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Research Article

Exploitation of heterosis and inbreeding depression for yield and nutritional quality improvement in tomato (*Lycopersicon esculentum* mill.)

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Abstract: A Diallel analysis was carried out to study the heterotic performance in F_1 and F_2 generation of tomato. The study exposed that significant positive as well as negative heterosis and inbreeding depression was recorded in most of the crosses for all the traits under observation. This experiment comprising a total of 100 treatments (45 F_1+ 45 F_2+ 10 parents) one standard check (Pusa Ruby) was evaluated in RBD. Promising combination for Number of fruits per plant and number of fruits per cluster was EC-145057 × Floradade (159.63% and 54.55%, respectively) showing highest significant heterosis. EC-620406 x EC-164563 (135.19%) showed highly significant positive heterosis over better parent for number of fruits per plant along with considerable inbreeding depression while, EC-165700 x EC-164563 (142.14%) cross showed promising results for ascorbic acid content. The present investigation was carried out to study the heterosis in F_1 over better parent, mid parent, standard parent and inbreeding depression over F_2 segregating generation for total yield and its related traits in tomato.

Keywords: Tomato, heterosis, inbreeding depression, F_1 hybrids, F_2 hybrids and Standard heterosis

Introduction

Tomato (*Lycopersicon esculantum* Mill.) is one of the most important fruit vegetable, which has achieved remarkable popularity during the last century and widely cultivated vegetable crops. Tomato being a moderate nutritional crop is considered as an important source of Vitamin A & C and minerals which play an important role as ingredients for table purpose, sambar preparation, chutney, pickles, ketchup, soup, juice pure etc. (Sekhar *et al*. 2010). Red colour of tomato is due to the presence of lycopene. Whereas, lycopene is valued for its anti-cancer property (Bose *et al*., 2002). The choice of parents for use in a plant breeding programme is one of the most important decisions that a breeder makes (Borem and Miranda, 2005). Now a day, farmers of is very much inclined to grow hybrid variety for having high yielding and to get good quality fruit. But there is lacking of good hybrid. So, development of hybrid variety of tomato is needed to support farmer's interest. It is costly to produce hybrid seeds every year by artificial emasculation and pollination. The nutrition importance of the tomato indicates there is need to formulate breeding programme and to develop cultivars rich in vitamins, nutrients and oxidants, processing traits with high quality of fruit as well as yield (Dagade *et al*., 2015). Total soluble solids, pericarp thickness, titratable acidity and ascorbic acid have been recognized as the most desirable attributes in tomato for contributing towards shelf life besides biochemical changes and processing industry (Shankar *et al*., 2014). The increase of 1% TSS in fruits results to increase 20% recovery of processed products (Dagade *et al*., 2015). Hybrid technology has been widely acclaimed as a modern approach for the genetic improvement of total yield in tomato. Inbreeding is the basic mechanism for providing the base material for selection. The nature and magnitude of inbreeding depression helps to the efficiency of selection.

Materials and Methods

The study was conducted during three seasons (Feb.2020, Aug-2020 and Feb-2021) at agriculture research farm of C.C.R. (PG) College Muzaffarnagar, U.P.

on Tomato. The material for the present study comprised of ten parents of tomato namely EC-620406, EC-163605, EC-165700, EC-631364, EC-164563, EC-521067, EC-528360, EC-145057, Floradade, and Arka Meghali and forty five hybrids were produced through half diallel mating design. The experiment was laid out in Randomized Block Design with each line consisted of ten plants in spacing at 60 x 45 cm. All the recommended package of practices was adopted for raising a healthy crop. The observations were recorded on randomly 5 plants in each parent and F_1 and 10 plants in each F_2 population on each replication. The selected pants were tagged and properly leveled before flowering and for recording the nine observations viz., Average fruit weight (g), number of fruit/plant, number of fruit/cluster, Pericarp thickness (mm), Total Soluble Solid (^oBrix), Ascorbic acid (mg/100g), Titratable acidity (%), and Total yield/plant (g). Heterosis and inbreeding depression for each trait was worked out by utilizing the overall mean of each hybrid over replications for each trait. Heterosis was examined over the superior parent (heterobeltiosis) over the mid parent and over the standard variety *i.e.*, Standard checks (economic heterosis) following the method described by Kempthorne (1957):-

$$\text{Mid parent} = \frac{\overline{F}_1 - \overline{MP}}{\overline{MP}} \times 100$$

$$\text{Heteroeltiosis} = \frac{\overline{F}_1 - \overline{BP}}{\overline{BP}}$$

$$\text{Economic check} = \frac{\overline{F}_1 - \overline{EC}}{\overline{EC}}$$

Where, $\overline{F}_1$= Mean value of the F_1 generation

$\overline{MP}$ = Mean performance of mid parent

$\overline{BP}$ = Mean value of the better parent (heterobeltiosis)

$\overline{EC}$ = Mean value of the economic cultivar (check).

Inbreeding depression

Inbreeding depression in F_2 generation was estimated as the mean difference between the F_1- F_2 populations.

$$\text{Inbreeding depression (\%)} = \frac{\overline{F}_1 - \overline{F}_2}{\overline{F}_2} \times 100$$

Where,

$\overline{F}_1$ = Mean value of the F_1Hybrid

$\overline{F}_2$ = Mean value of the F_2generation

Estimate of inbreeding depression from F_2 over F_1 were calculated in term of percentage.

Results and Discussion

Analysis of variance revealed for hybrids were significant for average fruit weight, number of fruit per plant, number of fruit per cluster, pericarp thickness, ascorbic acid, titrable acidity, TSS, total yield per plant, which indicated presence of substantial amount of heterosis in all cross combinations. Considerable genetic variation for various traits including yield and quality of fruit has been reported by many workers (Dagade *et al*., 2015, Meena and Bahadur, 2014, Shankar *et al.,* 2014 and Kumar and Singh, 2016). Heterosis was estimated as per cent increase or decrease of F_1 value over better parent (BP), mid parent (MP) and standard parent (SP) / standard variety (SV) as well as inbreeding depression. The extent of heterosis and inbreeding depression for different characters is presented in Table 1 to 9. The results obtained are described character wise in ensuring paragraphs.

