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GENETIC STUDIES ON SOME IMPORTANT CHARACTERS IN TOMATO.

1- ESTIMATES OF HETEROSIS FOR YIELD COMPONENTS AND SOME FRUIT CHARACTERS

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ABSTRACT: *The present investigation was carried out to study and generate informations about the heterosis degree for yield and its components, as well as , some fruit characters in tomato F_1 crosses, which would help to assess prepotency of parents in hybrid combinations. The genetic materials used were six tomato genotypes viz., the cultivars Super Beef Steak, Endless Summer and Roma and three lines viz., Bl.5, Bl.14 and Bl.18. The experiments were conducted during two summer seasons of 2012 and 2013. The parental genotypes were crossed, without reciprocals, to form a set of diallel crosses in the first season. The parents and their F_1 crosses, as well as, the check cv. Super Badr were evaluated for some traits in field experiment in the second season.*

Hybrid vigour was detected in F_1 hybrids for most studied traits in several crosses. Desirable heterosis values were observed for early and total yield in many crosses in relation to better parent and check cultivar, indicating heterobeltiosis for these characters. The hybrid vigour was also observed in total soluble solids and ascorbic acid contents. Other degrees of dominance (partial, complete and no-dominance) were also found in the studied traits in certain crosses. The estimated potence ratio were in accordance with the postulated degree of heterosis. The presence of desirable heterosis in yield and its components encourage using of F_1 hybrids of tomato in commercial production.

Key words: *Heterosis, dominance, potence ratio, heterobeltiosis, hybrid vigour, no-dominance.*

INTRODUCTION

Tomato (*Solanum lycopersicon* L.) known for its outstanding nutrive value, is the second most commonly grown vegetable crops in the world (Kumar, *et al*., 2006). The cultivated area, in Egypt, reached 91404 feddans (fed. 4200 m2) which produced 8544993 tons with an average of 16.586 tons/feddan in 2010*. Nowadays it is grown in most of the countries around the globe, except the colder region. As a cash crop, it has a great demond in the international market (Hannan, *et al*., 2007).

Heterosis in tomato was first observed by Hedrick and Booth (1968) for higher yield and more number of fruits. Since then, heterosis for yield, its components and quality traits were extensively studied. Choudhary *et al*., (1965) emphasized the extensive utilization of heterosis to step up tomato production.

Several investigations have been conducted on the heterosis in tomato for most traits. Hybrid vigour was observed for most traits by several investigators. Khalil (2004), Manna and Paul (2012) and Rajasekhar *et al*., (2013) reported desirable heterosis in relation to the better parent for total yield, early flowering, fruit number and average fruit weight. Positive heterosis was also observed by Manna and Paul (2012) and Rajasekhar *et al*., (2013) for fruit length, width, pericarp thickness and fruit firmness. Meanwhile, negative heterosis was detected by Asati *et al*., (2007); Ahmed *et al*., (2011) and Manna and Paul (2012) for number of days to flowering and fruit ripening, as well as, titratable acidity. Positive heterosis for vitamin C and total soluble solids content was reported by Manna and Paul (2012) and Rajasekhar (2013).

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On the other hand, other degrees of dominance (complete, partial and no-dominance) were found for certain characters. No-dominance was observed for early flowering (Khalil *et al*., 1983), early yield (Bayomy,2002), total fruit yield (Hatem, 2003), total fruit number (Khalil, 1987), average fruit weight (Youssef, 1997), fruit firmness and pericarp thickness (Khalil *et al*., 1987 and Hatem, 2003), total soluble solids (Sekar, 2001 and Bayomy, 2002) and vitamin C content (Hatem, 2003).

Complete dominance was found for few days to maturity (Khalil *et al.,* 1983 and Hatem, 2003); for high total fruit weight and number (Bayomy, 2002); for heavy fruit (Sekar, 2001); for thick flesh (Hatem, 2003); for high total soluble solids content (El-Sharkawy, *et al*., 1997 and Yousef, 1997) and high titratable acidity (Youssef, 1997).

Partial dominance was detected for many characters in tomato. Bayomy (2002) and Hatem (2003) for total yield as fruit number and weight; Abdel Ati *et al*., 2000) for small fruit weight; Bayomy (2002) for firmest fruit; Hassan *et al*., 2000 and Hatem, 2003 for high vitamin C content; and Sekar (2001) for titratable acidity.

