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Evaluation for Heterosis in Okra (*Abelmoschus esculentus* (L.) Moench)

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ABSTRACT

The present study was undertaken to identify potential parents and superior cross combinations for yield and other yield contributing characters for improvement in okra. Eleven bhendi genotypes were crossed in line x tester fashion (include direct crosses) in two replications in randomised block design for eleven characters. The results revealed that the highest and significant average heterosis was recorded by 38HU X 11-6 (55.07%) with heterobeltiosis (53.07%) and standard heterosis (36.42%) followed by 38HU X 11-14 (44.98%) with heterobeltiosis (36.65%) and standard heterosis (37.6%) and 38HU X 14-11-5 (32.77%) with heterobeltiosis (19.61%) and standard heterosis (32.97%) for yield and yield contributing traits. High estimates of heterosis obtain in hybrid combinations revealed considerable genetic divergence among parental lines.

Key words: *Line X Tester, F_1 hybrid, Averageheterosis, Heterobeltiosis, Standard heterosis.*

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) is a powerhouse of variable nutrients. It is commonly known as bhindi or lady's finger, belongs to the class dicotyledonae, order Malvales and family Malvaceae. It is propagated by seeds. Okra flowers are classified as an often cross-pollinated crop with somatic chromosome number 2n=130. India is the largest producer of okra. Okra is a surprising versatile vegetable. It also holds a high place in the nutritional charts for its fibrous content and other medicinal benefits. Its 100 g edible part contains 89.6 g moisture, 1.9 g protein, 0.2 g fibre, 6.4 g other carbohydrates, 66 mg calcium, 53 mg magnesium, 56 gm phosphorus, 0.35 mg iron, 6.98 mg sodium, 103 mg potassium, 0.19 mg copper, 30 mg sulphur, 88 IU vitamin A, 0.07 mg thiamine, 0.1 mg riboflavin, 0.6 mg nicotine acid, 13 mg vitamin C and 0.7 g mineral[1].

The yield potential of bhendi is low, so the productivity of this crop should be increased by improving the genetic architecture through hybridization and recombination. In spite of its importance, no major break-through has been made in this crop and the farmers are still growing their own local varieties or open pollinated varieties.

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Hence, an attempt has been made to study the 'Line X Tester' analysis[4] to know the standard heterosis for interested traits in okra[9]. Indeed knowledge of heterosis of yield and its component characters should be placed greater emphasis for the improvement of this crop.

MATERIAL AND METHODS

The experimental material consisted of eleven bhendi genotypes among which four lines viz., MTPH, 11-1, NO-3, 38HU and seven testers viz., 14-11-5, 11-14, PF, 11-6, BH-55, 93M and AKOV-107 were selected for Line X Tester' analysis[4] to generate 28 F_1 hybrids which were evaluated in randomized block design with two replications at the experimental farm of Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during summer 2015-2016 (Crossing programme) and Kharif 2016-2017 (Evaluation). The Exp Hy-1 was used as standard check. The seeds obtained from the crossing block were sown to raise the hybrids. Cultural and agronomic practices were followed as per the standard recommendation and need based plant protection measures were taken to maintain healthy crop stand. The observations on five randomly selected plants in each genotype were recorded for eleven characters included days to initial flowering, days to first harvest, plant height, internodal length, number of branches per plant, number of internodes per plant, number of fruits per plant, fruit length, diameter of fruit, weight of fruit and yield per plant.

RESULT AND DISCUSSION

In present investigation 24 F1 hybrids were evaluated using Line x Tester analysis with one commercial check hybrid (Exp Hy-1, mahyco). Significant variation has been observed among treatments. The interaction like parents vs. hybrids showed significant differences for most of the characters except for indicated that the selected material was appropriate for the study of manifestation of heterosis and gene effects involved in inheritance of different traits. Higher values are desirable for all the traits under study except for days to initiation of flowering, days required to first harvesting, plant height and diameter of fruit for which lower values are preferred and presented in Table 1.

The hybrids are normally assessed in terms of per cent increase over mid parent, better parent and standard check. Fruit yield is a complex trait. It is the end product of several basic yield components. The standard heterosis is more useful from practical point of view. In present study, standard heterosis ranged from -30.97 to 37.6 percent. Among 24 hybrids, thirteen hybrids exhibited significant standard heterosis for yield trait. Maximum standard heterosis was recorded in 38HU X 11-14 (37.6%) followed by 38HU X 11-6 (36.42%) and 38HU X 14-11-5 (32.97). In addition, the cross 38HU X 11-14 showed standard heterosis in desirable direction for other traits like days to early flowering, days for first harvest, internodal length, number of internodes, fruit length, fruit weight, number of fruits. This cross can be directly used in breeding for high yield coupled with earliness in okra. Breeding for early okra varieties and hybrids assumes greater significance in view of crop grow under rainfed condition.

