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Heterosis studies by using L x T design for yield and yield contributing traits in okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract
To determine superior hybrids, the current investigation in okra intended to examine and estimate the heterosis for various yield and yield-contributing traits. The Lx T mating design was used to create 33 cross combinations from 11 female lines and 3 testers, and enough F_1 seeds were produced in summer 2021. The F_1's were planted to observe the performance of various crosses with three checks in *kharif* 2021. At the Breeder Seed Production Unit VNMKV Parbhani, the experiment was carried out. The best crosses for upcoming studies on the creation of hybrids have been found to be these crosses. Although the level of heterosis varied between the characters, each character displayed significant heterosis. EC-305653 x IC-45800, EC-5612 x Parbhani Kranti, EC-305741 x IC-45800, EC-305652 x Parbhani Kranti, and EC-305664 x IC-45800 were the top five crosses. Nine of the 33 crosses tested outperformed the others in terms of high heterotic and desirable specific combining ability effect, as well as high per se performance for fruit yield. These hybrid okra varieties could be produced by further heterosis breeding using these crosses.

Keywords: Heterosis, line x tester, fruit yield, better parent, mid parent, standard check, okra

Introduction
The vegetable crop known as okra, or *Abelmoschus esculentus* (L.) Moench., is grown extensively throughout tropical and subtropical regions of the world. The majority of cultivated varieties of okra have a 2n = 130 amphidiploid genome. Abelmoschus coccineus' (2n=38) range to *Abelmoschus manihot's* (2n=185–198) Guinean type range was reported (Jambhale and Nerkar, 1986) [7]. The okra's soft, green fruits are a great source of vitamins A, B, and C, as well as calcium, potassium, and other minerals. It contains 1.9 g of protein, 1.2 g of fibre, 1.5 mg of iron, and 88 IU of vitamin A per 100 g of the edible part. 72% of the world's total vegetable planting area, which includes 72% of the okra is in India.
Dysentery and inflammation are treated with okra leaves. Because of the high iodine content of okra fruits, they are thought to be beneficial for goitre. Leucorrhoea, general weakness, and renal colic are additional benefits. Mucilage is produced by soaking the stem and roots in water overnight, and it is used to clarify sugarcane juice when making jaggery or gur (Chauhan, 1972) [15].
Utilizing heterosis in okra has been acknowledged as a useful tool for breeders looking to increase yield and other crucial traits. The plant breeder gives a lot of thought to the parents they choose when creating promising varieties through hybridization. The superiority of a high-yielding genotype may or may not be transmitted to its progeny. Therefore, useful gene combinations in the form of high combining inbreds are what determine a breeding program's success.

Materials and Methods
The present investigation for heterosis studies in Okra (*Abelmoschus esculentus* (L.) Moench)" was conducted at Breeder Seed Production Unit V.N.M.K.V. Parbhani during *summer* (crossing) 2021 and *kharif* 2021. The experiment was conducted on black cotton soil. Three testers and 11 exotic okra lines were obtained from NBPGR in New Delhi for the proposed work's experimental material. Total 50 genotypes comprising 33 crosses, 11 exotic lines, 3 testers and 3 checks *i.e* Mahyco bhindi No.10, Pusa Sawani and Parbhani okra. The Line x Tester (11x 3) crossing was affected and total 33 crosses were obtained, and this material was evaluated in a Randomized Block Design with two replications. Total eighteen observations were recorded including yield and yield contributing characters.

The average value of all the treatments for the investigated characters was calculated. The formula was used to determine the standard error and critical difference at the 1 and 5% level of significance (Panse and Sukhatme (1985) [10]. The F_1 hybrid's performance was calculated as the heterosis over standard checks, mid parent and better parent as per Fonseca and Patterson (1968) [5].

Results and Discussion

To evaluate the variation in the parental lines and crosses for eighteen characters, the analysis of variance was developed. The mean sum of squares due to treatments for all eighteen characters in the analysis of variance revealed that it was highly significant, indicating that the material under study had sufficient variability for yield and yield-contributing characters. For 18 traits, the estimates of heterosis over the better parent, mid parent, and standard checks in F_1 are shown in Table 1. The majority of the crosses for the majority of the studied characters showed significant heterosis, it has been observed. In okra, a medium to long plant height is preferred. Crosses that significantly enhance this trait's heterotic effects are regarded as desirable. The range of heterosis among the 33 cross combinations was -21.72% (EC-305714 x Parbhani Kranti) to 33.22% (EC-305675 x IC-45800) over mid parent, -28.99% (EC-305652 x VROR- 159) to 33.22% (EC-305675 x IC-45800) over better parent, and 7.23% (EC-305675 x Parbhani Kranti) to 3 Mahyco bhindi No. 10 has a variance of between 9.91% (EC-305714 x VROR- 159) and 51.09% (EC-305613 x IC-45800) over the standard check. Pusa sawani and 7.23% to 36.40% (EC-305613 x IC-45800) over Parbhani okra (EC-305675 x Parbhani Kranti). Twelve, seven, seventeen, and nineteen of the 33 evaluated crosses, respectively, showed significant positive heterosis over the mid parent, better parent, standard check, Mahyco bhindi. No.10 Pusa sawani, and Parbhani Kranti. The cross EC-305675 x IC-45800 (37.29%), EC-305714 x VROR-159 (32.20%), and EC-305653 x Parbhani Kranti (29.95%) showed the highest significant positive heterosis over mid parent. The cross (33.22%) (EC-305675 x IC-45800) showed the highest significant positive heterosis over the better parent, followed by (31.98%) (31.98%) and (24.21%) (31.98%) (31.98%) EC- 305714 x VROR- 159 and EC-305652 x Parbhani Kranti. In terms of the trait plant height, the cross EC-305613 x IC-45800 (36.40%, 51.09%, and 36.40%) showed the highest significant positive heterosis, followed by EC-305652 x Parbhani Kranti (35.62%, 50.22%, and 35.62%), EC-305653 x VROR-159 (34.68%, 49.39%, and 34.86%). Similar finding in okra have been reported by Ahmed *et al*., (1999) [1] and Rynjah *et al*., (2020) [13] and Chavan *et al.,* (2021) [4].

In the 33 crosses that were examined, the heterosis varied from -29.27% (EC-305653 x Parbhani kranti) to 19.44% (EC-305685 x VROR-159) over the mid parent and from 29.27% (EC-305653 x Parbhani kranti) to -9.76% (EC-305653 x IC-45800) over the better parent. Over standard check Pusa sawani, heterosis ranged from -13.16% (EC-305652 x VROR-159) to -18.42, and over standard check Mahyco bhindi No -10 (hybrid), heterosis ranged from -11.43% (EC305613 x Parbhani Kranti) to 22.86% (EC-305664 x Parbhani Kranti) (EC305613 x Parbhani Kranti). Three, seven, and nine of the 33 evaluated crosses, respectively, showed significantly positive heterosis over the mid parent, better parent, and standard check, Pusa sawani, and Parbhani okra. While six, twelve, and seven cross over standard check, twenty-four cross over better parent, and seventeen cross over mid parent For this trait, Pusa sawani, Parbhani okra, and Mahyco bhindi No. 10 all showed significantly negative heterosis. Similar results with significant positive heterosis for number of branches were reported by Nagesh *et al*. (2014) [9] and Chavan *et al.,* (2021) [4].

In terms of the number of nodes per plant, the range of heterosis over mid parent was between -21.44% (EC305613 x Parbhani Kranti) and 8.39% (EC-305675 x IC-45800). The cross had the highest positive heterosis over the middle parent, and EC-305714 x VROR-159 came in second (6.91%). From -22.05% (EC305613 x Parbhani Kranti) to 5.99% (EC-305675 x IC-45800), the heterosis was observed over the superior parent. The cross EC-305714 x VROR-159 (6.73%) and EC-305675 x IC-45800 (5.99%) showed the highest positive heterosis over better parents, respectively. The range of node heterosis was -4.55% (EC-305613 x VROR- 159) to 17.83% (EC-305653 x IC-45800), 9.64 (EC-305613 x VROR- 159) to 35.34% (EC-305741 x IC-45800), and -8.08 (EC-305613 x VROR- 159) to 10.44 ((EC-305653 x IC-45800) over standard check.

The farmer prefers a cultivar that requires fewer days until the first harvest. Therefore, negative heterosis is thought to be advantageous for this character. 33 crosses were made, and 21 of them resulted in better parents. Five cross combinations showed significant negative heterosis in the middle parent. EC-305675 x IC-45800 had the highest significantly negative heterosis over the mid parent (-12.73). EC-305612 x IC-45800 came in second (-11.01%), followed by EC-305664 x IC-45800 (-10.19%). EC-305675 x IC-45800 (- 12.73) had the highest significantly negative heterosis over the better parent, followed by EC-305612 x IC-45800 (-12.61%) and EC-305664 x IC-45800 (- 10.19%). For the number of days until the first harvest, none of the cross combinations showed any discernible negative heterosis compared to standard hybrid checks.

