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## GENERATION MEAN ANALYSIS IN OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH)

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### ABSTRACT

The present investigation was undertaken to study the genetics of yield and yield components through generation mean analysis based on six parameter model in four crosses namely of Okra (*Abelmoschus esculentus* L. Moench) derived through eight parental diallel cross and their back crosses were analyzed for ten characters namely; days to flowering, height of plant (cm), number of branches per plant, number of first fruiting node, number of nodes per plant, length of internode (cm), length of fruit (cm), width of fruit (cm), number of fruits per plant and yield per plant (g) at Department of Horticulture, Janta College Bakewar, Etawah during the year 2022. Scaling test showed the presence of non-allelic gene interactions in all the crosses for all the characters under study as significant value of either of the scale A, B and/or C. Generation mean analysis revealed that dominance components were more prominent than additive components for all the characters based on all the crosses studied. The Digenic Epistasis was additive x dominance and dominance x dominance in nature. Duplicate type of epistasis was observed in most of the crosses. Except in VRO-3x PK for nodes/plant, KS-312xVRO-5 for width of fruits and AB-2x KS-312 for yield per plant where it was Complimentary type.

**Keywords:** Additive, Dominance, Diallel, Duplicate Gene Action, Epistasis, Okra, Quantitative Traits.

### Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an important vegetable crop grown in the tropical and subtropical parts of the globe. Okra belongs to family Malvaceae with having  $2n = 130$  chromosomes and amphidiploid nature. It is usually consumed for its green tender fruits as a vegetable in a variety of ways. The tender fruits are used as vegetable, eaten culinary preparations as sliced and fried pieces. It has nutritive value is higher than Brinjal, tomato and most of the cucurbits. It is a good source of iodine besides other minerals and vitamin. Its mature fruit and stems contain crude fiber, which is used in the paper industry. The roots and stem of okra are used as clarifier for cane juice from brown sugar or gur is prepared (Chauhan, 1972). The classical breeding systems that make use of additive genetic variance will be effective breeding procedures for improving the yield. To exploit the existing genetic variability present in

breeding material for yield as efficiently as possible, the breeder would need the basic information regarding the inheritance of yield and its closely related components for devising an efficient selection programme. For genetic improvement of the crop, the breeding method to be adopted depends mainly on the nature of gene action involved in the expression of quantitative traits. The presence or absence of epistasis can be detected by the analysis of generation means using the scaling test, which measures epistasis accurately, whether it is complimentary or duplicate at the digenic level. Hayman (1958) was simultaneously used for determining the nature of gene action involved in the inheritance of yield and yield contributing characters. The information regarding gene action involved in control of inheritance for yield and yield contributing characters through generation mean analysis is of immense use to the plant breeder to decide suitable breeding strategy for improvement of these characters.

## Materials and Methods

The experiment was conducted with four crosses involving for genetically diverse parents viz AB-2, AB-1, KS-312, VRO-3, VRO-5 and PK were crossed in Kharif 2021 by hand emasculation and pollination. The  $F_1$ 's and parents were grown in summer 2022. To advance the  $F_2$ 's and to obtain  $BC_1$  and  $BC_2$  Crosses. Thus the seed of six generation  $P_1$ ,  $P_2$ ,  $F_1$ ,  $F_2$   $BC_1$  and  $BC_2$  of for crosses were evaluated during Kharif 2022 in a randomized block design with three replications at the Research Farm of the Department of Horticulture, Janta College Bakewar, Etawah. Each plot considered row of  $P_1$ ,  $P_2$ ,  $F_1$ ,  $BC_1$  and  $BC_2$  and three rows of  $F_2$ . Each row was three meter long. The row to row and Plant To Plant distance was kept 45cm. The observations were recorded for 10 quantitative Characters namely days to flowering, height of plant (cm), number of branches per plant, number of first fruiting node, number of nodes per plant, length of internode (cm), length of fruit (cm), width of fruit (cm), number of fruits per plant and yield per plant (g) on 10 randomly selected plants from  $P_1$ ,  $P_2$ ,  $F_1$ ,  $F_2$   $BC_1$  and  $BC_2$  and Six Parents of all the four crosses for each replication. The data were first tested for non-allelic interaction by scaling test A, B and C given by Mather (1949). For Computation of gene effects for yield and its components with six basic generations Hayman's (1958) six parameter model were used.

