www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2021; 10(1): 292-295
© 2021 TPI
www.thepharmajournal.com
Received: 25-11-2020
Accepted: 28-12-2020

Kalyani D Deshmukh
M.Sc. Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

VS Khandare
Research Officer, Horticulture Research Scheme Vegetable, VNMKV, Parbhani, Maharashtra, India

BM Kharat
M.Sc. Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Kalyani D Deshmukh
M.Sc. Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Estimation of generation mean analysis and scaling test for fruit yield and its attributing traits in okra (*Abelmoschus esculentus* L. Moench)

Kalyani D Deshmukh, VS Khandare and BM Kharat

Abstract
The experimental material comprised of six generations (P_1, P_2, F_1, F_2, BC_1 and BC_2) through generation mean analysis of six crosses with different parents. The generations were analysed during *kharif* 2019 in Randomized Block Design with randomization of generations within each cross in two replications. The traits were studied plant height (cm), number of branches per plant, internodal length, days to 50% flowering, first flowering node, first fruiting node. The scaling test indicated the presence of non-allelic interaction in all the crosses. The PBNOK-6 x Pusa Makhmali and VRO-103 x Hissar Naveen showed superior mean performance in all the traits. In days to 50% flowering all crosses showed superior mean performance. In most of the crosses additive type (d) component showed superior performance in the characters first flowering node, number of branches per plant, internodal length. In all the six crosses days to 50% flowering was observed superior in all type of gene action. Additive x additive type (j) of gene action was observed to be important in the characters like number of branches per pant and internodal length. Most of the characters showed complementary type of gene action. Complementary type of gene action play role in transfer inheritance characters. Some characters showed duplicate type of epistasis. Its play important role for transgressive selection of the characters.

Keywords: Okra, generation mean analysis, yield components, gene effects, epistasis

Introduction
Okra is one of the important vegetable crop grown during spring summer and rainy season. It has cultivation, export potential and high nutritive value. Okra is highly energetic of variable leading position among vegetables due to its wide adoptability and year round nutrients. It is commonly known as bhindi or lady's finger, belongs to the class dicotyledonae, order Malvales and family Malvaceae. Okra flowers are often cross-pollinated crop with somatic chromosome number 2n=130. In India, okra is trading crop grown in the states of Gujrat, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka. It is grown all over the tropical and sub-tropical regions as well as in the warmer parts of the temperate regions. The yield potential of okra is low with straight varieties (10.39t/ha) shows that there is a big difference in productivity. It is an introduced vegetable crop in India. It is extensively grown for its tender pods, which are used as a very popular, tasty and gelatinous vegetable, it is a highly energetic of valuable nutrients. It has massive socio-economic potential for enhancing livelihoods in both rural and urban areas.

Materials and Methods
The present consideration entitled "Studies on Generation Mean Analysis in Okra (*Abelmoschus esculentus* (L.) Moench)" was aimed to determine gene effects for nineteen characters in six crosses of okra. The experiment was conducted at the Experimental Farm, Horticulture Research Scheme (Vegetable), Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The generations were analysed during *kharif* 2019 in Randomized Block Design with randomization of generations within each cross in two replications. In each replication observations were recorded on 5 random competative plant of P_1, P_2, F_1, 20 plants on F_2 and BC_1, BC_2 on 15 plants. The crosses were delibrated *viz*., PBNOK 2 x Parbhani Bhendi, PBNOK 2 x Parbhani Kranti, PBNOK 2 x Pusa Makhmali, PBNOK 4 x Parbhani Bhendi, PBNOK 6 x Pusa Makhmali, VRO 103 x Hissar Naveen. These crosses along with their parental lines PBNOK-2, PBNOK-4, PBNOK-6, VRO-103, Parbhani Bhendi, Parbhani Kranti, Pusa Makhmali, HIssar Naveen.

Analysis of variance showed highly significant differences and was present all over the crosses studied for all the characters. Presence of non-allelic gene interactions in all the crosses indicated in scaling test. Duplicate type of interaction and complementary epistasis in six crosses estimated gene effects for different traits. The duplicate type of interaction was used for improvement of traits through hybridization method. Whereas, complementary type of epistasis used for improvement of traits by transgressive selection.