For trait No. of fruits per plant, 14 of the 33 crosses showed noticeably positive heterosis over the mid parent. The cross of EC305652 and Parbhani Kranti showed the highest significant positive heterosis (26.64%) over the mid parent. Over mid parent, thirteen crosses showed significantly negative heterosis. According to reports, EC-305741 x Parbhani Kranti (-29.16), EC-305716 x Parbhani Kranti (-26.06) and EC-305716 x IC-45800- have the highest significantly negative heterosis over the mid parent (-21.27). Nine of the 33 crosses had heterosis over the better parent that was significantly positive. The cross EC305613 x Parbhani Kranti (19.43%) had the highest significant positive heterosis, followed by EC305652 x Parbhani Kranti (17.14) and EC-305675 x Parbhani Kranti (15.72). Seven, eighteen, and seven crosses, respectively, showed positive heterosis over the checks Mahyco bhindi No 10 and Pusa sawani and Parbhani okra. As positive heterosis may be caused by the advantageous genes, Makdoomi *et al*., (2018) [8] and Gavint *et al*., (2017) [6] observed positive heterosis for increased number of fruits per plant in okra.

For the character fruit weight (g) the most significant positive heterosis over mid parent was shown by the cross EC-305716 x IC-45800EC 27.05%. In terms of fruit weight, the cross combinations EC-305685 x IC-45800 (61.15%, 59.92%, and 31.76%), EC-305685 x VROR-159 (60.77%, 59.24%, and

31.45%), and EC-305685 x Parbhani Kranti (52.31%, 51.15%, and 24.53%) all showed significant positive heterosis. The standard check, Mahyco Bhindi No. 10, Pu Correspondence result for significant positive heterosis for average weight of fruit in okra were also reported by Chauhan and Singh (2002) [3], Bhalekar *et al*. (2004) [2] and Zate *et al*. (2021) [14].

The farmer prefers a cultivar that produces marketable fruit in fewer days. Therefore, negative heterosis is thought to be advantageous for this character. Fourteen cross combinations out of 33 showed significant negative midheterosis, and 24 crossed produced better parents. EC-305675 x IC-45800 had the highest significantly negative heterosis over the mid parent (-12.28), followed by EC-305612 x IC-45800 (-10.62%) and EC-305664 x IC-45800 (-9.82%) EC-305675 x IC-45800 had the highest significantly negative heterosis over the better parent (-13.04), followed by EC-305612 x IC-45800 (-12.17%) and EC-305664 x IC-45800 (- 9.82%). None of the cross combinations showed any discernible negative heterosis for the number of days until the first harvest when compared to the standard checks. These findings agree with those of Makdoomi *et al*. (2018) [8].

The heterotic estimate was between -27.78 and 84.95% over the midpoint, between -32.47 and 82.98% over the better parent, and between 27 and 58% over the check Mahyco bhindi. 10. Pusa sawani from 25.74 to 56.44% over check and Parbhani okra from 29.59 to 61.22% over check significant negative heterosis was present in the eight and ten crosses compared to the mid parent, the better parent. Over the mid parent, better parent, and standard check Mahyco bhindi, the crosses EC305613 x Parbhani Kranti and EC-305664 x VROR-159 recorded significant negative heterosis. No. 10 for the incidence of fruit borer, respectively Pusa sawani and Parbhani okra. Prakash *et al*. (2019) [12] reported finding a similar result in okra.

Okra's fruit yield per plant is a significant yield-contributing factor. The cross between EC-305612 and Parbhani Kranti (42.47%) and EC-305652 and Parbhani Kranti (42.21%) over mid parent showed the highest significant heterosis. The crosses EC-305612 x Parbhani Kranti (38.39%) and EC-305652 x Parbhani Kranti (37.69%) showed the highest significant heterosis over the better parent. The crosses were EC-305714 x Parbhani Kranti (24.81%) and EC-305653 x IC-45800 (73.58%) to EC-305664 x VROR-159 (19.44%) and EC-305653 x IC-45800 (96.21%) from EC-305613 x VROR-159 (-25.33%) to (EC-305653 x IC-45800) to (EC-305653 x IC Parbhani okra and pusa sawani, respectively. Patel *et al*. (2016) [11] and Rynjah *et al*. (2020) [13] have both reported finding a similar result in okra.

Nine of the 33 evaluated crosses crosses 9, 6, 19, and exhibited significant positive heterosis over the mid parent, better parent, standard check, and Mahyco hybrid No. 10. Parbhani okra and pusa sawani, respectively. The cross between EC-305612 and Parbhani Kranti (42.47%) demonstrated the highest significant positive heterosis over the mid parent, followed by EC-305672 and Parbhani Kranti (41.2%) and EC305652, respectively (42.21). Following EC-305652 x Parbhani Kranti (37.69%) and EC-305672 x Parbhani Kranti (33.43%), the cross EC-305612 x Parbhani Kranti (38.39%) recorded the highest significant positive heterosis over the better parent. The Mahyco Bhindi No. 10 has the highest significant positive heterosis, EC-305653 x IC-45800(73.58, 96.21, 41.46) over the check. For fruit yield per plant, respectively Pusa sawani and Parbhani okra.

Table 1: The estimates of percent heterosis over mid parent better parent and standard heterosis over three checks

SN	Genotypes	Plant Height (cm)					No. of Branches					No. of Nodes				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	14.32 **	12.02 **	24.20 **	37.58 **	24.20 **	-14.63 **	-14.63 **	-11.43 *	-18.42 **	-11.43 *	-21.44 **	-22.05 **	3.50 **	18.88 **	-0.34 NS
2	EC305652 x Parbhani kranti	25.17 **	24.21 **	35.62 **	50.22 **	35.62 **	-10.26 **	-14.63 **	0.00 NS	-7.89 NS	0.00 NS	-7.59 **	-11.18 **	7.69 **	23.69 **	3.70 **
3	EC-305653 x Parbhani kranti	29.95 **	20.94 **	28.89 **	42.77 **	28.89 **	-29.27 **	-29.27 **	-5.71 NS	-13.16 **	-5.71 NS	-1.06 NS	-3.26 **	10.84 **	27.31 **	6.73 **
4	EC-305664 x Parbhani kranti	-4.72 NS	-9.06 *	18.36 **	31.11 **	18.36 **	7.89 *	0.00 NS	22.86 **	13.16 **	22.86 **	-8.56 **	-10.73 **	8.74 **	24.90 **	4.71 **
5	EC-305672 x Parbhani kranti	-15.37 **	-16.99 **	7.23 *	18.77 **	7.23 *	-2.78 NS	-5.41 NS	0.00 NS	-7.89 NS	0.00 NS	2.84 **	1.99 NS	10.49 **	26.91 **	6.40 **
6	EC-305675 x Parbhani kranti	14.91 **	9.71 **	32.99 **	47.32 **	32.99 **	-7.89 *	-14.63 **	5.71 NS	-2.63 NS	5.71 NS	-4.54 **	-9.50 **	10.84 **	27.31 **	6.73 **
7	EC-305685 x Parbhani kranti	-9.46 **	-16.34 **	9.07 *	20.82 **	9.07 *	-26.83 **	-26.83 **	-11.43 *	-18.42 **	-11.43 *	-1.64 NS	-5.36 **	6.64 **	22.49 **	2.69 **
8	EC-305612 x Parbhani kranti	-10.62 **	-15.22 **	4.80 NS	16.08 **	4.80 NS	-20.51 **	-24.39 **	-5.71 NS	-13.16 **	-5.71 NS	-3.39 **	-4.04 **	5.59 **	21.29 **	1.68 NS
9	EC-305714 x Parbhani kranti	-21.72 **	-22.70 **	14.93 **	27.31 **	14.93 **	0.00 NS	0.00 NS	17.14 **	7.89 NS	17.14 **	-3.49 **	-9.79 **	10.84 **	27.31 **	6.73 **
10	EC-305716 x Parbhani kranti	-14.24 **	-27.18 **	17.70 **	30.38 **	17.70 **	-17.50 **	-19.51 **	0.00 NS	-7.89 NS	0.00 NS	-5.60 **	-6.94 **	7.34 **	23.29 **	3.37 **
11	EC-305741 x Parbhani kranti	1.58 NS	-11.69 **	26.18 **	39.77 **	26.18 **	-7.89 *	-10.26 *	5.71 NS	-2.63 NS	5.71 NS	6.78 **	4.87 **	14.34 **	31.33 **	10.10 **
12	EC-305613 x VROR-159	-15.53 **	-22.09 **	-3.13 NS	7.30 NS	-3.13 NS	-22.50 **	-24.39 **	5.71 NS	-2.63 NS	5.71 NS	-11.63 **	-15.43 **	-4.55 **	9.64 **	-8.08 **
13	EC-305652 x VROR-159	-17.00 **	-28.99 **	30.64 **	44.71 **	30.64 **	-20.51 **	-24.39 **	-5.71 NS	-13.16 **	-5.71 NS	-12.68 **	-14.20 **	3.15 **	18.47 **	-0.67 NS
14	EC-305653 x VROR-159	-11.31 **	-22.30 **	34.86 **	49.39 **	34.86 **	-13.51 **	-13.51 **	-5.71 NS	-13.16 **	-5.71 NS	4.15 **	2.61 *	17.48 **	34.94 **	13.13 **
15	EC-305664 x VROR-	-0.31	-7.28 *	3.14	14.25	3.14	-20.51	-24.39	5.71	-2.63	5.71	-7.93	-12.17	3.15 **	18.47	-0.67

