of variance showed the existence of both additives G.C.A and non-additive effects for all characters with the exception of pod length, which exhibited an additive effect G.C.A, thereby suggesting the predominant role of additive genetic variance in the expression of these traits. Only one hybrid 'Emerald' x'Pusa Sawani' showed significant positive S.C.A effects on the number of green pods/plants, weight of green pods/plant, and total green pod yield. Based on G.C.A effects, the parent 'Pusa Sawani' was a good general combiner for days to 50% flowering, plant height, green pod length, number of green pods/plant, weight of green pods/plant and total green pod yield characters and can be used in breeding programs for improvement of the fruit yield and other yield components characters.

Keywords: *General combining ability, Half diallel analysis, Okra, Specific combining ability, Yield.*

Introduction

Okra or Lady's finger (*Abelmoschus esculentus* L. Moench) is an annual summer vegetable crop that belongs to the *Malvaceae* Family. It is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. The cultivated area of okra during 2022 was about 22,631feddan and produced nearly 114 thousand tons with an average 5.05 tons/fed. (Agricultural Statistics, Economic Affairs Sector, 2022).

Okra is a key ingredient in many traditional Egyptian dishes, making it an important crop for both subsistence and commercial farming. In Egypt and many countries of the world, okra is consumed as immature pods, in various states, such as fresh, canned, frozen, and dried, and is a nutritious and delicious vegetable rich in vitamins and minerals (Ranga and Darvhankar, 2022). Okra dry seeds also contain 18-20 % oil and 20-23 % crude protein. In West Africa, leaves, buds and okra flowers are also consumed (Ranga and Darvhankar, 2022).

Diallel technique analysis has been effectively used in self and cross-pollinated crops to provide a picture of the genetic behavior of the parents and the extent of the nature of heterosis, additive and non-additive effects, contributing to the phenotypic

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variance for a particular trait. Usage of the diallel crosses technique and estimation of combining ability give the breeder an effective procedure to evaluate the breeding material and identify the most suitable parents that produce better hybrids and produce a new cultivar (Kumar and Tanu, 2021).

Combining ability analysis helps to choose suitable parents for hybridization and provides valuable information regarding F1 crosses to be exploited commercially. A parent's breeding value directly influences general combining ability (G.C.A.), which is driven by additive genetic factors. In contrast, specific combining ability (S.C.A.) is the relative performance of a cross and is primarily attributed to non-additive genetic effects such as dominance, epistasis, and the interaction between genotype and environment (Falconer and Mackay, 1996, Rukundo *et al*., 2017). Information on the combining abilities of the genotypes will be helpful in the analysis and interpretation of the genetic basis of important traits (Pawar *et al*., 2016). Therefore, the objective of the present investigation was to study the genetic systems controlling variation in the improvement of several agro-economic characteristics of okra using seven cultivars within a half-diallel crossing system.

Materials and Methods

The present genetic study was carried out during the summer seasons of 2022 and 2023 on a clay soil at the Experimental Farm of Vegetable Crops Department, Faculty of Agriculture, Assiut University, Assiut. Seven cultivars of okra were used as parents (P) for this study. The parents were Balady Assiut (P1), Balady Qena (P2), Eskandrany (P3), Lee (P4), Emerald (P5), Clemson Spineless (P6), and Pusa Sawani (P7).

Experimental Material

On April 15, 2022, the seven cultivars, each represented by five plants, were planted and used for intercrossing to produce a 7×7 diallel cross with reciprocals. The production of self and hybrid seeds was carried out entirely through hand pollination. On April 15, 2023, seeds of the 7 parental cultivars and 21 F1 hybrids were planted in the field using a randomized complete block design with three replicates.

Each replicate is represented by 21 plots of F1 hybrids and 7 plots of parents. Each plot consisted of one row of 10 plants spaced 30 cm between plants and 70 cm between rows. Standard agricultural practices for okra production, including cultivation, irrigation, fertilization, and weed and pest control, were applied as recommended.

Measurements recorded

The following characters were measured

1- Plant height (cm) was measured from the cotyledonary to the terminal bud of the main stem at the end of the picking season of each of the five randomly selected plants from the plot at maturity.

2- Number of branches/plant: the total number of primary branches was counted at the end of the picking season on five randomly selected plants and averaged.

3- Days to 50% flowering, recorded as number of days from planting to flowering i.e., when 50% of the plants were in bloom.

