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HETEROSIS STUDIES IN OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) FOR GROWTH AND EARLINESS PARAMETERS THROUGH LINE X TESTER ANALYSIS

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ABSTRACT

The study of heterosis would help in selection of heterotic crosses for commercial exploitation of F1 hybrids in okra (*Abelmoschus esculentus* (L.) Moench). 36 F1s were developed by crossing 3 Lines and 12 Testers of okra by using Line x Tester mating design during kharif 2022. All 36 F1s along with their 15 parents and 1 standard Check (Radhika) were evaluated in a randomized block design with three replicates during kharif 2023 and kharif 2024 at Department of Vegetable Science, Dr. PDKV, Akola, Maharashtra. Maximum desirable heterosis for growth parameters was observed in the cross Kokan Bhendi x AKO-74 for plant height over standard check and the over better parent (90.70% and 27.88%) in kharif 2023. For number of nodes per plant AKO-1-P-2 x AKO-7 over better parent and over standard check (61.36% and 83.23%) in kharif 2023. For earliness characters in internodal length Kokan Bhendi x AKO-10 showed highest negatively significant heterosis over better parent (-45.23%) in kharif 2023 and the over standard check (-9.02%) in kharif 2024. For node at which first flower appeared the cross Kokan Bhendi x Phule Vimukta exhibited maximum negatively significant heterosis over the better parent (-37.93%) in kharif 2024 and over standard check (-34.00) in kharif 2023. For days to initiation of first flower the cross AKO-1-P-2 X AKO-73 (-16.84 %) over better parent in kharif 2024 and Korchi x AKO-73 (-9.57) over standard check in kharif 2023. For days to 50% flowering the cross Korchi x EC (-14.81) over better parent in kharif 2023 and cross Korchi x AKO-74 (-14.00) over standard check in kharif 2024 showed the maximum significant negative heterosis. High estimates of heterosis obtained in hybrid combinations revealed considerable genetic divergence among the parental lines and also reveals good scope for commercial exploitation of heterosis in okra.

Keywords: Heterosis, Standard heterosis, Heterobeltiosis, okra.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an annual, summer and rainy season vegetable crop belongs to the family Malvaceae, genus - *Abelmoschus* an amphidiploid having chromosome number $2n=130$ and propagated by seed. It is often cross-pollinated crop. It is commonly known as Bhindi, lady's finger or gumbo etc. originating from tropical Africa. In India, it is cultivated in the area of 5.57 lakh hectares with the annual production of 7305.41 million tonnes/ha with

the productivity of 13.12 tonnes/ha. In Gujarat, largest its area is 0.93 lakh hectares, production 1133.08 million tonnes/ha and in Maharashtra, its area 0.13 lakh hectares, production 140.88 million tonne/ha. respectively (Department of Agriculture and Farmers Welfare 2023-24). The magnitude of heterosis is used as a basis for genetic diversity and provides direction for selecting ideal parents in order to produce desirable F1 hybrids. Additionally, F1 hybrids mature earlier and are more consistent than variety, which lowers the cost of harvesting and grading. Heterosis breeding in okra

for growth and earliness characteristics therefore provides a rapid quantum boost in production and productivity. As a result, an effort has been made to evaluate the degree and direction of heterosis for okra development and earliness parameters. Prakash Kerure *et al.*, 2019.

Material and Methods

The investigation on heterosis studies in okra was carried out at the Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra state. The experimental material comprised of 15 parents (3 Lines and 12 Testers), which were collected from the department itself and their 36 F1 hybrids along with one commercial check (Radhika) by using Line x Tester mating design (Kempthorne, 1957). The experiment was conducted during three seasons, crossing block in kharif 2022, evaluation trials in kharif 2023 and kharif 2024. The experiment was laid out in randomized block design with three replications. Each treatment or a genotype in each replication was represented by one row each accommodating 20 plants at a row to row spacing of 60cm and 45cm from plant to plant. Five plants were randomly selected for each genotype from each replication and evaluated for the quantitative characters and the replicated mean values of various characters of parents and hybrids were subjected to Line x Tester analysis.

Results and Discussion

The analysis of variance displayed significant differences among treatments for all the traits indicating the presence of appreciable genetic diversity among the parents and hybrids. Significant and high magnitude of heterobeltiosis and standard heterosis was observed in the desirable direction for all the growth and earliness parameters. Heterosis for growth and earliness parameters were presented in Table 1 to 3.

For plant height out of 36 crosses, 1 cross combinations over better parent, 31 cross combinations over standard hybrid check in *kharif* 2023 season. The cross combination in *kharif* 2023 Kokan Bhendi x AKO-74 (27.88 %) over the better parent, the cross Kokan Bhendi x AKO-74 (90.70 %) over standard hybrid check. while in *kharif* 2024 season 2 crosses over better parent, 26 crosses over standard hybrid check. During *kharif* 2024 the cross Kokan Bhendi x AKO-74 (24.55 %) over better parent, the cross AKO-1-P-2 x Phule Vimukta (79.49 %) over standard hybrid check. 1 cross combinations over better parent, 28 cross combinations over standard hybrid check in pooled and the cross combination in pooled Kokan

Bhendi x AKO-74 (26.23 %) over the better parent, the cross Kokan Bhendi x AKO-74 (79.49 %) found significant positive heterosis over standard hybrid check. The results were in accordance with Kumar *et al.* (2013) and Sweta *et al.* (2022)

