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Research Article

Heterosis breeding for yield and its attributes in brinjal (*Solanum melongena* L.)

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Abstract
A study on heterosis in brinjal was carried out during the year 2019-20 at the Department of Genetics and Plant Breeding, Annamalai University. Seven genotypes were hybridised in full diallel fashion and the resultant 42 hybrids were evaluated along with parents in RBD. The mean squares of the 11 traits revealed significant differences among the entries. The hybrid ICO-345590 x Arka Kusumkar recorded high heterobeltiosis for fruit yield per plant and its associated traits except for fruit grith, fruit length, plant height, and days to first harvest. High standard heterosis was recorded by the hybrid ICO-344674 x ICO-383119 for plant height, ICO-344674 x Arka Kusumkar for days to first harvest, Arka Kusumkar x ICO-345590 for fruit length and ICO-345590 x ICO-545862 for fruit girth. The application of heterosis in brinjal will aid in the production of superior cross combinations, which will help meet the expanding demand for brinjal due to its bioactive properties.

Keywords: brinjal, heterosis, fruit yield, diallel.

INTRODUCTION

Brinjal (*Solanum melongena* L., 2n = 24) belongs to the family Solanaceae. It originated in India and is widely cultivated throughout the year in India. (Desai *et al*, 2017). Brinjal is referred as the king of vegetables due to its wide utility in various dishes (Kumar *et al*., 2020) and as eggplant. It is one of the main sources of reliable revenue for small farmers (Shende *et al*., 2016).

The growing interest in brinjal amongst society and scientists is due to the various antioxidant properties and polyphenol activities (Somawathi *et al*., 2014). The edible part of the plant in the fruit, botanically a berry. It contains anti-oxidant (Sharma and Kaushik, 2021), anti-cancer compounds (Huang *et al.,* 2010) and anti-microbial properties (Matsubara *et al*., 2005) and the fruit colour of brinjal may be white, green, purple or striped with a blend of these three colours. Abundant landraces and varieties of brinjal are cultivated all over India. However, the productivity of brinjal in India is very less compared to other brinjal-growing countries (Chaudhari *et al*., 2020). Since brinjal contains many compounds with bioactive properties (Plazas *et al*., 2013), demand for brinjal is also increasing. To meet the above-stated requirements, exploitation of heterosis present in brinjal is imperative. Heterosis refers to F1 hybrid's better performance than their parents or the check variety (Shull, 1948). Therefore, the current research was conducted to explore the most performing crosses for developing hybrids with enhanced yield through heterosis.

MATERIALS AND METHODS

A total of seven genotypes *viz.,* ICO 345590, ICO 383119, ICO 427029, ICO 545862, ICO 216794, ICO 344674 and Arka Kusumkar (**Table 1**) were used as parents in the investigation . The parents were crossed in full diallel fashion (Griffing, 1956b) and the resultant 42 hybrids along with their seven parents were raised in Randomized Block Design (RBD) with three replications during 2019-

Table 1. List of brinjal genotypes and their sources.

Parent number	Name of the genotype	Source
P1	ICO 345590	NBPGR, New Delhi
P2	ICO 383119	NBPGR, New Delhi
P3	ICO 427029	NBPGR, New Delhi
P4	ICO 545862	NBPGR, New Delhi
P5	ICO 216794	NBPGR, New Delhi
P6	ICO 344674	NBPGR, New Delhi
P7	Arka Kusumkar	IIHR, Bangalore

2020 at Plant Breeding Farm, Department of Genetics and Plant Breeding, Annamalai University. Basic agronomic practices like weeding, manuring, plant protection, etc., needed for optimum growth of brinjal were followed.

In each replication, observations were recorded in five random plants on 11 traits namely days to first flowering (days), plant height (cm), number of branches per plant (Nos), number of flowers per cluster (Nos), number of fruits per cluster (Nos), days to first harvest (days), fruit length (cm), fruit grith (cm), average fruit weight (g), number of fruits per plant (Nos) and fruit yield per plant (g). The mean performance for the lines was calculated over replications and used for the estimation of heterobeltiosis and standard heterosis using the standard procedure.