	159	NS		NS	**	NS	**	**	NS	NS	NS	**	**		**	NS
16	EC-305672 x VROR-159	20.43 **	4.34 NS	-5.58 NS	4.59 NS	-5.58 NS	-2.78 NS	-14.63 **	0.00 NS	-7.89 NS	0.00 NS	-4.50 **	-6.10 **	10.84 **	27.31 **	6.73 **
17	EC-305675 x VROR-159	11.72 **	-0.83 NS	18.89 **	31.69 **	18.89 **	-2.94 NS	-10.81 *	-5.71 NS	-13.16 **	-5.71 NS	1.44 NS	-3.35 **	6.29 **	22.09 **	2.36 *
18	EC-305685 x VROR-159	-3.45 NS	-8.93 **	0.01 NS	10.78 **	0.01 NS	19.44 **	4.88 NS	-11.43 *	-18.42 **	-11.43 *	-6.47 **	-7.72 **	3.85 **	19.28 **	-0.00 NS
19	EC-305612 x VROR-159	9.60 **	6.77 NS	3.69 NS	14.86 **	3.69 NS	-12.50 **	-14.63 **	-11.43 *	-18.42 **	-11.43 *	3.10 **	-0.32 NS	0.70 NS	15.66 **	-3.03 **
20	EC-305714 x VROR-159	32.20 **	31.98 **	-0.78 NS	9.91 *	-0.78 NS	-2.63 NS	-5.13 NS	17.14 **	7.89 NS	17.14 **	6.91 **	6.73 **	12.59 **	29.32 **	8.42 **
21	EC-305716 x VROR-159	1.16 NS	-5.33 NS	4.79 NS	16.07 **	4.79 NS	-22.50 **	-24.39 **	0.00 NS	-7.89 NS	0.00 NS	-3.63 **	-9.50 **	5.59 **	21.29 **	1.68 NS
22	EC-305741 x VROR-159	2.91 NS	-3.34 NS	12.32 **	24.41 **	12.32 **	-18.52 **	-19.51 **	17.14 **	7.89 NS	17.14 **	-5.48 **	-6.21 **	2.45 *	17.67 **	-1.35 NS
23	EC-305613 x IC-45800	9.88 **	6.00 NS	36.40 **	51.09 **	36.40 **	6.49 NS	2.50 NS	11.43 *	2.63 NS	11.43 *	2.42 *	-1.55 NS	7.69 **	23.69 **	3.70 **
24	EC-305652 x IC-45800	5.26 NS	2.16 NS	33.95 **	48.37 **	33.95 **	-13.58 **	-14.63 **	5.71 NS	-2.63 NS	5.71 NS	-6.83 **	-8.90 **	6.99 **	22.89 **	3.03 **
25	EC-305653 x IC-45800	10.58 **	-5.11 NS	29.98 **	43.97 **	29.98 **	-5.13 NS	-9.76 *	-11.43 *	-18.42 **	-11.43 *	3.48 **	3.15 **	14.69 **	31.73 **	10.44 **
26	EC-305664 x IC-45800	-17.11 **	-27.15 **	0.43 NS	11.25 **	0.43 NS	0.00 NS	0.00 NS	11.43 *	2.63 NS	11.43 *	-10.78 **	-13.33 **	3.50 **	18.88 **	-0.34 NS
27	EC-305672 x IC-45800	5.27 NS	-1.76 NS	8.42 *	20.10 **	8.42 *	-15.38 **	-19.51 **	14.29 **	5.26 NS	14.29 **	-9.51 **	-12.46 **	12.59 **	29.32 **	8.42 **
28	EC-305675 x IC-45800	37.29 **	33.22 **	32.98 **	47.30 **	32.98 **	-8.33 *	-19.51 **	5.71 NS	-2.63 NS	5.71 NS	8.39 **	5.99 **	10.14 **	26.51 **	6.06 **
29	EC-305685 x IC-45800	2.12 NS	1.89 NS	1.23 NS	12.13 **	1.23 NS	8.82 *	0.00 NS	-11.43 *	-18.42 **	-11.43 *	-1.67 NS	-2.64 *	5.94 **	21.69 **	2.02 *
30	EC-305612 x IC-45800	-12.75 **	-18.05 **	6.10 NS	17.52 **	6.10 NS	-2.78 NS	-14.63 **	-11.43 *	-18.42 **	-11.43 *	-0.94 NS	-5.93 **	7.69 **	23.69 **	3.70 **
31	EC-305714 x IC-45800	18.10 **	12.06 **	-4.76 NS	5.50 NS	-4.76 NS	-8.33 *	-19.51 **	17.14 **	7.89 NS	17.14 **	-2.72 **	-4.10 **	10.84 **	27.31 **	6.73 **
32	EC-305716 x IC-45800	-3.31 NS	-5.74 NS	0.77 NS	11.62 **	0.77 NS	-8.82 *	-16.22 **	5.71 NS	-2.63 NS	5.71 NS	-1.82 NS	-3.57 **	3.85 **	19.28 **	-0.00 NS
33	EC-305741 x IC-45800	-6.29 *	-10.00 **	15.21 **	27.62 **	15.21 **	-13.89 **	-24.39 **	17.14 **	7.89 NS	17.14 **	-10.70 **	-14.54 **	17.83 **	35.34 **	13.47 **
	SE±	3.21	3.71				0.07	0.08				0.16	0.18			

*, ** denotes significance at 5% and 1% respectively

SN	Genotypes	Internode Length					No. of Ridges per Fruit					Days to 50% Flowering				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	45.53 **	43.70 **	20.00 **	15.71 **	24.62 **	32.73 **	30.36 **	27.59 **	34.55 **	32.14 **	-5.10 *	-7.92 **	1.09 NS	3.33 NS	0.00 NS
2	EC305652 x Parbhani kranti	35.20 **	29.01 **	25.93 **	21.43 **	30.77 **	-8.85 *	-9.65 *	-10.34 *	-5.45 NS	-7.14 NS	-8.25 **	-10.10 **	2.17 NS	4.44 NS	1.08 NS
3	EC-305653 x Parbhani kranti	31.47 **	25.00 **	16.30 **	12.14 **	20.77 **	-16.67 **	-27.63 **	-6.90 NS	-1.82 NS	-3.57 NS	-3.13 NS	-4.12 NS	1.09 NS	3.33 NS	0.00 NS
4	EC-305664 x Parbhani kranti	4.00 NS	-2.99 NS	8.89 **	5.00 NS	13.08 **	54.13 **	52.73 **	46.55 **	54.55 **	51.79 **	-1.57 NS	-6.93 **	3.26 NS	5.56 NS	2.15 NS
5	EC-305672 x Parbhani kranti	-17.74 **	-18.66 **	-2.96 NS	-6.43 *	0.77 NS	-3.57 NS	-5.26 NS	-1.72 NS	3.64 NS	1.79 NS	-3.70 NS	-8.08 **	0.00 NS	2.22 NS	-1.08 NS
6	EC-305675 x Parbhani kranti	20.30 **	19.40 **	20.00 **	15.71 **	24.62 **	-20.61 **	-31.58 **	-6.90 NS	-1.82 NS	-3.57 NS	-0.53 NS	-4.12 NS	1.09 NS	3.33 NS	0.00 NS
7	EC-305685 x Parbhani kranti	-8.33 **	-18.24 **	2.22 NS	-1.43 NS	6.15 *	41.54 **	21.05 **	60.34 **	69.09 **	66.07 **	-0.49 NS	-0.98 NS	10.87 **	13.33 **	9.68 **
8	EC-305612 x Parbhani kranti	-7.53 **	-12.84 **	-0.74 NS	-4.29 NS	3.08 NS	-18.80 **	-28.95 **	-6.90 NS	-1.82 NS	-3.57 NS	-3.48 NS	-4.90 *	3.26 NS	5.56 NS	2.15 NS
9	EC-305714 x Parbhani kranti	-19.29 **	-23.65 **	3.70 NS	0.00 NS	7.69 *	-27.63 **	-27.63 **	-6.90 NS	-1.82 NS	-3.57 NS	4.52 *	1.96 NS	11.96 **	14.44 **	10.75 **
10	EC-305716 x Parbhani kranti	-9.41 **	-23.98 **	9.63 **	5.71 *	13.85 **	-16.28 **	-28.00 **	-10.34 *	-5.45 NS	-7.14 NS	9.74 **	5.94 *	6.52 *	8.89 **	5.38 NS
11	EC-305741 x Parbhani kranti	-4.64 NS	-15.79 **	10.37 **	6.43 *	14.62 **	9.09 **	-4.00 NS	32.76 **	40.00 **	37.50 **	5.70 *	3.03 NS	3.26 NS	5.56 NS	2.15 NS
12	EC-305613 x VROR-159	-4.95 NS	-15.79 **	1.48 NS	-2.14 NS	5.38 NS	-29.80 **	-30.26 **	29.31 **	36.36 **	33.93 **	-5.76 *	-7.22 **	-3.26 NS	-1.11 NS	-4.30 NS
13	EC-305652 x VROR-159	-5.26 NS	-20.12 **	26.67 **	22.14 **	31.54 **	0.00 NS	-1.79 NS	-3.45 NS	1.82 NS	-0.00 NS	-11.68 **	-13.86 **	-1.09 NS	1.11 NS	-2.15 NS