The extent of heterosis and inbreeding depression for different characters is presented in Table 2. The maximum significant positive heterosis for **average fruit weight** was recorded in EC- 165700 x EC- 528360 (59.26 over better parent and 66.89 over mid parent) cross and 12 F_2 population showed negative inbreeding depression than their respective F_1s. Average fruit weight directly affects the total yield, so this character is very important so far total yield is concerned. Shankar *et al.* (2014) and Kumari and Sharma (2011) also reported positive heterosis up to 10 to 40 per cent for average fruit weight in tomato. High average fruit weight is of prime importance in breeding high yielding cultivars.

The maximum significant positive heterosis for **number of fruit per plant (**Table 3**)** was recorded in EC-620406 x EC- 164563 (135.19 over better parent) and EC-145057 x Arka Meghali 159.63 over mid parent) cross and 6 F_2 population showed negative inbreeding depression than their respective F_1s. Number of fruits directly affects the total fruit yield per plant, so this character is very important for total yield. These findings are in close agreement with Asati *et al.* (2007) and Kumari and Sharma (2011).

The maximum significant positive heterosis for **number of fruit per cluster (**Table 4**)** in tomato was recorded in EC- 145057 x Floradade (54.55 over better parent and 54.55 over mid parent) cross and 15 F_2 populations showed negative inbreeding depression than their respective F_1s. Highest standard heterosis for number of fruits per cluster which was similar to our result.

The maximum significant negative heterosis for **Pericarp thickness (Table 5)** was recorded in EC- 163605 x EC- 521067 (-40.08 over better parent and -23.21 over mid parent) cross and 9 F_2 population showed negative inbreeding depression than their respective F_1s. Similar results were reported by Kurian *et al.* (2001), Singh, *et al.* (2008), and Asati *et al*. (2007).

The maximum significant negative heterosis for **Total Soluble Solids (Table 6)** was recorded in EC- 528360 x Floradade (- 44.64 over better parent) and Floradade x Arka Meghali (- 36.01 over mid parent) cross and 4 F_2 population showed negative inbreeding depression than their respective F_1s. These results are in accordance with the findings of Kurian and Peter (2001), Singh, *et al.* (2008), Kumar *et al.* (2009) and Kumari and Sharma (2011).

The maximum significant Positive heterosis for **Ascorbic Acid (Table 7)** was recorded in Floradade x Arka Meghali (167.27 over better parent and 182.80 over mid parent) cross and 30 F_2 populations showed negative inbreeding depression than their respective F_1s. Heterosis for vitamin C was also reported by Dod and Kale (1992) and Bhatt *et al.* (2001).

The maximum significant positive heterosis for **Titrable acidity (Table 8)** was recorded in EC- 620406 x EC- 164563 (66.67 over better parent and 90.48 over mid parent) cross and 28 F_2 population showed negative inbreeding depression than their respective F_1s.

The maximum significant positive heterosis for **Total yield per plant (Table 9)** was recorded in EC- 165700 x EC- 164563 (123.71 over better parent and 66.89 over mid parent) cross and 11 F_2 population showed negative inbreeding depression than their respective F_1s. These findings are in close agreement with the findings of Asati *et al.* (2007), Singh *et al.* (2008) and Kumari and Sharma (2011). Positive and significant heterosis over mid parent and better parent along with positive inbreeding depression may be attributed to major contribution from dominance (h) and additive x additive (i) gene effects. Thus, selection will be effective only in later generations. Total yield is controlled by polygenes. The positive and high magnitude of heterosis for total yield per plant noticed is may be under the influence of one or more yield contributing characters (Chandrakala *et al*., 2010). So that this cross is most promising for this trait. Highly significant positive heterosis for vitamin C, and TSS content was also recognized by Dagade *et al*. (2015), Singh *et al*. (2008), Kumar *et al*. (2009) and Kumari and Sharma (2011). Heterosis breeding may be one of the most prominent approaches for quality improvement, as most of the quality characters are governed by non-additive gene action.

Table 1. Analysis of variance for parent and F_1S & F_2S in tomato (*Lycopersicon esculantum* Mill.)

Sourced of variation	d.f	Average Fruit Weight (g)	No. of Fruits /Plant	No. of Fruits /Cluster	Total Yield/Plant (g)
Replication	2	15.32	4.48	0.63	4007.98
Parents	9	1453.63**	796.98**	1.24**	1712692.40**
F_1 Hybrid	44	284.81**	703.78**	1.55**	726066.68**
Parents verses F_1 Hybrid	1	1393.27**	1501.87**	6.41**	190572.28**
F_2 Hybrid	44	275.30**	706.19**	1.37**	709849.37**
Parents verses F_2 Hybrid	1	1471.04**	1629.91**	5.18**	188543.53**
Error	198	9.70	8.12	0.30	3423.16

Sourced of variation	d.f	Pericarp thickness	TSS (° Brix)	Ascorbic Acid (mg/100 g)	T. A. (%)
Replication	2	0.35	0.43	0.04	0.0010
Parents	9	1.96**	1.42**	116.26**	0.0724**
F1 Hybrid	44	1.46**	0.08	674.02**	0.0065**
Parents verses F_1 Hybrid	1	0.68**	7.23**	12774.44**	0.0866**
F_2 Hybrid	44	1.51**	0.07	691.02**	0.0065**
Parents verses F_2 Hybrid	1	1.06**	7.63**	12430.77**	0.1003**
Error	198	0.15	0.07	9.10	0.0006