RESULTS AND DISCUSSION

The phenomenon of heterosis is nowadays used as an important and efficient tool for achieving higher yields (Pal and Singh, 1949, Dhaka *et al.,* 2017). Analysis of Variance for 11 traits (**Table 2)**, demonstrated that both parents and their hybrids differed significantly among themselves indicating the existence of high genetic variability in the experimental population. The list of best-performing crosses for different traits was mentioned in **Table 3.**

Days to First Flowering and Days to First Harvest both were observed to have significant and negative heterosis, reflecting the earliness in flowering and fruit maturity, respectively. Such traits are preferable by the farmers for their economic sustainability (Owusu, 2015). The results for heterobeltiosis and standard heterosis of direct crosses were given in **Tables 4 and 5**. For the character days to first flowering, the crosses13 and 18 showed negative significant relative heterosis and heterobeltiosis respectively. Only one out of 42 crosses recorded significant commercial heterosis. ICO-216794 x ICO-345590 recorded maximum significant negative heterobeltiosis and standard heterosis. Similar results were reported by Dishri *et al*. (2018) and Ansari (2017).

The crosses ICO-345590 x Arka Kusumkar and ICO-344674 x ICO-383119 exhibited maximum significant negative heterobeltiosis and negative standard heterosis for plant height (**Tables 4, 5**). These observations on plant height concorded with the results of Kalaiyarasi *et al.* (2018). For number of branches per plant, the cross ICO-345590 x ICO-545862 exhibited maximum significant and positive standard heterosis. Das *et al*. (2009) and Rani *et al*. (2018) reported comparable results. For number of flowers per cluster, the crosses ICO-344674 x ICO-

Table 2. Analysis of variance for various characters

S. No.	Characters	df	MSS	'F' value
1	Days to first flowering	48	100.46**	72.47
2	Plant height	48	629.59**	631.11
3	Number of branches per plant	48	2.63**	32.47
4	Number of flowers per cluster	48	3.16**	39.15
5	Number of fruits per cluster	48	3.69**	22.48
6	Days to first harvest	48	95.22**	60.82
7	Fruit length	48	19.13**	7.29
8	Fruit grith	48	4.91**	119.07
9	Average fruit weight	48	278.32**	20.46
10	Number of fruits per plant	48	291.22**	31.54
11	Fruit yield per plant	48	1.4**	30.62

Table 3. List of best performing crosses for different traits

S.No.	Trait	Best performing crosses
1	Days to first flowering	ICO-345590 x Arka Kusumkar
2	Plant height	ICO-344674 x ICO-383119
3	No. of branches per plant	ICO-345590 x Arka Kusumkar
4	No. of flowers per cluster	ICO-345590 x Arka Kusumkar
5	No. of fruits per cluster	ICO-345590 x Arka Kusumkar
6	Days to first harvest	ICO-344674 x Arka Kusumkar
7	Fruit length	Arka Kusumkar x ICO-345590
8	Fruit girth	ICO-345590 x ICO-545862
9	Average fruit weight	ICO-345590 x Arka Kusumkar
10	Number of fruits per plant	ICO-345590 x Arka Kusumkar
11	Fruit yield per plant	ICO-345590 x Arka Kusumkar