4-Green pod length, in cm, the length of ten pods chosen randomly from each of the five selected plants was measured and then averaged.

5-Green pod weight (g).

6-Number of green pods/plant. Total number of edible pods that are picked per plant during the growing season.

7-Weight of green pods/plant (g).

8-Total green pod yield (ton/feddan): weight of all edible pods that were picked all over the growing season.

9-Dry matter content was determined as the average of three different pickings and expressed as dry weight/fresh weight × 100. The drying was carried out in an electric oven at 70° C for 24 hr. and then at 105° C for 2 hr.

10-Percent fibers of the pod on a dry weight basis according to the methods outlined by the Association of Official Analytical Chemistry (2005) at the Laboratory of Food Science and Technology Dept., Faculty of Agriculture, Assiut University, Assiut.

$$\text{Percentage of crude fiber} = \frac{\text{Weight loss}}{\text{Weight of samples}} \times 100$$

11-Crude protein content

The macro Kjeldahl method as described by AOAC (2005) was used to determine the protein content. At the Laboratory of Food Science and Technology Department, Faculty of Agriculture, Assiut University, Assiut.

12-Percent of oil in the seed

The soxhlet extraction method outlined in AOAC (2005) was used in determining the fat content of the samples. At the Laboratory of Food Science and Technology Department, Faculty of Agriculture, Assiut University, Assiut.

$$\text{Fat\%} = \frac{\text{Weight of fat}}{\text{Weight of samples}} \times 100$$

Statistical analysis

The data were analyzed using the methods proposed by Griffing (1956b), specifically Method 2, Model 1, to estimate general combining ability G.C.A and specific combining ability SCA.

Results and Discussion

The analysis of variance (Table 1) showed the existence of both additive G.C.A and non-additive effects for 12 characters, except green pod length and dry matter content characters. Also, in a study by Bhatt et al., 2015, the G.C.A and S.C.A mean squares were significant for all the traits, except G.C.A mean square for fruit length.

In our study, the analysis showed the existence of additive effect G.C.A, indicating the predominant role of additive type of the genetic variance in the expression of these characters. The mean square for G.C.A was greater than that of S.C.A., for seven characters viz, plant height, number of branches, green pod length, number of green pods, weight of green pods, total green pod yield, and dry matter content, indicating the predominance of additive type of genetic variance in the expression of these characters. Conversely, the results of work by Wakode et al., 2016, indicated the pre-dominance of non-additive gene action in inheritance of okra characters such as days to first flower, plant height, fruit length, fruit weight, number of fruits, and yield per plant (Wakode et al., 2016).

In our work, the mean square for S.C.A was greater than that of G.C.A for 5 characters viz, days to 50% flowering, green pod weight, percent fibers, crude protein content, and percent oil, indicating the predominance of non-additive genetic variance in the expression of these characters (Raju and Selvam, 2017 and El-Sherbeny *et al.,* 2018). In a study by Nanthakumar et al., 2021, the authors observed a predominance of non-additive gene action for all the traits in okra (Nanthakumar et al., 2021). Indeed, specific combining ability effects can indicate heterosis as they symbolize both dominant and epistatic gene influences (Wakode et al., 2016).

Table 1. Analysis of variance for yield and yield attribute characters in the 7×7 diallel cross.

Character	S.O.V.	D.F.	Mean Square
Days to 50% flowering	G.C.A.	6	34.03**
	S.C.A.	21	72.39**
Plant height (cm)	G.C.A.	6	4291.2**
	S.C.A.	21	2140.3**
Number of branches / plants	G.C.A.	6	3.550**
	S.C.A.	21	1.061*
Green pod length(cm)	G.C.A.	6	1.697*
	S.C.A.	21	0.753
Green pod weight (g)	G.C.A.	6	0.851**
	S.C.A.	21	1.047**
Number of green pods / plants	G.C.A.	6	777.2**
	S.C.A.	21	255.2**
Weight of green pods/plant (g)	G.C.A.	6	21584.9**
	S.C.A.	21	9468.2**
Total green pod yield (ton/feddan)	G.C.A.	6	7.785**
	S.C.A.	21	3.415**
Dry matter content	G.C.A	6	252.5*
	S.C.A.	21	64.08
Percent fibers of the pod	G.C.A	6	1.520**
	S.C.A.	21	1.742**
Crude protein content	G.C.A	6	37.71**
	S.C.A.	21	44.02**
Percent oil of the seed	G.C.A	6	10.08*
	S.C.A.	21	21.27**

*, ** Significant at *P*= 0.05, and *P*= 0.01, respectively, G.C.A: General combining ability, S.C.A: Specific combining ability, D.F: Degrees of freedom

Estimates of G.C.A for the individual array parents and S.C.A for individual cross combinations for all characters are given in Tables 2 and 3.