Hence, the present investigation was carried out to study and generate informations about the heterosis degree for yield and its components, as well as, some fruit characters in tomato F_1 crosses which would help to assess prepotency of parents in hybrid combinations.

MATERIALS AND METHODS

The genetic materials used were started by six tomato genotypes, viz, the cultivars Super Beef Steak (1), Endless Summer (2) and Roma (3) (from USA) and three lines which were developed in previous studies by (Khalil 2009), these lines were Bl.5 (4), Bl.14 (5) and Bl.18 (6).

In the summer season of 2012, the six parental genotypes were planted in field and all possible crosses, without reciprocals, were made to generate F_1 populations. In the summer season of 2013, the 15 F_1's with their six parents ,as well as, the check cv. Super Badr were evaluated in a randomized complete block design experiment with three replicates at the Experimental Farm, Faculty of Agriculture, Minufiya University, Shebein El- Kom, Egypt. The plot contained two rows of 4.00 meters long and one meter wide with spacing of 40 cm. within plants. The field practices were in accordance with the usual procedures followed with tomato management. The other normal agricultural practices for tomato production, i.e., irrigation, fertilization, weeding, and pests control were practiced as recommended in the area. This experiment was designed for measuring the heterosis for some characters ,viz, No. of days from transplanting to flowering, No. of days from transplanting to ripening, early fruit weight, total fruit No./ plant, total fruit weight/ plant (Kg.), average fruit weight (gm.), fruit shape index (L/D), fruit firmness (gm./cm2) as determined by the fruit and vegetable tester (John Chatillon & Sons Inc. Kew Gardens, New York, U.S.A), pericarp thickness, total soluble solids (which was determined by a hand refractometers), ascorbic acid (V.C) and titratable acidity were determined according to A.O.A.C, 1990.

Statistical Procedures :-

Difference among means for all studied characters were tested for significancy according to the least significant differences (L.S.D) (Snedecor and Cochran, 1990). Average degree of heterosis (ADH%), was expressed as percent increase or decrease of the F_1 performance above mid-parent (MP), the better parent (BP) and check cultivar (ST). Degree of dominance was determined by estimating the potence ratio according to Mather and Jinks (1971).

RESULTS AND DISCUSSION

Average degree of heterosis (ADH %) from the mid-parents (MP-heterosis), better parent (BP-heterosis or heterobeltiosis) and check cultivar (Standard heterosis) were estimated for all studied characters of the developed F_1 crosses. Data are presented in Table 1-5.

Table (1): Estimates of mid parent (MP), better parent(BP) and standered(ST) heterosis for No. of days from transplanting to flowering, No. of days from transplanting to ripening and Early fruit weight.

Hybrids #	No. of days from transplanting to flowering			No. of days from transplanting to ripening.			Early fruit weight.		
	Heterosis (%)		ST	Heterosis (%)		ST	Heterosis (%)		ST
	MP	BP		MP	BP		MP	BP	
1 x 2	-24.62**	-5.77**	2.08	-13.41**	5.97**	3.90**	201.21**	94.36**	5.74**
1 x 3	-13.71**	-8.60**	-11.46**	-23.96**	-20.22**	-28.78**	30.23**	28.83**	-28.37**
1 x 4	-15.79**	-15.38**	-8.33**	-3.85**	-0.50	-2.44*	-23.93**	-45.34**	-31.95**
1 x 5	-12.12**	-7.45**	-9.38**	-3.40**	-0.99	-2.93**	74.67**	34.00**	36.44**
1 x 6	-9.90**	-7.143**	-5.21**	-0.98	0.50	-1.46	-3.89	-27.69**	-22.06**
2 x 3	-30.12**	-6.45**	-9.375**	-16.03**	8.74**	-2.93**	104.46**	31.29**	-27.00**
2 x 4	-36.40**	-20.95**	-13.54**	-4.35**	12.56**	18.05**	-9.08**	-48.77**	-36.21**
2 x 5	-27.20**	-3.19*	-5.21**	-7.17**	10.43**	13.66**	64.33**	-5.08**	-3.35**
2 x 6	-33.86**	-14.29**	-12.50**	-7.63**	11.11**	12.20**	31.65**	-24.53**	-18.65**
3 x 4	-15.15**	-9.68**	-12.50**	-14.07**	-6.56**	-16.59**	49.12**	7.85**	34.28**
3 x 5	-11.23**	-10.75**	-13.54**	-8.12**	-1.09	-11.71**	57.82**	21.99**	24.22**
3 x 6	-2.62*	0.00	-3.13*	-11.79**	-6.01**	-16.10**	4.558*	-20.75**	-14.58**
4 x 5	-6.53**	-1.06	-3.13*	-3.29**	-2.37*	0.49	-20.80**	-28.01**	-10.38**
4 x 6	-7.39**	-4.08**	-2.08	-6.64**	-4.83**	-3.90**	-32.94**	-37.44**	-22.11**
5 x 6	-1.04	1.06	-1.04	-1.91	-0.97	0.00	-1.058	-3.80*	3.707*

