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Heterosis studies for yield and yield component in okra (*Abelmoschus esculentus* (L). Moench)

MA Kharat, RV Bhalerao, DR Bhise and PA Sasane

Abstract
Twenty F1 hybrid were generated from twelve parents through line x tester mating design, these F1s along with 12 parents and 3 commercial checks were evaluated to study the magnitude of heterosis. significant heterosis was found over mid parent, better parent and standard checks for all the traits studied in desirable direction. Maximum desirable heterosis was observed in the cross IC-293590 X EC-305653 for internodal length and number of nodes on the main stem over mid parent (-16.43% and 7.54%), Better parent (-19.46% and 6.25%). The cross IC-293590 X EC-305741 exhibited maximum standard heterosis over the mid parent (12.50%) and over the better parent (11.24%) for days to 50% flowering. High estimate of heterosis obtained in hybrid combination releveled considerable genetic divergent among the parental line and also reveals good scope for commercial exploitation of heterosis in okra.

Keywords: Heterosis, standard heterosis, genetic divergent, okra

1. Introduction
Okra (*Abelmoschus esculentus* L. (Moench), is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This crop is suitable for cultivation as a garden crop as well as on large commercial farms. It is grown commercially in India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Burma, Japan, Malayasia, Brazil, Ghana, Ethiopia, Cyprus and the Southern United States.

In India, Okra is cultivated in an area of 0.51 million hectare with 6.18 million tonnes of produce with an average productivity of 12.04 tonnes per hectare and in Maharashtra it occupies an area of 13.98 thousand hectare with an annual production of 139.40 thousand tonnes and productivity of 9.97 tonnes per hectare (Anonymous, 2018) [1]. The states which are majorly involved in okra production are west Bengal, Gujarat, Orissa, Bihar and Andhra Pradesh.

Heterosis breeding based on the recognition of the parents and their cross combinations is capable of producing the highest level of transgressive segregates (Falconer, 1960) [2]. Exploitation of heterosis in okra has been identified as an important method for improving the yield and other important traits. One of the most important factors in determining the workability of hybrid is the nature and extent of heterosis and Sexploitation. therefore, for improving the genetic yield potential of varieties and hybrids, choice of right type of parents for hybridization is important. This points up the importance of testing the parents for combining ability and indication of hybrid vigor, because many times the high yielding parents may not combine well to give good hybrids. Hence, useful gene combinations between parents are essential to get needed heterosis in crosses.

Heterosis that has superiority over better parent is useful in deciding the direction of future hybrid breeding programme. It also identifies the cross combinations which are promising in conventional breeding programme. Heterosis leads to increase in yield, reproductive ability adaptability, biotic and abiotic resistance, general vigour and quality. The wide range of heterosis observed by various workers in okra may not be of much practical value unless it is manifested as increase over standard commercial varieties. In some cases, over-dominance was observed for days to first flowering, fruit length and weight, plant height and yield per plant. Thus, it suggests, that hybrid vigour can be exploited in okra for increasing pod yield through early flowering, increased plant height, fruit length and weight. The potential of this approach is evident from the reports where more than 100% increase in yield over better parent has been recorded and also presence of dominance gene effects for yield and yield contributing traits. Inbreeding depression defines to decrease in fitness and vigour due to

inbreeding effect.
It increases homozygosity in the genotype by continuous selfing. It results due to fixation of undesirable recessive genes in F_{1s}.

2. Material and Method

The investigation on heterosis studies in okra was carried out at the Department of horticulture, College of Agriculture, VNMKV, Parbhani Dist. Parbhani, Maharashtra. The Experimental material comprised 12 parents among which 10 line and 2 testers were collected from NBPGR, New Delhi and their 20 F1s hybrid with 3 standard checks (Mahyco bhindi No-10, Pusa Sawani, Parbhani Kranti). Each 12-parent cross among each other in line x tester mating design crosses to derive 20 F1 hybrid. The experiment was laid out in randomized block design with two replications. Each treatment or genotype in each replication was represented by one row each according to 20 plants at a spacing row to row spacing of 60 cm and 30 cm from plant to plant. Five plants were randomly selected for each genotype from each replication and evaluated for the quantitative characters of parents and hybrid.

3. Result and Discussion

The analysis of variance revealed significant difference among treatments for all characters indicating the presence of appreciable genetic diversity among the parents and cross combination. Heterosis for growth parameter is an indication of heterosis for yield as growth, and yield parameters are strongly associated (Bhatt *et al*., 2016) [3]. Heterosis for growth parameter were presented in Table 1 to 8

For days to 50% flowering out of the 20 crosses evaluated nine (IC-293590 X EC-305741), nine (IC-293590 X EC-305741), and (Punjab-8 x EC-305612) fifteen crosses displayed significant positive heterosis over mid parent, better parent, standard check Mahyco bhindi No-10. The cross IC-293590 x EC-305741 (12.50%) exhibited the highest significant positive heterosis over mid parent, The cross IC-293590 x EC-305741 (11.24%) exhibit highest significant positive heterosis over better parent, The cross Punjab-8 x EC-305689 (9.20%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10. Similar observations were reported by Reddy *et al*. (2012) [9], Sapavadiya *et al*. (2019) [10] for days to 50% flowering.

Among 20 crosses evaluated for number of days to 1st harvest crosses nine (IC-293590 X EC- 305741), nine (IC-293590 X EC-305741), and fourteen (Punjab-8 X EC-305653) displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10. IC-293590 x EC-305741 (10.00%) exhibited the highest significant positive heterosis over mid parent, The cross IC-293590 x EC-305741 (8.91%) exhibit highest significant positive heterosis over better parent The cross Punjab-8 x EC-305653 (5.05%) exhibit highest significant positive heterosis followed over standard check Mahyco bhindi Hybrid No-10. Similar results reported by Reddy *et al*. (2012) [9], and Nagesh *et al*. (2014) [7].

For number of nodes at which 1st flowering out of the 20 crosses evaluated crosses four (IC- 293590 X EC-305612), four (IC-293590 X EC-305612), five (IC-293590 X EC-305672) and five (IC-293590 X EC-305672) displayed significant negative heterosis over mid parent, better parent, standard check Mahyco hybrid No-10 and Parbhani Kranti, respectively and cross fourteen (Punjab-8 X EC-305653) exhibit highly positively significant over standard check Pusa Sawani. The cross IC-293590 x EC-305012 (-24.32%) exhibited the highest significant negative heterosis over mid parent, The cross IC-293590 x EC-305612 (-26.32%) exhibit highest significant negative heterosis over better parent, The cross Punjab-8 x EC- 305653 (11.54%) exhibit highest significant positive heterosis followed over standard check Mahyco bhindi Hybrid No-10, The cross Punjab-8 x EC-305653 (14.47%) exhibit highest significant positive heterosis over standard check Pusa Sawani. The cross IC-293590 x EC-305672 (-16.67%) exhibit highest significant negative heterosis over standard check Parbhani Kranti. Fruiting at early node is desirable in okra crop similar results reported by Reddy *et al*. (2012) [9], Nagesh *et al*. (2014) [7].