Table 4. Estimation of heterobeltiosis for direct crosses

S. No.	CROSSES	DFF	PH	NBP	NFC	NFRC	DFH	FL	FG	AFW	NFP	FYP
1.	P1 X P2	4.60**	-9.98**	-30.37**	-35.54**	-34.69**	-0.03	-12.29	-8.54**	-2.63	7.89	19.23*
2.	P1 X P3	-18.72**	12.18**	-3.07	-20.09**	-14.47*	-15.34**	-43.18**	9.35**	-8.65*	32.84**	-23.59**
3	P1 X P4	-14.60**	3.87**	-5.86	35.03**	41.94**	-9.32**	33.11**	22.36**	-39.07**	39.62**	18.07*
4.	P1 X P5	-14.48**	14.68**	-24.89**	35.67**	54.51**	-9.43**	5.30	-30.50**	2.05	-16.25**	30.29**
5.	P1 X P6	-3.29**	18.83**	-10.93**	-8.58*	1.90	-4.50**	-37.29**	-23.95**	11.93**	7.50	28.79**
6.	P1 X P7	-20.89**	-20.55**	32.06**	30.51**	63.21**	-19.01**	12.07	48.29**	14.78**	25.52**	109.39**
7.	P2 X P3	-6.31**	5.98**	-28.38**	-10.76**	-17.04**	13.46**	-13.64	-38.80**	-12.13*	34.60**	18.28*
8.	P2 X P4	7.06**	1.01	-16.58**	-18.62**	-24.44**	12.26**	-27.31**	-10.43**	29.63**	31.26**	108.92**
9.	P2 X P5	15.63**	21.72**	-9.22**	-27.87**	-20.30**	15.04**	37.75**	11.58**	44.34**	-24.37**	30.21**
10.	P2 X P6	-3.99**	-9.01**	-12.27**	0.52	15.68**	1.08	-1.60	-34.96**	-15.29**	50.27**	27.70**
11.	P2 X P7	0.93	2.55**	-25.00**	5.99	15.34**	-11.40**	43.98**	28.14**	14.64**	-10.41*	13.30
12.	P3 X P4	12.33**	10.22**	-30.24**	49.20**	42.14**	2.16*	-23.85*	-41.11**	17.78**	10.98*	44.00**
13.	P3 X P5	11.77**	-10.80**	-4.72	25.85**	8.42	4.52**	67.66**	27.82**	37.26**	26.13**	112.69**
14.	P3 X P6	6.33**	21.70**	-1.93	38.74**	72.68**	-5.42**	-4.01	-9.28**	10.68*	8.37	17.45*
15.	P3 X P7	-3.86**	-7.90**	-12.41**	-5.50	1.78	-8.74**	42.28**	8.93**	-14.33**	-42.48**	-41.94**
16.	P4 X P5	0.69	27.75**	-31.17**	31.33**	26.65**	7.11**	28.49**	-5.47*	5.99	-21.24**	-16.15*
17.	P4 X P6	-7.32**	4.28**	-30.55**	37.56**	13.06	8.44**	28.10*	-5.23*	-11.99**	4.06	-5.55
18.	P4 X P7	6.59**	-0.18	-31.05**	2.96	1.78	-3.73**	29.61**	-5.11*	60.21**	8.74*	68.79**
19.	P5 X P6	-0.91	-10.79**	-6.37	34.81**	73.00**	3.62**	-10.91	7.02**	-30.27**	-14.93**	-24.34**
20.	P5 X P7	-1.95	14.80**	24.22**	7.04*	-13.48*	-19.78**	100.27**	26.04**	71.69**	13.34**	88.58**
21.	P6 X P7	9.24**	5.46**	-23.06**	3.02	3.72	-22.60**	9.27	3.13	7.51	-16.95**	14.49*

*Significant at 5 per cent level, ** Significant at 1 per cent level

P1 – ICO 345590, P2- ICO-383119, P3 – ICO-427029, P4 – ICO-545682, P5- ICO-216794, P6- 344674, P7 – Arka Kusumkar, DFF – Days to First Flowering, PH – Plant Height, NBP – Number of Branches per Plant, NFC – Number of Flowers per Cluster, NFRC – Number of Fruits per Cluster, DFH – Days to First Harvest, FL – Fruit Length, FG – Fruit girth, AFW – Average Fruit Weight, NFP – Number of Fruits per Plant, FYP- Fruit Yield per Plant, dii – heterobeltiosis, diii – standard heterosis.