These findings are in agreement with those of Manivannan *et al*[6]., Hosamani *et al*[2]., Singh *et al*[8]., Solankey *et al*[9]., Nagesh *et al*[7]., Jethava[3] and Kumar[5].

Early flowering is an important trait. Out of 28 crosses, twenty exhibited significant standard heterosis for this trait. The cross MTPH X BH-55 (-11.24%) flowers early followed by MTPH X 93M (-8.99%) and MTPH X 11-6 (-6.74%).

Plant height is another important trait. Nine out of twenty eight crosses exhibited significant negative standard heterosis for this trait. Highest significant heterosis was recorded in 38HU X 93M (-21.34%) followed by 11-1 X PF (-5.68%) and 38HU X AKOV-107 (-3.53%) among crosses. The cross having more height was recorded in 11-1 X 14-11-5 (66.04%).

The crosses with shorter internodal length are MTPH X BH-55 (-67.07%)

followed by MTPH X 93M (-65.52%) and MTPH X 14-11-5 (-65.34%).

Number of branches is another important trait that determine yield of okra but in this investigation, it was not much contributed to the increasing yield parameter. The cross with more number of branches has been recorded in MTPH X 11-14 (43.75%) and MTPH X PF (30.00%) and least number of branches has been observed in MTPH X 11-14 (90.08%). More number of internodes was recorded in NO-3 X 14-11-5 (76.78%) followed by 11-1 X 93M (69.29 %) and 11-1 X AKOV-107 (63.67 %).

In okra, fruit length and weight of fruit are the important yield components. Such high heterotic response would be useful for obtaining higher pod yield. In case of fruit length, 7 hybrids showed significant positive standard heterosis. Increased fruit length in heterotic hybrids of okra has been observed in the present investigation, confirmed by Manivannan *et al*[6]., Hosamani *et al*[2]., Solankey *et al*[9]., Singh *et al*[8]., Nagesh *et al*[7]., and Kumar[5]. The crosses NO-3 X AKOV-107 (22.00 %) followed by NO-3 X 11-6 (18.13 %) and 11-1 X 93M (18.02 %) recorded long fruit length. Diameter of individual fruit was recorded and the cross 11-1 X 11-6 (22.75 %) showing lowest diameter of fruit. Fruit weight was recorded more in 38HU X 14-11-5 (29.78 %) followed by MTPH X 93M (28.93 %) and 38HU X 11-6 (28.06 %).

Number of fruits per plant is another important trait that determine yield of okra but in this investigation, it was not much contributed to the increasing yield parameter. The highest positive significant standard heterosis was recorded in 38HU X 11-14 (52.63 %) followed by NO-3 X 11-6 (47.36 %) and MTPH X 14-11-5 (42.1 %) with 17 crosses showing positive significant standard heterosis for number of fruits per plant trait.

Table 1: Estimation of standard heterosis (Exp Hy1) for different characters in okra