Result and Discussion

Scaling test were performed as given by Hayman (1958) [5]. Scaling tests *viz.*, A, B, C, D (Table 1), showed presence of appreciable amount of epistasis in different characters. Presence of epistatic gene action for yield and its related traits have been reported earlier by Panda and Singh (2003) [10], Akthar *et al.* (2010), Mistry (2013) [9] which confirmed present results. The chi square (x^2) values were significant according to joint scaling test for first fruiting node in all six crosses studied. The significant value of chi square for this trait in all the crosses indicated that the three parameter model did not adequately explain the genetic variability for these traits. The inadequacy of the model was also indicated the presence of epistasis (non-allelic gene interaction), which was also inferred from the generation means. As the three parameter model did not satisfactorily explain the genetic variability for this trait, therefore, a six parameter model was applied to accommodate epistatic interactions. The results showed that non-allelic gene interactions of six parameter model of generation mean analysis was presented in Table 2. Estimate of gene effects from the generation mean analysis mean effect (m) was positively significant.

Plant height

The plant height at 30 DAS, the estimates of epistatic gene effects were showed that additive component (d) positively significant in the two crosses PBNOK-2 x Parbhani Bhendi and PBNOK-4 x Parbhani Bhendi and cross PBNOK-2 x Parbhani Kranti, PBNOK-2 x Pusa Makhmali was negatively significant. The dominance (h) was found positively significant in the four crosses. The additive x additive (i) was found negatively significant in the two cross PBNOK-2 x Parbhani Bhendi, PBNOK-2 x Parbhani Kranti and three crosses was found positively significant. Additive x dominance interaction (j) was negatively significant in cross PBNOK-2 x Pusa Makhmali and three crosses was found to be positively significant. Dominance x dominance (1) type interaction was negatively significant in three crosses. Complementary type of interaction was found to be presented in all six.

Plant height

In plant height at 60 DAS, the additive (d) component and additive x dominance (j) component was positively significant for all the crosses, except cross PBNOK-4 x Parbhani Bhendi was positively non-significant. Duplicate type of interaction was showed to be presented in all the crosses. Similar results was noted with previous findings by Senthil *et al.* (2006).

Plant height

The plant height at 90 DAS, the dominance (h) component was negatively significant for all the crosses. Duplicate type of interaction was showed to be presented in all the crosses except cross PBNOK-2 x Parbhani Kranti.

Number of branches per plant

The number of branches per plant, the additive component (d) the three crosses was found to be negatively significant. Dominance component (h), additive x additive (i) and additive x dominance (j) component was positively significant in two crosses PBNOK-4 x Parbhani Bhendi and VRO-103 x Hissar Naveen. The cross VRO- 103 x Hissar Naveen was found to be positively significant interaction in dominance x dominance (l). Complementary type of interaction was showed to be presented in three crosses. Whereas in three crosses showed duplicate type of interaction. The similar results were found by Senthil *et al.* (2006).

Internodal length

In internodal length, the additive (d) and additive x dominace (j) components was found negatively significant in five crosses except cross PBNOK-2 x Parbhani Kranti. The dominance (h) and Additive x additive (i) interaction effect was found positively significant in two crosses PBNOk-2 x Parbhani Bhendi and VRO-103 x Hissar Naveen, while, cross PBNOK-4 x Parbhani Bhendi was found negatively significant. Dominance x dominance interaction effect (1) was negatively significant in four crosses. Duplicate type of interaction was showed to be presented in five crosses due to having opposite signs of dominance (h) and dominance x dominance (1) components. In cross PBNOK-2 x Parbhani Kranti genetic components (h) and (1) were having same sign this indicating complimentary type of gene effect. Similar results were confirmed with previous findings by Arora *et al.* (2007) [3].

Days to 50% flowering

The days to 50% flowering, the Additive component (d) was found to be positively significant in three crosses. Dominance (h) and additive x additive (i) component was found to be positively significant in four crosses. Additive x dominance (j) and dominance x dominance (l) interaction effect was negatively significant in the two crosses. Duplicate type of interaction was observed to be presented in all the six crosses. Similar results was found by Singh (2010) [10].