Negative heterosis is considered to be desirable for the trait internodal length as it can facilitates more number of nodes where one can expect more fruits per plant. Out of 36 crosses, 19 cross combinations over better parent, and only one on standard hybrid check in *kharif* 2023 season. The cross combination Kokan Bhendi x AKO-10 (-45.23 %) over better parent the cross Kokan Bhendi x AKO-10 (-2.06) over standard hybrid check in *kharif* 2023 season. While in *kharif* 2024 season 8 cross combinations over better parent and only one cross over standard hybrid check. while Kokan Bhendi x AKO-10 (-41.17) cross combination over better parent, the cross combination Kokan Bhendi x AKO-10 (-9.02) over standard hybrid check during *kharif* 2024 season. 13 cross combinations over better parent, and only one on standard hybrid check in pooled. The cross combination Kokan Bhendi x AKO-10 (-39.89 %) showed highest negative significant heterosis over better parent, the cross Kokan Bhendi x AKO-10 (-5.67) showed highest negative significant heterosis over standard hybrid check in pooled. Similar results were obtained by Thirupathi *et al.* (2012) and Kumar *et al.* (2013).

Out of 36 crosses, 19 cross combinations over better parent, only one cross combinations over standard hybrid check in *kharif* 2023 season. The cross combinations Korchi x IC (63.33%) over better parent, the cross combination AKO-1-P-2 x AKO-2 (112.00%), over standard check in *kharif* 2023 season. However, during *kharif* 2024 season 23 crosses over better parent, only 1 cross over standard check, while during *kharif* 2024 season the cross combinations Korchi x IC (62.67%) over better parent, the cross AKO-1-P-2 x AKO-2 (107.69%) over standard check respectively. 20 cross combinations over better parent, only 1 cross combinations over standard hybrid check in pooled recorded the significant positive heterosis for number of branches per plant. The cross combinations Korchi x IC (62.90%) over better parent, the cross combination AKO-1-P-2 x AKO-2 (109.80%), showed highest positive heterosis over standard check in pooled. Vegetative growth is essential for higher yield and the number of branches directly related to the number of fruits per plant hence significant and positive heterosis is desirable for number of branches per plant. The results obtained are in consonance with Kumar *et al.* (2013).

Number of nodes per plant directly related to the number of fruits per plant hence significant and positive heterosis is desirable. this character, showed highest significant positive heterosis out of 36 crosses, 11 cross combinations over better parent and 15 cross combinations over standard hybrid check in *kharif* 2023 season. The cross combination AKO-1-P-2 x AKO-7 (61.36%) over better parent, while the cross combination AKO-1-P-2 x AKO-7 (83.23%) over standard hybrid check during *kharif* 2023 season. While 10 cross combinations over better parent and 10 cross combinations over standard hybrid check in *kharif* 2024 season. On the other hand, AKO-1-P-2 x AKO-7 (54.40%) over better parent, the cross combination AKO-1-P-2 x AKO-7 (58.76%) over standard hybrid check during *kharif* 2024 season. 11 cross combinations over better parent and 14 cross combinations over standard hybrid check in pooled. The cross combination AKO-1-P-2 x AKO-7 (57.82%), over better parent, while the cross combination AKO-1-P-2 x AKO-7 (70.18%) showed positively significant heterosis over standard hybrid check during pooled. Similar result was obtained by Sweta *et al.* (2022) and Ranga *et al.* (2024).

Node at which first flower appeared is desirable for minimum days to 50 % flowering and indicator of the earliness in okra. Out of 36 crosses, 12 cross combinations over better parent and 14 cross combinations over standard hybrid check in *kharif* 2023 season. Among 36 crosses Kokan Bhendi x Phule Vimukta (-37.77%) over better parent and Kokan Bhendi x Phule Vimukta (-34.00%) over standard hybrid check during *kharif* 2023 season. While 13 cross combinations over better parent and 15 cross combinations over standard hybrid check in *kharif* 2024 season. During *kharif* 2024 the cross combination Kokan Bhendi x Phule Vimukta (-37.93%) over better parent and over standard hybrid check cross Korchi x AKO-Red (-28.00%). 13 cross combinations over better parent and 16 cross combinations over standard hybrid check in pooled. Among 36 crosses Korchi x AKO-Red (-36.84%) over better parent and the cross combinations Korchi x AKO-Red (-28.00%) showed highest negative heterosis over standard hybrid check during pooled. These results are in accordance with Thirupathi *et al.* (2012).

In days to initiation of first flower out of 36 crosses, 24 cross combinations over better parent and 16 cross combinations over standard hybrid check in *kharif* 2023 season. Among 36 crosses AKO-1-P-2 x AKO-74 (-16.35%) over better parent and the cross combination Korchi x AKO-73 (-9.57%) over standard hybrid check during *kharif* 2023 season. While 19

cross combinations over better parent and 16 cross combinations over standard hybrid check in *kharif* 2024 season. During *kharif* 2024 the cross combination AKO-1-P-2 x AKO-73 (-16.84%) over better parent and over standard hybrid check cross Korchi x AKO-74 (-8.70%). 22 cross combinations over better parent and 15 cross combinations displayed the significant negative heterosis over standard hybrid check in pooled. Among 36 crosses AKO-1-P-2 x AKO-73 (-16.10%) showed highest negatively significant heterosis over better parent and the cross combinations Korchi x AKO-73 (-9.14%) showed highest negative heterosis over standard hybrid check during pooled. These results are in consonance with Rai *et al.* (2011), Thirupathi *et al.* (2012).