Table 2. Estimates of general combining ability effects of parents for yield and yield attribute characters in the 7×7 diallel cross.

Character	Parents							S.E. (g_i - g_j)
	1	2	3	4	5	6	7	
Days to 50% flowering	-0.286**	0.233**	0.899**	1.122**	0.751**	-0.619**	-2.101**	±0.142
Plant height (cm)	0.955	-0.858	-13.69**	-3.311	8.723	-13.85**	22.04**	±9.835
Number of branches / plants	0.593**	0.050*	0.228**	-0.081**	-0.157**	-0.041*	-0.592**	±0.036
Green pod length(cm)	-0.251**	-0.243**	0.084**	0.331**	-0.265**	0.104**	0.240**	±0.034
Green pod weight (g)	-0.087**	-0.144**	0.110**	0.150**	-0.260**	0.242**	-0.011	±0.009
Number of green pods / plants	-5.651**	-0.092	-3.655**	-2.047*	3.973**	-2.570*	10.04**	±0.801
Weight of green pods/plant (g)	-31.65**	-4.868	-16.22	-7.563	15.44	-10.78	55.65**	±23.47
Total green pod yield (ton/feddan)	-0.601**	-0.093**	-0.308**	-0.144**	0.293**	-0.205**	1.057**	±0. 008
Dry matter content	-0.057	-1.038	1.732	-3.531	4.684	1.936	-3.725	±5.429
Percent fibers of the pod	-0.341**	0.116**	-0.223**	0.179**	-0.021**	-0.060**	0.350**	±0.008
Crude protein content	-2.117**	1.461**	0.269**	1.077**	-0.480**	-0.480**	0.269**	±0.0002
Percent oil of the seed	-0.320**	-0.490**	0.068**	-0.145	-0.206*	-0.238*	1.331**	±0.192

*, ** Significant at P= 0.05, and P= 0.01, respectively

Table 3. Estimates of specific combining ability effects of cross combinations for yield and yield attribute characters in the 7×7 diallel cross.

Cross	Days to 50% flowering	Plant height (cm)	Number of branches / plant	Green pod length (cm)	Green pod weight (g)	Number of green pods / plant	Weight of green pods/ plant (g)	Total green pod yield (ton/feddan)	Dry matter content	Percent fibers of the pod	Crude protein content	Percent of oil in the seed
1×2	4.898**	-23.62	0.074	-0.048	-0.035	-3.082	-16.24	-0.312	-1.426	-0.654**	-1.726**	1.760*
1×3	3.565**	13.29	0.396**	-0.369**	-0.282**	-0.372	-9.038	-0.170	-4.058	0.115**	-3.104**	0.023
1×4	-5.657**	31.58	0.321*	0.551**	0.151**	14.86**	85.76	1.630**	0.188	0.843**	-2.201**	-0.028
1×5	-7.620**	-33.24	-1.129**	0.114	-0.119**	-12.49**	-66.39	-1.257**	3.449	0.099**	4.505**	-1.601*
1×6	1.750	-0.028	0.472**	-0.129	-0.010	-3.314	-18.27	-0.346	4.258	-1.345**	-4.075**	-1.642*
1×7	-3.102**	-43.27	-0.261	0.876**	0.006	-4.138	-25.11	-0.478	-6.339	-1.002**	3.756**	-0.861
2×3	-1.620**	10.57	0.162	0.397**	0.169**	-2.588	-10.55	-0.195	-3.608	-0.792**	1.899**	-0.144
2×4	0.824	33.20	0.734**	0.044	-0.001	0.891	5.829	0.112	-5.655	-0.823**	-4.489**	-3.068**
2×5	-3.806**	-17.21	-0.090	-0.054	0.386**	-12.43**	-57.24	-1.089**	-5.057	0.156**	2.218**	-2.714**
2×6	-7.435**	-8.151	-0.886**	0.344*	0.274**	4.694	37.30	0.709**	-2.155	0.882**	2.647**	-0.436
2×7	6.380**	-33.33	-0.225	-0.132	-0.103*	6.416*	27.09	0.514	5.945	1.298**	-2.821**	3.395**
3×4	-3.843**	-6.442	-0.587**	0.663**	1.148**	11.37**	93.64	1.777**	-3.958	1.069**	0.993**	2.844**
3×5	2.861**	13.99	0.232	0.202	-0.035	-8.154**	-45.12	-0.861**	1.804	0.265**	4.270**	7.185**
3×6	2.565**	-10.32	-0.397**	-0.004	0.853**	1.259	25.82	0.491	-1.288	0.154**	-0.450**	-0.894
3×7	-2.954**	-35.37	0.294*	0.074	0.573**	-7.468**	-28.59	-0.541	6.836	-0.233**	1.371**	-2.756**
4×5	3.972**	-25.27	0.054	-0.441**	-0.485**	0.105	-14.13	-0.268	5.740	-0.190**	3.032**	-1.439
4×6	4.676**	-19.31	0.039	-0.157	0.210**	-9.162**	-48.96	-0.929**	6.615	0.879**	8.172**	1.033
4×7	7.491**	-21.50	-0.898**	-1.119**	-0.591**	-16.50**	-102.3	-1.941**	-1.988	0.069*	-4.157**	-0.243
5×6	4.713**	12.15	-0.362*	-0.608**	-0.940**	3.221	-9.105	-0.173	1.296	0.045	-4.301**	2.160**
5×7	-2.139**	21.63	-0.778**	0.490**	0.516**	21.65**	137.5*	2.611**	-1.196	-0.415**	-0.020**	1.874*
6×7	4.231**	22.21	0.689**	-0.492**	-0.936**	-0.806	-31.91	-0.607*	2.398	0.379**	-4.310**	2.576**
S.E. (Sij)	±0.516	±35.65	± 0.131	±0.123	±0.034	±2.904	±85.10	±0.307	±19.68	±0.029	±0.029	±0.696