14	EC-305653 x VROR-159	-14.67 **	-24.26 **	14.81 **	10.71 **	19.23 **	2.65 NS	1.75 NS	-6.90 NS	-1.82 NS	-3.57 NS	-2.56 NS	-4.04 NS	-4.35 NS	-2.22 NS	-5.38 NS
15	EC-305664 x VROR-159	7.64 **	-4.14 NS	0.00 NS	-3.57 NS	3.85 NS	12.12 **	-2.63 NS	46.55 **	54.55 **	51.79 **	-3.63 NS	-4.12 NS	0.00 NS	2.22 NS	-1.08 NS
16	EC-305672 x VROR-159	26.39 **	11.11 **	-14.81 **	-17.86 **	-11.54 **	-2.80 NS	-3.70 NS	-3.45 NS	1.82 NS	-0.00 NS	-4.08 NS	-6.93 **	-3.26 NS	-1.11 NS	-4.30 NS
17	EC-305675 x VROR-159	10.56 **	2.61 NS	11.85 **	7.86 **	16.15 **	-1.82 NS	-5.26 NS	-6.90 NS	-1.82 NS	-3.57 NS	-4.12 NS	-6.06 *	1.09 NS	3.33 NS	0.00 NS
18	EC-305685 x VROR-159	3.16 NS	-3.92 NS	-3.70 NS	-7.14 *	0.00 NS	31.78 **	11.84 **	63.79 **	72.73 **	69.64 **	-1.04 NS	-2.06 NS	11.96 **	14.44 **	10.75 **
19	EC-305612 x VROR-159	6.07 NS	-0.00 NS	2.96 NS	-0.71 NS	6.92 *	-17.99 **	-32.94 **	-1.72 NS	3.64 NS	1.79 NS	-6.60 **	-8.91 **	-1.09 NS	1.11 NS	-2.15 NS
20	EC-305714 x VROR-159	23.66 **	23.66 **	-11.85 **	-15.00 **	-8.46 **	-23.94 **	-36.47 **	-3.45 NS	1.82 NS	-0.00 NS	-4.62 *	-6.06 *	3.26 NS	5.56 NS	2.15 NS
21	EC-305716 x VROR-159	4.94 NS	4.55 NS	-0.74 NS	-4.29 NS	3.08 NS	15.53 **	9.41 **	-5.17 NS	0.00 NS	-1.79 NS	5.70 *	5.15 *	-2.17 NS	0.00 NS	-3.23 NS
22	EC-305741 x VROR-159	8.94 **	3.08 NS	9.63 **	5.71 *	13.85 **	-0.92 NS	-1.82 NS	31.03 **	38.18 **	35.71 **	-2.06 NS	-5.94 *	10.87 **	13.33 **	9.68 **
23	EC-305613 x IC-45800	7.28 *	6.87 *	26.67 **	22.14 **	31.54 **	-3.57 NS	-5.26 NS	29.31 **	36.36 **	33.93 **	7.29 **	4.04 NS	2.17 NS	4.44 NS	1.08 NS
24	EC-305652 x IC-45800	12.98 **	12.12 **	25.19 **	20.71 **	30.00 **	-20.61 **	-31.58 **	-3.45 NS	1.82 NS	-0.00 NS	3.16 NS	1.03 NS	4.35 NS	6.67 *	3.23 NS
25	EC-305653 x IC-45800	6.81 *	-8.59 **	13.33 **	9.29 **	17.69 **	42.59 **	42.59 **	-8.62 NS	-3.64 NS	-5.36 NS	-5.47 *	-5.94 *	3.26 NS	5.56 NS	2.15 NS
26	EC-305664 x IC-45800	-6.80 *	-15.95 **	-2.96 NS	-6.43 *	0.77 NS	35.14 **	31.58 **	46.55 **	54.55 **	51.79 **	-10.55 **	-11.00 **	4.35 NS	6.67 *	3.23 NS
27	EC-305672 x IC-45800	15.93 **	4.91 NS	-3.70 NS	-7.14 *	0.00 NS	-13.85 **	-26.32 **	-5.17 NS	0.00 NS	-1.79 NS	-7.61 **	-9.00 **	1.09 NS	3.33 NS	0.00 NS
28	EC-305675 x IC-45800	26.53 **	20.16 **	20.74 **	16.43 **	25.38 **	-26.03 **	-41.30 **	-6.90 NS	-1.82 NS	-3.57 NS	-13.73 **	-14.56 **	8.70 **	11.11 **	7.53 *
29	EC-305685 x IC-45800	3.85 NS	3.05 NS	-4.44 NS	-7.86 **	-0.77 NS	14.09 **	-7.61 **	58.62 **	67.27 **	64.29 **	-8.91 **	-10.68 **	11.96 **	14.44 **	10.75 **
30	EC-305612 x IC-45800	-11.88 **	-12.88 **	-1.48 NS	-5.00 NS	2.31 NS	-33.33 **	-39.13 **	-1.72 NS	3.64 NS	1.79 NS	-11.00 **	-13.59 **	4.35 NS	6.67 *	3.23 NS
31	EC-305714 x IC-45800	21.29 **	13.53 **	-14.07 **	-17.14 **	-10.77 **	-2.70 NS	-5.26 NS	-6.90 NS	-1.82 NS	-3.57 NS	-5.58 *	-7.92 **	9.78 **	12.22 **	8.60 **
32	EC-305716 x IC-45800	-1.52 NS	-2.26 NS	-2.96 NS	-6.43 *	0.77 NS	66.67 **	66.67 **	-1.72 NS	3.64 NS	1.79 NS	5.64 *	4.04 NS	7.61 *	10.00 **	6.45 *
33	EC-305741 x IC-45800	4.91 NS	4.51 NS	-2.22 NS	-5.71 *	1.54 NS	-14.29 **	-25.00 **	31.03 **	38.18 **	35.71 **	-5.70 *	-6.19 *	5.43 NS	7.78 *	4.30 NS
	SE±	0.19	0.22				0.22	0.25				1.04	1.20			

*, ** denotes significance at 5% and 1% respectively

SN	Genotypes	No. of Days to First Harvest					No. of Fruits Per Plant					Fruit Weight				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	-2.83 NS	-5.50 *	0.00 NS	3.06 NS	0.00 NS	21.65 **	19.43 **	-2.67 NS	11.03 *	-2.99 NS	-10.73 **	-11.56 **	16.92 **	16.03 **	-4.40 NS
2	EC305652 x Parbhani kranti	-8.06 **	-10.19 **	0.99 NS	4.08 NS	0.99 NS	26.64 **	17.14 **	2.00 NS	16.35 **	1.66 NS	11.85 **	6.69 NS	34.23 **	33.21 **	9.75 *
3	EC-305653 x Parbhani kranti	-1.90 NS	-3.74 NS	0.00 NS	3.06 NS	0.00 NS	24.39 **	11.71 **	15.33 **	31.56 **	14.95 **	6.76 *	-4.29 NS	32.69 **	31.68 **	8.49 *
4	EC-305664 x Parbhani kranti	-2.42 NS	-7.34 **	1.98 NS	5.10 NS	1.98 NS	10.45 *	7.69 NS	9.00 *	24.33 **	8.64 NS	-12.31 **	-18.75 **	12.31 *	11.45 *	-8.18 *
5	EC-305672 x Parbhani kranti	-3.88 NS	-8.33 **	0.00 NS	3.06 NS	0.00 NS	14.44 **	10.36 *	9.00 *	24.33 **	8.64 NS	23.66 **	21.05 **	25.38 **	24.43 **	2.52 NS
6	EC-305675 x Parbhani kranti	-1.46 NS	-5.61 *	0.00 NS	3.06 NS	0.00 NS	23.79 **	15.72 **	9.67 *	25.10 **	9.30 *	4.04 NS	-12.12 **	25.38 **	24.43 **	2.52 NS
7	EC-305685 x Parbhani kranti	-0.46 NS	-0.91 NS	8.91 **	12.24 **	8.91 **	-15.19 **	-17.31 **	-13.00 **	-0.76 NS	-13.29 **	22.60 **	21.47 **	52.31 **	51.15 **	24.53 **
8	EC-305612 x Parbhani kranti	-3.67 NS	-4.55 *	1.98 NS	5.10 NS	1.98 NS	24.07 **	19.64 **	17.33 **	33.84 **	16.94 **	14.57 **	7.36 NS	41.92 **	40.84 **	16.04 **
9	EC-305714 x Parbhani kranti	3.23 NS	1.82 NS	9.90 **	13.27 **	9.90 **	-29.16 **	-33.78 **	-14.00 **	-1.90 NS	-14.29 **	-17.45 **	-24.75 **	18.08 **	17.18 **	-3.46 NS
10	EC-305716 x Parbhani kranti	9.00 **	5.50 *	4.95 NS	8.16 **	4.95 NS	-26.06 **	-34.58 **	-16.00 **	-4.18 NS	-16.28 **	-24.85 **	-29.40 **	13.08 **	12.21 *	-7.55 NS
11	EC-305741 x Parbhani kranti	4.76 *	1.85 NS	1.98 NS	5.10 NS	1.98 NS	-20.13 **	-25.23 **	-16.67 **	-4.94 NS	-16.94 **	23.27 **	9.89 **	50.00 **	48.85 **	22.64 **
12	EC-305613 x VROR-	-6.22	-8.41	-3.96	-1.02	-3.96	0.00	-3.43	-11.67	0.76	-11.96	-25.53	-28.54	3.85	3.05	-15.09