*, ** significant at 5% and 1% levelsignificance, respectively

2. Heterotic effect for Average Fruit Weight (g) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	40.94	-19.05 **	32.43 **	6.13	-4.07
2.	EC-620406 x EC-165700	29.17	-42.32 **	-20.69 **	-24.38**	-3.43
3.	EC-620406 x EC-164563	31.54	-37.63 **	-35.63 **	-18.23**	-1.06
4.	EC-620406 x EC-631364	26.43	-47.75 **	-46.11 **	-31.49**	-9.80**
5.	EC-620406 x EC-521067	38.26	-24.35 **	-5.55	-0.81	0.38
6.	EC-620406 x EC-528360	45.24	-10.55 *	26.62 **	17.28**	-1.47
7.	EC-620406 x EC-145057	39.25	-22.39 **	3.90	1.76	-8.20**
8.	EC-620406 x floradade	48.88	-44.85 **	-29.77 **	26.72**	-5.46
9.	EC-620406 x ArkaMeghali	37.72	-25.42 **	-14.59 **	-2.21	-1.77
10.	EC-163605 x EC-165700	15.47	-32.72 **	-9.66	-59.90**	1.29
11.	EC-163605 x EC-164563	10.46	-77.94 **	-64.34 **	-72.87**	5.13
12.	EC-163605 x EC-631364	37.09	-21.91 **	26.27 **	-3.84	-3.59
13.	EC-163605 x EC-521067	18.16	-40.34 **	-12.88	-52.92**	-3.67
14.	EC-163605 x EC-528360	23.81	14.01	48.20 **	-38.27**	-11.57**
15.	EC-163605 x EC-145057	25.65	2.68	41.60 **	-33.49**	-1.31
16.	EC-163605 x Floradade	17.98	-79.72 **	-64.00 **	-53.39**	-10.01**
17.	EC-163605 x ArkaMeghali	11.48	-69.58 **	-53.13 **	-70.23**	-1.36
18.	EC-165700 x EC-164563	38.77	-18.27 **	10.10	0.50	-2.05
19.	EC-165700 x EC-631364	16.32	-65.64 **	-53.70 **	-57.69**	-1.76
20.	EC-165700 x EC-521067	23.31	-23.42 **	-12.75	-39.57**	-1.15
21.	EC-165700 x EC-528360	36.61	59.26 **	66.89 **	-5.08	1.06
22.	EC-165700 x EC-145057	29.30	17.26	22.14 *	-24.05**	-4.67
23.	EC-165700 x Floradade	33.44	-62.27 **	-40.08 **	-13.31*	7.66*
24.	EC-165700 x ArkaMeghali	26.87	-28.82 **	-11.52	-30.33**	-5.44
25.	EC-164563 x EC-631364	46.41	-2.30	-2.23	20.32**	4.31
26.	EC-164563 x EC-521067	38.28	-19.30 **	-1.69	-0.76	-7.71*
27.	EC-164563 x EC-528360	42.66	-10.06	24.89 **	10.60	-2.82
28.	EC-164563 x EC-145057	30.34	-36.04 **	-16.21 *	-21.34**	-3.07
29.	EC-164563 x Floradade	34.07	-61.56 **	-49.93 **	-11.68*	6.03*
30.	EC-164563 x ArkaMeghali	46.27	-2.46	8.62	19.95**	4.63
31.	EC-631364 x EC-521067	42.58	-10.37	9.25	10.38*	-5.79*
32.	EC-631364 x EC-528360	28.59	-39.82 **	-16.40 *	-25.89**	-7.62*
33.	EC-631364 x EC-145057	40.50	-14.74 **	11.75	5.00	-5.19
34.	EC-631364 x Floradade	29.58	-66.63 **	-56.54 **	-23.31**	-15.11**
35.	EC-631364 x ArkaMeghali	40.21	-15.35 **	-5.67	4.25	13.45**
36.	EC-521067 x EC-528360	23.32	-23.38 **	-9.12	-39.54**	-13.78**
37.	EC-521067 x EC-145057	18.84	-38.11 **	-32.01 **	-51.16**	13.50**
38.	EC-521067 x Floradade	28.19	-68.19 **	-52.65 **	-26.91**	-10.90**
39.	EC-521067x ArkaMeghali	27.42	-27.37 **	-19.58 **	-28.91**	12.16**
40.	EC-528360 x EC-145057	21.25	-14.96	-7.36	-44.92**	3.13
41.	EC-528360 x Floradade	20.38	-77.01 **	-62.78 **	-47.17**	3.14
42.	EC-528360 x ArkaMeghali	26.52	-29.75 **	-9.54	-31.24**	-9.06**
43.	EC-145057 x Floradade	32.99	-62.78 **	-41.93 **	-14.47**	-6.06

44.	EC-145057 x ArkaMeghali	26.52	-29.76 **	-15.47 *	-31.26**	12.56**
45.	Floradade x ArkaMeghali	34.90	-60.63 **	-44.78 **	-9.53	-13.09**
SE ±			2.66	2.31		
CD at 5%				5.37		4.65

3. Heterotic effect for Number of Fruit /Plant in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	25.33	-64.32 **	-43.07 **	-36.14**	-9.21**
2.	EC-620406 x EC-165700	26.67	-1.23	18.52 *	-32.77**	5.45
3.	EC-620406 x EC-164563	42.33	135.19 **	139.62 **	6.72	-2.82
4.	EC-620406 x EC-631364	18.67	-12.50	-5.08	-52.94**	6.73*
5.	EC-620406 x EC-521067	39.00	48.10 **	75.94 **	-1.68	5.64
6.	EC-620406 x EC-528360	39.67	-13.14 **	24.61 **	0.00	-0.49
7.	EC-620406 x EC-145057	28.67	-3.37	20.28 *	-27.73**	2.93
8.	EC-620406 x floradade	45.67	21.24 **	64.07 **	15.13**	-6.19**
9.	EC-620406 x ArkaMeghali	23.67	-1.39	12.70	-40.34**	5.63*
10.	EC-163605 x EC-165700	62.67	-11.74 **	27.89 **	57.98**	2.13
11.	EC-163605 x EC-164563	63.00	-11.27 **	42.64 **	58.82**	2.65
12.	EC-163605 x EC-631364	39.00	-45.07 **	-15.52 **	-1.68	-2.56
13.	EC-163605 x EC-521067	54.33	-23.47 **	11.64 **	36.97**	2.46
14.	EC-163605 x EC-528360	34.33	-51.64 **	-41.14 **	-13.45**	6.80*
15.	EC-163605 x EC-145057	41.33	-41.78 **	-17.88 **	4.20	10.49**
16.	EC-163605 x Floradade	65.67	-7.51 *	20.86 **	65.55**	2.03
17.	EC-163605 x ArkaMeghali	62.00	-12.68 **	30.53 **	56.30**	-9.14**
18.	EC-165700 x EC-164563	47.67	76.54 **	115.04 **	20.17**	-1.40
19.	EC-165700 x EC-631364	36.33	34.57 **	50.34 **	-8.40*	6.42*
20.	EC-165700 x EC-521067	29.67	9.88	11.25	-25.21**	-4.50
21.	EC-165700 x EC-528360	32.67	-28.47 **	-10.09	-17.65**	-1.02
22.	EC-165700 x EC-145057	38.33	29.21 **	35.29 **	-3.36	3.48
23.	EC-165700 x Floradade	32.67	-13.27 *	1.03	-17.65**	-1.02
24.	EC-165700 x ArkaMeghali	37.67	39.51 **	47.71 **	-5.04	-6.76*
25.	EC-164563 x EC-631364	17.67	-17.19	-8.62	-55.46**	17.00**
26.	EC-164563 x EC-521067	26.33	0.00	20.61 *	-33.61**	7.60**
27.	EC-164563 x EC-528360	17.67	-61.31 **	-43.92 **	-55.46**	1.88
28.	EC-164563 x EC-145057	38.67	30.34 **	64.54 **	-2.52	4.51
29.	EC-164563 x Floradade	59.33	57.52 **	115.76 **	49.58**	9.55**
30.	EC-164563 x ArkaMeghali	42.00	75.00 **	103.23 **	5.88	7.94**
31.	EC-631364 x EC-521067	22.67	-13.92	-4.90	-42.86**	12.10**
32.	EC-631364 x EC-528360	46.33	1.46	38.31 **	16.80**	4.32
33.	EC-631364 x EC-145057	23.33	-21.35 **	-8.50	-41.18**	4.27