## Results and Discussion

The results obtained in the present investigation for scaling test are presented in table 1. The scaling tests were significant suggesting the presence of digenic interaction in the inheritance of these characters. The results of gene effects are presented in table 2 are discussed as below:

**Days to flowering:** In case of Degree freedom all the crosses showed significant values of scales indicating the presence of epistasis for the characters. Cross combination AB-2 x KS-312 had significant Values of m, i and h components. The value d and h was negatively significant. Among digenic gene effects only dominance x dominance was significant AB-1 x PK dominance component was higher than additive one. The gene interaction showed that additive x additive, and dominance x dominance were negative and significant only additive x dominance interaction was positive and significant which showed that the distribution of genes in parents were in equal proportion.

Duplicate type of epistasis was noted in all the crossed as opposite sign of h and l were seen. The results are on accordance with Akhtar *et al.* (2010).

**Height of Plant:** Significant values of d and h revealed the significance of both additive and non additive genes for controlling plant height. In all the crosses AB-2 x KS-312 and VRO-3 x PK both showed its nature towards tallness as positive and Significant values of d and h components while in KS-312 x VRO-5 showed negative values indicating more contribution of dwarfness genes. The epistatic components showed additive x additive components towards tallness in AB-2 x KS-312 and VRO-3 x PK while it was dominance x dominance type in KS-312 x VRO-5. The opposite sign between h and l components indicated the presence of duplicate epistasis in all the crosses. These findings are enclosed with those of Bashir *et al.* (2023).

**No. of Branches/Plant:** The values of additive components d was non-significant in all the crosses except AB-1 x PK. Where it was significant but negative direction. Dominance components d was in positive direction in case of AB- 2 x KS-312 and VRO-3 x PK revealing the opportunity of higher number of branches. Heterosis breeding will be more appropriate for informing the branches in these crosses. The gene interaction showed additive x additive in nature except KS-312 x VRO-5. Duplicate epistasis was predominant in all the crosses studied similar results are also noted by Mistry (2013).

**No. of First fruiting node:** The first fruiting node is also related with early fruiting in okra. AB-2 x KS-312 and VRO-3 x PK showed positive values of additive components means provide opportunity of selection breeding. AB-1x PK, KS- 312x VRO-5 and VRO-3 x PK showed the presence of both addition and non additive gene action. Although the nature of dominance component h was negative in direction. The epistatic component was mostly of dominance x dominance in nature. Hence simple Selection could not be feasible only Heterosis breeding after biparental mating would be more appropriate as also reported by Vinay *et al.* (2021) the opposite sign between h and l revealed duplicate epistasis.

**No. of Nodes/Plant:** Significant values of four scaling test revealed the presence of epistasis in all the four crosses studies. The additive component was non-significant in all the crosses, Dominance component h was significant in all the crosses except VRO- 3 x PK. Hence these crosses showed preponderance of non additive expression of this character. Dominance x dominance epistasis was more prominent in all the crosses and of duplicate type due to opposite sign of h and l components. Cross combination VRO-3 x PK showed the presence of complementary type of gene interaction as h and l components showed same sign. The Simple selection may not be suitable for this

character based on these crosses and only ploidy and Heterosis breeding will be more appropriate and also revealed similar results. Selection based on advanced generation n could be preferable to get durable transgressive segregates.

**Length of Internode:** Shorter internodes length is preferable in okra, the significant and negative values of d and h components for KS-312 x VRO-5 and VRO-3 x PK showed the presence of both additive and non additive gene in the Crosses. Cross AB-2 x KS-312 express towards long internodes. Higher the value of dominance components h than additive component d were revealed more contribution of dominance component in all the crosses. Among gene interaction negative and significant values of i component showed the presence of additive x additive epistasis. Dominance x dominance epistasis was also prevailing in desirable direction in cross combination AB-2 x KS-312 and AB-1 x PK. All the crosses showed Duplicate epistasis. The findings of Safa and Al-Khadi (2023) are in close agreement with these results.

**Length of Fruit:** In case of length of fruit all the crosses showed more contribution of dominance rather than additive one. Among the non allelic interactions additive x additive epistasis was more effective than other. In case of AB-2 x KS-312 and AB-1 x PK. Cross combination KS-312 x VRO-5 showed more contribution and presence of dominance x dominance gene interaction. All the crosses showed duplicate type epistasis Jogi *et al.* (2018) also reported similar results.