	159	**	**	NS	NS	NS	NS	NS	*	NS	**	**	**	NS	NS	**
13	EC-305652 x VROR-159	-10.80 **	-12.84 **	-1.98 NS	1.02 NS	-1.98 NS	-20.21 **	-30.42 **	-12.33 **	0.00 NS	-12.62 **	-30.88 **	-34.72 **	27.69 **	26.72 **	4.40 NS
14	EC-305653 x VROR-159	-2.83 NS	-4.63 *	-4.95 NS	-2.04 NS	-4.95 NS	-1.31 NS	-9.04 *	-7.00 NS	6.08 NS	-7.31 NS	5.43 NS	-5.56 NS	21.92 **	20.99 **	-0.31 NS
15	EC-305664 x VROR-159	-4.27 *	-5.61 *	-0.99 NS	2.04 NS	-0.99 NS	-7.45 *	-12.05 **	-1.00 NS	12.93 *	-1.33 NS	-19.58 **	-23.23 **	6.54 NS	5.73 NS	-12.89 **
16	EC-305672 x VROR-159	-3.77 NS	-6.42 **	-3.96 NS	-1.02 NS	-3.96 NS	2.51 NS	-12.57 **	0.00 NS	14.07 **	-0.33 NS	-1.27 NS	-9.82 **	34.23 **	33.21 **	9.75 *
17	EC-305675 x VROR-159	-4.27 *	-6.48 **	0.00 NS	3.06 NS	0.00 NS	9.84 **	-1.14 NS	-2.00 NS	11.79 *	-2.33 NS	2.68 NS	-10.85 **	37.31 **	36.26 **	12.26 **
18	EC-305685 x VROR-159	-1.90 NS	-3.74 NS	9.90 **	13.27 **	9.90 **	0.77 NS	-6.57 NS	-17.33 **	-5.70 NS	-17.61 **	-25.42 **	-26.26 **	60.77 **	59.54 **	31.45 **
19	EC-305612 x VROR-159	-5.16 *	-7.34 **	-1.98 NS	1.02 NS	-1.98 NS	20.89 **	11.22 **	14.33 **	30.42 **	13.95 **	6.54 NS	1.87 NS	7.69 NS	6.87 NS	-11.95 **
20	EC-305714 x VROR-159	-4.72 *	-6.48 **	1.98 NS	5.10 NS	1.98 NS	14.63 **	11.90 **	-20.67 **	-9.51 NS	-20.93 **	13.00 **	11.64 **	20.77 **	19.85 **	-1.26 NS
21	EC-305716 x VROR-159	4.27 *	2.80 NS	-2.97 NS	0.00 NS	-2.97 NS	-11.97 **	-12.71 **	-13.33 **	-1.14 NS	-13.62 **	15.12 **	0.00 NS	5.00 NS	4.20 NS	-14.15 **
22	EC-305741 x VROR-159	-1.90 NS	-5.50 *	8.91 **	12.24 **	8.91 **	24.38 **	10.34 **	-13.33 **	-1.14 NS	-13.62 **	8.05 *	1.65 NS	25.38 **	24.43 **	2.52 NS
23	EC-305613 x IC-45800	6.22 **	2.78 NS	0.99 NS	4.08 NS	0.99 NS	-13.86 **	-19.12 **	7.00 NS	22.05 **	6.64 NS	-5.25 NS	-15.43 **	40.00 **	38.93 **	14.47 **
24	EC-305652 x IC-45800	1.92 NS	-0.93 NS	2.97 NS	6.12 *	2.97 NS	-18.45 **	-21.00 **	10.67 *	26.24 **	10.30 *	-22.53 **	-25.76 **	38.46 **	37.40 **	13.21 **
25	EC-305653 x IC-45800	-5.07 *	-5.50 *	1.98 NS	5.10 NS	1.98 NS	-9.42 *	-18.03 **	16.67 **	33.08 **	16.28 **	13.87 **	6.85 *	48.85 **	47.71 **	21.70 **
26	EC-305664 x IC-45800	-10.19 **	-10.19 **	2.97 NS	6.12 *	2.97 NS	-9.40 **	-13.11 **	-2.00 NS	11.79 *	-2.33 NS	-16.92 **	-26.03 **	12.31 *	11.45 *	-8.18 *
27	EC-305672 x IC-45800	-7.91 **	-8.33 **	0.00 NS	3.06 NS	0.00 NS	-12.91 **	-13.77 **	6.33 NS	21.29 **	5.98 NS	-12.75 **	-16.16 **	39.62 **	38.55 **	14.15 **
28	EC-305675 x IC-45800	-12.73 **	-13.51 **	6.93 *	10.20 **	6.93 *	10.28 *	7.72 NS	1.67 NS	15.97 **	1.33 NS	-14.21 **	-24.34 **	40.38 **	39.31 **	14.78 **
29	EC-305685 x IC-45800	-8.68 **	-9.91 **	9.90 **	13.27 **	9.90 **	10.20 **	6.07 NS	-13.67 **	-1.52 NS	-13.95 **	-21.31 **	-33.89 **	61.15 **	59.92 **	31.76 **
30	EC-305612 x IC-45800	-11.01 **	-12.61 **	2.97 NS	6.12 *	2.97 NS	7.53 *	0.33 NS	16.67 **	33.08 **	16.28 **	-14.36 **	-16.71 **	43.46 **	42.37 **	17.30 **
31	EC-305714 x IC-45800	-5.16 *	-7.34 **	7.92 **	11.22 **	7.92 **	-1.51 NS	-16.00 **	-17.67 **	-6.08 NS	-17.94 **	3.03 NS	-4.29 NS	23.08 **	22.14 **	0.63 NS
32	EC-305716 x IC-45800	4.72 *	2.78 NS	6.93 *	10.20 **	6.93 *	-21.27 **	-29.14 **	-6.67 NS	6.46 NS	-6.98 NS	27.05 **	12.06 **	9.62 *	8.78 NS	-10.38 *
33	EC-305741 x IC-45800	-6.16 **	-7.48 **	5.94 *	9.18 **	5.94 *	5.70 NS	-2.00 NS	-0.33 NS	13.69 **	-0.66 NS	-27.18 **	-29.29 **	52.31 **	51.15 **	24.53 **
	SE±	1.06	1.22				0.51	0.59				0.53	0.61			

*, ** denotes significance at 5% and 1% respectively

SN	Genotypes	Fruit Length					Fruit Diameter					Leaf Area				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	15.56 **	6.48 *	8.10 *	27.92 **	16.73 **	-3.18 *	-5.91 **	9.76 **	7.46 **	5.88 **	-13.37 **	-18.75 **	-12.77 **	13.26 **	16.67 **
2	EC305652 x Parbhani kranti	22.83 **	19.54 **	10.56 **	30.83 **	19.39 **	-1.79 NS	-4.30 *	7.62 **	5.37 **	3.82 *	-2.84 **	-6.83 **	-15.15 **	10.18 **	13.50 **
3	EC-305653 x Parbhani kranti	26.14 **	18.51 **	17.96 **	39.58 **	27.38 **	-11.76 **	-12.23 **	3.66 *	1.49 NS	0.00 NS	-3.33 **	-3.39 **	-2.06 *	27.17 **	31.00 **
4	EC-305664 x Parbhani kranti	-3.93 NS	-8.19 **	-4.93 NS	12.50 **	2.66 NS	1.81 NS	-0.54 NS	8.23 **	5.97 **	4.41 **	-6.96 **	-20.67 **	-5.38 **	22.86 **	26.56 **
5	EC-305672 x Parbhani kranti	-1.89 NS	-3.00 NS	-4.58 NS	12.92 **	3.04 NS	-15.12 **	-16.85 **	-4.27 *	-6.27 **	-7.65 **	23.40 **	3.24 **	14.71 **	48.94 **	53.43 **
6	EC-305675 x Parbhani kranti	24.45 **	21.35 **	30.28 **	54.17 **	40.68 **	-14.78 **	-15.69 **	-4.88 **	-6.87 **	-8.24 **	-12.97 **	-29.57 **	-18.11 **	6.33 **	9.54 **
7	EC-305685 x Parbhani kranti	25.47 **	25.26 **	30.28 **	54.17 **	40.68 **	1.35 NS	-3.84 *	17.38 **	14.93 **	13.24 **	14.99 **	12.52 **	-1.90 *	27.37 **	31.21 **
8	EC-305612 x Parbhani kranti	17.54 **	11.30 **	15.49 **	36.67 **	24.71 **	1.34 NS	-3.58 *	19.51 **	17.01 **	15.29 **	-0.51 NS	-4.82 **	-41.45 **	-23.97 **	-21.68 **
9	EC-305714 x Parbhani kranti	-12.04 **	-13.70 **	2.82 NS	21.67 **	11.03 **	-9.26 **	-11.00 **	8.84 **	6.57 **	5.00 **	-41.08 **	-45.81 **	-0.13 NS	29.67 **	33.58 **
10	EC-305716 x Parbhani kranti	-31.56 **	-33.33 **	-19.01 **	-4.17 NS	-12.55 **	3.18 *	1.71 NS	11.28 **	8.96 **	7.35 **	1.85 *	-12.72 **	8.63 **	41.05 **	45.30 **