* - Significant at 5 % level, and ** - Significant at 1% level.
# 1= Super Beef Steak, 2=Endless Summer, 3=Roma, 4=Bl.5, 5=Bl.14 and 6=Bl.18.

1- Earliness:-

Earliness was determined by estimating number of days from transplanting to both flowering and fruit ripening, as well as, early yield per plant. Data illustrated in Table (1) show that most crosses showed significant negative heterosis values in relation to mid-parent, better parent and check cultivar, indicating hybrid vigour for the short period to flowering in most studied crosses. The significant negative heterosis values were also observed in most crosses, indicating MP heterosis for the short period of fruit ripening. When the heterosis was calculated from the better parent, five crosses (Super Beef Steak x Roma, Roma x Bl.5, Roma x Bl.18, Bl.5 x Bl.14 and Bl.5 x Bl.18) gave significant negative BP heterosis values, suggesting over dominance for the short period to maturity. Standard heterosis was observed in 8 crosses, indicating that these hybrids are earlier than the check cultivar Super Badr. Regarding, the early yield, of the studied 15 F_1 crosses, nine ones showed MP heterosis, six crosses showed BP heterosis (heterobeltiosis) and five ones showed standard heterosis. This result indicates superiority of the F_1 crosses over their respective better parent and the used check cultivar. Accordingly, the F_1 hybrids could be used in commercial tomato production. Some crosses showed partial dominance for the early fruit yield, these crosses showed significant positive MP heterosis and significant negative BP heterosis values (Endless Summer x Bl.14,

Endless Summer x Bl.18 and Roma x Bl.18). The no-dominance gene action was observed in two crosses (Super Beef Steak x Bl.18 and Bl.14 x Bl.18), which showed insignificant MP heterosis values, as shown in Table (1). Desirable heterosis for early flowering, early ripening and early fruit yield was also reported by several investigators, among them were Rajasekhar *et al*., 2013 and Manna and Paul 2012, complete and no-dominance were also found by Hatem (2003).

2- Total yield and average fruit weight:-

Total fruit yield was assessed as fruit number and weight per plant. Number of fruits per plant showed significant positive MP heterosis values in most crosses, suggesting dominance towards the large number of fruits. Only six crosses exhibited over dominance, they showed significant positive BP heterosis (heterobeltiosis). The best two crosses in this respect were Super Beef Steak x Endless Sumer and Roma x Bl.14, receptively. The check cultivar was surpassed by seven crosses, since they showed significant standard heterosis (Table 2). No dominance was found by two crosses, i.e., Super Beef Steak x Bl.5 and Endless Summer x Roma, which gave insignificant MP heterosis. Meanwhile, insignificant BP heterosis values were found in other six crosses, reflecting dominance for the large fruit number. With regard to fruit weight /plant, most F_1 crosses which showed positive BP heterosis for fruit number, exhibited BP heterosis for total fruit yield. This mean that number of fruits have considerable effect on total yield as reported by Asati *et al*., (2007), who stated that number of fruits per plant is one of the major components for yield.