The minimum days required for days to 50 % of flowering are directly proportional to the earliness. Out of 36 crosses, 24 cross combinations over better parent, 20 cross combinations over standard check during *kharif* 2023 season. The crosses Korchi x EC-3293384 (-14.81%) over better parent and Korchi x AKO-74 (-15.00%) over standard hybrid check in *kharif* 2023 season. Where as in *kharif* 2024 season 23 crosses over better parent, 20 crosses over standard check. While Korchi x EC-3293384 (-9.91%) cross combination over better parent and Korchi x AKO-74 (-14.00%) over standard hybrid check in *kharif* 2024 season. Among 36 crosses, 25 cross combinations over better parent, 20 cross combinations over standard hybrid check displayed significant negative heterosis during pooled. The crosses Korchi x EC-3293384 (-12.44%) over better parent and Korchi x AKO-74 (-14.50%) over standard hybrid check in pooled had negative heterosis for days to 50 % flowering. These results are in accordance with Thirupathi *et al.* (2012), Kerure *et al.* (2019), Shwetha *et al.* (2021).

Days required for first harvesting is most important earliness indicating character in okra. Out of 36 crosses, 26 cross combinations over better parent, 15 cross combinations over standard check during *kharif* 2023 season. The cross AKO-1-P-2 x AKO-74 (-18.75%) over better parent and Korchi x AKO-74 (-9.90%) over standard hybrid check in *kharif* 2023 season. Where as in *kharif* 2024 season 19 crosses over better parent, 14 crosses over standard check hybrid. While AKO-1-P-2 x AKO-73 (-18.19%) cross combination over better parent. The cross combination Korchi x AKO-74 (-10.00%) over standard hybrid check in *kharif* 2024 season. Among 36 crosses, 21 cross combinations over better parent, 13 cross combinations over standard hybrid check displayed significant negative heterosis during pooled. The crosses AKO-1-P-2 x AKO-74 (-18.02%) over better

parent and Korchi x AKO-74 (-9.95%) over standard to first harvest. These results are in consonance with hybrid check in pooled had negative heterosis for days Kumar *et al.* (2023).

Table 1: Heterosis (%) over better parent, and the commercial check for plant height and number of branches per plant in okra