**Width of fruit:** For the character only AB-2 x KS-312 showed the preponderance of additive genes and it can improved through Selection. Two crosses under study namely AB-1 x PK and VRO-3 x PK were under the control of dominance components. All the crosses except KS-312 x VRO-5 was showed duplicate epistasis while KS-312 x VRO-5 had complementary epistasis which can be improved through selection en advanced generation. The reports Mistry (2013) of also showed similar results.

**No. of Fruits/Plant:** Number of fruits per plant is main yield contributing character which directly influenced the yield in okra. Four combination which are under study revealed the significant values of either of the scale while tested for scaling test which showed the presence of epistasis for this character in all the crosses, only cross Combination AB-2 x KS-312 revealed the presence of both additive and non-additive genetic effects. However the contribution of dominance effect was more than additive one. Dominance component was also noted in AB-1 x PK, considering the digenic epistasis additive x additive

type was noted in positive direction in AB-2 x KS-312 and AB-1 x PK while it was in negative direction in rest of the crosses. The dominance x dominance epistasis most important one is VRO-3 x PK. Heterosis breeding and/or recurrent selection will be appropriate for improvement of this character. Similar findings were also reported Patel and Patel (2023).

**Yield/ Plant:** For yield per plant Cross Combination AB-2 x KS- 312 showed significant values for both additive and dominance components. Cross AB-1 x PK showed the preponderance of dominance component. The epistatic components revealed that the presence of complementary type in case of AB-2 x KS-312 which can be further improved by selection in advanced generations and may produce. Transgressive segregates if additive effect of one parent and Complementary effect of other words in same direction. The additive x additive and dominance x dominance in positive direction in the cross VRO-3 x PK reflect the opportunity of selection for yield improvement in okra with recurrent selection and Heterosis breeding.

### Conclusion

In the present investigation, both additive and non-additive gene effects were important in the genetic control of yield per plant and its component under study. However, the magnitude of non-additive gene effects were higher in magnitude for yield per plant as well as its components indicating that the non-additive types of gene action contributing maximum for inheritance of these characters. Exploiting this type of variability, population improvement approach is generally suggested. Some forms of recurrent selection like diallel selective mating (Jensen, 1970) or bi-parental mating in early segregating generation as suggested by Joshi and Dhawan (1966) might prove to be effective alternative approach. These methods utilize both additive and non-additive genetic variance during selection of genotypes and permit the release of conceal variability. The prevalence of duplicate epistasis in the inheritance of traits including yield indicated that these traits might be improved through recurrent selection in bi-parental progenies that would help in exploiting the duplicate type of non-allelic interaction and allow recombination and concentration of gene having cumulative effects in population as this method is helpful in breaking up undesirable linkage. Arora *et al.* (2007), Akhtar *et al.*(2010), Arora *et al.* (2010), Mistry and Vashi (2011), Medagam *et al.* (2012) and Mistry (2013) have reported additive and non-additive types of gene action and prevalence of duplicate type or epistasis in okra.

**Table 1A :** Scaling Test for 10 characters in 4 crosses in Okra.

Crosses	Days to Flowering			Height of Plant (cm)			No. of Branches / Plant			No. of first Fruiting Node			No. of Nodes / Plant		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
AB-2 x KS-312	-3.61**	-3.01*	-2.90	1.49	5.98	-16.91**	0.99	0.19	-2.11**	0.00	0.37	0.97*	-3.00	1.60	-15.90**
SE±	0.99	1.36	2.52	2.27	3.50	5.71	0.64	0.23	0.74	0.31	0.45	0.32	1.62	1.73	2.63
AB-1x PK	2.99*	-1.01	-14.29**	7.81*	0.99	16.49**	0.36	0.26	4.18**	0.16	0.87	5.58**	-0.60	-1.67	-15.07**
SE±	1.30	1.19	1.47	3.57	3.21	5.65	0.35	0.29	0.81	0.63	0.47	0.93	1.62	1.76	2.63
KS-312xVRO-5	-2.53*	-3.20*	-6.27*	-2.01	-0.00	23.97**	-0.02	-0.73	2.95*	0.56	-0.04	3.91**	2.06	-0.05	-10.90**
SE±	1.23	1.29	3.13	3.49	2.55	5.30	0.42	0.43	1.26	0.76	0.90	1.42	1.70	1.75	3.11
VRO-3x PK	-0.02	-0.01	9.12*	20.99**	-0.02	6.65	-0.45	-0.30	5.55**	1.78**	-0.02	6.56**	1.49	-2.68	2.25*
SE±	1.15	1.10	2.19	2.85	3.02	4.74	0.42	0.29	1.02	0.32	0.46	1.08	1.71	1.66	0.66