11	EC-305741 x Parbhani kranti	0.70 NS	-7.12 **	3.17 NS	22.08 **	11.41 **	6.63 **	4.82 **	19.21 **	16.72 **	15.00 **	16.48 **	-2.08 *	11.69 **	45.02 **	49.39 **
12	EC-305613 x VROR-159	-2.37 NS	-6.80 **	8.10 *	27.92 **	16.73 **	-5.16 **	-9.57 **	12.50 **	10.15 **	8.53 **	-16.23 **	-31.89 **	-1.30 NS	28.16 **	32.02 **
13	EC-305652 x VROR-159	-21.80 **	-23.70 **	15.49 **	36.67 **	24.71 **	1.59 NS	0.00 NS	11.28 **	8.96 **	7.35 **	-26.64 **	-30.59 **	21.83 **	58.19 **	62.96 **
14	EC-305653 x VROR-159	-4.04 NS	-11.36 **	10.56 **	30.83 **	19.39 **	-3.61 *	-5.38 **	6.71 **	4.48 **	2.94 NS	-17.74 **	-23.84 **	-18.27 **	6.12 **	9.32 **
15	EC-305664 x VROR-159	4.24 NS	-0.32 NS	1.41 NS	20.00 **	9.51 **	0.56 NS	-4.26 *	10.67 **	8.36 **	6.76 **	-13.22 **	-22.65 **	-35.57 **	-16.34 **	-13.82 **
16	EC-305672 x VROR-159	0.96 NS	-4.56 NS	-4.23 NS	13.33 **	3.42 NS	2.32 NS	0.57 NS	2.13 NS	0.00 NS	-1.47 NS	-12.31 **	-14.19 **	-36.06 **	-16.98 **	-14.48 **
17	EC-305675 x VROR-159	13.56 **	1.82 NS	22.89 **	45.42 **	32.70 **	-1.73 NS	-3.68 *	-0.91 NS	-2.99 NS	-4.41 **	-1.20 NS	-5.48 **	-29.78 **	-8.82 **	-6.07 **
18	EC-305685 x VROR-159	-11.48 **	-17.93 **	16.20 **	37.50 **	25.48 **	-0.70 NS	-5.59 **	19.21 **	16.72 **	15.00 **	-8.76 **	-16.10 **	27.94 **	66.13 **	71.13 **
19	EC-305612 x VROR-159	-10.12 **	-12.58 **	2.11 NS	20.83 **	10.27 **	-9.51 **	-10.54 **	16.77 **	14.33 **	12.65 **	16.57 **	16.00 **	-21.18 **	2.35 *	5.43 **
20	EC-305714 x VROR-159	29.60 **	19.35 **	-13.03 **	2.92 NS	-6.08 NS	-10.34 **	-11.61 **	13.41 **	11.04 **	9.41 **	-18.73 **	-20.97 **	12.91 **	46.61 **	51.02 **
21	EC-305716 x VROR-159	25.21 **	19.35 **	-5.99 NS	11.25 **	1.52 NS	7.09 **	2.39 NS	12.20 **	9.85 **	8.24 **	-6.88 **	-13.01 **	-30.25 **	-9.43 **	-6.70 **
22	EC-305741 x VROR-159	15.70 **	11.95 **	2.82 NS	21.67 **	11.03 **	18.25 **	11.68 **	19.21 **	16.72 **	15.00 **	-40.53 **	-40.79 **	-5.36 **	22.89 **	26.59 **
23	EC-305613 x IC-45800	9.16 **	6.57 *	8.80 **	28.75 **	17.49 **	7.37 **	1.13 NS	3.96 *	1.79 NS	0.29 NS	-0.94 NS	-3.62 **	-29.39 **	-8.32 **	-5.56 **
24	EC-305652 x IC-45800	15.56 **	6.48 *	8.10 *	27.92 **	16.73 **	-3.18 *	-5.91 **	9.76 **	7.46 **	5.88 **	-13.37 **	-18.75 **	-12.77 **	13.26 **	16.67 **
25	EC-305653 x IC-45800	-7.28 **	-13.57 **	15.85 **	37.08 **	25.10 **	18.31 **	11.40 **	3.35 NS	1.19 NS	-0.29 NS	2.45 **	-6.26 **	-5.37 **	22.88 **	26.58 **
26	EC-305664 x IC-45800	2.33 NS	-9.44 **	9.15 **	29.17 **	17.87 **	11.31 **	4.53 *	4.57 **	2.39 NS	0.88 NS	-11.38 **	-17.16 **	-2.08 *	27.14 **	30.97 **
27	EC-305672 x IC-45800	5.81 **	-3.24 NS	-3.52 NS	14.17 **	4.18 NS	6.41 **	-2.93 NS	-4.88 **	-6.87 **	-8.24 **	5.07 **	2.26 **	-1.99 *	27.27 **	31.10 **
28	EC-305675 x IC-45800	-0.95 NS	-7.92 **	19.37 **	41.25 **	28.90 **	-5.91 **	-10.94 **	-5.49 **	-7.46 **	-8.82 **	-24.63 **	-30.73 **	19.14 **	54.70 **	59.36 **
29	EC-305685 x IC-45800	-4.32 NS	-15.54 **	20.07 **	42.08 **	29.66 **	-2.68 NS	-7.63 **	19.82 **	17.31 **	15.59 **	-41.85 **	-45.39 **	17.99 **	53.20 **	57.82 **
30	EC-305612 x IC-45800	-12.54 **	-20.23 **	18.66 **	40.42 **	28.14 **	-12.87 **	-14.76 **	20.43 **	17.91 **	16.18 **	-44.59 **	-45.81 **	2.63 **	33.25 **	37.27 **
31	EC-305714 x IC-45800	10.79 **	3.56 NS	3.17 NS	22.08 **	11.41 **	-12.87 **	-17.72 **	7.01 **	4.78 **	3.24 NS	-30.30 **	-31.57 **	-1.11 NS	28.40 **	32.27 **
32	EC-305716 x IC-45800	10.37 **	-2.08 NS	-8.10 *	8.75 *	-0.76 NS	4.55 **	-1.01 NS	7.62 **	5.37 **	3.82 *	24.07 **	23.47 **	3.62 **	34.55 **	38.60 **
33	EC-305741 x IC-45800	-6.15 **	-13.95 **	-1.06 NS	17.08 **	6.84 NS	-0.65 NS	-3.04 NS	14.63 **	12.24 **	10.59 **	-26.81 **	-30.10 **	12.77 **	46.43 **	50.84 **
	SE±	0.33	0.38				0.02	0.03				0.46	0.53			

*, ** denotes significance at 5% and 1% respectively

SN	Genotypes	No. of Seeds per fruit					100 Seed Weight					Days to Marketable Fruit				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	-49.24 **	-50.62 **	-31.76 **	-35.30 **	-17.52 **	-22.75 **	-23.08 **	-22.40 **	-13.39 **	-20.49 **	-2.73 NS	-5.31 *	0.00 NS	2.94 NS	0.00 NS
2	EC305652 x Parbhani kranti	-33.33 **	-37.37 **	-11.88 **	-16.45 **	6.52 **	-35.00 **	-43.97 **	-30.40 **	-22.32 **	-28.69 **	-7.76 **	-9.82 **	0.95 NS	3.92 NS	0.95 NS
3	EC-305653 x Parbhani kranti	-27.55 **	-32.80 **	-3.03 **	-8.07 **	17.21 **	15.79 **	13.79 **	12.00 **	25.00 **	14.75 **	-1.83 NS	-3.60 NS	0.00 NS	2.94 NS	0.00 NS
4	EC-305664 x Parbhani kranti	-41.36 **	-43.86 **	-17.94 **	-22.20 **	-0.81 NS	16.49 **	-3.42 NS	2.40 NS	14.29 **	4.92 NS	-2.33 NS	-7.08 **	1.90 NS	4.90 NS	1.90 NS
5	EC-305672 x Parbhani kranti	-32.97 **	-33.49 **	-4.55 **	-9.50 **	15.38 **	85.09 **	77.38 **	25.60 **	40.18 **	28.69 **	-3.74 NS	-8.04 **	0.00 NS	2.94 NS	0.00 NS
6	EC-305675 x Parbhani kranti	-34.31 **	-34.70 **	-16.01 **	-20.37 **	1.53 *	38.62 **	16.96 **	8.80 **	21.43 **	11.48 **	-1.41 NS	-5.41 *	0.00 NS	2.94 NS	0.00 NS
7	EC-305685 x Parbhani kranti	2.96 **	-4.58 **	67.65 **	58.95 **	102.65 **	28.76 **	28.21 **	17.60 **	31.25 **	20.49 **	-0.44 NS	-0.88 NS	8.57 **	11.76 **	8.57 **
8	EC-305612 x Parbhani kranti	-18.94 **	-22.25 **	18.45 **	12.30 **	43.18 **	51.00 **	30.17 **	15.20 **	28.57 **	18.03 **	-3.54 NS	-4.39 *	1.90 NS	4.90 NS	1.90 NS
9	EC-305714 x	-15.41	-17.78	25.61	19.09	51.83	-2.63	-4.31	-0.80	10.71	1.64	3.11	1.75	9.52	12.75	9.52