Out of 20 cross evaluated second (IC-293590 X EC-305652), second (IC-293590 X EC- 305652), second (IC-293590 X EC-305652) and fourteen (Punjab-8 X EC-305653) crosses displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10 for number of fruit per plant The cross IC-293590 x EC-305652 (43.48%) exhibited the highest significant positive heterosis over mid parent, The cross IC- 293590 x EC-305652 (43.48%) exhibit highest significant positive heterosis over better parent, The cross Punjab-8 x EC-305653 (17.16%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10 Similar results are in confirmation with the earlier findings of Reddy *et al*. (2012) [9], and Nagesh *et al*. (2014) [7].

Out of the 20 crosses evaluated fourteen (Punjab-8 X EC-305653), fourteen (Punjab-8 X EC- 305653), seventeen (Punjab-8 X EC-305664), seventeen (Punjab-8 X EC-305664) and seventeen (Punjab-8 X EC-305664), crosses displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10, Pusa Sawani, Parbhani Kranti for weight of fruit. The cross Punjab8 x EC-305653 (17.53%) exhibited the highest significant positive heterosis over mid parent, The cross Punjab-8x EC-305653 (15.15%) exhibit highest significant positive heterosis over better parent, The cross Punjab-8 x EC-305664 (28.89%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No- 10, The cross Punjab-8 x EC-305664 (45.00%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross Punjab8 x EC-305664 (25.41%) exhibit highest significant positive heterosis over standard check Parbhani Kranti Similar results were reported by Patel *et al*. (2015) [8], Singh *et al*. (2015) [11] and Suganthi *et al*. (2019) [12].

For length of fruit out of the 20 crosses, evaluated ten (IC-293590 X EC-305675), ten (IC- 293590 X EC-305675), crosses each displayed significant negative heterosis over mid parent and better parents and crosses seventeen (Punjab-8 X EC-305664) each displayed significant positive heterosis over standard check Mahyco Hybrid No.10, Pusa Sawani, Parbhani Kranti. The cross IC-293590 x EC-305675 (-14.22%) exhibited the highest significant negative heterosis over mid parent, The cross IC-293590 x EC-305675 (-15.77%) exhibit highest significant negative heterosis over better parent, The cross Punjab8 x EC-305664 (20.41%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No- 10, The cross Punjab-8 x EC-305664 (13.46%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross Punjab8 x EC-305664

(9.77%) exhibit highest significant positive heterosis over standard check Parbhani Kranti Similar results were reported by, Patel *et al*. (2015) [8], Singh *et al*. (2015) [11].

Out of the 20 crosses evaluated one (IC-293590 X EC-305741), one (IC-293590 X EC- 305741), eighteen (Punjab-8 x EC-305613) crosses displayed significant negative heterosis over mid parent, better parents, and standard check Mahyco Hybrid No-10. And crosses second (IC-293590 X EC-305652), second (IC-293590 X EC-305652) displayed significant positive heterosis over standard check Pusa Sawani and Parbhani Kranti for diameter of fruit. The cross IC-293590 x EC-30514 (-20.00%) exhibited the highest significant negative heterosis over mid parent, The cross IC-293590 x EC-3056714 (-21.05%) exhibit highest significant negative heterosis over better parent, The cross Punjab-8 x EC-305613 (-7.89%) exhibit highest significant negative heterosis over standard check Mahyco bhindi Hybrid No- 10, The cross IC-293590 x EC-305652 (14.29%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross IC-293590 x EC-305652 (11.11%) exhibit highest significant positive heterosis over standard check Parbhani Kranti Similar results were reported by, Patel *et al*. (2015) [8], Singh *et al*. (2015) [11].

For number of ridges per fruit out of the 20 crosses evaluated three (IC-293590 X EC- 305689), nine (IC-293590 X EC-305741) and twenty (Punjab-8 X EC-305714) crosses displayed significant positive heterosis over mid parent, better parent respectively. The cross IC-293590 x EC305689, IC-293590 x EC-305741 and Punjab8 x EC305614 (20.20%) exhibited the highest significant positive heterosis over mid parent. The cross IC-293590 x EC305689, IC-293590 x EC-305741 and Punjab8 x EC305614 (20.20%) exhibit highest significant positive heterosis over better parent. Similar results reported by Mulge *et al*. (2018) [16].

Among 20 crosses evaluated four (IC-293590 X EC-305612), four (IC-293590 X EC- 305612), and six (IC-293590 X EC-305741) crosses displayed significant negative heterosis over mid parent, better parent, standard check Mahyco hybrid No-10 for number of nodes per plant and crosses ten each (IC-293590 X EC-305675) displayed significant positive heterosis over standard check Pusa Sawani, Parbhani Kranti. The cross Punjab8 x EC-305653 (8.67%) exhibited the highest significant positive heterosis over mid parent, The cross IC-293590 x EC-305653 (6.25%) exhibit highest significant positive heterosis over better parent, The cross IC-293590 x EC-305675 (8.76%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10, The cross IC-293590 x EC-305675 (11.32%) exhibit highest significant positive heterosis over standard check Pusa Sawani,The cross IC- 293590 x EC-305675 (16.26%) exhibit highest significant positive heterosis over standard check Parbhani Kranti. Number of nodes per plant directly related to number of fruits per plant hence significant positive heterosis is desirable for this character. Similarly result obtained by Medagam *et al*. (2013) [15].

For plant height out of the 20 crosses evaluated three (IC-293590 X EC-305689), three (IC- 293590 X EC-305689) sixteen (Punjab-8 X EC-305612) sixteen (Punjab-8 X EC-305612), sixteen (Punjab-8 X EC-305612) crosses displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10, Pusa Sawani and Parbhani Kranti. The cross IC-293590 x EC-305689 (6.73%) exhibited the highest significant positive heterosis over mid parent, The cross IC-293590 x EC-305689 (6.05%) exhibit highest significant positive heterosis over better parent, The cross Punjab8 x EC-305612 (15.35%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No- 10, The cross Punjba8 x EC-305612 (10.66%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross Punjab8 x EC-305612 (18.41%) exhibit highest significant positive heterosis over standard check Parbhani Kranti. Plant height is one of the most important yields contributing traits along with the number of nodes per plant which influence the yield and hence significant and positive heterosis for plant height is desirable character. Similar results were obtained by Singh *et al.* (2015) [11], Sapavadiya *et al*. (2019) [10].

Among the 20 crosses evaluated for number of branches per plant twelve, twelve (Punjab-8 X EC-305652), eleven (Punjab-8 X EC-305675) eleven (Punjab-8 X EC-305675) crosses displayed significant negative heterosis over mid parent, better parent, Pusa Sawani and Parbhani Kranti and fourteen (Punjab-8 X EC-305653) cross displayed significant positive heterosis over standard check Mahyco bhindi No.10. The cross Punjab-8 x EC-305652 (- 35.21%) exhibited the highest significant negative heterosis over mid parent, The cross Punjab-8 x EC-305652 (-42.50%) exhibit highest significant negative heterosis over better parent, The cross Punjab8 x EC-305653 (42.86%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10, The cross Punjba8 x EC-305675 (-18.18%) exhibit highest significant negative heterosis over standard check Pusa Sawani, Punjab-8 x EC-305612 (-12.12%).The cross Punjab8 x EC-305675 (-20.59%) exhibit highest significant positive heterosis over standard check Parbhani Kranti. Vegetative growth is essential for higher yield and 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. Similar results reported by Reddy *et al.* (2012) [9], Kumar *et al*. (2017) [3], and Sapavadiya *et al*. (2019) [10].