34.	EC-631364 x Floradade	48.00	27.43 **	62.71 **	21.01**	4.42
35.	EC-631364 x ArkaMeghali	26.33	9.72	16.18	-33.61**	7.60**
36.	EC-521067 x EC-528360	16.67	-63.50 **	-53.70 **	-57.98**	-8.98**
37.	EC-521067 x EC-145057	24.67	-16.85 *	-11.90	-37.81**	13.51**
38.	EC-521067 x Floradade	27.00	-28.32 **	-15.63 *	-31.93**	-7.41**
39.	EC-521067x ArkaMeghali	35.67	35.44 **	41.72 **	-10.08**	-13.08**
40.	EC-528360 x EC-145057	45.00	-1.46	19.47 **	13.44**	4.44
41.	EC-528360 x Floradade	46.00	0.73	10.40 *	15.97**	4.35
42.	EC-528360 x ArkaMeghali	40.00	-12.41 *	14.83 *	0.84	-5.00
43.	EC-145057 x Floradade	71.67	90.27 **	112.87 **	80.67**	-1.91
44.	EC-145057 x ArkaMeghali	69.67	134.83 **	159.63 **	75.63**	-2.87
45.	Floradade x ArkaMeghali	71.33	89.38 **	131.35 **	79.83**	-4.10
SE ±			2.32	2.01		
CD at 5%				4.67		4.05

4. Heterotic effect for Number of Fruit /Cluster in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	4.33	-13.33	4.00	30.00**	-15.37**
2.	EC-620406 x EC-165700	4.33	30.00 *	30.00 *	30.00**	-7.69**
3.	EC-620406 x EC-164563	4.00	9.09	14.29	20.01	-8.33**
4.	EC-620406 x EC-631364	3.00	-10.00	-10.00	-9.99	11.10**
5.	EC-620406 x EC-521067	4.67	16.67	27.27 *	40.02**	-7.22*
6.	EC-620406 x EC-528360	5.67	30.77 **	47.83 **	70.03**	-17.65**
7.	EC-620406 x EC-145057	4.67	27.27 *	33.33 **	40.02**	-7.16*
8.	EC-620406 x floradade	4.33	18.18	23.81 *	30.00**	-15.37**
9.	EC-620406 x ArkaMeghali	4.33	-13.33	4.00	30.00**	7.78**
10.	EC-163605 x EC-165700	6.00	20.00 *	44.00 **	80.02**	-22.22**
11.	EC-163605 x EC-164563	4.33	-13.33	0.00	30.00**	-15.37**
12.	EC-163605 x EC-631364	5.67	13.33	36.00 **	70.03**	-11.77**
13.	EC-163605 x EC-521067	3.67	-26.67 **	-18.52 *	10.02	18.16**
14.	EC-163605 x EC-528360	4.33	-13.33	-7.14	30.00**	3.85
15.	EC-163605 x EC-145057	3.67	-26.67 **	-15.38	10.02	9.08**
16.	EC-163605 x Floradade	4.33	-13.33	0.00	30.00**	-15.37**
17.	EC-163605 x ArkaMeghali	5.67	13.33	13.33	70.03**	-5.89
18.	EC-165700 x EC-164563	4.33	18.18	23.81 *	30.00**	7.71**
19.	EC-165700 x EC-631364	4.67	40.00 **	40.00 **	40.02**	7.14*
20.	EC-165700 x EC-521067	4.33	8.33	18.18	30.00**	7.78**
21.	EC-165700 x EC-528360	4.67	7.69	21.74 *	40.02**	-7.22**
22.	EC-165700 x EC-145057	4.67	27.27 *	33.33 **	40.02**	21.43**

23.	EC-165700 x Floradade	3.33	-9.09	-4.76	0.00	-9.99**
24.	EC-165700 x ArkaMeghali	3.67	-26.67 **	-12.00	10.02	9.08**
25.	EC-164563 x EC-631364	5.33	45.45 **	52.38 **	60.01**	-6.24
26.	EC-164563 x EC-521067	4.00	0.00	4.35	20.01**	8.33**
27.	EC-164563 x EC-528360	4.67	7.69	16.67	40.02**	-7.22
28.	EC-164563 x EC-145057	3.33	-9.09	-9.09	0.00	10.11**
29.	EC-164563 x Floradade	5.00	36.36 **	36.36 **	50.02**	6.66
30.	EC-164563 x ArkaMeghali	4.33	-13.33	0.00	30.00**	-7.69**
31.	EC-631364 x EC-521067	5.00	25.00 *	36.36 **	50.02**	6.66
32.	EC-631364 x EC-528360	3.67	-15.38	-4.35	10.02	-9.19**
33.	EC-631364 x EC-145057	4.00	9.09	14.29	20.01**	-8.33**
34.	EC-631364 x Floradade	3.67	0.00	4.76	10.02	9.08**
35.	EC-631364 x ArkaMeghali	3.67	-26.67 **	-12.00	10.02	18.16**
36.	EC-521067 x EC-528360	4.00	-7.69	-4.00	20.01**	-8.25
37.	EC-521067 x EC-145057	4.00	0.00	4.35	20.01	33.33**
38.	EC-521067 x Floradade	3.67	-8.33	-4.35	10.02	9.08**
39.	EC-521067x ArkaMeghali	5.00	0.00	11.11	50.02**	-6.66
40.	EC-528360 x EC-145057	4.67	7.69	16.67	40.02**	-7.22**
41.	EC-528360 x Floradade	4.33	0.00	8.33	30.00**	7.55**
42.	EC-528360 x ArkaMeghali	4.33	-13.33	-7.14	30.00**	7.78**
43.	EC-145057 x Floradade	5.67	54.55 **	54.55 **	70.03**	-5.89
44.	EC-145057 x ArkaMeghali	5.33	6.67	23.08 *	60.01**	-6.24
45.	Floradade x ArkaMeghali	5.67	13.33	30.77 **	70.03*	5.88*
SE ±			0.45	0.39		
CD at 5%				0.92		0.79