	Parbhani kranti	**	**	**	**	**	NS	NS	NS	**	NS	NS	NS	**	**	**
10	EC-305716 x Parbhani kranti	31.48 **	6.81 **	38.67 **	31.47 **	67.62 **	-37.84 **	-41.03 **	-32.80 **	-25.00 **	-31.15 **	8.68 **	5.31 *	4.76 NS	7.84 **	4.76 NS
11	EC-305741 x Parbhani kranti	40.93 **	11.38 **	39.01 **	31.79 **	68.02 **	15.34 **	3.81 NS	-8.80 **	1.79 NS	-6.56 *	4.59 *	1.79 NS	1.90 NS	4.90 NS	1.90 NS
12	EC-305613 x VROR- 159	-29.55 **	-44.88 **	-33.19 **	-36.66 **	-19.25 **	17.97 **	14.29 **	-6.40 *	4.46 NS	-4.10 NS	-5.99 **	-8.11 **	-3.81 NS	-0.98 NS	-3.81 NS
13	EC-305652 x VROR- 159	-14.50 **	-26.06 **	-13.14 **	-17.65 **	4.99 **	6.80 NS	-5.98 NS	-29.60 **	-21.43 **	-27.87 **	-10.41 **	-12.39 **	-1.90 NS	0.98 NS	-1.90 NS
14	EC-305653 x VROR- 159	-19.55 **	-32.50 **	-1.85 **	-6.95 **	18.64 **	19.08 **	15.73 **	8.80 **	21.43 **	11.48 **	-2.73 NS	-4.46 *	-4.76 NS	-1.96 NS	-4.76 NS
15	EC-305664 x VROR- 159	-42.20 **	-52.04 **	-2.86 **	-7.91 **	17.41 **	-3.48 NS	-13.39 **	-6.40 *	4.46 NS	-4.10 NS	-4.11 *	-5.41 *	-0.95 NS	1.96 NS	-0.95 NS
16	EC-305672 x VROR- 159	-21.97 **	-31.50 **	-3.03 **	-8.07 **	17.21 **	-30.95 **	-35.56 **	24.00 **	38.39 **	27.05 **	-3.64 NS	-6.19 **	-3.81 NS	-0.98 NS	-3.81 NS
17	EC-305675 x VROR- 159	-17.70 **	-29.95 **	-5.81 **	-10.70 **	13.85 **	27.85 **	3.70 NS	8.80 **	21.43 **	11.48 **	-4.11 *	-6.25 **	0.00 NS	2.94 NS	0.00 NS
18	EC-305685 x VROR- 159	-31.48 **	-42.33 **	20.13 **	13.90 **	45.21 **	3.64 NS	-5.19 NS	42.40 **	58.93 **	45.90 **	-1.83 NS	-3.60 NS	9.52 **	12.75 **	9.52 **
19	EC-305612 x VROR- 159	-9.94 **	-25.80 **	9.27 **	3.59 **	32.08 **	34.19 **	34.19 **	24.00 **	38.39 **	27.05 **	-4.98 *	-7.08 **	-1.90 NS	0.98 NS	-1.90 NS
20	EC-305714 x VROR- 159	-24.24 **	-39.32 **	21.65 **	15.34 **	47.05 **	35.32 **	16.24 **	-7.20 *	3.57 NS	-4.92 NS	-4.55 *	-6.25 **	1.90 NS	4.90 NS	1.90 NS
21	EC-305716 x VROR- 159	48.62 **	17.82 **	40.61 **	33.31 **	69.96 **	28.38 **	25.64 **	-38.40 **	-31.25 **	-36.89 **	4.11 *	2.70 NS	-2.86 NS	0.00 NS	-2.86 NS
22	EC-305741 x VROR- 159	5.83 **	-7.92 **	50.72 **	42.89 **	82.18 **	6.27 *	-6.49 *	-7.20 *	3.57 NS	-4.92 NS	-1.83 NS	-5.31 *	8.57 **	11.76 **	8.57 **
23	EC-305613 x IC-45800	7.54 **	-9.25 **	-19.63 **	-23.80 **	-2.85 **	4.20 NS	-19.48 **	-16.00 **	-6.25 NS	-13.93 **	5.99 **	2.68 NS	0.95 NS	3.92 NS	0.95 NS
24	EC-305652 x IC-45800	-49.24 **	-50.62 **	-31.76 **	-35.30 **	-17.52 **	-22.75 **	-23.08 **	-22.40 **	-13.39 **	-20.49 **	-2.73 NS	-5.31 *	0.00 NS	2.94 NS	0.00 NS
25	EC-305653 x IC-45800	23.00 **	8.06 **	-2.78 **	-7.83 **	17.52 **	-8.06 **	-12.98 **	8.00 *	20.54 **	10.66 **	-4.89 *	-5.31 *	1.90 NS	4.90 NS	1.90 NS
26	EC-305664 x IC-45800	-43.34 **	-51.73 **	-16.68 **	-21.01 **	0.71 NS	8.84 **	-10.69 **	-6.40 *	4.46 NS	-4.10 NS	-9.82 **	-9.82 **	2.86 NS	5.88 *	2.86 NS
27	EC-305672 x IC-45800	-27.52 **	-38.96 **	-4.80 **	-9.74 **	15.07 **	-27.57 **	-32.82 **	23.20 **	37.50 **	26.23 **	-7.62 **	-8.04 **	0.00 NS	2.94 NS	0.00 NS
28	EC-305675 x IC-45800	-29.29 **	-34.11 **	-2.61 **	-7.67 **	17.72 **	1.12 NS	-10.53 **	4.80 NS	16.96 **	7.38 *	-12.28 **	-13.04 **	6.67 *	9.80 **	6.67 *
29	EC-305685 x IC-45800	-32.40 **	-34.79 **	48.95 **	41.21 **	80.04 **	-0.85 NS	-23.03 **	21.60 **	35.71 **	24.59 **	-8.37 **	-9.57 **	9.52 **	12.75 **	9.52 **
30	EC-305612 x IC-45800	-33.41 **	-34.90 **	7.50 **	1.92 **	29.94 **	17.42 **	1.97 NS	25.60 **	40.18 **	28.69 **	-10.62 **	-12.17 **	2.86 NS	5.88 *	2.86 NS
31	EC-305714 x IC-45800	-20.23 **	-26.78 **	28.64 **	21.96 **	55.50 **	-0.73 NS	-13.38 **	-6.40 *	4.46 NS	-4.10 NS	-4.98 *	-7.08 **	7.62 **	10.78 **	7.62 **
32	EC-305716 x IC-45800	-2.30 **	-13.21 **	38.42 **	31.23 **	67.31 **	47.72 **	13.38 **	-32.80 **	-25.00 **	-31.15 **	4.55 *	2.68 NS	6.67 *	9.80 **	6.67 *
33	EC-305741 x IC-45800	-12.51 **	-23.21 **	42.29 **	34.90 **	72.00 **	15.24 **	-1.27 NS	-10.40 **	0.00 NS	-8.20 *	-5.94 **	-7.21 **	5.71 *	8.82 **	5.71 *
	SE±	0.33	0.38				0.18	0.20				1.06	1.22			

*, ** denotes significance at 5% and 1% respectively

SN	Genotypes	Pod Borer Infestation					YVMV Infestation					Yield Per Plant				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	EC305613 x Parbhani kranti	39.82 **	36.46 *	3.25 NS	-18.35 NS	-13.45 NS	-27.78 **	-32.47 **	-12.00 NS	-10.20 NS	-12.87 NS	8.50 NS	5.51 NS	13.79 NS	28.62 **	-7.27 NS
2	EC305652 x Parbhani kranti	4.05 NS	-4.26 NS	-14.53 NS	-32.42 **	-28.36 **	-10.78 NS	-22.08 **	2.00 NS	4.08 NS	0.99 NS	42.21 **	37.69 **	36.88 **	54.72 **	11.55 NS
3	EC-305653 x Parbhani kranti	11.98 NS	11.56 NS	-16.92 NS	-34.31 **	-30.36 **	24.39 **	-0.65 NS	21.00 NS	23.47 NS	19.80 NS	31.18 **	7.09 NS	52.92 **	72.86 **	24.62 **
4	EC-305664 x Parbhani kranti	5.66 NS	-6.54 NS	-13.67 NS	-31.73 **	-27.64 **	7.26 NS	-0.75 NS	-1.00 NS	1.02 NS	-1.98 NS	-3.02 NS	-8.01 NS	22.30 **	38.24 **	-0.33 NS
5	EC-305672 x Parbhani kranti	38.69 **	35.99 **	31.24 **	3.77 NS	10.00 NS	0.44 NS	0.00 NS	14.00 NS	16.33 NS	12.87 NS	41.27 **	33.43 **	36.57 **	54.37 **	11.30 NS
6	EC-305675 x Parbhani kranti	15.67 NS	4.91 NS	-1.74 NS	-22.30 *	-17.64 NS	29.13 **	16.67 NS	-3.00 NS	-1.02 NS	-3.96 NS	27.29 **	1.88 NS	37.44 **	55.36 **	12.01 NS
7	EC-305685 x Parbhani kranti	47.68 **	39.48 **	14.97 NS	-9.09 NS	-3.64 NS	51.75 **	29.10 **	5.00 NS	7.14 NS	3.96 NS	3.89 NS	0.47 NS	32.32 **	49.57 **	7.83 NS