Sr. No.	Crosses	Plant Height						Internodal Length					
		2023		2024		Pooled		2023		2024		Pooled	
		BP	SH	BP	SH	BP	SH	BP	SH	BP	SH	BP	SH
1	Korchi x Phule Vimukta	-37.24**	15.61**	-36.87**	11.38**	-37.05**	13.42**	7.83	82.35*	9.54	69.40*	8.68*	75.64**
2	Korchi x Arka Anamika	-28.00**	32.63*	-25.81**	30.89**	-26.89**	31.73**	3.48	75.00**	23.67**	91.26**	13.50**	83.43**
3	Korchi x Ako-Red	-30.48**	28.07**	-35.12**	14.47**	-32.83**	21.01**	-1.04	67.35*	-15.33*	38.80*	-5.61	52.55*
4	Korchi x Ako-11	-44.00**	3.16	-40.09**	5.69	-42.01**	4.47	-16.52**	41.18*	-17.67**	27.32**	-17.09*	33.99*
5	Korchi x Ako-1	-38.10**	14.04**	-36.96**	11.22**	-37.52**	12.57*	-2.76	107.35**	-3.82	92.62**	-3.29	99.72**
6	Korchi x Ako-2	-22.81**	42.19**	-32.53**	19.02**	-27.75**	30.17**	-6.09	58.82*	-4.59**	47.54**	-5.35	52.97**
7	Korchi x Ako-7	-28.86**	31.05**	-27.19**	28.46*	-28.01**	29.70**	-19.13**	36.76**	-6.36**	44.81**	-12.80*	40.93**
8	Korchi x Ako-10	-10.95**	64.04**	-10.41**	58.05**	-10.68**	60.93**	19.30	101.76*	28.62**	98.91**	23.93*	100.28**
9	Korchi x Ako-73	-30.67**	27.72*	-36.41**	12.20**	-33.58**	19.66**	-12.31*	52.94**	-6.67	53.01**	-9.47*	52.97**
10	Korchi x Ako-74	-6.57	72.11*	-11.34**	56.42**	-8.99	63.97**	-29.22*	19.71	35.16**	109.02**	2.72	66.01**
11	Korchi x IC-42472	-37.48**	15.18**	-32.26**	19.51**	-34.82**	17.43**	12.10**	93.53**	0.00	63.93**	5.98**	78.19**
12	Korchi x EC- 3293384	-33.33**	22.81**	-33.00**	18.21**	-33.16**	20.42**	-2.26*	65.29**	-7.24**	43.44**	-4.73**	53.97**
13	AKO-1-P-2 x Phule Vimukta	-48.85**	1.75**	-4.74**	79.67**	-26.55**	42.19**	31.50**	132.06**	26.25**	118.58**	28.77*	125.07**
14	AKO-1-P-2 x Arka Anamika	-22.84**	53.51**	-21.38**	48.29**	-22.10**	50.80**	40.67**	148.24**	36.66*	136.61**	38.57**	142.21**
15	AKO-1-P-2 x Ako Red	-20.41**	58.33**	-20.86**	49.27**	-20.64**	53.63**	25.00**	120.59**	36.66*	136.61**	30.96*	128.90**
16	AKO-1-P-2 x Ako-11	-36.51**	26.32**	-34.40**	23.74*	-35.44**	24.98**	12.00**	97.65**	23.88**	114.48**	18.07*	106.37**
17	AKO-1-P-2 x Ako-1	-34.30**	30.70**	-31.72**	28.78**	-33.00**	29.70**	-17.24*	76.47**	-4.50	91.26**	-10.84**	84.14**
18	AKO-1-P-2 x Ako-2	-43.21**	12.98**	-46.72**	0.49	-44.99**	6.50**	-6.33**	65.29**	-13.99	48.91**	-10.29**	56.80**
19	AKO-1-P-2 x Ako-7	-39.51**	20.35**	-32.50**	27.32**	-35.96**	23.97**	-10.50**	57.94**	-5.31	63.93**	-7.86	61.05**
20	AKO-1-P-2 x Ako-10	-43.92**	11.58**	-40.95**	11.38**	-42.41**	11.48**	15.00**	102.94**	10.47	91.26**	12.64**	96.88**
21	AKO-1-P-2 x Ako-73	-49.91**	-0.35	-44.22**	5.20	-47.04**	2.53	20.83**	113.24**	15.68	100.27*	18.15*	106.52**
22	AKO-1-P-2 x Ako-74	-20.63**	57.89**	-20.69**	49.59**	-20.66**	53.59**	7.33**	89.41**	-5.31	63.93**	0.81	76.20**
23	AKO-1-P-2 x IC-42472	-45.77**	7.89**	-42.84**	7.80**	-44.29**	7.85**	0.00	76.47**	-1.68	70.22**	-0.89	73.23**
24	AKO-1-P-2 x EC-3293384	-46.74**	5.96**	-49.57**	-4.88**	-48.17**	0.34	-15.00**	50.00**	-10.05	55.74**	-12.48**	52.97**
25	Kokan Bhendi x P. Vimukta	-47.37**	-21.05**	-46.90**	-24.88**	-47.13**	-23.04**	-22.53**	38.53**	-0.07	36.61**	-12.36**	37.54**
26	Kokan Bhendi x A. Anamika	-35.29**	-3.51**	-37.72**	-15.45**	-36.50**	-9.70**	-15.63**	50.88**	6.33**	45.36**	-5.69**	48.02**
27	Kokan Bhendi x Ako-Red.	-4.65**	42.19**	-4.19**	30.08**	-4.42**	35.91**	-6.58**	67.06**	0.00	63.93**	4.29**	65.44**
28	Kokan Bhendi x Ako-11	-1.82*	46.40**	2.99*	39.84**	0.56	43.00**	-1.32	76.47**	39.91**	91.26**	17.33**	84.14**
29	Kokan Bhendi x Ako-1	-17.65**	22.81**	-17.37*	12.20	-17.51**	17.30*	-18.76*	73.24**	-18.14*	63.93**	-18.45*	68.41**
30	Kokan Bhendi x Ako-2	-25.88**	10.53**	-32.34**	-8.13**	-29.08**	0.84	-19.41**	44.12**	-8.02	40.98**	-10.26	42.49**
31	Kokan Bhendi x Ako-7	-42.71**	-14.56**	-37.72**	-15.45**	-40.24**	-15.02**	-22.70**	38.24**	0.13	36.89**	-12.36**	37.54**
32	Kokan Bhendi x Ako-10	-26.47**	9.65**	-24.19**	2.93*	-25.34**	6.16**	-45.23**	-2.06*	-41.17*	-9.02**	-39.89**	-5.67**
33	Kokan Bhendi x Ako-73	-29.41**	5.26**	-29.22**	-3.90**	-29.32**	0.51	-22.86**	37.94**	-11.17*	45.63**	-16.01*	41.93**
34	Kokan Bhendi x Ako-74	27.88**	90.70**	24.55**	69.11**	26.23**	79.49**	-1.32	76.47**	30.91**	78.96**	13.27**	77.76
35	Kokan Bhendi x IC-42472	-17.65**	22.81**	-17.13**	12.52**	-17.39**	17.47**	-4.61**	70.59**	14.33**	87.43**	6.66**	79.32**
36	Kokan Bhendi x EC-3293384	-8.82**	35.96**	0.00	35.77**	-4.45**	35.86**	-10.53**	60.00**	19.92**	63.93**	3.25*	62.04**
SE±		4.62	4.62	4.96	4.96	4.53	4.53	0.17	0.17	0.19	0.19	0.17	0.17
C. D. 5%		9.24	9.24	9.92	9.92	9.06	9.06	0.35	0.35	0.38	0.38	0.35	0.35

BP-Better parent, SH-Standard heterosis

Table 2: Heterosis (%) over better parent, and the commercial check for number of branches/plant and Number of nodes/plant in okra