Out of the 20 crosses evaluated a six (IC-293590 X EC-305653) each crosses displayed significant negative heterosis over mid parent and better parent whereas Ten (IC-293590 X EC-305675) each displayed over three standard checks for internodal length The cross IC- 293590 x EC-305653 (-16.43%) exhibited the highest significant negative heterosis over mid parent, The cross IC-293590 x EC-305653 (-19.46%) exhibit highest significant negative heterosis over better parent, The cross IC-293590 x EC-305675 (-12.62%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10, The cross IC-293590 x EC-305675 (-13.88%) exhibit highest significant negative heterosis over standard check Pusa Sawani, The cross IC-293590 x EC-305675 (-9.09%) exhibit highest significant negative heterosis over standard check Parbhani Kranti. Internodal length is inversely proportional to the number of nodes per plant hence significant and negative heterosis is desirable for this character. Similarly, results were reported by Reddy *et al*. (2012) [9], Medagam *et al.* (2013) [15].

For number of seed per fruit out of the 20 crosses evaluated six (IC-293590 X EC-305653) and fourteen (Punjab-8 X EC-305653), However, nineteen (Punjab-8 X EC-305741) each cross displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10, Pusa Sawani and Parbhani Kranti. The cross IC-293590 x EC-

305653 (22.59%) exhibited the highest significant positive heterosis over mid parent, The cross Punjba8 x EC-305653 (15.54%) exhibit highest significant positive heterosis over better parent, The cross Punjab8 x EC-305741 (15.19%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10, The cross Punjba8 x EC-305741 (27.23%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross Punjab8 x EC-305741 (23.34%) exhibit highest significant positive heterosis over standard check Similar result was found in Patel *et al*. (2015) [8] and Makdoomi *et al*. (2018) [4].

Among the 20 crosses evaluated five (IC-293590 X EC-305672), three (IC-293590 X EC- 305689) crosses displayed significant positive heterosis over mid parent and better parent whereas seven (IC-293590 X EC-305613), each crosses displayed significant negative heterosis over standard check Mahyco Hybrid No.10, Pusa Sawani, and Parbhani Kranti for weight of 100 seed The cross IC-293590 x EC-305613 (40.87%) exhibited the highest significant positive heterosis over mid parent, The cross IC-293590 x EC-305689 (13.76%) exhibit highest significant positive heterosis over better parent, The cross IC-203590 X EC- 305613 (-22.79%) exhibit highest negative heterosis over standard check Mahyco bhindi No - 10 ,The cross IC-293590 x EC-305613 (-26.57%) exhibit highest negative heterosis over standard check Pusa Sawani, The cross IC-293590 x EC-305613 (-20.45%) exhibit highest negative heterosis over standard check Parbhani Kranti, Similar result was found by Makdoomi *et al*. (2018) [4].

For yield per plant among 20 crosses evaluated Second (IC-293590 X EC-305652) cross displayed significant positive heterosis over mid parent, better parent, standard check Mahyco hybrid No-10, Pusa Sawani and Parbhani Kranti. The cross IC-293590 x EC-305652 (56.59%) exhibited the highest significant positive heterosis over mid parent, The cross Punjab8x EC-305653 (55.00%) exhibit highest significant positive heterosis over better parent, The cross IC-293590 x EC-305652 (32.25%) exhibit highest significant positive heterosis over standard check Mahyco bhindi Hybrid No-10, The cross IC-293590 x EC- 305652 (51.25%) exhibit highest significant positive heterosis over standard check Pusa Sawani, The cross IC-293590 x EC-305652 (27.47%) exhibit highest significant positive heterosis over standard check Parbhani Kranti. Similar results are in confirmation with the earlier findings of Reddy *et al*. (2012) [9] and Nagesh *et al*. (2014) [7].

Out of the 20 crosses evaluated sixteen (Punjab-8 X EC-305613), eight (IC-293590 X EC- 305664), thirteen (Punjab-8 X EC-305672), second (IC-293590 X EC-305652), seventeen (Punjab-8 X EC-305664) and second (IC-293590 X EC-305652), seventeen (Punjab-8 X EC- 305664) crosses displayed Minimum pod borer infestation over mid parent, better parent, standard check Mahyco hybrid No.10, Pusa Sawani, Parbhani Kranti The cross Punjab-8 x EC-305612 (-23.16%) exhibited the minimum incidence of pod borer infestation over mid parent, The cross IC-293590 x EC-305741 (-17.33%) exhibit minimum incidence of pod borer infestation over better parent, The cross Punjab-8 x EC-305741 (-22.51%) exhibit minimum incidence of pod borer infestation over standard check Mahyco bhindi Hybrid No.10, The cross IC-293590 x EC-305652, Punjab-8 x EC-305664 (-25.19%) exhibit minimum incidence of pod borer infestation over standard check Pusa Sawani, The cross IC293590 x EC-305689, Punjab-8 x EC-305612 (-24.62%) exhibit minimum incidence of pod borer infestation over standard check Parbhani Kranti. similar result was reported by Medagam *et al*. (2013) [15].

Out of the 20 crosses evaluated sixteen (Punjab-8 X EC-305612) fourteen (Punjab-8 X EC- 305653), one (IC-293590 X EC-305714), fourteen (Punjab-8 X EC-305653), and sixteen (Punjab-8 X EC-305612) crosses displayed Minimum incidence of yellow vein mosaic virus over mid parent, better parent, standard check Mahyco hybrid No-10, Pusa Sawani and Parbhani Kranti. The cross Punjab-8 x EC-305612 (-19.80%) exhibited the minimum incidence of yellow vein mosaic virus over mid parent, The cross Punjab-8 x EC-305653 (- 12.28%) exhibit minimum incidence of yellow vein mosaic virus over better parent, The cross IC-293590 x EC-305714 (-16.42%) exhibit minimum incidence of yellow vein mosaic virus over standard check Mahyco bhindi No. 10 followed by IC-293590x EC-305741 (- 17.16%) and Punjab-8 x EC-305741 (-35.82%). The cross Punjab-8 x EC-305653 (-29.63%) exhibit minimum incidence of yellow vein mosaic virus over standard check Pusa Sawani followed by IC-293590x EC-305675 (-31.85%) and IC-293590 x EC-305664 (-34.07%). The cross Punjab-8 x EC-305612 (-16.55%) exhibit minimum incidence of yellow vein mosaic virus over standard check Parbhani Kranti followed by IC- 293590x EC-305714 (-19.42%) and IC-293590 x EC-305741 (-20.14%). Similar results reported by Medagam *et al*. (2013) [15] and Medagam *et al*. (2013) [15].