8	EC-305612 x Parbhani kranti	65.96 **	57.66 **	46.85 **	16.12 NS	23.09 *	46.41 **	33.04 **	-2.00 NS	0.00 NS	-2.97 NS	42.47 **	38.39 **	66.45 **	88.15 **	35.65 **
9	EC-305714 x Parbhani kranti	21.56 NS	17.97 NS	-4.99 NS	-24.87 **	-20.36 *	84.95 **	82.98 **	-2.00 NS	0.00 NS	-2.97 NS	-41.83 **	-50.07 **	1.54 NS	14.77 NS	-17.25 **
10	EC-305716 x Parbhani kranti	47.49 **	39.76 **	14.53 NS	-9.43 NS	-4.00 NS	16.16 NS	-0.75 NS	-18.00 NS	-16.33 NS	-18.81 NS	-44.95 **	-53.84 **	-5.10 NS	7.27 NS	-22.66 **
11	EC-305741 x Parbhani kranti	17.53 NS	11.28 NS	-0.65 NS	-21.44 *	-16.73 NS	-11.43 NS	-19.13 NS	-1.00 NS	1.02 NS	-1.98 NS	-2.42 NS	-17.88 **	24.81 **	41.08 **	1.71 NS
12	EC-305613 x VROR- 159	-5.62 NS	-8.10 NS	-1.08 NS	-21.78 *	-17.09 NS	-15.51 NS	-16.84 NS	-7.00 NS	-5.10 NS	-7.92 NS	-25.34 **	-25.75 **	-8.38 NS	3.56 NS	-25.33 **
13	EC-305652 x VROR- 159	30.83 *	25.27 NS	-23.64 *	-39.62 **	-36.00 **	9.84 NS	0.00 NS	14.00 NS	16.33 NS	12.87 NS	-45.32 **	-54.57 **	11.99 NS	26.59 **	-8.73 NS
14	EC-305653 x VROR- 159	36.86 **	18.51 NS	-26.90 *	-42.20 **	-38.73 **	37.78 **	34.78 **	39.00 **	41.84 **	37.62 **	2.94 NS	-14.15 **	13.40 NS	28.19 **	-7.58 NS
15	EC-305664 x VROR- 159	28.30 *	19.60 NS	-22.56 NS	-38.77 **	-35.09 **	-12.87 NS	-20.00 NS	27.00 *	29.59 *	25.74 *	-25.30 **	-25.73 **	5.66 NS	19.44 *	-13.89 *
16	EC-305672 x VROR- 159	13.54 NS	4.79 NS	22.56 NS	-3.09 NS	2.73 NS	-25.00 **	-26.09 **	8.00 NS	10.20 NS	6.93 NS	-0.45 NS	-21.14 **	34.19 **	51.68 **	9.36 NS
17	EC-305675 x VROR- 159	-2.79 NS	-18.51 NS	-12.36 NS	-30.70 **	-26.55 **	-4.35 NS	-12.32 NS	13.00 NS	15.31 NS	11.88 NS	10.85 *	-11.90 **	34.62 **	52.17 **	9.71 NS
18	EC-305685 x VROR- 159	11.17 NS	0.00 NS	4.99 NS	-16.98 NS	-12.00 NS	-13.91 NS	-28.26 **	58.00 **	61.22 **	56.44 **	-24.75 **	-29.54 **	32.78 **	50.09 **	8.21 NS
19	EC-305612 x VROR- 159	69.47 **	60.90 **	37.53 **	8.75 NS	15.27 NS	-12.64 NS	-14.93 NS	30.00 *	32.65 **	28.71 *	29.19 **	24.13 **	23.09 **	39.14 **	0.31 NS
20	EC-305714 x VROR- 159	12.13 NS	-3.62 NS	-14.32 NS	-32.25 **	-28.18 **	-19.83 *	-23.62 *	54.00 **	57.14 **	52.48 **	29.45 **	24.92 **	-4.18 NS	8.31 NS	-21.91 **
21	EC-305716 x VROR- 159	44.02 **	33.17 *	6.07 NS	-16.12 NS	-11.09 NS	-4.11 NS	-17.32 NS	14.00 NS	16.33 NS	12.87 NS	1.21 NS	-12.64 **	-9.02 NS	2.84 NS	-25.86 **
22	EC-305741 x VROR- 159	46.22 **	23.09 *	-8.24 NS	-27.44 **	-23.09 *	-21.60 **	-26.87 **	-6.00 NS	-4.08 NS	-6.93 NS	33.27 **	12.18 *	8.56 NS	22.71 *	-11.53 NS
23	EC-305613 x IC-45800	-14.12 NS	-20.36 *	-8.89 NS	-27.96 **	-23.64 *	-15.15 NS	-15.52 NS	-5.00 NS	-3.06 NS	-5.94 NS	-19.00 **	-31.57 **	49.79 **	69.32 **	22.08 **
24	EC-305652 x IC-45800	39.82 **	36.46 *	3.25 NS	-18.35 NS	-13.45 NS	-27.78 **	-32.47 **	-12.00 NS	-10.20 NS	-12.87 NS	8.50 NS	5.51 NS	13.79 NS	28.62 **	-7.27 NS
25	EC-305653 x IC-45800	20.37 NS	18.96 NS	-31.02 *	-45.45 **	-42.18 **	-20.16 *	-26.12 **	38.00 **	40.82 **	36.63 **	2.29 NS	-12.49 *	73.58 **	96.21 **	41.46 **
26	EC-305664 x IC-45800	6.67 NS	-2.98 NS	-26.68 *	-42.02 **	-38.55 **	-18.78 *	-19.13 NS	27.00 *	29.59 *	25.74 *	-25.19 **	-35.76 **	10.02 NS	24.36 **	-10.34 NS
27	EC-305672 x IC-45800	-10.09 NS	-11.56 NS	19.31 NS	-5.66 NS	0.00 NS	10.68 NS	0.00 NS	16.00 NS	18.37 NS	14.85 NS	-23.83 **	-26.06 **	48.39 **	67.73 **	20.93 **
28	EC-305675 x IC-45800	-20.14 NS	-27.99 *	-16.49 NS	-33.96 **	-30.00 **	-2.11 NS	-7.33 NS	14.00 NS	16.33 NS	12.87 NS	-5.66 NS	-18.42 **	42.62 **	61.21 **	16.23 *
29	EC-305685 x IC-45800	-23.88 *	-24.04 *	1.52 NS	-19.73 *	-14.91 NS	-4.15 NS	-15.33 *	50.00 **	53.06 **	48.51 **	-12.43 *	-23.99 **	39.01 **	57.13 **	13.28 *
30	EC-305612 x IC-45800	30.48 **	20.73 NS	34.27 **	6.17 NS	12.55 NS	-10.74 NS	-28.00 **	32.00 **	34.69 **	30.69 *	-7.61 NS	-11.40 *	67.22 **	89.02 **	36.28 **
31	EC-305714 x IC-45800	-18.79 NS	-34.73 **	-18.44 NS	-35.51 **	-31.64 **	-15.04 *	-15.67 NS	34.00 **	36.73 **	32.67 **	0.23 NS	-19.49 **	1.41 NS	14.63 NS	-17.36 **
32	EC-305716 x IC-45800	-11.11 NS	-21.81 *	1.95 NS	-19.38 *	-14.55 NS	27.94 **	19.70 *	15.00 NS	17.35 NS	13.86 NS	-1.48 NS	-20.60 **	2.33 NS	15.67 NS	-16.60 *
33	EC-305741 x IC-45800	24.68 *	2.42 NS	-13.67 NS	-31.73 **	-27.64 **	16.07 NS	-1.52 NS	-8.00 NS	-6.12 NS	-8.91 NS	-22.75 **	-26.39 **	51.46 **	71.21 **	23.43 **
	SE±	2.36	2.72				0.49	0.57				12.04	13.91			

*, ** denotes significance at 5% and 1% respectively

Conclusion

These crosses were determined to be the best crosses for future research on the development of hybrids. All characters showed significant heterosis, but the degree varied depending on the character. The best five crosses were EC-305653 x IC-45800, EC-5612 x Parbhani Kranti, EC-305741 x IC-45800, EC-305652 x Parbhani Kranti, and EC-305664 x IC-45800. Out of the thirty-three crosses tested, nine were found to be superior in terms of high heterotic and desirable specific combining ability effect, along with high per se performance for fruit yield these crosses could be recognised for additional heterosis breeding to create hybrid okra varieties.

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