Sr. No.	Crosses	Number of Branches per Plant						Number of Nodes per Plant					
		2023		2024		Pooled		2023		2024		Pooled	
		BP	SH	BP	SH	BP	SH	BP	SH	BP	SH	BP	SH
1	Korchi x Phule Vimukta	-33.33**	-20.00**	-37.43*	-23.08	-35.48**	-21.57*	6.74**	17.42**	-2.76*	-0.56	1.85*	7.83**
2	Korchi x Arka Anamika	-66.67**	-60.00**	-68.72**	-61.54**	-67.74**	-60.78**	-11.14*	-2.26	-13.54**	-11.58**	-12.38**	-7.23*
3	Korchi x Ako-Red	-12.50	12.00	-11.76	15.38**	-12.12	13.73	14.66	26.13**	8.56	11.02	11.52	18.07**
4	Korchi x Ako-11	-77.61**	-40.00**	-73.53**	-30.77**	-75.56**	-35.29**	-24.93*	-17.42*	0.28	2.54*	-11.95*	-6.78
5	Korchi x Ako-1	-33.33**	-20.00*	-18.67	0.00	-25.81*	-9.80*	-8.21	0.97	-9.23**	-7.18**	-8.73*	-3.37
6	Korchi x Ako-2	-17.65*	12.00	-11.76**	15.38	-14.71*	13.73	-0.29	9.68	2.38	4.69	1.08	7.02
7	Korchi x Ako-7	20.00	44.00*	-5.26	38.46**	5.88	41.18*	24.05**	36.45**	17.68*	20.34*	20.77**	27.86**
8	Korchi x Ako-10	26.67	52.00*	18.87	46.15**	22.58*	49.02*	-13.49	-4.84	-5.52	-3.39	-9.39	-4.07
9	Korchi x Ako-73	-33.33**	-20.00**	-37.43*	-23.08**	-35.48**	-21.57**	-12.02*	-3.23	-0.55	1.69	-6.12	-0.60
10	Korchi x Ako-74	0.00	20.00	-6.15	15.38**	-3.23	17.65*	12.90**	24.19**	6.08**	8.47**	9.39**	15.81**
11	Korchi x IC-42472	63.33**	96.00**	62.67*	100.00**	62.90**	98.04**	7.92**	18.71**	8.01**	10.45**	7.97**	14.31**
12	Korchi x EC- 3293384	-40.47*	12.00**	-28.05**	38.46**	-34.02*	25.49**	8.50**	19.35**	5.52**	7.91**	6.97**	13.25**
13	AKO-1-P-2 x Phule Vimukta	-47.46*	24.00**	-46.67**	23.08**	-47.06**	23.53**	-1.70	11.61**	0.55	3.39	-0.56	7.23*
14	AKO-1-P-2 x Arka Anamika	-59.32*	-4.00**	-56.67**	0.00	-57.98**	-1.96*	-13.92	-2.26	-24.73**	-22.60**	-19.41*	-13.10*
15	AKO-1-P-2 x Ako Red	-55.93*	4.00**	-50.00**	15.38**	-52.94**	9.80**	-23.01*	-12.58*	-26.92*	-24.86*	-25.00**	-19.13*
16	AKO-1-P-2 x Ako-11	-35.82*	72.00**	-32.35*	76.92**	-34.07*	74.51**	-4.83	8.06**	0.00	2.82	-2.37	5.27
17	AKO-1-P-2 x Ako-1	-45.76*	28.00**	-43.33**	30.77**	-44.54**	29.41**	1.14	14.84**	-0.14	2.68	0.49	8.36**
18	AKO-1-P-2 x Ako-2	-10.17	112.00**	-10.00**	107.69**	-10.08*	109.80**	44.32*	63.87**	43.13**	47.18**	43.72**	54.97**
19	AKO-1-P-2 x Ako-7	-35.59*	52.00**	-36.67**	46.15**	-36.13**	49.02**	61.36**	83.23**	54.40**	58.76**	57.82**	70.18**
20	AKO-1-P-2 x Ako-10	-32.20*	60.00**	-46.67**	23.08**	-39.50**	41.18**	-16.19	-4.84	4.40	7.34	-5.73	1.66
21	AKO-1-P-2 x Ako-73	-66.10**	-20.00**	-63.33**	-15.38**	-64.71**	-17.65**	-33.81*	-24.84*	-26.92*	-24.86*	-30.31**	-24.85**
22	AKO-1-P-2 x Ako-74	-22.03*	84.00**	-23.33**	76.92**	-22.69*	80.39**	33.52*	51.61**	34.62**	38.42**	34.08**	44.58**
23	AKO-1-P-2 x IC-42472	-67.80**	-24.00**	-66.67**	-23.08**	-67.23**	-23.53**	-16.19	-4.84	-25.82**	-23.73**	-21.09**	-14.91*
24	AKO-1-P-2 x EC-3293384	-49.15*	20.00**	-50.00**	15.38**	-49.58**	17.65**	-24.72*	-14.52	-29.67**	-27.68**	-27.23**	-21.54*
25	Kokan Bhendi x P. Vimukta	-50.00*	-4.00**	-44.04**	7.69**	-46.94**	1.96	-33.23*	-28.06*	-23.78**	-27.12**	-28.48*	-27.56*
26	Kokan Bhendi x A. Anamika	-58.33*	-20.00**	-60.03**	-23.08**	-59.18**	-21.57**	-14.67**	-8.06**	-11.96**	-15.82**	-13.31**	-12.20**
27	Kokan Bhendi x Ako-Red.	-47.92*	0.00	-44.04**	7.69**	-45.92**	3.92**	-8.38*	-1.29	-3.69**	-7.91**	-6.02*	-4.82*
28	Kokan Bhendi x Ako-11	-62.69**	0.00	-64.71**	-7.69**	-63.70**	-3.92**	-19.16*	-12.90	-7.24**	-11.30**	-13.16*	-12.05**
29	Kokan Bhendi x Ako-1	-33.33*	28.00**	-36.04**	23.08**	-34.69*	25.49**	-8.68	-1.61	-6.27	-4.52	-4.39	-3.16
30	Kokan Bhendi x Ako-2	-58.33*	-20.00**	-52.03**	-7.69**	-55.10**	-13.73**	-31.14**	-25.81**	-7.24	-11.30	-19.11*	-18.07*
31	Kokan Bhendi x Ako-7	-47.92*	0.00	-56.03**	-15.38**	-52.04**	-7.84**	-15.27*	-8.71	-27.33**	-30.51**	-21.34**	-20.33**
32	Kokan Bhendi x Ako-10	-41.67*	12.00**	-40.04**	15.38**	-40.82*	13.73**	6.29**	14.52**	9.60**	4.80	7.96*	9.34**
33	Kokan Bhendi x Ako-73	-39.58*	16.00**	-40.04**	15.38**	-39.80*	15.69**	-21.86*	-15.81	-11.37**	-15.25**	-16.58*	-15.51*
34	Kokan Bhendi x Ako-74	-29.17*	36.00**	-32.05**	30.77**	-30.61*	33.33**	21.56*	30.97**	20.53**	15.25**	21.04**	22.59**
35	Kokan Bhendi x IC-42472	-12.50	68.00**	-32.05**	30.77**	-22.45*	49.02**	-45.21**	-40.97**	-23.19**	-26.55**	-34.13**	-33.28**
36	Kokan Bhendi x EC-3293384	-8.33	76.00**	-12.06**	69.23**	-10.20	72.55**	20.96**	30.32**	31.76**	25.99**	26.39**	28.01**
SE±		0.16	0.16	0.15	0.15	0.16	0.16	4.01	4.01	1.23	1.23	1.26	1.26
C. D. 5%		0.33	0.33	0.31	0.31	0.32	0.32	8.03	8.03	2.47	2.47	2.52	2.52