  

Crosses	Length of Internodes (cm)			Length of Fruits (cm)			Width of Fruits (cm)			No. of Fruits/Plant			Yield/ Plant (g)		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
AB-2 x KS-312	0.00	0.00	-13.30**	-1.21	0.99	-2.99**	0.05	-0.31	0.59**	-1.00	-2.00	-8.20**	-5.00	-58.63**	-117.43**
SE±	0.56	0.65	1.17	0.83	1.02	1.05	0.11	0.11	0.16	1.51	1.56	2.83	14.56	14.24	18.44
AB-1x PK	-1.01	0.00	-6.80**	2.19**	1.00	-4.05*	0.10	-0.19	0.85**	0.00	0.00	-9.40**	10.00	-13.33	-77.00**
SE±	0.74	0.92	1.50	1.09	1.06	0.73	0.19	0.18	0.28	1.83	1.68	3.01	13.71	20.50	25.67
KS-312xVRO-5	1.52	-0.11	5.02**	0.78	-1.03	2.06*	-0.19	0.14	-1.27*	1.90	-0.01	8.10*	10.01	-5.67	75.57**
SE±	1.04	0.75	1.43	0.80	0.61	0.66	0.12	0.16	0.61	1.20	1.27	3.22	12.22	12.41	14.95
VRO-3x PK	-0.14	-0.01	8.87**	3.32**	1.54	3.85	0.22	0.29	-0.69*	1.20	0.10	17.09**	-15.33	-39.33	144.33**
SE±	0.71	0.90	1.24	1.00	1.14	2.33	0.18	0.36	0.34	1.77	1.49	3.28	29.77	31.25	61.97

**Table 2:** Estimates of gene effects in 4 Crosses based on 6 parameters model for 10 Quantitative characters in Okra

Crosses	<i>m</i>	<i>d</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>l</i>	Type of Epistasis
1. Days to Flowering							
AB-2 x KS-312	37.20**	-1.34*	-10.84**	-3.72	-0.30	10.34** 3.48	Duplicate
SE±	0.53	0.60	2.53	2.43	0.77		
AB-1x PK	40.70**	-1.67*	14.88**	-16.26**	2.00*	-18.23**	Duplicate
SE±	0.17	0.72	1.73	1.60	0.79	3.24	
KS-312xVRO-5	40.37**	1.28	-3.89	0.53	0.34	5.20	Duplicate
SE±	0.69	0.66	3.14	3.05	0.78	4.08	
VRO-3x PK	47.42**	-2.56**	11.02**	9.15**	-0.00	9.17**	Duplicate
SE±	0.44	0.63	2.26	2.17	0.67	3.34	
2. Height of Plant (cm)							
AB-2 x KS-312	95.73**	3.70**	31.01**	24.39**	-2.24	-31.86**	Duplicate
SE±	0.81	0.64	4.21	3.49	1.67	6.26	
AB-1x PK	126.10**	-4.04**	20.00**	-7.68**	3.41	-1.13	Duplicate
SE±	0.55	0.67	3.66	2.58	2.07	6.26	
KS-312xVRO-5	101.80**	-4.47**	-22.71**	-25.98**	-1.00	27.99**	Duplicate
SE±	0.55	0.66	3.52	2.57	1.76	5.92	
VRO-3x PK	117.10**	0.06	34.91**	14.32**	10.51**	-35.29**	Duplicate
SE±	0.49	0.66	3.21	2.38	1.89	5.43	
3. No. of Branches/ Plant							
AB-2 x KS-312	2.00**	0.31	2.90*	3.30**	0.40	-4.49**	Duplicate
SE±	0.17	0.32	0.95	0.94	0.34	1.46	
AB-1x PK	4.30**	-0.70**	-3.35**	3.56**	0.05	2.94**	Duplicate
SE±	0.17	0.13	0.77	0.74	0.20	0.96	
KS-312xVRO-5	3.95**	-0.09	-4.16**	-3.82**	0.82**	6.11**	Duplicate
SE±	0.20	0.14	0.88	0.86	0.20	1.05	
VRO-3x PK	2.80**	0.30	4.63**	4.80**	-0.07	-4.05**	Duplicate
SE±	0.23	0.17	1.01	0.98	0.23	1.22	
4. No. of first Fruiting Node							
AB-2 x KS-312	7.40**	0.30*	-7.22**	-6.80**	0.42	5.23**	Duplicate
SE±	0.23	0.13	0.98	0.96	0.24	1.14	
AB-1x PK	7.90**	-1.51**	-5.46**	-4.55**	-0.35	3.51*	Duplicate
SE±	0.17	0.31	0.98	0.93	0.34	1.56	
KS-312xVRO-5	8.00**	-0.85**	-2.89*	-3.38**	0.30	2.85	Duplicate
SE±	0.17	0.32	1.13	0.95	0.45	1.92	