*,** Significant at $P= 0.05$, and $P= 0.01$, respectively.

1- Plant height

Parent 7 showed a highly significant G.C.A effect for tall plants, while P3 and P6 showed significant G.C.A effects for short plants. For practical breeding, P7 is a good general combiner for tallness, while P3 and P6 are good general combiners for shortness.

2- Number of branches/plant

The G.C.A effects were highly significant in five parents. P1 and P3 exhibited significant positive G.C.A effects for a large number of branches, while P5 and P7 showed significant negative G.C.A effects for a small number of branches. The S.C.A effects were highly significant in ten hybrids, with four crosses showing significant positive effects for a large number of branches.

3- Days to 50% flowering

Parents 4, 3, 5 and 2 showed significant G.C.A effects for late flowering, while the other parents showed significant G.C.A effects for early flowering. Ten hybrids showed significant S.C.A effects for late flowering and nine hybrids showed significant S.C.A effects for early flowering.

4-Green pod length

Parents 3, 4, 6 and 7 showed highly significant positive G.C.A effects, while P1, P2 and P5 showed negative significant G.C.A effects for pod length. Six hybrids showed significant positive S.C.A effects, while five hybrids exhibited significant negative S.C.A effects for pod length.

5-Green pod weight

Parent 6 followed by 4 and 3 showed significant positive G.C.A effects for pod weight, while P5, followed by P2 and P1 showed negative significant effects. Seven hybrids showed significant positive S.C.A effects, while eight hybrids exhibit significant negative effects.

6-Number of green pods/plant

Parents 7 and 5 showed significant positive G.C.A effects for large number of green pods per plant. P1, P3, P4 and P6 showed significant negative G.C.A. effects for small number of green pods per plant. The S.C.A. effects were significant in ten hybrids. Hybrid P5xP7 showed significant positive S.C.A. effects for the large number of green pods per plant while, hybrid P4xP7 showed significant negative S.C.A. effects for the small number of green pods per plant.

7-Weight of green pods/plant

Parent 7, 'Pusa Sawani' showed a highly significant positive G.C.A. effect for increasing pods weight. Parent 1 (Balady Assiut) showed significant negative G.C.A. effects for smaller pods weight.

The S.C.A. effects were significant in eight hybrids, six hybrids showed significant positive S.C.A. effects for this character. Only one cross, P5xP7 showed significant positive S.C.A. effects for increasing pods weight per plant. In agreement with our results crosses with Pusa Sawani showed an increase in average fruit weight, and displayed a highly significant S.C.A. effects in positive direction (Narkhede et al., 2021).