Table 1: Heterosis percentage over mid parent, better parent, and standard check in line x tester crosses in okra

SN	Genotypes	Days to 50% Flowering					No days to 1st Harvest				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	0.56 ns	-1.11 ns	6.90 **	2.20 ns	0.00 ns	3.52 ns	3.00 ns	3.03 ns	-0.97 ns	-0.97 ns
2	IC293590 X EC305652	1.69 ns	0.00 ns	0.00 ns	-4.40 *	-6.45 **	1.01 ns	0.00 ns	-2.02 ns	-5.83 **	-5.83 **
3	IC293590 X EC305689	-2.25 ns	-4.40 *	4.60 *	0.00 ns	-2.15 ns	-1.00 ns	-1.98 ns	3.03 ns	-0.97 ns	-0.97 ns
4	IC293590 X EC305612	3.37 ns	1.10 ns	5.75 **	1.10 ns	-1.08 ns	6.53 **	4.95 ns	4.04 ns	0.00 ns	0.00 ns
5	IC293590 X EC305672	2.30 ns	2.30 ns	4.60 *	0.00 ns	-2.15 ns	3.03 ns	3.03 ns	3.03 ns	-0.97 ns	-0.97 ns
6	IC293590 X EC305653	8.05 **	8.05 **	1.15 ns	-3.30 ns	-5.38 **	7.61 **	7.07 **	1.01 ns	-2.91 ns	-2.91 ns
7	IC293590 X EC305613	0.00 ns	-2.20 ns	6.90 **	2.20 ns	0.00 ns	-1.98 ns	-3.88 ns	4.04 ns	0.00 ns	0.00 ns
8	IC293590 X EC305664	5.62 **	3.30 ns	4.60 *	0.00 ns	-2.15 ns	5.47 *	2.91 ns	3.03 ns	-0.97 ns	-0.97 ns
9	IC293590 X EC305741	12.50 **	11.24 **	3.45 ns	-1.10 ns	-3.23 ns	10.00 **	8.91 **	1.01 ns	-2.91 ns	-2.91 ns
10	IC293590 X EC305675	0.00 ns	-1.12 ns	4.60 *	0.00 ns	-2.15 ns	-2.51 ns	-3.96 ns	2.02 ns	-1.94 ns	-1.94 ns
11	Punjab 8 x EC305675	-1.12 ns	-3.30 ns	0.00 ns	-4.40 *	-6.45 **	-1.48 ns	-3.85 ns	0.00 ns	-3.88 ns	-3.88 ns
12	Punjab 8 x EC305652	3.37 ns	1.10 ns	4.60 *	0.00 ns	-2.15 ns	2.97 ns	0.00 ns	4.04 ns	0.00 ns	0.00 ns
13	Punjab 8 x EC305672	2.20 ns	-2.11 ns	2.30 ns	-2.20 ns	-4.30 *	0.99 ns	-0.97 ns	2.02 ns	-1.94 ns	-1.94 ns
14	Punjab 8 x EC305653	-4.40 *	-8.42 **	4.60 *	0.00 ns	-2.15 ns	-3.48 ns	-5.83 *	5.05 *	0.97 ns	0.97 ns
15	Punjab 8 x EC305689	3.41 ns	2.25 ns	9.20 **	4.40 *	2.15 ns	2.00 ns	0.99 ns	4.04 ns	0.00 ns	0.00 ns

16	Punjab 8 x EC305612	4.55 *	3.37 ns	2.30 ns	-2.20 ns	-4.30 *	3.52 ns	1.98 ns	2.02 ns	-1.94 ns	-1.94 ns
17	Punjab 8 x EC305664	3.41 ns	2.25 ns	2.30 ns	-2.20 ns	-4.30 *	0.99 ns	-0.97 ns	4.04 ns	0.00 ns	0.00 ns
18	Punjab 8 x EC305613	0.00 ns	-1.12 ns	0.00 ns	-4.40 *	-6.45 **	-0.50 ns	-2.91 ns	0.00 ns	-3.88 ns	-3.88 ns
19	Punjab 8 x EC305741	6.90 **	6.90 **	0.00 ns	-4.40 *	-6.45 **	4.04 ns	4.04 ns	0.00 ns	-3.88 ns	-3.88 ns
20	Punjab 8 x EC305714	4.60 *	4.60 *	0.00 ns	-4.40 *	-6.45 **	3.55 ns	3.03 ns	-1.01 ns	-4.85 *	-4.85 *
	SE±	0.41	0.94	0.82			1.11	1.28	1.05		

SN	Genotypes	No.of node at 1st flowering					Number of Fruits / Plant				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-21.05 **	-25.00 **	-5.13 ns	-2.63 ns	-11.90 *	24.42 **	17.39 **	-17.49 **	-22.36 **	-24.24 **
2	IC293590 X EC305652	-21.05 **	-25.00 **	-7.69 ns	-5.26 ns	-14.29 **	43.48 **	43.48 **	14.19 **	7.45 ns	4.85 ns
3	IC293590 X EC305689	-5.41 ns	-7.89 ns	2.56 ns	5.26 ns	-4.76 ns	-2.17 ns	-22.41 **	-10.89 *	-16.15 **	-18.18 **
4	IC293590 X EC305612	-24.32 **	-26.32 **	3.85 ns	6.58 ns	-3.57 ns	0.35 ns	-16.67 **	8.25 ns	1.86 ns	-0.61 ns
5	IC293590 X EC305672	-4.90 ns	-5.56 ns	-10.26 *	-7.89 ns	-16.67 **	28.18 **	2.65 ns	8.91 ns	2.48 ns	0.00 ns
6	IC293590 X EC305653	-2.10 ns	-2.78 ns	2.56 ns	5.26 ns	-4.76 ns	-3.34 ns	-18.88 **	15.51 **	8.70 ns	6.06 ns
7	IC293590 X EC305613	1.39 ns	1.39 ns	-7.69 ns	-5.26 ns	-14.29 **	29.63 **	4.17 ns	-7.92 ns	-13.35 **	-15.45 **
8	IC293590 X EC305664	-6.94 ns	-6.94 ns	-5.13 ns	-2.63 ns	-11.90 *	20.49 **	1.49 ns	-1.65 ns	-7.45 ns	-9.70 *
9	IC293590 X EC305741	-2.78 ns	-2.78 ns	2.56 ns	5.26 ns	-4.76 ns	-24.81 **	-39.02 **	-24.09 **	-28.57 **	-30.30 **
10	IC293590 X EC305675	-5.56 ns	-5.56 ns	-2.56 ns	-0.00 ns	-9.52 *	-19.35 **	-31.40 **	14.85 **	8.07 ns	5.45 ns
11	Punjab 8 x EC305675	-1.89 ns	-10.34 **	-8.97 ns	-6.58 ns	-15.48 **	15.21 **	-9.30 **	11.88 *	5.28 ns	2.73 ns
12	Punjab 8 x EC305652	-5.66 ns	-13.79 **	-7.69 ns	-5.26 ns	-14.29 **	16.92 **	-3.66 ns	10.89 *	4.35 ns	1.82 ns
13	Punjab 8 x EC305672	-6.33 ns	-13.95 **	-7.69 ns	-5.26 ns	-14.29 **	5.49 ns	-7.41 ns	8.25 ns	1.86 ns	-0.61 ns
14	Punjab 8 x EC305653	-8.86 *	-16.28 **	11.54 *	14.47 **	3.57 ns	38.40 **	28.15 **	17.16 **	10.25 *	7.58 ns
15	Punjab 8 x EC305689	5.96 ns	1.27 ns	10.26 *	13.16 *	2.38 ns	3.45 ns	-15.09 **	-10.89 *	-16.15 **	-18.18 **
16	Punjab 8 x EC305612	7.28 ns	2.53 ns	1.28 ns	3.95 ns	-5.95 ns	19.71 **	3.14 ns	4.95 ns	-1.24 ns	-3.64 ns
17	Punjab 8 x EC305664	-4.11 ns	-5.41 ns	-5.13 ns	-2.63 ns	-11.90 *	32.26 **	11.86 **	-2.64 ns	-8.39 ns	-10.61 *
18	Punjab 8 x EC305613	9.59 *	8.11 ns	-5.13 ns	-2.63 ns	-11.90 *	33.33 **	18.64 **	-14.19 **	-19.25 **	-21.21 **
19	Punjab 8 x EC305741	-1.37 ns	-2.70 ns	-7.69 ns	-5.26 ns	-14.29 **	20.26 **	7.31 ns	-32.67 **	-36.65 **	-38.18 **
20	Punjab 8 x EC305714	1.37 ns	0.00 ns	-7.69 ns	-5.26 ns	-14.29 **	21.63 **	14.62 **	-24.09 **	-28.57 **	-30.30 **
	SE±	0.14	0.16	0.18			0.46	0.54	0.76		