Table 5. Estimation of standard heterosis for direct crosses

S. No.	CROSSES	DFF	PH	NBP	NFC	NFRC	DFH	FL	FG	AFW	NFP	FYP
1.	P1 X P2	32.96**	7.97**	-28.38**	-34.48**	25.48**	-7.73**	38.75**	42.75**	46.57**	-29.57**	0.19
2.	P1 X P3	3.31*	34.56**	-7.50*	-33.89**	-19.91**	-15.69**	-10.12	40.16**	37.51**	-50.95**	-34.53**
3	P1 X P4	8.55**	24.59**	3.00	11.71**	32.92**	-16.31**	110.56**	82.11**	-8.29	11.72**	-0.79
4.	P1 X P5	8.71**	37.55**	-33.08**	12.24**	44.69**	-16.40**	66.58**	-2.59	53.62**	-17.37**	22.76**
5.	P1 X P6	22.93**	42.53**	-19.92**	-24.36**	-4.57	-11.86**	-0.80	-12.52**	68.49**	-16.28**	36.28**
6.	P1 X P7	0.55	-4.70**	32.06**	30.51**	63.21**	-19.01**	77.27**	70.57**	72.78**	25.52**	109.39**
7.	P2 X P3	12.84**	12.96**	-26.33**	-9.28**	-5.34	-13.81**	14.96	-4.47	6.77	-1.69	1.34
8.	P2 X P4	29.72**	12.96**	-8.73**	-17.27**	-13.79*	0.63	-3.24	39.80**	52.56**	5.03	55.03**
9.	P2 X P5	36.69**	34.22**	-6.62	-26.67**	-9.06	4.57**	83.36**	74.15**	69.88**	-25.38**	22.69**
10.	P2 X P6	19.98**	2.33**	-9.75**	2.19	31.99**	-8.21**	30.98*	1.52	19.31**	17.02**	35.12**
11.	P2 X P7	19.32**	9.31**	-22.85**	7.75*	31.60**	-11.40**	91.66**	12.16**	34.92**	-10.41*	13.30
12.	P3 X P4	36.10**	23.26**	-23.67**	-6.03	3.72	2.16*	-6.17	-12.34**	43.11**	-11.20*	23.38**
13.	P3 X P5	34.62**	-1.64**	-9.07*	-14.49**	-23.16**	4.52**	75.32**	79.16**	66.78**	24.45**	100.40**
14.	P3 X P6	32.88**	36.88**	-6.41	-15.08**	22.39**	-5.42**	16.73	16.28**	55.89**	-15.61**	24.28**
15.	P3 X P7	15.79**	-7.45**	-12.41**	-5.50	1.78	-8.74**	48.78**	39.62**	4.09	-42.48**	-41.94**
16.	P4 X P5	22.00**	42.86**	-24.69**	-10.76**	-7.59	7.11**	58.32**	40.70**	4.97	-22.29**	-21.00**
17.	P4 X P6	15.83**	17.28**	-24.01**	-13.36**	-17.51**	8.44**	57.83**	41.06**	23.96**	-16.73**	-0.06
18.	P4 X P7	29.15**	11.63**	-24.56**	2.96	1.78	-3.73**	59.70**	41.23**	60.21**	8.74*	68.79**
19.	P5 X P6	23.83**	0.34	-15.83**	-8.40**	-6.20	3.62**	8.34	50.00**	-1.79	-16.07**	-19.94**
20.	P5 X P7	4.29**	26.58**	24.22**	7.04*	-13.48*	-19.78**	100.27**	76.65**	19.81**	13.34**	88.58**
21.	P6 X P7	36.52**	18.61**	-23.06**	3.02	3.72	-22.60**	32.89*	3.13	51.42**	-16.95**	21.15**

*Significant at 5 per cent level, ** Significant at 1 per cent level,
P1 – ICO 345590, P2- ICO-383119, P3 – ICO-427029, P4 – ICO-545682, P5- ICO-216794, P6- 344674, P7 – Arka Kusumkar, DFF – Days to First Flowering, PH – Plant Height, NBP – Number of Branches per Plant, NFC – Number of Flowers per Cluster, NFRC – Number of Fruits per Cluster, DFH – Days to First Harvest, FL – Fruit Length, FG – Fruit girth, AFW – Average Fruit Weight, NFP – Number of Fruits per Plant, FYP- Fruit Yield per Plant, dii – Heterobeltiosis, diii – standard heterosis.

545862 and ICO-345590 x Arka Kusumkar exhibited maximum significant positive heterobeltiosis and standard heterosis respectively. Santhosha *et al*. (2017) and Dishri *et al.* (2018) arrived at a similar conclusion for this trait. In case of number of fruits per cluster, the crosses ICO-345590 x ICO-216794, ICO-344674 x ICO-545862 and ICO-345590 x Arka Kusumkar recorded maximum positive and significant average heterosis, mid-parent heterosis and commercial heterosis respectively. For days to first harvest, the crosses which are negatively significant are preferred (Rani *et al.,* 2018). The reciprocal cross Arka Kusumkar x ICO-344674 was found to exhibit maximum significant negative heterobeltiosis whereas its direct cross ICO-344674 x Arka Kusumkar registered maximum significant negative standard heterosis as mentioned in **Table 6** and **Table 7**. Similar findings were also recorded by Makani *et al*. (2013) and Santhosha *et al*. (2017).