8-Total green pod yield

Parents 7 and 5 were good general combiners for increasing total green pod yield. P1, P2, P4 and P6 showed significant effects for lower yield. The crosses P5xP7, P1xP4 and P3xP4 showed significant S.C.A. effects for higher yield. Six crosses showed the significant S.C.A. effects for lower yield.

9-Dry matter content

The analysis shows the existence of additive G.C.A indicating the predominant role of additive type of the genetic variance in the expression of this character.

10-Percent fibers of the pod

The partitioning of the variance into additive G.C.A. and non-additive S.C.A. components, revealed the existence of additive and non-additive effects. The mean square for S.C.A. was greater than that of G.C.A., indicating the predominance of non-additive type of genetic variance in the expression of this character.

11-Crude protein content

The mean square for S.C.A. was greater than that of G.C.A., indicating the predominance of non-additive type of genetic variance in the expression of this character.

12-Percent of oil in the seed

The mean square for G.C.A. was smaller than that of S.C.A., indicating the predominance of non-additive type of genetic variance in the expression of this character.

The correlation coefficient between parental performances ($\bar{x}$) and general combining ability effects (gi)

It is clear from (Table 4) that there were significant positive correlations between parental performances ($\bar{x}$) and general combining ability effects (gi) confirming the predominant of additive gene action for days to 50% flowering, plant height, number of branches/plant, green pod length, number of green pods/plant, weight of green pods/plant, total green pod yield and dry matter content characters.

Correlation coefficient among studied characters

The highest significant positive correlation (0.989) was found between number of green pods/plant and weight of green pods/plant (Table 5). On the other hand, the highest negative correlation was found between green pod length and dry matter content (-0.517).

Table 4. Rank correlation between parental performance ($\overline{x}$) and G.C.A effects (gi) of okra

Character	Cor. Coefficient (r) between $\overline{x}$ and g_i
1. Days to 50% flowering	0.774*
2. Plant height (cm)	0.923**
3. Number of branches / plants	0.854*
4. Green pod length (cm)	0.894**
5. Green pod weight (g)	-0.056
6. Number of green pods / plants	0.985**
7. Weight of green pods/plant (g)	0.963**
8. Total green pod yield (Ton/feddan)	0.971**
9. Dry matter content	0.810*
10. Percent fibers of the pod	-0.150
11. Crude protein content	0.654
12. Percent oil of the seed	-0.554

*. Correlation is significant at the 0.05 level, **. Correlation is significant at the 0.01 level.

Table 5. The correlation coefficient for pairs of studied characters in the 7×7 diallel.

Character	1	2	3	4	5	6	7	8	9	10	11	12
1	--	-0.121	0.151	-0.352**	0.092	-0.399**	-0.458**	-0.443**	0.140	-0.004	-0.236**	0.231**
2		--	0.047	0.032	-0.014	0.411**	0.404**	0.424**	-0.237**	0.083	-0.286**	0.177*
3			--	0.009	0.093	0.027	0.010	-0.191*	0.017	-0.299**	-0.241**	-0.161
4				--	0.014	0.331**	0.362**	0.329**	-0.517**	0.119	0.250**	0.034
5					--	0.036	0.024	-0.040	-0.231**	0.057	-0.098	-0.051
6						--	0.989**	0.609**	-0.450**	0.036	0.023	-0.050
7							--	0.627**	-0.438**	0.044	0.045	-0.063
8								--	-0.118	0.179*	-0.011	0.134
9									--	-0.072	0.021	0.021
10										--	0.315**	0.296**
11											--	0.046
12												--

1. Days to 50% flowering (days)	2. Plant height (cm)
3. Number of branches/plant	4. Green pod length (cm)
5. Green pod weight (g)	6. Number of green pods/plant
7. Weight of green pods/plant (g)	8. Total green pod yield (Ton/feddan)
9. Dry matter content	10. Percent fibers of the pod
11. Crude protein content	12. Percent oil of the seed

*. Correlation is significant at the 0.05 level, **. Correlation is significant at the 0.01 level.