SN	Genotypes	Fruit Weight (g)					Fruit Length (cm)				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-20.37 **	-22.73 **	13.89 *	28.13 **	10.81 ns	-2.83 ns	-5.07 ns	7.14 *	0.96 ns	-2.33 ns
2	IC293590 X EC305652	13.58 **	11.11 *	26.67 **	42.50 **	23.24 **	-7.06 **	-8.11 **	9.69 **	3.37 ns	0.00 ns
3	IC293590 X EC305689	-20.18 **	-20.91 **	1.11 ns	13.75 ns	-1.62 ns	1.22 ns	0.48 ns	11.22 **	4.81 ns	1.40 ns
4	IC293590 X EC305612	-5.80 ns	-9.72 *	23.89 **	39.38 **	20.54 **	-5.16 ns	-9.01 **	15.31 **	8.65 **	5.12 ns
5	IC293590 X EC305672	-5.02 ns	-5.45 ns	3.33 ns	16.25 *	0.54 ns	-5.44 *	-7.41 *	7.65 *	1.44 ns	-1.86 ns
6	IC293590 X EC305653	8.65 *	3.67 ns	18.89 **	33.75 **	15.68 *	-5.94 *	-7.21 *	7.14 *	0.96 ns	-2.33 ns
7	IC293590 X EC305613	-7.83 *	-9.25 *	-1.11 ns	11.25 ns	-3.78 ns	-5.61 *	-8.60 **	10.20 **	3.85 ns	0.47 ns
8	IC293590 X EC305664	-4.00 ns	-10.13 *	21.67 **	36.87 **	18.38 **	-1.58 ns	-1.80 ns	8.16 *	1.92 ns	-1.40 ns
9	IC293590 X EC305741	8.19 ns	-0.91 ns	15.00 *	29.37 **	11.89 ns	-11.64 **	-13.08 **	10.71 **	4.33 ns	0.93 ns
10	IC293590 X EC305675	8.14 ns	4.04 ns	20.00 **	35.00 **	16.76 *	-14.22 **	-15.77 **	4.08 ns	-1.92 ns	-5.12 ns
11	Punjab 8 x EC305675	1.65 ns	-2.27 ns	21.11 **	36.25 **	17.84 **	5.46 *	3.74 ns	10.20 **	3.85 ns	0.47 ns
12	Punjab 8 x EC305652	3.74 ns	2.46 ns	26.11 **	41.87 **	22.70 **	-3.21 ns	-4.95 ns	12.76 **	6.25 *	2.79 ns
13	Punjab 8 x EC305672	0.00 ns	-6.82 ns	1.67 ns	14.37 *	-1.08 ns	-2.10 ns	-5.41 ns	9.18 **	2.88 ns	-0.47 ns
14	Punjab 8 x EC305653	17.53 **	15.15 **	12.78 *	26.88 **	9.73 ns	-3.15 ns	-3.15 ns	9.18 **	2.88 ns	-0.47 ns
15	Punjab 8 x EC305689	-17.65 **	-18.02 **	5.56 ns	18.75 *	2.70 ns	-0.91 ns	-6.44 *	13.27 **	6.73 *	3.26 ns
16	Punjab 8 x EC305612	6.19 ns	0.45 ns	23.33 **	38.75 **	20.00 **	-0.66 ns	-3.00 ns	18.88 **	12.02 **	8.37 **
17	Punjab 8 x EC305664	-17.70 **	-19.83 **	28.89 **	45.00 **	25.41 **	-4.74 ns	-10.59 **	20.41 **	13.46 **	9.77 **
18	Punjab 8 x EC305613	-0.47 ns	-7.76 ns	9.44 ns	23.12 **	6.49 ns	-8.30 **	-11.02 **	11.22 **	4.81 ns	1.40 ns
19	Punjab 8 x EC305741	-14.63 **	-19.09 **	22.22 **	37.50 **	18.92 **	1.65 ns	-0.92 ns	5.61 ns	-0.48 ns	-3.72 ns
20	Punjab 8 x EC305714	10.89 *	10.61 *	10.00 ns	23.75 **	7.03 ns	-3.64 ns	-4.50 ns	13.27 **	6.73 *	3.26 ns
	SE±	0.41	0.48	0.55			0.27	0.32	0.3		

SN	Genotypes	Fruit Diameter (cm)					No of Ridges / fruit				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-20.00 **	-21.05 **	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
2	IC293590 X EC305652	-2.63 ns	-2.63 ns	5.26 *	14.29 **	11.11 **	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
3	IC293590 X EC305689	-5.41 *	-5.41 *	-5.26 *	2.86 ns	0.00 ns	20.00 **	20.00 **	0.00 ns	0.00 ns	0.00 ns
4	IC293590 X EC305612	-9.33 **	-10.53 **	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
5	IC293590 X EC305672	-5.41 *	-5.41 *	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
6	IC293590 X EC305653	-6.67 **	-7.89 **	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
7	IC293590 X EC305613	-5.41 *	-5.41 *	-5.26 *	2.86 ns	0.00 ns	-9.09 **	-16.67 **	0.00 ns	0.00 ns	0.00 ns
8	IC293590 X EC305664	-12.00 **	-13.16 **	-2.63 ns	5.71 *	2.78 ns	-9.09 **	-16.67 **	20.00 ns	20.00 ns	20.00 ns
9	IC293590 X EC305741	-4.11 ns	-5.41 *	0.00 ns	8.57 **	5.56 *	20.00 **	20.00 **	0.00 ns	0.00 ns	0.00 ns
10	IC293590 X EC305675	-10.81 **	-13.16 **	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns

11	Punjab 8 x EC305675	-6.85 **	-8.11 **	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
12	Punjab 8 x EC305652	-2.70 ns	-5.26 *	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	20.00 ns	20.00 ns	20.00 ns
13	Punjab 8 x EC305672	-2.70 ns	-2.70 ns	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
14	Punjab 8 x EC305653	6.67 **	5.26 *	-5.26 *	2.86 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
15	Punjab 8 x EC305689	-5.26 *	-7.69 **	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
16	Punjab 8 x EC305612	-6.49 **	-7.69 **	2.63 ns	11.43 **	8.33 **	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
17	Punjab 8 x EC305664	-2.70 ns	-2.70 ns	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
18	Punjab 8 x EC305613	-4.00 ns	-5.26 *	-7.89 **	0.00 ns	-2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
19	Punjab 8 x EC305741	0.00 ns	-2.70 ns	-2.63 ns	5.71 *	2.78 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns	0.00 ns
20	Punjab 8 x EC305714	1.37 ns	-2.63 ns	0.00 ns	8.57 **	5.56 *	20.00 **	20.00 **	0.00 ns	0.00 ns	0.00 ns
	SE±	0.03	0.04	0.04			0	0	0		

SN	Genotypes	No of Nodes / plant					Plant Height (cm)				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	4.19 *	-0.88 ns	-3.23 ns	-0.94 ns	3.45 ns	-1.68 ns	-2.57 ns	-7.72 **	-11.47 **	-5.27 *
2	IC293590 X EC305652	3.50 *	-1.77 ns	6.91 **	9.43 **	14.29 **	0.34 ns	0.00 ns	10.88 **	6.37 **	13.82 **
3	IC293590 X EC305689	-5.91 **	-12.29 **	0.46 ns	2.83 ns	7.39 **	6.73 **	6.05 **	2.17 ns	-1.99 ns	4.88 *
4	IC293590 X EC305612	-10.25 **	-16.53 **	-5.53 *	-3.30 ns	0.99 ns	-9.14 **	-10.23 **	-3.39 ns	-7.32 **	-0.82 ns
5	IC293590 X EC305672	1.94 ns	0.96 ns	-5.99 *	-3.77 ns	0.49 ns	-7.60 **	-11.35 **	-4.43 *	-8.31 **	-1.88 ns
6	IC293590 X EC305653	7.54 **	6.25 **	-4.61 *	-2.36 ns	1.97 ns	-11.30 **	-15.37 **	-0.19 ns	-4.25 *	2.46 ns
7	IC293590 X EC305613	-2.10 ns	-6.67 **	-0.46 ns	1.89 ns	6.40 *	-9.47 **	-12.78 **	1.69 ns	-2.44 ns	4.40 *
8	IC293590 X EC305664	-4.67 **	-9.33 **	-6.45 **	-4.25 ns	0.00 ns	-8.97 **	-12.78 **	-6.78 **	-10.57 **	-4.30 *
9	IC293590 X EC305741	-2.40 ns	-4.25 *	4.15 ns	6.60 **	11.33 **	-7.10 **	-8.72 **	-2.73 ns	-6.68 **	-0.14 ns
10	IC293590 X EC305675	-4.58 *	-6.60 **	8.76 **	11.32 **	16.26 **	-11.27 **	-13.30 **	0.33 ns	-3.75 *	3.00 ns
11	Punjab 8 x EC305675	4.08 *	1.88 ns	-4.15 ns	-1.89 ns	2.46 ns	0.18 ns	-3.27 ns	7.82 **	3.43 ns	10.68 **
12	Punjab 8 x EC305652	-0.96 ns	-3.29 ns	3.69 ns	6.13 *	10.84 **	-10.60 **	-14.16 **	6.87 **	2.53 ns	9.71 **
13	Punjab 8 x EC305672	-1.87 ns	-6.25 **	-2.30 ns	-0.00 ns	4.43 ns	-12.58 **	-17.65 **	2.64 ns	-1.54 ns	5.36 **
14	Punjab 8 x EC305653	8.67 **	3.57 ns	-1.84 ns	0.47 ns	4.93 *	5.61 **	-1.05 ns	6.40 **	2.08 ns	9.23 **
15	Punjab 8 x EC305689	1.40 ns	-3.54 ns	3.23 ns	5.66 *	10.34 **	-4.70 **	-11.43 **	12.05 **	7.50 **	15.03 **
16	Punjab 8 x EC305612	-4.43 *	-9.29 **	4.15 ns	6.60 **	11.33 **	-9.40 **	-16.24 **	15.35 **	10.66 **	18.41 **
17	Punjab 8 x EC305664	-3.32 ns	-6.42 **	0.46 ns	2.83 ns	7.39 **	-6.54 **	-9.38 **	5.46 **	1.17 ns	8.26 **
18	Punjab 8 x EC305613	-1.66 ns	-5.05 *	2.30 ns	4.72 *	9.36 **	-1.85 ns	-5.36 **	5.46 **	1.17 ns	8.26 **
19	Punjab 8 x EC305741	1.41 ns	-2.70 ns	-5.99 *	-3.77 ns	0.49 ns	-0.55 ns	-3.57 *	-0.94 ns	-4.97 **	1.69 ns
20	Punjab 8 x EC305714	-4.47 *	-8.56 **	-6.45 **	-4.25 ns	0.00 ns	-8.33 **	-11.61 **	-2.07 ns	-6.05 **	0.53 ns
	SE±	0.18	0.21	0.23			1.7	1.96	1.94		