First flowering node

In first flowering node, the additive component (d) was negatively significant in three crosses. The Dominance (h) and Additive x additive (i) interaction was negatively significant in three crosses. The gene effect of additive x dominance (j) and dominance x dominance (l) interaction was found to be negatively significant in two crosses PBNOK-2 x Parbhani Kranti and VRO-103 x Hissar Naveen. Duplicate type of interaction was observed to be presented in five crosses. In the cross PBNOK-4 x Parbhani Bhendi indicated complimentary type of gene effect. The similar results were observed by Akthar *et al.* (2010).

First fruiting node

The first fruiting node, in the cross PBNOK-2 x Parbhani Bhendi was found positively significant and cross PBNOK-4 x Parbhani Bhendi was found to be negatively significant in additive (d) component interaction. In the dominance (h) and additive x additive (i) component the cross PBNOK-4 x Parbhani Bhendi was found positively significant and cross PBNOK-6 x Pusa Makhmali was found to be negatively significant. The additive x dominance (j) and dominance x dominance (l) component was positively significant in cross

PBNOK-2 x Parbhani Kranti. Complementary type of interaction was showed to be presented in cross PBNOK-4 x Parbhani Bhendi. Duplicate type of interaction was showed in five crosses due to having opposite sign of genetic components (h) and (l). The similar results were observed by Akthar *et al.* (2010).

Table 1: Scaling test for 19 characters in 6 crosses of okra

Character and crosses	A	B	C	D
Plant height (cm) 30 DAS				
PBNOK 2 X Parbhani Bhendi	3.38** ± 0.54	-.0.67 ± 0.43	4.55** ± 1.85	0.92** ± 0.09
PBNOK 2 X Parbhani Kranti	0.59 ± 0.23	0.23 ± 0.43	2.80** ± 1.01	0.99** ± 0.08
PBNOK 2 X Pusa Makhmali	2.75** ± 0.84	4.78** ± 1.48	3.90* ± 3.41	-1.81** ± 0.04
PBNOK 4 X Parbhani Bhendi	1.88** ± 0.34	0.23 ± 0.86	1.27 ± 1.61	-0.42 ± 0.07
PBNOK 6 X Pusa Makhmali	3.47** ± 0.82	2.69** ± 0.52	2.91* ± 1.45	-1.62** ± 0.13
VRO 103 X Hissar Naveen	3.49** ± 1.04	1.48 ± 0.74	-0.87 ± 3.09	-2.92** ± 0.10
Plant height (cm) 60 DAS				
PBNOK 2 X Parbhani Bhendi	4.84** ± 3.49	-12.94** ± 2.83	-5.69* ± 7.45	1.20 ± 0.73
PBNOK 2 X Parbhani Kranti	2.13 ± 12.0	-3.59 ± 13.91	-10.75 ± 49.66	-4.65** ± 0.02
PBNOK 2 X Pusa Makhmali	-5.27** ± 1.73	-10.97** ± 0.38	-2.13 ± 5.62	7.05** ± 1.28
PBNOK 4 X Parbhani Bhendi	-0.63 ± 2.27	-1.77 ± 1.06	7.33** ± 5.96	4.86** ± 1.07
PBNOK 6 X Pusa Makhmali	5.05** ± 3.41	-1.17 ± 6.53	20.58** ± 22.24	8.35** ± 2.98
VRO 103 X Hissar Naveen	13.21** ± 3.10	9.51** ± 2.87	12.70** ± 11.61	-5.01** ± 0.30
Plant height (cm) 90 DAS				
PBNOK 2 X Parbhani Bhendi	-0.13 ± 13.72	-6.15** ± 5.31	2.89 ± 24.48	4.58** ± 0.58
PBNOK 2 X Parbhani Kranti	11.31** ± 8.61	4.66** ± 3.03	22.34** ± 9.85	3.18 ± 3.87
PBNOK 2 X Pusa Makhmali	-8.19** ± 0.91	11.93** ± 5.95	9.35* ± 13.98	2.80* ± 1.82
PBNOK 4 X Parbhani Bhendi	-32.82** ± 3.85	-20.11** ± 2.21	-33.98** ± 10.16	9.47** ± 1.65
PBNOK 6 X Pusa Makhmali	-25.68** ± 28.13	-18.70* ± 53.07	-34.61** ± 122.46	4.88** ± 2.66
VRO 103 X Hissar Naveen	-20.07** ± 10.22	-11.88** ± 17.39	-22.04** ± 44.92	4.95** ± 0.90
Number of branches per plant				
PBNOK 2 X Parbhani Bhendi	-0.44 ± 0.29	0.67 ± 0.15	0.40 ± 0.67	0.08** ± 0.00
PBNOK 2 X Parbhani Kranti	0.00 ± 0.07	0.50** ± 0.02	-0.50 ± 0.10	-0.50** ± 0.00
PBNOK 2 X Pusa Makhmali	-0.93** ± 0.09	0.33 ± 0.13	-0.60 ± 0.27	0.00 ± 0.00
PBNOK 4 X Parbhani Bhendi	0.64** ± 0.04	-0.40* ± 0.03	-0.50 ± 0.16	-0.37** ± 0.01
PBNOK 6 X Pusa Makhmali	-0.80** ± 0.00	-0.80** ± 0.03	-0.40 ± 0.05	0.60** ± 0.00
VRO 103 X Hissar Naveen	0.74 ± 0.15	-2.14** ± 0.12	-2.10** ± 0.47	-0.35** ± 0.01