BP-Better parent, SH-Standard heterosis

Table 3: Heterosis (%) over better parent, and the commercial check for node at which first flower appeared and days to initiation of first flower in okra.

Sr. No.	Crosses	Node at which first flower appeared						Days to Initiation of first flower					
		2023		2024		Pooled		2023		2024		Pooled	
		BP	SH	BP	SH	BP	SH	BP	SH	BP	SH	BP	SH
1	Korchi x Phule Vimukta	-18.92	-14.00	-8.40**	-12.00**	-13.86*	-13.00*	-3.38**	-8.51**	0.00	-6.52**	-1.71*	-7.53**
2	Korchi x Arka Anamika	-0.07	-8.00**	-4.42**	-12.00**	1.12	-10.00**	-3.38	-8.51**	-2.30	-7.61	-2.29	-8.06**
3	Korchi x Ako-Red	-35.71*	-28.00*	-37.93**	-28.00**	-36.84**	-28.00**	-8.43**	-7.45**	-3.23*	-2.17*	-5.85**	-4.84**
4	Korchi x Ako-11	-13.15	-8.00	-26.67*	-12.00**	-20.35**	-10.00	-13.60**	-5.32**	-1.00	7.61**	-7.39**	1.08
5	Korchi x Ako-1	-23.21**	-14.00*	-28.57*	-20.00**	-25.89**	-17.00*	-5.38	-6.38	0.01	-3.26	-2.75	-4.84
6	Korchi x Ako-2	0.07	0.00	-3.94	-4.00	-2.00	-2.00	-7.69	2.13	0.00	8.70**	-3.92	5.38
7	Korchi x Ako-7	-5.36	6.00**	3.57	16.00*	-0.89	11.00**	-13.89**	-1.06	-5.10**	1.09	-9.71**	0.00
8	Korchi x Ako-10	-13.11	-20.00**	-4.69	-20.00**	-6.98	-20.00**	0.00	-2.13*	0.00	-6.52**	0.56	-4.30
9	Korchi x Ako-73	-13.11*	-20.00**	0.00	-20.00**	-6.98**	-20.00**	-6.59	-9.57*	-2.33	-8.70	-3.43	-9.14*
10	Korchi x Ako-74	-13.11	-20.00**	0.00	-20.00**	-6.98	-20.00*	-4.50**	-9.57**	-2.33*	-8.70**	-3.43**	-9.14**
11	Korchi x IC-42472	36.86**	26.00**	33.33*	28.00**	39.56*	27.00**	-2.15*	-3.19*	-0.01	-5.43**	-1.11	-4.30**
12	Korchi x EC- 3293384	8.62**	0.00	19.05	0.00	16.28**	0.00	-15.09**	-4.26**	-10.10**	-3.26*	-12.68**	-3.76**
13	AKO-1-P-2 x Phule Vimukta	5.59	12.00**	3.91**	8.00**	5.77**	10.00**	-3.85**	6.38**	-5.95**	3.26*	-4.88**	4.84**
14	AKO-1-P-2 x Arka Anamika	30.85**	36.00**	30.85**	36.00**	30.77**	36.00**	3.85**	14.89**	-4.96**	4.35**	-0.49	9.68**
15	AKO-1-P-2 x Ako Red	0.00	12.00**	3.45**	20.00**	1.75*	16.00**	-8.65**	1.06	-13.87*	-5.43	-11.22*	-2.15
16	AKO-1-P-2 x Ako-11	13.28	20.00**	16.67	40.00**	15.04	30.00**	-9.62**	0.00	-6.94**	2.17*	-8.29**	1.08
17	AKO-1-P-2 x Ako-1	-17.86*	-8.00**	-10.71**	0.00	-14.29**	-4.00**	-9.62**	0.00	-4.96**	4.35**	-7.32**	2.15*
18	AKO-1-P-2 x Ako-2	1.99*	6.00**	15.46**	20.00**	8.65**	13.00**	0.96	11.70	3.95**	14.13**	2.44	12.90*
19	AKO-1-P-2 x Ako-7	10.71	24.00**	10.71	24.00**	10.71	24.00**	-10.19**	3.19	-5.95**	3.26*	-6.80**	3.23
20	AKO-1-P-2 x Ako-10	-3.78**	0.00	7.76**	12.00**	1.92*	6.00**	-11.54**	-2.13*	-13.87**	-5.43**	-12.68**	-3.76**
21	AKO-1-P-2 x Ako-73	-17.25**	-14.00**	-11.48**	-8.00**	-14.42**	-11.00**	-15.38**	-6.38**	-16.84**	-8.70**	-16.10**	-7.53**
22	AKO-1-P-2 x Ako-74	-23.03**	-20.00**	-23.03**	-20.00**	-23.08**	-20.00**	-16.35*	-7.45	-14.86*	-6.52**	-15.61*	-6.99**
23	AKO-1-P-2 x IC-42472	-3.78**	0.00	15.46**	20.00**	5.77**	10.00**	-7.69**	2.13*	-10.90**	-2.17*	-9.27**	0.00
24	AKO-1-P-2 x EC-3293384	-3.78**	0.00	-3.78**	0.00	-3.85**	0.00	-5.66**	6.38**	-6.94**	2.17*	-5.37**	4.30**
25	Kokan Bhendi x P. Vimukta	-37.77*	-34.00**	-16.72**	-20.00**	-27.72*	-27.00**	-6.38**	-6.38**	0.00	-4.35**	-3.30**	-5.38**
26	Kokan Bhendi x A. Anamika	16.28*	0.00	8.62**	0.00	12.36**	0.00	-2.13*	-2.13*	-2.27*	-6.52**	-2.20*	-4.30**
27	Kokan Bhendi x Ako-Red.	-17.86**	-8.00**	-31.03**	-20.00**	-24.56**	-14.00**	-5.27	-4.26	-5.38	-4.35	-5.32	-4.30
28	Kokan Bhendi x Ako-11	-5.60	0.00	0.00	20.00**	-2.65	10.00**	-9.71**	-1.06	-11.00**	-3.26*	-10.34**	-2.15*
29	Kokan Bhendi x Ako-1	-10.71*	0.00	-21.43*	-12.00**	-16.07*	-6.00**	-5.32**	-5.32**	0.01	-3.26	-2.20	-4.30
30	Kokan Bhendi x Ako-2	0.07	0.00	0.07	0.00	0.00	0.00	-9.62	0.00	-8.00	0.00	-8.82	0.00
31	Kokan Bhendi x Ako-7	-23.21*	-14.00**	-17.86	-8.00**	-20.54**	-11.00**	-9.26**	4.26**	-2.04	4.35	-5.83**	4.30
32	Kokan Bhendi x Ako-10	16.28**	0.00	13.64**	0.00	14.94**	0.00	-4.26**	-4.26**	-2.27*	-6.52**	-3.30**	-5.38**
33	Kokan Bhendi x Ako-73	6.98**	-8.00**	-9.09**	-20.00**	-1.15	-14.00**	2.13*	2.13*	4.55**	0.00	3.30*	1.08
34	Kokan Bhendi x Ako-74	6.98**	-8.00**	13.64**	0.00	10.34**	-4.00**	-4.26	-4.26	-2.27	-6.52	-3.30	-5.38
35	Kokan Bhendi x IC-42472	34.88*	16.00**	20.83**	16.00**	27.47*	16.00**	-2.13	-2.13	2.27*	-2.17*	0.00	-2.15
36	Kokan Bhendi x EC-3293384	25.58**	8.00**	22.73**	8.00**	24.14**	8.00**	-13.21**	-2.13*	-8.08**	-1.09	-10.73**	-1.61**
SE±		0.12	0.12	0.15	0.15	0.13	0.13	0.44	0.44	0.41	0.41	0.39	0.39
C. D. 5%		0.25	0.25	0.30	0.30	0.26	0.26	0.88	0.88	0.83	0.83	0.79	0.79