SN	Genotypes	No of Branches / plant					Inter nodal Length (cm)				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-21.74 **	-22.86 **	17.86 **	-0.00 ns	-2.94 ns	-8.91 **	-14.76 **	-10.19 **	-11.48 **	-6.57 **
2	IC293590 X EC305652	-24.24 **	-28.57 **	10.71 **	-6.06 ns	-8.82 **	-2.58 ns	-7.80 *	-1.94 ns	-3.35 ns	2.02 ns
3	IC293590 X EC305689	-24.64 **	-25.71 **	10.71 **	-6.06 ns	-8.82 **	3.08 ns	-4.29 ns	-3.88 ns	-5.26 *	0.00 ns
4	IC293590 X EC305612	-30.30 **	-34.29 **	7.14 ns	-9.09 **	-11.76 **	0.26 ns	-5.85 ns	-3.88 ns	-5.26 *	0.00 ns
5	IC293590 X EC305672	-31.15 **	-38.24 **	14.29 **	-3.03 ns	-5.88 ns	-9.98 **	-12.22 **	-3.88 ns	-5.26 *	0.00 ns
6	IC293590 X EC305653	-0.00 ns	-6.45 ns	0.00 ns	-15.15 **	-17.65 **	-16.43 **	-19.46 **	-0.97 ns	-2.39 ns	3.03 ns
7	IC293590 X EC305613	-25.37 **	-26.47 **	0.00 ns	-15.15 **	-17.65 **	-8.74 **	-10.48 **	-3.88 ns	-5.26 *	0.00 ns
8	IC293590 X EC305664	-15.63 **	-18.18 **	3.57 ns	-12.12 **	-14.71 **	-3.69 ns	-4.39 ns	-5.34 *	-6.70 **	-1.52 ns
9	IC293590 X EC305741	-4.76 ns	-11.76 **	25.00 **	6.06 ns	2.94 ns	-4.81 ns	-5.71 ns	-11.17 **	-12.44 **	-7.58 **
10	IC293590 X EC305675	0.00 ns	-3.23 ns	25.00 **	6.06 ns	2.94 ns	-7.54 **	-7.77 *	-12.62 **	-13.88 **	-9.09 **
11	Punjab 8 x EC305675	-24.32 **	-30.00 **	-3.57 ns	-18.18 **	-20.59 **	-4.27 ns	-4.72 ns	7.28 **	5.74 **	11.62 **
12	Punjab 8 x EC305652	-35.21 **	-42.50 **	17.86 **	-0.00 ns	-2.94 ns	-8.87 **	-10.38 **	-1.94 ns	-3.35 ns	2.02 ns
13	Punjab 8 x EC305672	-2.94 ns	-2.94 ns	3.57 ns	-12.12 **	-14.71 **	-12.74 **	-13.55 **	0.00 ns	-1.44 ns	4.04 ns
14	Punjab 8 x EC305653	-4.62 ns	-8.82 *	42.86 **	21.21 **	17.65 **	-3.58 ns	-5.61 ns	2.91 ns	1.44 ns	7.07 **
15	Punjab 8 x EC305689	-1.59 ns	-8.82 *	21.43 **	3.03 ns	0.00 ns	-7.48 **	-9.17 **	3.88 ns	2.39 ns	8.08 **
16	Punjab 8 x EC305612	0.00 ns	-3.23 ns	3.57 ns	-12.12 **	-14.71 **	-6.38 *	-9.17 **	5.83 **	4.31 *	10.10 **
17	Punjab 8 x EC305664	0.00 ns	-5.88 ns	7.14 ns	-9.09 **	-11.76 **	-4.81 ns	-5.71 ns	0.00 ns	-1.44 ns	4.04 ns
18	Punjab 8 x EC305613	-8.20 *	-9.68 *	7.14 ns	-9.09 **	-11.76 **	-0.73 ns	-0.97 ns	-1.46 ns	-2.87 ns	2.53 ns
19	Punjab 8 x EC305741	-12.50 **	-17.65 **	21.43 **	3.03 ns	0.00 ns	-4.12 ns	-5.71 ns	1.94 ns	0.48 ns	6.06 **
20	Punjab 8 x EC305714	-4.92 ns	-6.45 ns	10.71 **	-6.06 ns	-8.82 **	-4.41 ns	-4.88 ns	-0.49 ns	-1.91 ns	3.54 ns
	SE±	0.05	0.06	0.05			0.27	0.32	0.21		

SN	Genotypes	No of Seeds / Fruit					100 Seed wt (g)				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-30.05 **	-35.62 **	-15.58 **	-6.75 ns	-9.61 **	21.37 **	11.81 **	-10.29 *	-14.69 **	-7.58 ns
2	IC293590 X EC305652	6.52 ns	1.43 ns	1.18 ns	11.76 **	8.34 *	15.06 **	12.88 **	7.35 ns	2.10 ns	10.61 *
3	IC293590 X EC305689	-33.08 **	-38.87 **	-30.37 **	-23.09 **	-25.45 **	14.81 **	13.76 **	5.88 ns	0.70 ns	9.09 ns
4	IC293590 X EC305612	-16.94 **	-20.29 **	-13.81 **	-4.79 ns	-7.71 *	18.67 **	8.33 *	-22.06 **	-25.87 **	-19.70 **
5	IC293590 X EC305672	-2.37 ns	-22.43 **	-4.73 ns	5.23 ns	2.01 ns	24.79 **	14.96 **	-0.00 ns	-4.90 ns	3.03 ns
6	IC293590 X EC305653	22.59 **	8.78 ns	-10.26 **	-0.87 ns	-3.91 ns	10.42 **	8.33 *	6.62 ns	1.40 ns	9.85 *
7	IC293590 X EC305613	-13.26 **	-25.51 **	-1.78 ns	8.50 *	5.17 ns	40.87 **	31.71 **	-22.79 **	-26.57 **	-20.45 **
8	IC293590 X EC305664	-15.64 **	-18.02 **	-30.77 **	-23.53 **	-25.87 **	12.94 **	9.09 **	-9.56 *	-13.99 **	-6.82 ns
9	IC293590 X EC305741	10.65 *	-13.70 **	-3.16 ns	6.97 ns	3.70 ns	21.70 **	11.72 **	-6.62 ns	-11.19 *	-3.79 ns
10	IC293590 X EC305675	-15.69 **	-26.80 **	-4.73 ns	5.23 ns	2.01 ns	-17.69 **	-18.94 **	-19.85 **	-23.78 **	-17.42 **
11	Punjab 8 x EC305675	-31.29 **	-38.70 **	-32.15 **	-25.05 **	-27.35 **	2.81 ns	-9.86 **	-6.62 ns	-11.19 *	-3.79 ns
12	Punjab 8 x EC305652	-1.11 ns	-2.62 ns	-17.36 **	-8.71 *	-11.51 **	-7.30 *	-10.56 **	-9.56 *	-13.99 **	-6.82 ns
13	Punjab 8 x EC305672	-14.57 **	-26.71 **	-35.50 **	-28.76 **	-30.94 **	5.17 ns	-2.40 ns	-5.88 ns	-10.49 *	-3.03 ns
14	Punjab 8 x EC305653	19.03 **	15.54 **	-9.66 **	-0.22 ns	-3.27 ns	13.62 **	10.61 **	4.41 ns	-0.70 ns	7.58 ns
15	Punjab 8 x EC305689	-36.57 **	-39.55 **	-17.55 **	-8.93 *	-11.72 **	16.60 **	2.86 ns	-8.09 ns	-12.59 **	-5.30 ns
16	Punjab 8 x EC305612	-10.17 **	-17.39 **	4.34 ns	15.25 **	11.72 **	-22.06 **	-24.29 **	2.94 ns	-2.10 ns	6.06 ns
17	Punjab 8 x EC305664	-15.49 **	-17.29 **	10.26 **	21.79 **	18.06 **	12.40 **	0.74 ns	-0.74 ns	-5.59 ns	2.27 ns
18	Punjab 8 x EC305613	-9.27 *	-18.60 **	-10.45 **	-1.09 ns	-4.12 ns	8.61 **	7.41 *	5.15 ns	0.00 ns	8.33 ns
19	Punjab 8 x EC305741	-4.05 ns	-14.73 **	15.19 **	27.23 **	23.34 **	-16.00 **	-26.57 **	-21.32 **	-25.17 **	-18.94 **
20	Punjab 8 x EC305714	-21.83 **	-22.69 **	-12.43 **	-3.27 ns	-6.23 ns	-10.55 **	-13.99 **	-2.94 ns	-7.69 ns	-0.00 ns
	SE±	1.82	2.11	1.57			0.19	0.22	0.31		