5. Heterotic effect for pericarp thickness (mm) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	4.06	-7.24	13.04	-45.21**	-1.48
2.	EC-620406 x EC-165700	3.98	-9.06	5.71	-46.29**	-7.61**
3.	EC-620406 x EC-164563	3.75	-14.24	-13.91 *	-49.35**	-8.87**
4.	EC-620406 x EC-631364	4.22	-13.65 *	-8.93	-43.09**	-2.77
5.	EC-620406 x EC-521067	4.22	-15.78 *	-10.12	-43.09**	-2.54
6.	EC-620406 x EC-528360	4.33	-0.99	15.10 *	-41.52**	-6.23*
7.	EC-620406 x EC-145057	3.89	-11.04	-0.30	-47.46**	-0.15
8.	EC-620406 x floradade	3.87	-18.85 **	-15.34 *	-47.73**	-1.29
9.	EC-620406 x ArkaMeghali	3.48	-20.56 **	-14.37 *	-53.08**	-1.55
10.	EC-163605 x EC-165700	2.53	-19.66	-14.99	-65.82**	-2.09
11.	EC-163605 x EC-164563	3.02	-30.54 **	-15.62	-59.28**	-1.79

12.	EC-163605 x EC-631364	2.96	-39.32 **	-22.93 **	-60.01**	-1.11
13.	EC-163605 x EC-521067	3.00	-40.08 **	-23.21 **	-59.51**	-1.67
14.	EC-163605 x EC-528360	3.04	-3.70	1.90	-59.01**	-2.11
15.	EC-163605 x EC-145057	3.06	-10.87	-1.92	-58.70**	-2.39
16.	EC-163605 x Floradade	3.35	-29.89 **	-11.70	-54.83**	-1.79
17.	EC-163605 x ArkaMeghali	2.95	-21.19 *	-9.92	-60.19**	-1.12
18.	EC-165700 x EC-164563	3.44	-20.87 **	-8.31	-53.62**	-1.95
19.	EC-165700 x EC-631364	3.48	-28.67 **	-13.31	-53.00**	-5.74*
20.	EC-165700 x EC-521067	3.58	-28.56 **	-12.34	-51.73**	0.00
21.	EC-165700 x EC-528360	3.09	-2.11	-2.11	-58.34**	0.42
22.	EC-165700 x EC-145057	3.16	-7.86	-3.95	-57.31**	0.54
23.	EC-165700 x Floradade	3.25	-31.91 **	-18.00 *	-56.14**	-7.69**
24.	EC-165700 x ArkaMeghali	3.08	-17.72 *	-10.68	-58.43**	-3.25
25.	EC-164563 x EC-631364	4.87	-0.34	5.49	-34.32**	-7.13*
26.	EC-164563 x EC-521067	4.66	-6.99	-0.39	-37.15**	7.37*
27.	EC-164563 x EC-528360	3.94	-9.29	5.11	-46.83**	4.31
28.	EC-164563 x EC-145057	3.96	-8.83	1.84	-46.56**	-10.35**
29.	EC-164563 x Floradade	3.88	-18.78 **	-14.95 *	-47.68**	-2.50
30.	EC-164563 x ArkaMeghali	4.04	-6.98	-0.08	-45.48**	1.49
31.	EC-631364 x EC-521067	4.76	-4.93	-3.74	-35.76**	-8.61**
32.	EC-631364 x EC-528360	4.49	-8.05	11.74	-39.41**	-2.45
33.	EC-631364 x EC-145057	4.82	-1.37	15.83 *	-34.99**	2.14
34.	EC-631364 x Floradade	5.51	12.76	14.05 *	-25.68**	0.78
35.	EC-631364 x ArkaMeghali	4.51	-7.65	4.56	-39.14**	-2.88
36.	EC-521067 x EC-528360	4.90	-2.06	20.18 **	-33.83**	5.04
37.	EC-521067 x EC-145057	4.62	-7.66	9.56	-37.61**	10.53**
38.	EC-521067 x Floradade	4.65	-7.19	-4.98	-37.29**	-6.39**
39.	EC-521067x ArkaMeghali	4.50	-10.05	2.93	-39.23**	-8.73**
40.	EC-528360 x EC-145057	3.09	-10.10	-6.28	-58.34**	-1.20
41.	EC-528360 x Floradade	3.13	-34.43 **	-21.03 **	-57.76**	7.35*
42.	EC-528360 x ArkaMeghali	3.21	-14.34	-7.01	-56.72**	6.64*
43.	EC-145057 x Floradade	3.40	-28.84 **	-17.22 *	-54.16**	14.81**
44.	EC-145057 x ArkaMeghali	3.16	-15.58	-11.94	-57.35**	2.85
45.	Floradade x ArkaMeghali	4.18	-12.36	-1.76	-43.55**	-0.79
SE ±			0.33	0.29		
CD at 5%				0.67		0.58