The present study pointed out clearly that both G.C.A. and S.C.A. were highly significant, showing the existence of both additive and dominance effects. Hence, it may be concluded, because of the magnitude of the G.C.A. item, that the additive effect is very important in the expression of many characters. The parent, ‘Pusa Sawani’ (P7) was a good general combiner for days to 50% flowering, plant height, green pod length, number of green pods/plant, weight of green pods/plant, and total green pod yield, to be worthy of exploitation in practical plant breeding programs. In addition, the hybrid (Emerald × Pusa Sawani) exhibited strong general combining ability for multiple characteristics. The hybrid (Lee × Clemson Spineless) also demonstrated high special combining ability for protein content, while the hybrid (Eskandrany × Emerald) showed high special combining ability for seed oil content (Kumar *et al.*, 2014; El-Sherbeny *et al* 2018; Pachiyappan and Saravanan, 2018; Suganthi *et al*., 2020; Shwetha *et al.*, 2021 and Mritunjay *et al*., 2022).

In conclusion, the genetic analysis revealed a considerable amount of variation in okra that a plant breeder can easily manipulate and use in breeding programs to boost overall green yield, seed oil content, and protein content in okra.

References

AOAC, (2005). Association of Official Analytical Chemists. Official Methods 965.33. Official Methods of Analysis*,* 17" Ed., Gaithersburg, MD.

Bhatt, J. P., Kathiria, K. B., Christian, S. S., and Acharya, R. R. (2015). Combining ability studies in okra (*Abelmoschus esculentus* (L.) Moench) for yield and its component characters. Electronic Journal of Plant Breeding, 6(2): 479-485.

El-Sherbeny, G.A.R., Khaled A. G. A., Obiadalla-Ali, H.A. and Ahmed, A. Y.M. (2018). Estimates of heterosis and combining ability in okra under different environments. Journal of Sohag Agriscience (JSAS), No. (1): 50-64.

Falconer, D. S., and Mackay, T. F. C. (1996). Introduction to Quantitative Genetics, 4th Edn. Harlow: Pearson Prentice Hall.

Griffing, B. (1956). Concept of general and specific combining ability in relations to diallel system. Aus. J. Biol. Sci., 9: 483-493.

Hayman, B.I. (1954a). The theory and analysis of diallel crosses. Genetics, 39: 789-809.

Kumar, S.; Singh, A.K.; Das, R.; Datta, S. and Arya, K. (2014). Combining ability and its relationship with gene action in okra (*Abelmoschus esculentus* (L.) Moench). Journal Crop Weed, 10(1): 82-92.

Kumar A.; Gaurav, S.S and Tanu, S. (2021). Combining ability studies in okra (*Abelmoschus esculentus* (L.) moench) through diallel analysis for yield and yield attributing characters. The Pharma Innovation Journal, 10(5), 480-485.

Mritunjay, R.; Singh, R. K.; Sharma, V. and Mishra, A. C. (2022). Studies on genetic parameters in okra [*Abelmoschus esculentus* (L.) Moench]. Electronic Journal of Plant Breeding. 12(2): 590 – 596.

Nanthakumar, S., Kuralarasu, C., and Gopikrishnan, A. (2021). Heterosis and combining abilities studies in okra [*Abelmoschus esculentus* (L.) Moench].

Narkhede, G. W., Thakur, N. R., and Ingle, K. P. (2021). Studies on combining ability for yield and contributing traits in okra (*Abelmoschus esculentus* L. Moench). Electronic Journal of Plant Breeding, 12(2): 403-412.

Pachiyappan, R. and Saravanan, K. (2018). Combining ability for yield and yield components characters of bhindi (*Abelmoschus esculentus* L. Moench). Electronic J. of Pl. Breeding, 9(1): 321-331.

Paul, T., Desai, R.T. and Choudhary, R. (2017). Genetic architecture, combining ability and gene action study in okra [*Abelmoschus esculentus* (L.) Moench]. Int. J. Curr. Microbiol. App. Sci 6(4): 851-858.

Pawar, M.B., Patel, S. R., Shinde, V. B. (2016). Study of heterotic expression and inbreeding depression in okra [*Abelmoschus esculentus* (L)]. European Journal of Biotechnology and Bioscience, 4(12):1-3.

Raju, C.V. and Selvam, Y.A. (2017). Combining ability studies in bhendi (*Abelmoschus esculentus* (L.) Moench). Plant Archives, 17(2): 1431-1434.

Ranga, A.D. and Darvhankar, M.S. (2022). Diversity analysis of phenotypic traits in okra (*Abelmoschus esculentus* L. Moench). J. Horti. Sci., 17(1):63-72.