Character and crosses	A	B	C	D
Internodal length (cm)				
PBNOK 2 X Parbhani Bhendi	-0.38** ± 0.00	0.74** ± 0.00	-1.01** ± 0.02	-0.68** ± 0.00
PBNOK 2 X Parbhani Kranti	-00.20 ± 0.04	0.02 ± 0.05	0.36 ± 0.14	0.07 ± 0.00
PBNOK 2 X Pusa Makhmali	0.16 ± 0.03	0.55** ± 0.03	0.19 ± 0.13	-0.26** ± 0.00
PBNOK 4 X Parbhani Bhendi	-0.76** ± 0.04	0.05 ± 0.02	0.91* ± 0.15	0.81** ± 0.01
PBNOK 6 X Pusa Makhmali	0.06 ± 0.04	0.88** ± 0.10	0.82 ± 0.23	-0.06 ± 0.01
VRO 103 X Hissar Naveen	0.42 ± 0.04	1.22** ± 0.02	0.82** ± 0.08	-0.41** ± 0.00
Days to 50% flowering				
PBNOK 2 X Parbhani Bhendi	8.60** ± 0.06	3.19** ± 0.11	-1.22* ± 0.34	-6.51** ± 0.07
PBNOK 2 X Parbhani Kranti	0.81* ± 0.13	4.36** ± 0.08	-5.07** ± 0.27	-5.12** ± 0.06
PBNOK 2 X Pusa makhmali	0.06 ± 0.09	-1.94** ± 0.18	7.60** ± 0.37	4.74** ± 0.03
PBNOK 4 X Parbhani Bhendi	-3.28** ± 0.06	-2.47** ± 0.09	-17.36** ± 0.30	-5.80** ± 0.03
PBNOK 6 X Pusa Makhmali	2.94** ± 0.09	-3.51** ± 0.11	8.11** ± 0.36	4.34** ± 0.04
VRO 103 X Hissar Naveen	3.54** ± 0.07	-3.68** ± 0.10	-5.89** ± 0.32	-2.87** ± 0.02
First flowering node				
PBNOK 2 X Parbhani Bhendi	0.17 ± 0.02	0.46** ± 0.00	1.50** ± 0.03	0.43** ± 0.00
PBNOK 2 X Parbhani Kranti	-1.30** ± 0.05	0.40** ± 0.01	-3.90** ± 0.08	-1.50** ± 0.00
PBNOK 2 X Pusa Makhmali	0.13 ± 0.01	0.10 ± 0.03	0.30 ± 0.04	0.03 ± 0.00
PBNOK 4 X Parbhani Bhendi	0.30 ± 0.09	-0.60* ± 0.05	-0.50 ± 0.22	-0.10 ± 0.01
PBNOK 6 X Pusa Makhmali	-0.13 ± 0.01	-0.10** ± 0.00	1.70** ± 0.05	0.96** ± 0.01
VRO 103 X Hissar Naveen	-0.56 ± 0.10	0.40** ± 0.03	1.50** ± 0.16	0.83** ± 0.00
First fruiting node				
PBNOK 2 X Parbhani Bhendi	0.93** ± 0.02	0.76** ± 0.04	1.80** ± 0.10	0.05 ± 0.00
PBNOK 2 X Parbhani Kranti	-0.50** ± 0.03	-1.23** ± 0.03	-1.70** ± 0.08	0.01 ± 0.00
PBNOK 2 X Pusa Makhmali	-0.43 ± 0.09	-0.53 ± 0.10	-0.50 ± 0.24	0.23 ± 0.01
PBNOK 4 X Parbhani Bhendi	-0.27 ± 0.03	-0.33 ± 0.03	-1.20** ± 0.11	-0.30** ± 0.00
PBNOK 6 X Pusa Makhmali	0.30** ± 0.02	0.27** ± 0.00	1.30** ± 0.02	0.36** ± 0.00
VRO 103 X Hissar Naveen	0.20 ± 0.09	-0.74 ± 0.15	-0.10 ± 0.37	-0.23 ± 0.01