BP-Better parent, SH-Standard heterosis

Table 4: Heterosis (%) over better parent, and the commercial check for days to 50% flowering and days to first harvest in okra

Sr. No.	Crosses	Days to 50 % Flowering						Days to First harvest					
		2023		2024		Pooled		2023		2024		Pooled	
		BP	SH	BP	SH	BP	SH	BP	SH	BP	SH	BP	SH
1	Korchi x Phule Vimukta	0.00	-8.00**	2.21*	-8.00**	1.10	-8.00**	-10.69**	-8.91**	-6.12	-8.00	-8.46	-8.46
2	Korchi x Arka Anamika	-3.26	-11.00*	-0.01	-10.00**	-1.65	-10.50	-9.71**	-7.92**	-6.12	-8.00**	-7.96**	-7.96**
3	Korchi x Ako-Red	-6.00	-6.00**	-2.02*	-3.00**	-4.02**	-4.50**	-8.57**	-4.95**	0.00	-1.00	-4.41	-2.99
4	Korchi x Ako-11	-14.29**	-10.00**	-4.81**	-1.00	-9.57**	-5.50**	-14.16**	-3.96**	-1.82*	8.00**	-8.07**	1.99*
5	Korchi x Ako-1	-7.14	-9.00	-3.19	-9.00	-5.21	-9.00	-2.92	-0.99	3.06	1.00	0.00	0.00
6	Korchi x Ako-2	-8.33	-1.00	-10.48	-6.00	-9.39	-3.50	-12.28**	-0.99	-14.41*	-5.00	-13.33*	-2.99
7	Korchi x Ako-7	-12.39*	-1.00	-2.94*	-1.00	-7.91*	-1.00	-13.79**	-0.99	-8.26**	0.00	-11.11**	-0.50
8	Korchi x Ako-10	-4.08**	-6.00**	-2.23*	-12.00**	-2.67*	-9.00**	-2.92*	-0.99	-3.06*	-5.00**	-2.99*	-2.99*
9	Korchi x Ako-73	-10.42*	-14.00*	-1.12	-11.00*	-5.91	-12.50*	-9.71*	-7.92	-6.12	-8.00**	-7.96**	-7.96**
10	Korchi x Ako-74	-10.53**	-15.00**	-5.49**	-14.00**	-8.06**	-14.50**	-11.66**	-9.90**	-8.16**	-10.00**	-9.95**	-9.95**
11	Korchi x IC-42472	-7.00**	-7.00**	-7.37**	-12.00**	-7.18**	-9.50**	-3.89**	-1.98**	-1.02	-3.00**	-2.49*	-2.49*
12	Korchi x EC- 3293384	-14.81**	-8.00**	-9.91**	-9.00**	-12.44**	-8.50**	-12.39**	-1.98**	-5.66**	0.00	-9.13**	-1.00
13	AKO-1-P-2 x Phule Vimukta	-4.68**	2.00	-6.80**	-4.00**	-5.71**	-1.00	-3.57**	6.93**	-6.37**	3.00*	-4.95**	4.98**
14	AKO-1-P-2 x Arka Anamika	2.80*	10.00**	-2.92*	0.00	0.00	5.00**	1.79*	12.87**	-7.28**	2.00*	-2.70*	7.46**
15	AKO-1-P-2 x Ako Red	-6.55	0.00	-5.83**	-3.00*	-6.19*	-1.50	-5.36	4.95	-10.91*	-2.00	-8.11**	1.49
16	AKO-1-P-2 x Ako-11	-6.55**	0.00	-3.85**	0.00	-4.76**	0.00	-10.62**	0.00	-8.19	1.00	-9.42	0.50
17	AKO-1-P-2 x Ako-1	-10.29**	-4.00**	-3.89**	-1.00	-7.14**	-2.50*	-8.93**	0.99	-5.46	4.00	-7.21	2.49
18	AKO-1-P-2 x Ako-2	-0.92	7.00**	1.90	7.00**	0.47	7.00**	-3.51	8.91	-0.90	10.00	-2.22	9.45