VRO-3x PK SE±	9.00** 0.26	0.30 0.25	-5.12** 1.16	-4.80** 1.15	0.90** 0.27	3.04* 1.47	Duplicate
5. No. of Nodes/ Plant							
AB-2 x KS-312 SE±	17.60** 0.40	0.55 0.72	20.75** 2.40	14.50** 2.16	-2.30* 1.10	-13.10** 3.89	Duplicate
AB-1x PK SE±	19.60** 0.40	-0.80 0.68	16.47** 2.36	12.80** 2.12	0.53 1.15	-10.53** 3.79	Duplicate
KS-312xVRO-5 SE±	15.00** 0.58	-0.45 0.68	14.15** 2.88	12.90** 2.69	1.05 1.19	-14.90** 4.15	Duplicate
VRO-3x PK SE±	22.27** 0.55	-0.65 1.00	-1.20 3.18	4.03 2.96	1.48 1.45	-24.67** 5.12	Complementary
6. Length of Internodes (cm)							
AB-2 x KS-312 SE±	5.60** 0.23	1.35** 0.23	12.45** 1.09	13.30** 1.03	0.00 0.42	-13.30** 1.48	Duplicate
AB-1x PK SE±	11.48** 0.22	-1.14** 0.36	7.22** 1.29	5.79** 1.13	-0.51 0.44	-4.77* 2.07	Duplicate
KS-312xVRO-5 SE±	11.30** 0.17	-0.66 0.39	-2.47* 1.21	-3.61** 1.04	0.81 0.53	2.20 2.10	Duplicate
VRO-3x PK SE±	15.20** 0.12	-0.35 0.36	-8.69** 1.03	-9.02** 0.85	-0.07 0.45	9.17** 1.90	Duplicate
7. Length of Fruits (cm)							
AB-2 x KS-312 SE±	10.30** 0.17	0.07 0.56	4.78** 1.37	2.78* 1.31	-1.10 0.63	-2.56 2.46	Duplicate
AB-1x PK SE±	13.00** 0.29	0.08 0.57	9.82** 1.74	7.24** 1.62	0.59 0.65	-10.43** 2.85	Duplicate
KS-312xVRO-5 SE±	12.15** 0.43	-0.04 0.76	6.51** 2.44	3.68 2.28	2.30** 0.77	-5.75 3.90	Duplicate
VRO-3x PK SE±	14.70** 0.51	-0.26 0.87	3.99 2.75	0.47 2.69	1.16 0.88	-4.80 4.19	Duplicate
8. Width of Fruits (cm)							
AB-2 x KS-312 SE±	1.80** 0.06	0.22* 0.08	0.12 0.32	0.24 0.28	0.28** 0.11	-0.77 0.49	Duplicate
AB-1x PK SE±	1.83** 0.04	-0.12 0.07	0.87** 0.25	0.76** 0.22	0.14 0.12	-0.76 0.41	Duplicate
KS-312xVRO-5 SE±	1.98** 0.08	-0.55** 0.13	-0.67 0.41	-0.22 0.40	-0.35* 0.15	-0.18 0.63	Complementary
VRO-3x PK SE±	2.09** 0.06	-0.06 0.17	1.28** 0.43	1.20** 0.41	-0.04 0.19	-1.71** 0.77	Duplicate
9. No. of Fruits/Plant							
AB-2 x KS-312 SE±	14.30** 0.40	3.30** 0.65	7.50** 2.38	5.20* 2.08	0.50 0.76	-2.20 3.86	Duplicate
AB-1x PK SE±	15.60** 0.35	0.60 0.68	12.10** 2.35	9.40** 1.94	0.00 0.92	-9.40* 4.05	Duplicate
KS-312xVRO-5 SE±	16.10** 0.72	0.15 0.66	-4.46 3.25	-6.21* 3.17	0.95 0.76	4.33 4.16	Duplicate
VRO-3x PK SE±	20.75** 0.43	-0.55 0.52	-12.65** 2.46	-14.90** 2.02	0.09 0.67	12.71** 3.88	Duplicate
10. Yield/ Plant (g)							
AB-2 x KS-312 SE±	163.20** 1.62	51.70** 7.64	88.68** 18.70	53.80** 16.58	26.82** 8.63	9.83 35.68	Complementary
AB-1x PK SE±	192.25** 5.63	16.67 11.17	126.67** 32.31	73.67* 31.22	11.67 11.89	-70.33 51.53	Duplicate
KS-312xVRO-5 SE±	188.35** 2.11	-2.05 6.97	-52.54** 17.43	-71.23** 16.30	7.84 8.06	66.89* 31.65	Duplicate
VRO-3x PK SE±	235.50** 5.63	2.00 6.39	-140.17** 38.79	199.00** 25.91	12.00 7.59	253.67** 67.04	Duplicate