Based on the fruit size, brinjal fruits are classified as round, oblong and long. Previous studies reported a positive association between fruit length and fruit yield (Angadi *et al*., 2017). Among the crosses ICO-216794 x Arka Kusumkar and hybrids Arka Kusumkar x ICO-345590 exhibited maximum significant positive heterobeltiosis and standard heterosis respectively for the above trait. Eggplant fruits widely differ in girth based on the cultivar used. The crosses ICO-345590 x Arka Kusumkar and ICO-216794 x ICO-345590 recorded significant positive better parent and commercial heterosis for fruit girth. The weight of a brinjal fruit is contributed by its seed content and flesh content. If fruit weight increases, yield per plant also increases. Therefore, the trait average fruit weight is regarded as one of the important yield attributes along with other fruit characteristics (Kaushik, 2019). The cross ICO-216794 x Arka Kusumkar exhibited maximum significant positive heterobeltiosis,

Table 6. Estimation of heterobeltiosis for reciprocal crosses

S. No.	Crosses	DFF	PH	NBP	NFC	NFRC	DFH	FL	FG	AFW	NFP	FYP
1.	P2 X P1	-5.91**	-0.28	0.00	-18.85**	-18.33**	-1.13	-20.62*	-57.25**	-16.95**	26.09**	17.77
2.	P3 X P1	-4.42**	-18.56**	28.66**	40.74**	-22.25**	-10.81**	-4.18	33.71**	4.73	40.62**	82.75**
3	P4 X P1	-12.92**	10.52**	30.92**	37.81**	52.61**	-10.38**	1.21	14.18**	18.13**	48.31**	142.76**
4.	P5 X P1	-23.91**	-3.33**	42.88**	46.68**	59.72**	13.23**	-1.21	30.70**	-36.55**	31.04**	26.93**
5.	P6 X P1	-1.32	16.34**	-3.19	32.17**	41.60**	1.31	-2.08	-19.60**	-20.22**	-47.20**	-54.45**
6.	P7 X P1	-4.03**	8.30**	-13.51**	7.63*	24.24**	-10.76**	43.94**	7.62*	-26.78**	-0.93	5.74
7.	P3 X P2	12.13**	0.06	-12.80**	20.13**	20.71**	-5.05**	-21.11*	-57.25**	2.48	-5.75	-2.49
8.	P4 X P2	-10.11**	4.88**	-6.86*	-16.52**	-20.84**	-8.56**	-11.80	-11.06**	23.63**	-22.21**	17.85
9.	P5 X P2	2.93*	12.38**	-9.08*	-12.57**	-23.15**	-3.82**	8.50	-46.65**	43.44**	-7.48	57.57**
10.	P6 X P2	-11.02**	-19.46**	13.53**	5.41	9.30	-4.61**	45.72**	-28.54**	-17.32**	60.57**	33.43**
11.	P7 X P2	9.64**	23.12**	21.02*8	-9.13**	-5.91	4.08**	6.74	-35.64**	1.82	-15.46**	-2.30
12.	P4 X P3	-0.75	-6.12**	-39.90**	58.31**	45.01**	-2.31*	52.13**	-30.71**	13.62**	-9.96	15.91
13.	P5 X P3	2.93*	11.48**	0.86	40.47**	48.52**	-7.04**	55.48**	-13.66**	-4.30	2.25	19.35*
14.	P6 X P3	4.95**	19.04**	-32.95**	23.09**	18.25**	-6.31**	31.50**	38.24**	16.76**	-29.49**	-17.41*
15.	P7 X P3	-18.90**	25.30**	37.18**	17.09**	-2.25	-17.68**	53.78**	33.98**	31.00**	23.36**	89.81**
16.	P5 X P4	1.29	-12.66**	-14.09**	68.76**	73.46**	1.69	-7.96	-17.13**	30.93**	27.16*	-4.18
17.	P6 X P4	8.96**	11.66**	-28.99**	73.52**	78.03**	9.76**	49.64**	-54.93**	-15.76**	22.24**	5.91
18.	P7 X P4	-8.98**	3.68**	4.36	-24.66**	-2.25	-19.79**	43.48**	-4.81*	49.29**	-15.54**	22.19**
19.	P6 X P5	-4.82**	17.87**	-11.38**	14.01**	52.43**	0.42	8.98	-18.57**	-23.58**	-5.69	-8.96
20.	P7 X P5	16.75**	12.09**	4.16	19.28**	-15.49**	-10.27**	21.66	-1.66	19.81**	-53.04**	-45.43**
21.	P7 X P6	2.64*	-17.02**	6.48	-2.78	2.87	-2.60**	21.61*	-28.44**	-19.39**	-48.90**	-47.58**