6. Heterotic effect for Total Soluble Solid (°Brix) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	2.88	1.76	1.76	-40.31**	-1.73
2.	EC-620406 x EC-165700	2.75	-12.23	-7.82	-43.06**	6.07*
3.	EC-620406 x EC-164563	3.00	-9.09	-2.17	-37.89**	-5.57*
4.	EC-620406 x EC-631364	2.92	-17.84 **	-8.62	-39.61**	2.50
5.	EC-620406 x EC-521067	3.05	-10.73	-2.40	-36.85**	1.64
6.	EC-620406 x EC-528360	3.17	11.76	16.92 *	-34.43**	-5.27*
7.	EC-620406 x EC-145057	2.75	-23.26 **	-14.29 *	-43.06**	-4.00
8.	EC-620406 x floradade	3.00	-37.72 **	-21.57 **	-37.89**	3.33
9.	EC-620406 x ArkaMeghali	3.00	-30.23 **	-15.89 **	-37.89**	-2.23
10.	EC-163605 x EC-165700	2.75	-12.23	-7.82	-43.06**	3.27
11.	EC-163605 x EC-164563	2.97	-10.10	-3.26	-38.57**	-1.15
12.	EC-163605 x EC-631364	2.75	-22.54 **	-13.84 *	-43.06*	6.18*
13.	EC-163605 x EC-521067	2.97	-13.17 *	-5.07	-38.57**	-7.65**
14.	EC-163605 x EC-528360	3.08	8.82	13.85	-36.17**	-4.31
15.	EC-163605 x EC-145057	2.97	-17.21 **	-7.53	-38.57**	-1.15
16.	EC-163605 x Floradade	2.75	-42.91 **	-28.10 **	-43.06**	-3.02
17.	EC-163605 x ArkaMeghali	2.97	-31.01 **	-16.82 **	-38.57**	-1.15
18.	EC-165700 x EC-164563	3.22	-2.53	0.00	-33.40**	-0.53
19.	EC-165700 x EC-631364	2.97	-16.43 *	-11.22	-38.57**	-1.69
20.	EC-165700 x EC-521067	2.75	-19.51 **	-16.03 **	-43.06**	-3.27
21.	EC-165700 x EC-528360	3.05	-2.66	6.71	-36.85**	3.28
22.	EC-165700 x EC-145057	2.83	-20.93 **	-15.63 **	-41.35**	9.78**
23.	EC-165700 x Floradade	2.92	-39.45 **	-26.62 **	-39.61**	-2.30
24.	EC-165700 x ArkaMeghali	3.05	-29.07 **	-17.94 **	-36.85**	1.97
25.	EC-164563 x EC-631364	2.75	-22.54 **	-19.71 **	-43.06**	-3.64
26.	EC-164563 x EC-521067	2.50	-26.83 **	-25.56 **	-48.24**	6.00*
27.	EC-164563 x EC-528360	2.83	-14.14 *	-3.68	-41.35**	2.36
28.	EC-164563 x EC-145057	2.92	-18.60 **	-15.25 **	-39.61**	-6.07
29.	EC-164563 x Floradade	2.92	-39.45 **	-28.13 **	-39.61**	-5.73*
30.	EC-164563 x ArkaMeghali	3.05	-29.07 **	-19.74 **	-36.85**	-5.48*
31.	EC-631364 x EC-521067	2.92	-17.84 **	-16.27 **	-39.61**	-0.58
32.	EC-631364 x EC-528360	2.88	-18.78 **	-5.98	-40.31**	5.79*
33.	EC-631364 x EC-145057	2.97	-17.21 **	-16.82 **	-38.57**	4.82
34.	EC-631364 x Floradade	2.75	-42.91 **	-34.26 **	-43.06**	-3.27
35.	EC-631364 x ArkaMeghali	3.05	-29.07 **	-22.29 **	-36.85**	1.64
36.	EC-521067 x EC-528360	2.50	-26.83 **	-16.67 *	-48.24**	6.40*

37.	EC-521067 x EC-145057	2.75	-23.26 **	-21.43 **	-43.06**	3.64
38.	EC-521067 x Floradade	2.92	-39.45 **	-29.15 **	-39.61**	-9.15**
39.	EC-521067x ArkaMeghali	2.97	-31.01 **	-23.11 **	-38.57**	4.48
40.	EC-528360 x EC-145057	2.67	-25.58 **	-13.51 *	-44.78**	-4.39
41.	EC-528360 x Floradade	2.67	-44.64 **	-27.93 **	-44.78**	9.49**
42.	EC-528360 x ArkaMeghali	2.63	-38.76 **	-23.49 **	-45.49**	4.44
43.	EC-145057 x Floradade	3.10	-35.64 **	-26.19 **	-35.82**	1.61
44.	EC-145057 x ArkaMeghali	3.00	-30.23 **	-23.89 **	-37.89**	-5.00
45.	Floradade x ArkaMeghali	2.92	-39.45 **	-36.01 **	-39.61**	6.27*
SE ±			0.23	0.20		
CD at 5%				0.46		0.40

7. Heterotic effect for Ascorbic Acid (mg/100 g) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	21.77	-17.03 *	5.92	-15.31	-1.53
2.	EC-620406 x EC-165700	31.70	20.84 **	21.13 **	23.33	3.15
3.	EC-620406 x EC-164563	26.23	-6.51	-3.36	2.06	-4.59
4.	EC-620406 x EC-631364	33.09	19.90 **	22.95 **	28.75	-2.12
5.	EC-620406 x EC-521067	42.27	32.64 **	45.50 **	64.44	-5.01
6.	EC-620406 x EC-528360	41.40	54.46 **	56.12 **	61.07	-0.80
7.	EC-620406 x EC-145057	42.67	8.84	30.41 **	66.00	-23.36
8.	EC-620406 x floradade	31.30	19.31 *	29.11 **	21.78	-0.80
9.	EC-620406 x ArkaMeghali	43.85	67.15 **	71.18 **	70.60	-0.76
10.	EC-163605 x EC-165700	24.87	-4.75	21.38 *	-3.25	-0.40
11.	EC-163605 x EC-164563	40.98	46.06 **	90.95 **	59.45	-1.67
12.	EC-163605 x EC-631364	29.96	8.54	41.08 **	16.55	-1.11
13.	EC-163605 x EC-521067	20.07	-37.01 **	-14.09	-21.90	-1.66
14.	EC-163605 x EC-528360	28.48	6.27	36.71 **	10.82	-3.51
15.	EC-163605 x EC-145057	43.05	9.81	59.24 **	67.48	11.87
16.	EC-163605 x Floradade	19.48	-12.45	4.97	-24.20	-1.71
17.	EC-163605 x ArkaMeghali	30.23	20.93 *	51.67 **	17.62	-1.10
18.	EC-165700 x EC-164563	67.94	142.14 **	150.87 **	164.34	-8.75
19.	EC-165700 x EC-631364	55.88	102.45 **	108.08 **	117.39	-0.69
20.	EC-165700 x EC-521067	58.17	82.55 **	100.69 **	126.33	-0.45
21.	EC-165700 x EC-528360	60.95	127.38 **	130.38 **	137.12	-0.37
22.	EC-165700 x EC-145057	59.84	52.64 **	83.25 **	132.80	-6.66
23.	EC-165700 x Floradade	54.29	107.95 **	124.52 **	111.22	-2.22
24.	EC-165700 x ArkaMeghali	62.06	137.72 **	142.86 **	141.45	-2.71
25.	EC-164563 x EC-631364	50.19	78.88 **	80.36 **	95.28	4.50