Table 2: Estimation of gene effects of 6 crosses for 19 characters in okra

Character and crosses	m	d	h	i	j	L	Type of epistasis	X2 values
Plant height (cm) 30 DAS								
PBNOK 2 X Parbhani Bhendi	12.42** ± 0.13	0.90** ± 0.14	-0.98 ± 0.86	-1.84** ± 0.59	2.02** ± 0.27	-0.87 ± 1.47	Complementary	S
PBNOK 2 X Parbhani Kranti	12.70** ± 0.10	-0.52** ± 0.18	-0.48 ± 0.72	-1.98** ± 0.56	0.18 ± 0.31	1.16 ± 1.24	Duplicate	S
PBNOK 2 X Pusa Makhmali	11.68** ± 0.09	-1.42** ± 0.07	4.07** ± 0.99	3.63** ± 0.41	-1.01* ± 0.58	-11.16** ± 1.86	Duplicate	S
PBNOK 4 X Parbhani Bhendi	12.35** ± 0.11	0.50** ± 0.15	2.23** ± 0.80	0.84 ± 0.54	0.82* ± 0.47	-2.95 ± 1.41	Duplicate	S
PBNOK 6 X Pusa Makhmali	11.76** ± 0.07	-0.15 ± 0.33	3.94** ± 0.93	3.25** ± 0.73	0.39 ± 0.47	-9.41** ± 1.81	Duplicate	S
VRO 103 X Hissar Naveen	11.45** ± 0.11	-0.24 ± 0.22	7.18** ± 1.06	5.84** ± 0.65	1.00** ± 0.34	-10.81** ± 1.97	Duplicate	S
Plant height (cm) 60 DAS								
PBNOK 2 X Parbhani Bhendi	31.52** ± 0.22	3.14** ± 0.73	-9.01** ± 2.14	-2.41 ± 1.71	8.89** ± 0.98	10.51** ± 4.00	Duplicate	S
PBNOK 2 X Parbhani Kranti	31.18** ± 0.05	0.20* ± 0.11	12.27** ± 3.53	9.31** ± 0.31	2.86** ± 0.73	-7.84 ± 7.06	Duplicate	S
PBNOK 2 X Pusa Makhmali	33.77** ± 0.50	5.68** ± 0.51	-9.70** ± 2.34	-14.11** ± 2.26	2.85** ± 0.63	30.35** ± 3.14	Duplicate	S
PBNOK 4 X Parbhani Bhendi	34.59** ± 0.46	0.22 ± 0.45	-2.79 ± 2.21	-9.73** ± 2.06	0.57 ± 0.91	12.13** ± 3.05	Duplicate	S
PBNOK 6 X Pusa Makhmali	35.15** ± 0.83	3.61** ± 0.47	-12.42** ± 3.84	-16.70** ± 3.45	3.11* ± 1.39	12.82** ± 8.29	Duplicate	S
VRO 103 X Hissar Naveen	30.66** ± 0.22	1.31** ± 0.11	12.13** ± 1.98	10.02** ± 1.11	1.85** ± 0.41	-32.74** ± 3.65	Duplicate	S