*Significant at 5 per cent level, ** Significant at 1 per cent level,
P1 – ICO 345590, P2- ICO-383119, P3 – ICO-427029, P4 – ICO-545682, P5- ICO-216794, P6- 344674, P7 – Arka Kusumkar, DFF – Days to First Flowering, PH – Plant Height, NBP – Number of Branches per Plant, NFC – Number of Flowers per Cluster, NFRC – Number of Fruits per Cluster, DFH – Days to First Harvest, FL – Fruit Length, FG – Fruit girth, AFW – Average Fruit Weight, NFP – Number of Fruits per Plant, FYP- Fruit Yield per Plant, dii – Heterobeltiosis, diii – standard heterosis.

while for this trait, standard heterosis was maximum in the hybrid ICO-545862 x ICO-345590. The results for average fruit weight, fruit length and fruit girth were in agreement with that of Sao and Mehta (2010).

For the trait number of fruits per plant, the crosses ICO-344674 x ICO-383119, ICO-345590 x ICO-216794 exhibited maximum significant positive heterobeltiosis and standard heterosis. This character directly contributes to the overall yield of the plant. Similar results were also reported by Shafeeq *et al.* (2013). Developing high-yielding crosses, suitable for farming conditions of the region combined with high market preference in the concerned area is necessary while breeding for fruit yield in brinjal. Heterobeltiosis for fruit yield was maximum in ICO-545862 x ICO-345590 and standard heterosis was maximum in the cross ICO-345590 x Arka Kusumkar. For the trait fruit yield per plant, significant heterosis was previously observed by Patel *et al.* (2017) and Makani *et al.* (2013).

The phenomenon of heterosis is used as an important tool for achieving better yields in plants. The present study shows that, the parents IC-345590, Arka Kusumkar were involved in crosses achieving high heterosis for most of the yield characters. The cross ICO-345590 x Arka Kusumkar is identified as top standard heterotic cross with better fruit yield per plant. These hybrids may further be tested over various locations before release for commercial cultivation.

Table 7. Estimation of standard heterosis for reciprocal crosses

S.No.	Crosses	DFF	PH	NBP	NFC	NFRC	DFH	FL	FG	AFW	NFP	FYP
1.	P2 X P1	19.60**	19.61**	2.86	-17.50**	-6.82	-8.74**	22.57	-33.27**	25.02**	-17.69**	-1.04
2.	P3 X P1	21.49**	-2.32**	22.78**	16.44**	-27.19**	-11.18**	51.58**	71.38**	57.65**	2.71	56.58**
3	P4 X P1	10.68**	32.56**	43.25**	14.02**	42.91**	-17.28**	60.10**	69.95**	77.82**	18.67**	103.99**
4.	P5 X P1	-3.28*	15.95**	27.29**	21.35**	49.57**	-19.92**	56.28**	83.18**	-4.49	29.29**	19.60*
5.	P6 X P1	25.43**	39.54**	-12.96**	9.34**	32.61**	-6.49**	54.90**	-7.51*	20.39**	-58.88**	-51.80**
6.	P7 X P1	21.99**	29.90**	-13.51**	7.63**	24.24**	-10.76**	127.70**	23.79**	10.23	-0.93	5.74
7.	P3 X P2	35.05**	6.65**	-10.30**	22.12**	37.72**	-5.44**	5.02	-33.27**	24.51**	-31.17**	-16.45*
8.	P4 X P2	8.92**	17.28**	1.91	-15.14**	-9.68	-18.04**	17.40	38.82**	45.50**	-37.75**	-12.55
9.	P5 X P2	21.68**	23.92**	-6.48	-11.12**	-12.32*	-12.57**	44.43**	-16.73**	68.81**	-8.72*	48.46**
10.	P6 X P2	11.20**	-9.42**	16.78**	7.16*	24.71**	-13.38**	93.96**	11.54**	16.44**	25.05**	41.19**
11.	P7 X P2	29.61**	31.23**	24.49**	-7.63*	7.36	4.08**	42.08**	0.45	19.83**	-15.46**	-2.30
12.	P4 X P3	20.25**	4.98**	-34.24**	0.30	5.81	-2.71**	87.44**	3.13	38.06**	-27.95**	-0.69
13.	P5 X P3	21.68**	22.92**	-3.75	-4.55	5.27	-7.42**	62.58**	21.02**	16.28**	0.89	12.46
14.	P6 X P3	31.17**	33.89**	-36.02**	-24.66**	-16.19**	-6.69**	59.92**	77.19**	64.44**	-45.09**	-12.61
15.	P7 X P3	-2.32	25.91**	37.18**	17.09**	-2.25	-17.68**	60.81**	71.74**	59.17**	23.36**	89.81**
16.	P5 X P4	22.73**	-2.32**	-6.00	14.67**	26.57**	-7.57**	13.40	23.35**	29.68**	-28.14**	-9.71
17.	P6 X P4	36.18**	25.59**	-22.31**	9.28**	29.90**	-0.32	84.38**	-32.92**	18.64**	-2.19	12.07
18.	P7 X P4	10.29**	15.95**	14.91**	-24.66**	-2.25	-19.79**	76.79**	41.68**	49.29**	-15.54**	22.19**
19.	P6 X P5	18.96**	18.96**	-20.33**	-22.53**	-17.35**	-8.72**	32.53*	14.13**	7.63	-6.95	-3.67
20.	P7 X P5	24.18**	23.59**	4.16	-19.28**	-15.49**	-10.27**	21.66	37.84**	71.69**	-53.04**	-45.43**
21.	P7 X P6	28.27**	-6.68**	6.48	-2.78	2.87	-2.60**	47.89**	-28.44**	13.53*	-48.90**	-44.53**