26.	EC-164563 x EC-521067	61.05	91.57 **	103.74 **	137.51	7.54
27.	EC-164563 x EC-528360	58.65	109.02 **	113.80 **	128.18	-5.51
28.	EC-164563 x EC-145057	64.55	64.68 **	91.95 **	151.15	-6.48
29.	EC-164563 x Floradade	64.84	131.08 **	157.74 **	152.27	-3.75
30.	EC-164563 x ArkaMeghali	63.41	125.99 **	139.03 **	146.71	4.87
31.	EC-631364 x EC-521067	50.69	59.08 **	70.49 **	97.23	-10.20
32.	EC-631364 x EC-528360	54.94	99.06 **	101.97 **	113.75	1.02
33.	EC-631364 x EC-145057	53.69	36.96 **	60.74 **	108.87	1.81
34.	EC-631364 x Floradade	54.89	98.88 **	120.21 **	113.55	9.76
35.	EC-631364 x ArkaMeghali	59.23	114.61 **	125.22 **	130.45	-7.99
36.	EC-521067 x EC-528360	60.33	89.33 **	105.67 **	134.73	3.59
37.	EC-521067 x EC-145057	56.16	43.27 **	58.05 **	118.50	1.76
38.	EC-521067 x Floradade	66.29	108.02 **	144.97 **	157.91	2.96
39.	EC-521067x ArkaMeghali	66.82	109.70 **	135.02 **	159.98	4.92
40.	EC-528360 x EC-145057	57.49	46.67 **	74.21 **	123.68	4.60
41.	EC-528360 x Floradade	59.39	121.58 **	142.13 **	131.06	-6.68
42.	EC-528360 x ArkaMeghali	62.24	132.22 **	140.31 **	142.16	-2.85
43.	EC-145057 x Floradade	64.52	64.60 **	109.99 **	151.03	-6.62
44.	EC-145057 x ArkaMeghali	65.80	67.87 **	104.99 **	156.01	-6.01
45.	Floradade x ArkaMeghali	66.82	167.27 **	182.80 **	159.96	-1.76
SE ±			2.11	1.83		
CD at 5%				4.25		3.68

8. Heterotic effect for Titratable Acidity (%) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	0.233	-42.62 **	-11.39	-52.74	-18.45
2.	EC-620406 x EC-165700	0.120	0.00	4.35	-75.66	-5.83
3.	EC-620406 x EC-164563	0.200	66.67 **	90.48 **	-59.43	-8.50
4.	EC-620406 x EC-631364	0.137	-34.92 **	-17.17	-72.21	14.60
5.	EC-620406 x EC-521067	0.197	63.89 **	87.30 **	-60.04	1.52
6.	EC-620406 x EC-528360	0.120	-36.84 **	-22.58 *	-75.66	-5.83
7.	EC-620406 x EC-145057	0.230	35.29 **	58.62 **	-53.35	-1.30
8.	EC-620406 x floradade	0.213	-57.62 **	-31.55 **	-56.80	-4.69
9.	EC-620406 x ArkaMeghali	0.143	-66.67 **	-47.88 **	-70.99	-2.10
10.	EC-163605 x EC-165700	0.307	-24.59 **	18.71 **	-37.73	-2.28
11.	EC-163605 x EC-164563	0.157	-61.48 **	-36.91 **	-68.15	-8.92
12.	EC-163605 x EC-631364	0.177	-56.56 **	-42.70 **	-64.10	-2.26
13.	EC-163605 x EC-521067	0.263	-35.25 **	6.04	-46.65	12.93
14.	EC-163605 x EC-528360	0.160	-60.66 **	-46.37 **	-67.55	12.50

15.	EC-163605 x EC-145057	0.147	-63.93 **	-49.13 **	-70.18	-4.76
16.	EC-163605 x Floradade	0.290	-42.38 **	-36.26 **	-41.18	-3.45
17.	EC-163605 x ArkaMeghali	0.213	-50.39 **	-49.00 **	-56.80	-20.19
18.	EC-165700 x EC-164563	0.137	24.24	36.67 *	-72.21	-17.52
19.	EC-165700 x EC-631364	0.170	-19.05 *	6.25	-65.52	-1.76
20.	EC-165700 x EC-521067	0.143	30.30	43.33 **	-70.99	-27.97
21.	EC-165700 x EC-528360	0.150	-21.05 *	0.00	-69.57	4.67
22.	EC-165700 x EC-145057	0.150	-11.76	7.14	-69.57	0.15
23.	EC-165700 x Floradade	0.190	-62.25 **	-38.04 **	-61.46	-1.58
24.	EC-165700 x ArkaMeghali	0.140	-67.44 **	-48.15 **	-71.60	-1.43
25.	EC-164563 x EC-631364	0.100	-52.38 **	-33.33 **	-79.72	4.00
26.	EC-164563 x EC-521067	0.153	70.37 **	70.37 **	-68.97	-3.92
27.	EC-164563 x EC-528360	0.183	-3.51	30.95 **	-62.88	9.84
28.	EC-164563 x EC-145057	0.233	37.25 **	79.49 **	-52.74	-9.87
29.	EC-164563 x Floradade	0.113	-77.48 **	-61.80 **	-77.08	2.65
30.	EC-164563 x ArkaMeghali	0.133	-68.99 **	-48.72 **	-73.02	6.77
31.	EC-631364 x EC-521067	0.127	-39.68 **	-15.56	-74.24	-7.87
32.	EC-631364 x EC-528360	0.160	-23.81 **	-20.00 *	-67.55	-3.13
33.	EC-631364 x EC-145057	0.133	-36.51 **	-29.82 **	-73.02	-2.26
34.	EC-631364 x Floradade	0.167	-66.89 **	-53.27 **	-66.13	1.80
35.	EC-631364 x ArkaMeghali	0.160	-62.79 **	-50.00 **	-67.55	3.75
36.	EC-521067 x EC-528360	0.100	-47.37 **	-28.57 *	-79.72	7.00
37.	EC-521067 x EC-145057	0.157	-7.84	20.51	-68.15	1.91
38.	EC-521067 x Floradade	0.193	-61.59 **	-34.83 **	-60.85	1.04
39.	EC-521067x ArkaMeghali	0.127	-70.54 **	-51.28 **	-74.24	-2.36
40.	EC-528360 x EC-145057	0.167	-12.28	-7.41	-66.13	1.80
41.	EC-528360 x Floradade	0.190	-62.25 **	-45.19 **	-61.46	2.63
42.	EC-528360 x ArkaMeghali	0.173	-59.69 **	-44.09 **	-64.91	-5.78
43.	EC-145057 x Floradade	0.193	-61.59 **	-42.57 **	-60.85	-4.15
44.	EC-145057 x ArkaMeghali	0.190	-55.81 **	-36.67 **	-61.46	-7.89
45.	Floradade x ArkaMeghali	0.227	-54.97 **	-51.43 **	-53.96	-6.17
SE ±			0.02	0.02		
CD at 5%				0.04		0.03