19	AKO-1-P-2 x Ako-7	-10.62**	1.00	-1.95	1.00	-6.05*	1.00	-6.03**	7.92**	-2.73	7.00	-4.00	7.46**
20	AKO-1-P-2 x Ako-10	-11.22**	-5.00**	-11.66	-9.00	-11.43**	-7.00	-13.39**	-3.96**	-16.37**	-8.00**	-14.86**	-5.97**
21	AKO-1-P-2 x Ako-73	-10.29**	-4.00**	-9.71**	-7.00**	-10.00**	-5.50**	-16.07**	-6.93**	-18.19**	-10.00**	-17.12**	-8.46**
22	AKO-1-P-2 x Ako-74	-10.29*	-4.00	-3.89	-1.00	-7.14*	-2.50	-18.75**	-9.90*	-17.28*	-9.00**	-18.02**	-9.45*
23	AKO-1-P-2 x IC-42472	-2.81*	4.00**	-2.92	0.00	-2.86	2.00	-7.14**	2.97*	-9.10**	0.00	-8.11**	1.49
24	AKO-1-P-2 x EC-3293384	-3.70**	4.00**	-2.92	0.00	-2.86	2.00	-3.54**	7.92**	-4.55**	5.00**	-3.60**	6.47**
25	Kokan Bhendi x P. Vimukta	-6.94**	-6.00**	-3.09*	-6.00**	-5.05**	-6.00**	-1.00	-0.99	2.04*	0.00	0.50	-0.50
26	Kokan Bhendi x A. Anamika	-2.98*	-2.00*	-4.12**	-7.00**	-3.54**	-4.50**	-2.98*	-2.97*	-6.12**	-8.00**	-4.52**	-5.47**
27	Kokan Bhendi x Ako-Red.	-3.97	-3.00	-4.04	-5.00	-3.52	-4.00**	-6.67**	-2.97*	-3.03	-4.00**	-4.90	-3.48**
28	Kokan Bhendi x Ako-11	-6.67**	-2.00*	-9.62**	-6.00**	-8.13**	-4.00	-14.16**	-3.96**	-14.55**	-6.00**	-14.35**	-4.98**
29	Kokan Bhendi x Ako-1	-7.93**	-7.00**	-2.06*	-5.00**	-5.05**	-6.00**	-5.95**	-5.94**	-5.10**	-7.00**	-5.53**	-6.47**
30	Kokan Bhendi x Ako-2	-7.40	0.00	-4.76	0.00	-6.10	0.00	-12.28**	-0.99	-11.71**	-2.00*	-12.00*	-1.49
31	Kokan Bhendi x Ako-7	-9.73	2.00	-1.96*	0.00	-6.05*	1.00	-6.90	6.93	-0.92	8.00**	-4.00	7.46
32	Kokan Bhendi x Ako-10	-7.93**	-7.00**	-8.25**	-11.00**	-8.08**	-9.00**	-1.00	-0.99	2.04*	0.00	0.50	-0.50
33	Kokan Bhendi x Ako-73	-4.96**	-4.00**	-5.15**	-8.00**	-5.05**	-6.00**	6.92**	6.93**	2.04*	0.00	4.52**	3.48**
34	Kokan Bhendi x Ako-74	-5.95	-5.00	-6.19**	-9.00**	-6.06*	-7.00**	-4.96	-4.95	-6.12	-8.00**	-5.53	-6.47
35	Kokan Bhendi x IC-42472	-7.93**	-7.00**	-6.19**	-9.00**	-7.07**	-8.00**	-1.00	-0.99	1.02	-1.00	0.00	-1.00
36	Kokan Bhendi x EC-3293384	-12.96**	-6.00**	-6.94**	-6.00**	-10.05**	-6.00**	-11.50**	-0.99	-6.60**	-1.00	-9.13**	-1.00
SE±		0.45	0.45	0.39	0.39	0.39	0.39	0.47	0.47	0.45	0.45	0.44	0.44
C. D. 5%		0.90	0.90	0.79	0.79	0.79	0.79	0.95	0.95	0.91	0.91	0.88	0.88

BP-Better parent, SH-Standard heterosis

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