*Significant at 5 per cent level, **Significant at 1 per cent level,
P1 – ICO 345590, P2- ICO-383119, P3 – ICO-427029, P4 – ICO-545682, P5- ICO-216794, P6- 344674, P7 – Arka Kusumkar, DFF – Days to First Flowering, PH – Plant Height, NBP – Number of Branches per Plant, NFC – Number of Flowers per Cluster, NFRC – Number of Fruits per Cluster, DFH – Days to First Harvest, FL – Fruit Length, FG – Fruit girth, AFW – Average Fruit Weight, NFP – Number of Fruits per Plant, FYP- Fruit Yield per Plant, dii – Heterobeltiosis, diii – standard heterosis.

REFERENCES

Abhinav Sao and Nandan Mehta. 2010. Heterosis in relation to combining ability for yield and quality attributes in Brinjal (*Solanum melongena* L.). *Electronic Journal of Plant Breeding*, **1**(4): 783-788.

Ansari, A.M. 2017. Heterosis studies for growth, yield and its component characters in brinjal (*Solanum melongena* L.). *Journal of Pharmacognosy and Phytochemistry*, **6**(4): 1920-1929.

Chaudhari, B.N., Patel, A.I. and Vashi, J.M. 2020. Study on heterosis over environments in brinjal (*Solanum melongena* L.). *International Journal of Current Microbiology and Applied Sciences*, **9**(7): 3358-3367. [Cross Ref]

Das, S., Mandal, A.B. and Hazra, P. 2009. Study of heterosis in brinjal (*Solanum melongena* L.) for yield attributing traits. *Journal of Crop and Weed*, **5**(2): 25-30.

Desai, K.M., Saravaiya, S.N., Maheta, V. and Patel, D.A. 2017. Combining ability for yield and yield attributing characters in brinjal (*Solanum melongena* L.). *Electronic Journal of Plant Breeding*, **8**(2): 480-484. [Cross Ref]

Dhaka, S.K., Kaushik, R.A., Laxman Jat, Shyopal Jat and Ramavtar Choudhary. 2017. Diallel analysis for combining ability studies in eggplant (*Solanum melongena* L.). *International Journal of Chemical Studies*, **5**(3): 173-183.

Dishri, M., Mishra, H.N., Senapati, N., Talekar, N.S. and Sahu, G.S. 2018. Estimation of heterosis for earliness, yield and its components in brinjal

(*Solanum melongena* L.). *Plant Archives*, **18**(2): 1405-1410.