Plant height (cm) 90 DAS								
PBNOK 2 X Parbhani Bhendi	80.21** ± 0.14	-3.65** ± 0.70	-20.39** ± 2.89	-9.17** ± 1.52	3.01* ± 2.98	15.45** ± 5.70	Duplicate	S
PBNOK 2 X Parbhani Kranti	83.04** ± 0.65	4.59** ± 1.47	-20.60** ± 4.03	-6.37 ± 3.93	3.32* ± 1.70	-9.60 ± 6.67	Complementary	S
PBNOK 2 X Pusa Makhmali	78.89** ± 0.66	-6.12** ± 0.28	-20.10** ± 3.01	-5.61* ± 2.70	-10.06** ± 1.26	1.87 ± 3.91	Duplicate	S
PBNOK 4 X Parbhani Bhendi	78.16** ± 0.48	-4.83** ± 0.84	-13.72** ± 2.86	-18.95** ± 2.57	-6.35** ± 0.84	71.88** ± 4.64	Duplicate	S
PBNOK 6 X Pusa Makhmali	75.93** ± 0.05	-1.78 ± 1.62	-15.92** ± 6.42	-9.77** ± 3.26	-3.49 ± 2.71	54.15** ± 12.84	Duplicate	S
VRO 103 X Hissar Naveen	76.85** ± 0.27	4.33** ± 0.78	-17.08** ± 3.81	-9.91** ± 1.90	-4.09** ± 1.50	41.86** ± 7.39	Duplicate	S
Number of branches per plant								
PBNOK 2 X Parbhani Bhendi	5.82** ± 0.00	-0.10** ± 0.03	-0.02 ± 0.41	-0.17** ± 0.06	-0.55* ± 0.24	-0.06 ± 0.82	Complementary	S
PBNOK 2 X Parbhani Kranti	6.15** ± 0.01	-0.20** ± 0.07	0.25 ± 0.23	1.00** ± 0.17	-0.25* ± 0.14	-1.50** ± 0.45	Duplicate	S
PBNOK 2 X Pusa Makhmali	5.90** ± 0.03	0.27** ± 0.05	1.50** ± 0.30	0.00 ± 0.16	-0.63** ± 0.22	0.60 ± 0.56	Complementary	S
PBNOK 4 X Parbhani Bhendi	5.80** ± 0.04	-0.83** ± 0.05	1.09** ± 0.28	0.74** ± 0.22	0.52** ± 0.08	-0.98* ± 0.46	Duplicate	S
PBNOK 6 X Pusa Makhmali	5.30** ± 0.04	0.20** ± 0.03	-0.20 ± 0.19	-1.20** ± 0.17	0.00** ± 0.09	2.80** ± 0.28	Duplicate	S
VRO 103 X Hissar Naveen	5.07** ± 0.02	0.04 ± 0.09	0.70* ± 0.40	0.70** ± 0.21	1.44** ± 0.11	0.70 ± 0.78	Complementary	S