Sr.	Crosses	Days to initiation of flowering	Days to first harvesting	Plant height (cm)	Internodal length (cm)	Number of branches / plant	Number of internodes / plant	Fruit length (cm)	Diameter of fruit (cm)	Weight of fruit (g)	Number of fruits / plant	Yield / Plant (g)
		1	2	3	4	5	6	7	8	9	10	11
1	MTPH X 14-11-5	-6.74**	-7.48**	15.32**	-65.34**	-20	-36.33**	-8.12	5.66	-1.78	42.1**	13.58**
2	MTPH X 11-14	-4.49*	-5.61**	35.27**	-59.48**	43.75**	9.36	-3.71	10.06*	27.31**	10.52**	12.56**
3	MTPH X PF	-6.74**	-5.61**	23.56**	-61.21**	30.00**	-6.37	14.69*	7.23	16.67*	10.52**	-8.25**
4	MTPH X 11-6	-6.74**	-7.48**	42.34**	-62.07**	-15.00	22.85**	16.08*	17.30**	16.57	31.57**	19.56**
5	MTPH X BH-55	-11.24**	-8.41**	14.35**	-67.07**	-30.00**	-10.49	-1.45	22.64**	18.80*	-5.26*	-7.66**
6	MTPH X 93M	-8.99**	-7.48**	30.01**	-65.52**	-27.50**	26.97**	8.07	4.40	28.93**	10.52**	11.07**
7	MTPH X AKOV-107	-5.62**	-0.93	21.34**	-60.86**	-20	19.85*	4.46	5.35	2.34	42.1**	13.82**
8	11-1 X 14-11-5	-6.74**	-1.87	66.04**	-58.62**	-5	18.35*	2.1	12.89**	21.07*	36.84**	29.08**
9	11-1 X 11-14	-2.25	-1.87	12.89**	-18.19**	-7.5	33.71**	9.09	10.06*	23.13**	0	-9.18**
10	11-1 X PF	-2.25	-5.61**	-5.68**	-21.55**	-12.5	20.97**	-8.98	21.38**	18.08*	15.79**	7.47**
11	11-1 X 11-6	-2.25	-3.74*	18.02**	-21.90**	-41.25**	58.05**	3.07	28.93**	8.24	5.26**	-6.87**
12	11-1 X BH-55	-6.74**	-5.61**	18.02**	-21.55**	-12.5	69.29**	-4.46	3.14	24.02**	-10.52	7.04**
13	11-1 X 93M	-4.49*	-5.61**	32.50**	8.10*	6.25	63.67**	18.02**	4.09	19.52*	-10.52	-23.21
14	11-1 X AKOV-107	-3.37	-1.87	26.13**	-10**	7.5	55.81**	-8.45	7.55	21.21*	0	-30.97
15	NO-3 X 14-11-5	-5.62**	-3.74*	32.43**	-5.09	-22.50*	76.78**	-4.68	-5.66	16.73*	0	-10.79**
16	NO-3 X 11-14	-6.74**	-3.74*	21.34**	-23.28**	-18.75	49.81**	-1.88	-12.58**	16.3	-10.52	-19.27*
17	NO-3 X PF	-4.49*	-5.61**	12.27**	5.86	2.5	35.96**	4.84	6.29	13.29	10.52**	-2.26**
18	NO-3 X 11-6	-6.74**	-7.48**	19.20**	-6.72*	-16.25	47.19**	18.13**	-3.77	6.21	47.36**	18.79**
19	NO-3 X BH-55	-6.74**	-5.61**	19.89**	-12.07**	-45.00**	31.84**	14.63*	6.29	15.92	5.26**	-4.96**
20	NO-3 X 93M	-2.25	-3.74*	10.74**	-18.10**	-22.50*	42.32**	16.73*	-0.63	8.91	0	-17.11*
21	NO-3 X AKOV-107	-4.49*	-5.61**	11.02**	-7.59*	-22.50*	20.97**	22.00**	12.58**	19.80*	0	-7.18**
22	38HU X 14-11-5	-5.62**	-6.54**	40.40**	-2.5	-37.50**	47.94**	-16.14*	-0.63	29.78**	31.57**	32.97**
23	38HU X 11-14	-6.74**	-5.61**	21.14**	-10.95**	-46.25**	39.70**	0.16	-6.92	16.1	52.63**	37.6**
24	38HU X PF	-2.25	-1.87	17.88**	4.14	-37.50 **	57.30**	2.31	-5.03	18.55*	36.84**	26.34 **
25	38HU X 11-6	-4.49 *	-1.87	34.93**	13.19**	-37.50**	36.33**	-8.39	10.06*	28.06**	36.84**	36.42 **
26	38HU X BH-55	-2.25	-1.87	10.46**	-14.48**	-55.00**	54.68**	10.92	8.18	9.95	5.26**	-9.856**
27	38HU X 93M	-6.74 **	-7.48**	-21.34**	-21.72**	-41.25**	18.35 *	-15.17 *	-8.18	23.31**	-5.26*	-9.011**
28	38HU X AKOV-107	-2.25	-3.74*	-3.53*	-7.33*	-46.25**	14.98 *	-19.10 **	-4.4	13.96	-10.52	-15.74*
	Range	-11.24- 2.25	-8.41 – -0.93	-21.34- 66.04	-67.07- 13.19	-46.25- 43.75	-36.33- 76.78	19.10 - 22	-12.58 - 28.93	-1.78 – 29.78	-10.526 – 52.63	-30.97 – 37.6
	S.E.	0.89	0.73	1.09	0.18	0.39	0.96	0.57	0.06	1.29	1.52	29.96
	C.D. 5%	1.82	1.51	2.25	0.37	0.8	1.97	1.18	0.14	2.66	3.13	61.49
	C.D. 1%	2.46	2.04	3.04	0.51	1.08	2.66	1.6	0.14	3.59	4.23	83.03

Note: * Significant at 5% level of significance
**Significant at 1% level of significance

CONCLUSION

The Cross 38HU X 11-14 exhibited highest significant positive standard heterosis (37.60%) over the check Exp Hy1 for fruit yield followed by 38HU X 11-6 (36.42%) and 38HU X 14-11-5 (32.97%). These cross can be directly used in breeding for high yield coupled with earliness in okra. Breeding for early okra varieties and hybrids assumes greater significance in view of crop grow under rainfed condition. Hence these crosses should be further tested in preliminary or multilocation hybrid trails for further commercial exploitation.

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