Griffing, B. 1956b. Concept of general and specific combining ability in relation to diallel crossing systems. *Australian Journal of Biological Sciences*, **9**: 463-493. [Cross Ref]

Huang, W.Y., Cai, Y.Z. and Zhang, Y.B. 2010. Natural phenolic compounds from medicinal herbs and dietary plants: Potential use for cancer prevention. *Nutrition and Cancer*, **62**: 1–20. [Cross Ref]

Kalaiyarasi, G., Ranjith Raja Ram, S. and Saravanan, K. R. 2018. Studies on heterosis for yield in brinjal (*Solanum melongena* L.). *Horticultural Biotechnology Research*, **4**: 35-38.

Kaushik, P. 2019. Genetic analysis for fruit phenolics content, flesh color, and browning related traits in eggplant (*Solanum melongena*). *International journal of molecular sciences*, **20**(12): 2990. [Cross Ref]

Kumar, M.K., Mishra, H.N., Manas, P. and Nayak, D.P. 2020. Genetic variability and correlation studies in brinjal (*Solanum melongena* L.). *The Pharma Innovation*, **9**(2): 416-419.

Makani, Y., Patel, A.L., Bhatt, M.M. and Patel, P.C. 2013. Heterosis for yield and its contributing attributes in brinjal (*Solanum melongena* L.). *The Bio Scan*, **8**(4): 1369-1371.

Matsubara, K., Kaneyuki, T., Miyake, T. and Mori, M. 2005. Antiangiogenic activity of nasunin, an antioxidant anthocyanin, in eggplant peels. *Journal of Agricultural and Food Chemistry*, **53**: 6272-6275. [Cross Ref]

Owusu, E. Y. 2015. *Genetic study of extra-early maturity in cowpea (Vigna unguiculata (L.) Walp.)* (Doctoral dissertation).

Pal, B. P. and Singh, H.B. 1949. Hybrid brinjal gives increased yields. *Indian Farming*, **10**: 378-380.

Patel, A. A., Gohil, D.P., Dhruve, J.J. and Damor, H.I. 2017. Heterosis for fruit yield and its quality characters in brinjal (*Solanum melongena* L.). *Journal of Pharmacognosy and Phytochemistry*, **6**(6): 975-978.

Plazas, M., Andújar, I., Vilanova, S., Hurtado, M., Gramazio, P., Herraiz, F.J. and Prohens, J. 2013. Breeding for chlorogenic acid content in eggplant: Interest and prospects. *Notulae Botanicae Horti Agrobotanici*, **41**(1): 26-35. [Cross Ref]

Praveenkumar Angadi, Indiresh, K.M. and Mohan Rao, A. 2017. Correlation studies for fruit yield and its attributing characters in brinjal (*Solanum melongena* L.). *International Journal of Current Microbiology and Applied Sciences*, **6**(12): 1007-1012. [Cross Ref]

Rani, M., Kumar, S. and Kumar, M. 2018. Estimation of heterosis for yield and its contributing traits in brinjal. *Journal of Environmental Biology*, **39**: 710-718. [Cross Ref]

Santhosha, H.M., Indiresh, K.M. and Lingaiah, H.B. 2017. Diallel analysis in brinjal (*Solanum melongena* L.) for fruit yield, its attributes and bacterial wilt resistance. *Journal of Pharmacognosy and Phytochemistry*, **6**(6): 860-872.

Shafeeq, A., Hanchinal, R.R. and Kolakar, S. Shashikala. 2013. Heterosis breeding in brinjal. *International Journal of Plant Sciences*, **8**(2): 377-380.

Sharma, M. and Kaushik, P. 2021. Biochemical composition of eggplant fruits: A review. *Applied Sciences*, **11**: 7078. [Cross Ref]

Shende, V.D., Chattopadhyay, A., Yadav, Y., Seth, T. and Mukherjee, S. 2016. Breeding round fruited brinjal for export from Eastern India. *Agricultural Research*, **5**(3): 219-229. [Cross Ref]

Shull, G.H. 1948. What Is “Heterosis”? *Genetics*, **33**: 439-446. [Cross Ref]

Somawathi, K.M., Rizliya, L., Wijesinghe, D.G.N.G. and Madhujith, W.M.T. 2014. Antioxidant activity and total phenolic content of different skin coloured brinjal (*Solanum melongena*). *Tropical Agricultural Research*, **26**(1): 152-161. [Cross Ref]