Character and crosses	m	d	h	i	J	L	Type of epistasis	X2 values
Internodal length (cm)								
PBNOK 2 X Parbhani Bhendi	3.96** ± 0.01	-0.35** ± 0.02	1.44** ± 0.09	1.37** ± 0.06	-0.56** ± 0.05	-1.73** ± 0.03	Duplicate	S
PBNOK 2 X Parbhani Kranti	4.16** ± 0.02	0.13* ± 0.07	-0.16 ± 0.25	-0.14 ± 0.17	0.09 ± 0.08	-0.08 ± 0.48	Complementary	S
PBNOK 2 X Pusa Makhmali	4.03** ± 0.02	-0.30** ± 0.03	0.32 ± 0.21	0.52** ± 0.12	-0.19** ± 0.06	-1.23** ± 0.39	Duplicate	S
PBNOK 4 X Parbhani Bhendi	4.32** ± 0.05	-0.10* ± 0.04	-0.72** ± 0.28	-1.62** ± 0.23	-0.40** ± 0.07	2.32** ± 0.43	Duplicate	S
PBNOK 6 X Pusa Makhmali	4.04** ± 0.05	-0.21** ± 0.02	0.03 ± 0.32	0.12 ± 0.24	-0.40** ± 0.16	-1.06* ± 0.49	Duplicate	S
VRO 103 X Hissar Naveen	4.24** ± 0.02	-0.23** ± 0.05	1.18** ± 0.19	0.83** ± 0.14	-0.40** ± 0.12	-2.48** ± 0.35	Duplicate	S
Days to 50% flowering								
PBNOK 2 X Parbhani Bhendi	44.50** ± 0.11	3.36** ± 0.14	13.50** ± 0.58	13.03** ± 0.55	2.71** ± 0.18	-24.84** ± 0.83	Duplicate	S
PBNOK 2 X Parbhani Kranti	44.90** ± 0.08	-1.24** ± 0.17	9.61** ± 0.53	10.25** ± 0.49	-1.77** ± 0.20	-15.42** ± 0.86	Duplicate	S
PBNOK 2 X Pusa Makhmali	48.85** ± 0.06	-1.07** ± 0.13	-5.50** ± 0.46	-9.48** ± 0.37	1.00** ± 0.20	11.36** ± 0.81	Duplicate	S
PBNOK 4 X Parbhani Bhendi	44.04** ± 0.07	-1.48** ± 0.11	12.60** ± 0.44	11.61** ± 0.38	-0.40** ± 0.13	-5.85** ± 0.71	Duplicate	S
PBNOK 6 X Pusa Makhmali	48.79** ± 0.08	1.98** ± 0.13	-8.56** ± 0.50	-8.69** ± 0.44	3.22** ± 0.15	9.26** ± 0.82	Duplicate	S
VRO 103 X Hissar Naveen	44.68** ± 0.07	1.97** ± 0.05	3.31** ± 0.39	5.75** ± 0.30	3.61** ± 0.15	-5.61** ± 0.61	Duplicate	S
First flowering node								
PBNOK 2 X Parbhani Bhendi	5.30** ± 0.02	-0.09* ± 0.04	-1.12** ± 0.15	-0.87** ± 0.13	-0.14* ± 0.06	0.24 ± 0.26	Duplicate	S
PBNOK 2 X Parbhani Kranti	4.65** ± 0.00	-1.00** ± 0.04	1.95** ± 0.16	3.00** ± 0.09	-0.85** ± 0.11	-2.10** ± 0.33	Duplicate	S
PBNOK 2 X Pusa Makhmali	5.35** ± 0.00	0.06* ± 0.03	0.58** ± 0.12	-0.07 ± 0.07	0.01 ± 0.11	-0.16 ± 0.25	Duplicate	S
PBNOK 4 X Parbhani Bhendi	5.00** ± 0.02	0.30** ± 0.09	0.15 ± 0.32	0.20 ± 0.21	0.45** ± 0.10	0.10 ± 0.61	Complementary	S
PBNOK 6 X Pusa Makhmali	4.95** ± 0.05	-0.06 ± 0.04	-2.18** ± 0.24	-1.93** ± 0.24	-0.01 ± 0.05	2.16** ± 0.29	Duplicate	S
VRO 103 X Hissar Naveen	4.85** ± 0.00	-0.53** ± 0.09	-2.81** ± 0.27	-1.66** ± 0.19	-0.48** ± 0.14	1.82** ± 0.55	Duplicate	S
First fruiting node								
PBNOK 2 X Parbhani Bhendi	5.12** ± 0.03	0.13** ± 0.05	0.14 ± 0.23	-0.11 ± 0.18	0.08 ± 0.08	-1.58** ± 0.39	Duplicate	S
PBNOK 2 X Parbhani Kranti	4.77** ± 0.00	0.06 ± 0.07	-0.83** ± 0.20	-0.03 ± 0.14	0.36** ± 0.09	1.76** ± 0.40	Duplicate	S
PBNOK 2 X Pusa Makhmali	4.70** ± 0.00	0.10 ± 0.12	-0.31 ± 0.34	-0.46* ± 0.24	0.05 ± 0.14	1.42* ± 0.69	Duplicate	S
PBNOK 4 X Parbhani Bhendi	4.80** ± 0.00	-0.17** ± 0.04	0.60** ± 0.18	0.60** ± 0.08	0.03 ± 0.04	0.00 ± 0.00	complementary	S
PBNOK 6 X Pusa Makhmali	4.95** ± 0.02	0.06 ± 0.05	-1.58** ± 0.15	-0.73** ± 0.14	0.01 ± 0.08	0.16 ± 0.27	Duplicate	S
VRO 103 X Hissar Naveen	4.40** ± 0.01	-0.03 ± 0.11	-0.24 ± 0.39	0.46* ± 0.24	0.47** ± 0.13	0.08 ± 0.77	Duplicate	S