SN	Genotypes	Yield/Plant (g)					Pod Borer Infestation(%)				
		MPH	BPH	SH1	SH2	SH3	MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	-3.85 *	-6.64 **	-12.63 **	-0.08 ns	-15.79 **	-48.39 **	-48.51 **	-23.56 **	11.45 ns	12.31 ns
2	IC293590 X EC305652	56.59 **	54.72 **	32.25 **	51.25 **	27.47 **	-38.85 **	-43.16 **	-48.69 **	-25.19 **	-24.62 **
3	IC293590 X EC305689	-23.14 **	-38.09 **	-16.72 **	-4.76 *	-19.74 **	5.84 ns	-23.76 **	-60.73 **	-42.75 **	-42.31 **
4	IC293590 X EC305612	-7.63 **	-23.12 **	20.82 **	38.17 **	16.45 **	16.41 *	-19.66 **	-26.18 **	7.63 ns	8.46 ns
5	IC293590 X EC305672	21.79 **	-1.63 ns	2.05 ns	16.71 **	-1.64 ns	-64.04 **	-71.78 **	14.66 **	67.18 **	68.46 **
6	IC293590 X EC305653	-0.05 ns	-16.57 **	27.03 **	45.28 **	22.43 **	-43.27 **	-57.69 **	13.09 **	64.89 **	66.15 **
7	IC293590 X EC305613	18.00 **	-6.08 **	-16.62 **	-4.64 *	-19.64 **	-37.80 **	-49.50 **	1.57 ns	48.09 **	49.23 **
8	IC293590 X EC305664	8.69 **	-10.66 **	9.69 **	25.45 **	5.72 **	-33.33 **	-48.72 **	-37.70 **	-9.16 ns	-8.46 ns
9	IC293590 X EC305741	-18.44 **	-27.87 **	-17.75 **	-5.93 **	-20.72 **	-4.57 ns	-17.33 **	5.24 ns	53.44 **	54.62 **
10	IC293590 X EC305675	-13.32 **	-20.42 **	26.79 **	45.00 **	22.20 **	-51.31 **	-60.26 **	-53.40 **	-32.06 **	-31.54 **
11	Punjab 8 x EC305675	19.26 **	-3.31 *	25.87 **	43.95 **	21.32 **	14.48 ns	-17.82 **	-39.79 **	-12.21 ns	-11.54 ns
12	Punjab 8 x EC305652	12.84 **	-5.45 **	30.89 **	49.69 **	26.15 **	-27.33 **	-50.00 **	-34.03 **	-3.82 ns	-3.08 ns
13	Punjab 8 x EC305672	7.34 **	2.40 ns	0.78 ns	15.26 **	-2.86 ns	0.00 ns	-27.72 **	-22.51 **	12.98 ns	13.85 ns
14	Punjab 8 x EC305653	55.97 **	55.00 **	24.68 **	42.58 **	20.16 **	-39.51 **	-58.12 **	-53.93 **	-32.82 **	-32.31 **
15	Punjab 8 x EC305689	-15.60 **	-30.52 **	-14.68 **	-2.42 ns	-17.76 **	-55.22 **	-62.87 **	-52.88 **	-31.30 **	-30.77 **
16	Punjab 8 x EC305612	18.37 **	0.80 ns	19.86 **	37.08 **	15.53 **	-23.16 **	-39.74 **	-30.37 **	1.53 ns	2.31 ns
17	Punjab 8 x EC305664	6.60 **	-10.48 **	13.99 **	30.37 **	9.87 **	46.00 **	8.42 ns	-48.69 **	-25.19 **	-24.62 **
18	Punjab 8 x EC305613	28.15 **	11.44 **	-16.66 **	-4.68 *	-19.67 **	30.12 **	-7.69 ns	-3.14 ns	41.22 **	42.31 **
19	Punjab 8 x EC305741	3.69 ns	0.04 ns	-22.53 **	-11.40 **	-25.33 **	0.26 ns	-3.96 ns	5.76 ns	54.20 **	55.38 **
20	Punjab 8 x EC305714	30.89 **	30.17 **	-15.73 **	-3.63 ns	-18.78 **	-43.20 **	-49.15 **	22.51 **	78.63 **	80.00 **
	SE±	2.19	2.53	2.51			0.53	0.61	0.44		

SN	Genotypes	Incidence of YVMV				
		MPH	BPH	SH1	SH2	SH3
1	IC293590 X EC305714	131.90 **	70.27 **	-16.42 *	-58.52 **	-19.42 *
2	IC293590 X EC305652	71.57 **	52.25 **	11.94 ns	-44.44 **	7.91 ns
3	IC293590 X EC305689	44.92 **	-7.07 *	29.85 **	-35.56 **	25.18 **
4	IC293590 X EC305612	27.41 **	-6.52 ns	-39.55 **	-70.00 **	-41.73 **
5	IC293590 X EC305672	67.86 **	9.30 *	-9.70 ns	-55.19 **	-12.95 ns
6	IC293590 X EC305653	-31.01 **	-48.26 **	3.73 ns	-48.52 **	0.00 ns
7	IC293590 X EC305613	17.35 **	-20.14 **	11.19 ns	-44.81 **	7.19 ns
8	IC293590 X EC305664	14.78 **	-8.33 ns	32.84 **	-34.07 **	28.06 **
9	IC293590 X EC305741	46.15 **	-2.56 ns	-17.16 *	-58.89 **	-20.14 *
10	IC293590 X EC305675	57.02 **	21.79 **	37.31 **	-31.85 **	32.37 **
11	Punjab 8 x EC305675	-23.97 **	-51.58 **	28.36 **	-36.30 **	23.74 **
12	Punjab 8 x EC305652	-20.29 **	-42.11 **	7.46 ns	-46.67 **	3.60 ns
13	Punjab 8 x EC305672	0.45 ns	-34.50 **	16.42 *	-42.22 **	12.23 ns
14	Punjab 8 x EC305653	16.73 **	-12.28 **	41.79 **	-29.63 **	36.69 **
15	Punjab 8 x EC305689	107.14 **	50.00 **	27.61 **	-36.67 **	23.02 **
16	Punjab 8 x EC305612	-19.80 **	-30.17 **	-13.43 ns	-57.04 **	-16.55 *
17	Punjab 8 x EC305664	35.20 **	-4.72 ns	-5.22 ns	-52.96 **	-8.63 ns

18	Punjab 8 x EC305613	30.52 **	9.45 ns	-38.06 **	-69.26 **	-40.29 **
19	Punjab 8 x EC305741	120.74 **	79.52 **	-61.19 **	-80.74 **	-62.59 **
20	Punjab 8 x EC305714	110.65 **	106.98 **	-35.82 **	-68.15 **	-38.13 **
	SE±	0.28	0.32	0.53		

*, ** denotes significance at 5% and 1% respectively Ns- denote non-significant

4. Conclusion

The hybrid derivatives or crosses like combinations IC-293590 x EC-305653, IC-293590 x EC-305741, Punjab-8 x EC-305613, IC-293590 x EC-305652, Punjba-8 x EC305653 Punjab- 8 x EC-305714 were found promising hybrid for the growth characters like plant height, number of branches, number of nodes per plant, node at which first flower appeared days required to 50% flowering, days required for first fruit of harvest and yield contributing characters like number of fruit per plant, length of fruit, weight of fruit, diameter of fruit, number of seed per fruit, weight of 100 seed, fruit yield per plant. They have also exhibited higher additive variance. Hence, they may be exploited for development of hybrid in okra.

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