Reddy M.T., Haribabu, K., Ganesh, M. and Begum, H. (2011). Combining ability analysis for growth, earliness and yield attributes in okra (*Abelmoschus esculentus* (L.) Moench). Thai Journal of Agricultural Science. 44(3): 207-218.

Rukundo, P., Shimelis, H., Laing, M. and Gahakwa, D. (2017). Combining Ability, Maternal Effects, and Heritability of Drought Tolerance, Yield and Yield Components in Sweetpotato. Frontiers in Plant Science. 7(10). DOI: 10.3389/fpls.2016.01981.

Sharma, B. R. (1993). Genetic improvement of vegetable crops: Okra – Abelmoschus spp. Pergamon Press Ltd. Published by Elsevier Ltd. Pp.751-769.

Shwetha, A., Mulge, R. and Raju, K.K (2021). Combining ability studies in okra [*Abelmoschus esculentus* (L.) Moench] for growth and earliness parameters. Journal of Pharmacognosy and Phytochemistry; 10(2): 1313-1316.

Singh, D.R., Singh, P.K., Syamal, M.M. and Gautam, S.S. (2009). Studies on combining ability in okra, Indian J. Hort., 66 (2): 277- 280.

Suganthi S., R., Priya, S., Kamaraj, A., Satheeshkumar,P. and Bhuvaneswari, R. (2020). Combining ability studies in bhindi (*Abelmoschus esculentus* L. Moench) through diallel analysis for yield and yield attributes characters. Plant Archives 20(1): 3609-3613.

Wakode, M. M., Bhave, S. G., Navhale, V. C., Dalvi, V. V., Devmore, J. P., and Mahadik, S. G. (2016). Combining ability studies in okra (*Abelmoschus esculentus* L. Moench). Electronic Journal of Plant Breeding, 7(4): 1007-1013.

دراسة القدرة على التآلف في الباميا لصفات النمو والمحصول والجودة

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الملخص

أجريت هذه الدراسة بمزرعة الخضر البحثية بكلية الزراعة، جامعة أسيوط خلال الموسم الصيفي 2022، 2023 وذلك لدراسة السلوك الوراثي لصفات المحصول ومكوناته في نبات الباميا. وقد أجري التهجين الأليلي في اتجاه واحد بين سبعة أصناف من الباميا وهي بلدي أسيوط، بلدي قنا، اسكندراني، لي، اميرالد، كليمسون سباينلس، بوذا سواني.

وتمت دراسة الصفات التالية في الأباء والهجن الناتجة (21 هجين) وحللت النتائج وراثيا بطريقة جريفنج.

وتتلخص النتائج فيما يلي:

1- أظهرت سبع صفات فقط معنوية عالية للقدرة العامة والقدرة الخاصة على التآلف وهذا يدل على أهمية كل من الفعل الإضافي والفعل غير الإضافي للجين في وراثة هذه الصفات بينما كانت القدرة العامة على التآلف أكبر من القدرة الائتلافية الخاصة لعدد ست صفات وهذا يدل على أهمية الفعل الإضافي للجين في التعبير عن هذه الصفات.

2- أظهرت صفة طول القرن الأخضر ومحتوى المادة الجافة معنوية لتأثير القدرة الائتلافية العامة فقط وهذا يدل على أن الاختلافات بين الأباء راجعة كلياً للفعل الإضافي للجين فقط.

3- أظهر الصنف (بوذا سواني) قدرة ائتلافية عامة عالية لصفات 50 % إزهار، وطول النبات، وطول القرن وعدد قرون النبات، ووزن قرون النبات، وكمية المحصول الكلي، ومحتوى الألياف، ومحتوى البروتين، ومحتوى الزيت في البذرة. وبالتالي يمكن التوصية باستخدامه في برامج التربية والتهجين في الباميا لهذه الصفات.

4- أظهر الهجين (اميرالد × بوذا سواني) قدرة ائتلافية خاصة عالية لصفات طول القرن الأخضر، ومتوسط وزن القرن، وعدد قرون النبات، ووزن قرون النبات، وكمية المحصول الكلي، ومحتوى الزيت في البذرة. وبالتالي يمكن التوصية باستخدامه في برامج التربية والتهجين في الباميا لهذه الصفات.

الكلمات المفتاحية: *القدرة العامة على التآلف، التهجين الأليلي في اتجاه واحد، الباميا، القدرة الخاصة على التآلف، المحصول.*