Note: \* Significant at 5% level, \*\* Significant at 1% level

*m*= Means Effects, *d*= Additive Gene Effects, *h*= Dominance Gene Effects, *j*= Additive x Additive Gene Interaction, *i*= Additive x Dominance Gene Interaction, *l*= Dominance x Dominance Gene Interaction

## References

- Abdelmageed, A. H. A. (2010). Inheritance studies of some economic characters in okra (*Abelmoschus esculentus* (L.) Moench). *Tropical and Subtropical Agroecosystems*, **12**, 619–627.
- Adiger, S., Shanthakumar, G. and Salimath, P. M. (2013). Selection of parents based on combining ability studies in okra (*Abelmoschus esculentus* (L.) Moench). *Karnataka Journal of Agricultural Sciences*, **26**(1), 6–9.
- Akhtar, M., Singh, J. N., Srivastava, K. and Shahi, J. P. (2010). Studies on generation mean analysis for yield and its associated traits in okra (*Abelmoschus esculentus* (L.) Moench). *International Journal of Plant Sciences*, **5**(1), 323–326.
- Akotkar, P. K., De, D. K. and Dubey, U. K. (2014). Genetic studies on fruit yield and yield attributes of okra (*Abelmoschus esculentus* (L.) Moench). *Electronic Journal of Plant Breeding*, **5**(1), 38–44.
- Alake, C. O., Ariyo, O. J. and Kehinde, O. B. (2012). A quantitative analysis of the genetics of yield and yield components in West African okra, *Abelmoschus cailliei* (A. Chev) Stevels. *International Journal of Plant Breeding and Genetics*, **6**(2), 94–104.
- Arora, D., Jindal, S. K. and Ghai, T. R. (2007). Generation mean analysis for earliness related traits in okra (*Abelmoschus esculentus* (L.) Moench). *Journal of Genetics and Breeding*, **61**, 1–7.
- Arora, D., Jindal, S. K. and Ghai, T. R. (2010). Quantitative inheritance for fruit traits in inter varietal crosses of okra (*Abelmoschus esculentus* (L.) Moench). *Electronic Journal of Plant Breeding*, **1**(6), 1434–1442.
- Bashir, M., et al. (2023). Generation mean analysis for yield components and disease resistance in okra. *Pakistan Journal of Botany*, **55**(4), 1057–1066.
- Cavalli, L. L. (1952). An analysis of linkage in quantitative genetics. In C. R. Rieve & C. H. Waddington (Eds.), *Quantitative inheritance* (pp. 135–144). HSMO, London.
- Chauhan, D. V. S. (1972). *Vegetable production in India*. Ram Prasad and Sons, Agra.
- Hayman, B. I. (1958). The separation of epistasis from additive and dominance variation in generation means. *Heredity*, **12**, 371–390.
- Jensen, N. F. (1970). A diallel selective mating system for cereal breeding. *Crop Science*, **10**(6), 629–635.
- Joshi, A. B. and Dhawan, N. L. (1966). Genetic improvement of yield with special reference to self-pollinated crops. *Indian Journal of Genetics*, **26**, 101–113.
- Khan, M. A., Ali, Q. and Ahmad, N. (2022). Genetic analysis of yield and quality traits in okra (*Abelmoschus esculentus* (L.) Moench) using generation mean analysis. *Genetics and Molecular Research*, **21**(1), Article 21.
- Mather, K. (1949). *Biometrical genetics*. Methuen and Co. Ltd., London.