References

1. Abdelmageed AHA. Inheritance studies of some economic characters in okra [*Abelmoschus esculentus* (L.) Moench]. Tropical and Subtropical Agro-ecosystems 2010;12:619-627.
2. Allolli S, Jagtap VS, Ahamed Z. Generation mean analysis with respect of yield and percent incidence of fruit borer and yellow vain mosaic virus (YVMV) in okra [*Abelmoschus esculentus* (L.) Moench]. Journal of Pharmacognosy and Phytochemistry 2020;9(1):2305-2308.
3. Arora D, Jindal SK, Ghai TR. Generation mean analysis for earliness related traits in okra [*Abelmoschus esculentus* (L.) Moench]. Electronic Journal of Plant Breeding 2010;1(6):1434-1442.
4. Cavalli LL. An analysis of Linkage in quantitative

inheritance, “Quantitative inheritance” H. M. Stationary Office. London 1952, P135-144.
5. Hayman BI. The separation of epistatic from additive and dominance variation in generation means. Heredity 1958;12:371-390.
6. Jinks JI, Jones RM. The analysis of diallel crosses. Maize genetics co-operative News Letter 1958;27:48-54.
7. Mather K, Jinks JL. Introduction to biometrical genetics. Chapman and Hall, London 1977, P237.
8. Mahajan RC, DJ Sonawane, Yamgar SV. Estimation of generation mean analysis and scaling test for fruit yield and its attributing traits in okra [*Abelmoschus esculentus* (L.) Moench]. Journal of Pharmacognosy and Phytochemistry 2017;6(6):2128-2135.
9. Mistry PM. Generation mean analysis in okra. [*Abelmoschus esculentus* (L.) Moench] Agricultural Science Digest 2013;33(1):21-26.
10. Panda PK, Singh KP. Generation mean analysis for yield and yield traits in okra. [*Abelmoschus esculentus* (L.) Moench]. Vegetable Science 2003;30(1):25-28.
11. Salameh MN, Kasrawi AM. Inheritance of fruit length, diameter and number of ridges per pod [*Abelmoschus esculentus* (L.) Moench]. Jordan Journal of Agricultural Sciences 2007;3(4):439-452.
12. Sindhumole P, Manju P. Genetic architecture to yellow vein mosaic and leaf spot diseases in okra [*Abelmoschus esculentus* (L.) Moench]. Electronic journal of plant breeding 2015;6(1):157-160.
13. Soher EA, EI-Gendy, Abd EI-Aziz MH. Generation mean analysis of economic traits in okra [*Abelmoschus esculentus* (L.) Moench]. Journal of Applied Sciences 2013;13(6):810-818.
14. Verma A, Sood S. Gene action studies on yield and quality traits in okra [*Abelmoschus esculentus* (L.) Moench]. African Journal of agricultural research 2015;10(43):4006-4009.
15. Wakode MM, Bhave SG, Navhale VC, Dalvi VV, Mahadik SG. Genetic analysis of yield and yield contributing traits in okra. Electronic Journal of Plant Breeding 2015;6(4):956-961.