9. Heterotic effect for Total Yield/Plant (g) in tomato (*Lycopersicon esculantum* Mill.)

S. No	Cross	Mean	Better Parent	Mid Parent	Standard Check	Inbreeding Depression
1.	EC-620406 x EC-163605	911.01	23.89 **	27.19 **	-22.97**	-10.54**
2.	EC-620406 x EC-165700	681.14	-2.30	-0.30	-42.41**	20.55**
3.	EC-620406 x EC-164563	1246.83	51.96 **	64.31 **	5.43	1.02

4.	EC-620406 x EC-631364	455.51	-48.22 **	-42.23 **	-61.48**	-27.18**
5.	EC-620406 x EC-521067	1410.67	94.73 **	98.47 **	19.28**	2.12
6.	EC-620406 x EC-528360	1693.07	75.33 **	103.64 **	43.16**	-6.57
7.	EC-620406 x EC-145057	873.85	18.94 **	22.06 **	-26.11**	9.47**
8.	EC-620406 x floradade	1941.73	-38.66 **	0.54	64.19**	-7.35*
9.	EC-620406 x ArkaMeghali	1132.29	9.90 *	31.10 **	-4.26	-6.73
10.	EC-163605 x EC-165700	942.90	28.23 **	34.26 **	-20.27**	-2.34
11.	EC-163605 x EC-164563	659.05	-19.68 **	-15.28 **	-44.27**	7.56*
12.	EC-163605 x EC-631364	1439.21	63.59 **	78.22 **	21.70**	-5.61
13.	EC-163605 x EC-521067	963.03	30.97 **	31.95 **	-18.57**	-2.37
14.	EC-163605 x EC-528360	903.83	-6.40	6.27	-23.57**	-16.16**
15.	EC-163605 x EC-145057	979.83	33.25 **	33.31 **	-17.15**	-5.92
16.	EC-163605 x Floradade	1203.83	-61.97 **	-38.28 **	1.79	0.89
17.	EC-163605 x ArkaMeghali	569.53	-44.72 **	-35.48 **	-51.84**	-1.73
18.	EC-165700 x EC-164563	1835.47	123.71 **	146.41 **	55.20**	-2.77
19.	EC-165700 x EC-631364	553.49	-37.09 **	-28.54 **	-53.20**	0.80
20.	EC-165700 x EC-521067	568.39	-21.54 **	-18.43 **	-51.94**	-0.14
21.	EC-165700 x EC-528360	1072.50	11.06 *	31.20 **	-9.31	-9.29**
22.	EC-165700 x EC-145057	957.47	30.32 **	36.39 **	-19.04**	-5.22
23.	EC-165700 x Floradade	1062.35	-66.44 **	-44.60 **	-10.17*	2.99
24.	EC-165700 x ArkaMeghali	938.44	-8.91 *	10.43 *	-20.65**	-10.66**
25.	EC-164563 x EC-631364	805.45	-8.45	-5.25	-31.89**	6.46
26.	EC-164563 x EC-521067	1003.97	22.36 **	29.97 **	-15.11**	6.64
27.	EC-164563 x EC-528360	750.28	-22.30 **	-15.99 **	-36.56**	-16.76**
28.	EC-164563 x EC-145057	1170.21	42.62 **	50.49 **	-1.05	-17.07**
29.	EC-164563 x Floradade	1886.78	-40.40 **	-5.33 **	59.54**	-0.41
30.	EC-164563 x ArkaMeghali	1928.68	87.21 **	108.42 **	63.08**	-3.47
31.	EC-631364 x EC-521067	1050.57	19.42 **	30.98 **	-11.17**	8.75**
32.	EC-631364 x EC-528360	1287.35	33.31 **	39.52 **	8.85*	-4.17
33.	EC-631364 x EC-145057	875.82	-0.45	8.50	-25.94**	-11.45**
34.	EC-631364 x Floradade	1450.13	-54.19 **	-28.31 **	22.62**	-2.23
35.	EC-631364 x ArkaMeghali	1193.35	15.83 **	24.96 **	0.91	19.27**
36.	EC-521067 x EC-528360	473.17	-51.00 **	-44.01 **	-59.99**	7.89*
37.	EC-521067 x EC-145057	647.57	-11.86 *	-11.24 *	-45.24**	-6.05
38.	EC-521067 x Floradade	717.94	-77.32 **	-63.09 **	-39.29**	9.27**
39.	EC-521067x ArkaMeghali	932.30	-9.51 *	6.26	-21.17**	0.33
40.	EC-528360 x EC-145057	900.35	-6.76	5.90	-23.87**	-7.42*
41.	EC-528360 x Floradade	943.34	-70.20 **	-54.33 **	-20.23**	3.54

42.	EC-528360 x ArkaMeghali	1062.15	3.10	6.43	-10.19**	9.45**
43.	EC-145057 x Floradade	2354.93	-25.61 **	20.76 **	99.13**	-12.86**
44.	EC-145057 x ArkaMeghali	1830.07	77.63 **	107.38 **	54.75**	1.82
45.	Floradade x ArkaMeghali	2607.04	-17.64 **	24.27 **	120.44**	-7.65*
SE ±			44.07	38.17		
CD at 5%				88.81		76.91

Conclusion

Study was conducted to determine heterosis in F_1 hybrids and inbreeding depression in F_2 generation of ten tomato 45 crosses with respect to total yield and its component traits. Among the hybrids for Number of fruits per plant and number of fruits per cluster was EC-145057 × Floradade (159.63% and 54.55%, respectively) showing highest significant heterosis. EC-620406 x EC-164563 (135.19%) showed highly significant positive heterosis over better parent for number of fruits per plant along with considerable inbreeding depression while, EC-165700 x EC-164563 (142.14%) cross showed promising results for ascorbic acid content. Heterosis breeding may be one of the most prominent approaches for quality improvement, as most of the quality characters are governed by non-additive gene action.

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