- Medagam, T. R., Kadiyala, H. B., Mutyala, G. and Begum, H. (2012). Diallel analysis for yield and its components in okra (*Abelmoschus esculentus* (L.) Moench). *The Asian and Australasian Journal of Plant Science and Biotechnology*, **6**(1), 53–61.
- Mehta, N., Asati, B. S. and Mamidwar, S. R. (2007). Heterosis and gene action in okra. *Bangladesh Journal of Agricultural Research*, **32**(3), 421–432.
- Mistry, P. M. (2013). Generation mean analysis in okra (*Abelmoschus esculentus* (L.) Moench). *Agricultural Science Digest*, **33**(1), 21–26.
- Mistry, P. M. and Vashi, P. S. (2011). Genetics of pod yield and yield contributing characters in okra (*Abelmoschus esculentus* (L.) Moench). *International Journal of Plant Sciences*, **6**(2), 298–303.
- Obiadalla-Ali, H. A., Eldekashy, M. H. Z. and Helaly, A. A. (2013). Combining ability and heterosis studies for yield and its components in some cultivars of okra (*Abelmoschus esculentus* (L.) Moench). *American-Eurasian Journal of Agricultural & Environmental Sciences*, **13**(2), 162–167.
- Pal, A. K. and Sabesan, T. (2009). Combining ability through diallel analysis in okra (*Abelmoschus esculentus* (L.) Moench). *Electronic Journal of Plant Breeding*, **1**, 84–88.
- Patel, K. D., Barad, A. V., Savaliya, J. J. and Butani, A. M. (2010). Generation mean analysis for fruit yield and its attributing traits in okra (*Abelmoschus esculentus* (L.) Moench). *The Asian Journal of Horticulture*, **5**(2), 256–259.
- Patel, S. K. and Patel, K. J. (2023). Evaluation of genetic variability and generation mean analysis for yield and quality traits in okra. *International Journal of Vegetable Science*, **29**(1), 25–34.
- Reddy, M. A., Sridevi, O., Salimath, P. M. and Nadaf, H. L. (2013). Combining ability for yield and yield components through diallel analysis in okra (*Abelmoschus esculentus* (L.) Moench). *IOSR Journal of Agriculture and Veterinary Science*, **5**(2), 1–6.
- Jogi, S. R., Toprope, V. N. and Thakur, N. R. (2018). Generation mean analysis in okra (*Abelmoschus esculentus* (L.) Moench). *Multilogic in Science*, **8**(25), 39–45.
- Safa, A. and Al-Khadi, S. (2023). Inheritance patterns of fruit traits in okra: A generation mean analysis approach. *Journal of Agricultural Science and Technology*, **25**(2), 135–145.
- Singh, P. A., Dhall, R. K. and Singh, J. (2012). Genetics of early and total yield in okra (*Abelmoschus esculentus* (L.) Moench). *Vegetable Science*, **39**(2), 165–168.
- El-Gendy, S. E. A. and Abd El-Aziz, M. H. (2013). Generation mean analysis of some economic traits in okra (*Abelmoschus esculentus* (L.) Moench). *Journal of Applied Sciences*, **13**(6), 810–818.
- Verma, A. and Sood, S. (2015). Gene action studies on yield and quality traits in okra (*Abelmoschus esculentus* (L.) Moench). *Indian Journal of Agricultural Research*, **10**(43), 4006–4009.
- Vinay, N. D., Yadav, R. K., Behera, T. K., Talukdar, A., Lata, S. and Das, A. (2021). Generation mean analysis unveils genetic effects controlling major yield traits in okra (*Abelmoschus esculentus* (L.) Moench). *Vegetable Science*, **48**(2), 164–171.