The no-dominance, complete and partial dominance were also reflected by some crosses. Data of average fruit weight showed that five crosses gave significant positive MP heterosis values. From these F_1 combinations, four ones showed significant positive BP heterosis values (heterobeltiosis), suggesting over-dominance for the large fruit. On the other hand, significant negative MP heterosis values were estimated for the remaining F_1 hybrids, indicating dominance towards the small fruit. Comparing with the check cultivar Super Badr, nine F1 hybrids gave significant positive standard heterosis values as shown in Table 2. Hybrid vigour for this trait was also reported by Asati, *et al*., (2007) and Ahmed, *et al*., (2011). Partial dominance to small fruit was also found by Youssef (1997) and Abdel Ati, *et al*., (2000). Asati, *et al*., (2007) mentioned that the observed high heterosis for fruit yield seems to be due to increase in individual fruit weight and fruit number/ plant.

3- Fruit shape index, fruit firmness and pericarp thickness:-

As shown in Table (3), none of the studied F1 crosses showed significant positive heterosis for high shape index (S.I). Two crosses (Super Beef Steak x Endless Summer and Endless Summer x Bl.18) showed insignificant heterosis values based on BP, indicating complete dominance for the high shape index. The cross Endless Summer x Bl.5 exhibited no-dominance, since the estimated MP-heterosis value was insignificant. Meanwhile, the most crosses gave significant negative MP heterosis suggesting dominance towards the low shape index. The estimated standard heterosis were significantly negative except one cross (Super Beef Steak x Bl.18).

With regard to fruit firmness, complete dominance for the firmest fruit was observed in the two crosses Super Beef Steak x Bl.14 and Bl.5 x Bl.18, insignificant BP heterosis was estimated. Heterobeltiosis (BP heterosis) was reflected by the cross Roma x Bl.5. On the other hand, five crosses reflected incomplete dominance for the trait, since they showed insignificant MP heterosis values (Table 3). The most remaining F_1's deviated towards the soft fruits with significant negative MP heterosis values. Estimated standard heterosis showed that none of the evaluated F_1's exceeded the cultivar Super Badr in fruit firmness, all crosses gave significant negative standard heterosis (Table 3). Similar results were found by Bayomy (2002) and Hatem (2003).

Table (2): Estimates of mid parent (MP), better parent(BP) and standered(ST) heterosis for total fruit No. / plant, total fruit weight /plant and average fruit weight.

Hybrids	Total fruit No./ plant.			Total fruit weight/ plant			Average fruit weight		
	Heterosis (%)		ST	Heterosis (%)		ST	Heterosis (%)		ST
	MP	BP		MP	BP		MP	BP	
1 x 2	83.02**	56.45**	11.49*	60.51**	43.63**	14.16**	-13.06**	-30.69**	6.50**
1 x 3	36.69**	0.00	9.20*	10.61*	5.87	-15.86**	-20.12**	-42.92**	-12.30**
1 x 4	5.04	-23.16**	-16.09**	1.24	-13.27**	-3.35	-18.66**	-24.68**	15.73**
1 x 5	45.90**	14.10**	2.30	38.03**	11.64**	43.66**	10.33**	4.29**	60.24**
1 x 6	19.05**	-8.54	-13.79**	13.35**	2.61	0.63	-11.98**	-18.30**	25.52**
2 x 3	8.28	-10.53*	-2.30	7.64	0.31	-27.12**	-3.98**	-17.33**	-24.50**
2 x 4	14.65*	-5.26	3.456	-1.05	-22.66**	-13.81**	-25.96**	-37.15**	-17.74**
2 x 5	32.86**	19.23**	6.90	16.07**	-12.33**	12.81**	34.39**	12.05**	53.31**
2 x 6	6.94	-6.10	-11.49*	14.95**	-5.74	-7.56*	2.28**	-13.36**	13.98**
3 x 4	46.32**	46.32**	59.77**	53.42**	26.72**	41.22**	-9.45**	-31.91**	-10.88**
3 x 5	63.01**	48.42**	62.07**	37.10**	7.25*	38.02**	-15.94**	-37.71**	-14.77**
3 x 6	9.60*	2.11	11.49*	0.06	-12.90**	-14.59**	-21.47**	-41.05**	-22.45**
4 x 5	20.23**	9.47	19.54**	-25.36**	-30.36**	-10.38**	-20.99**	-22.70**	5.7698**
4 x 6	16.38**	8.42*	18.39**	15.19**	8.27*	20.66**	27.51**	27.19**	67.33**
5 x 6	17.50**	14.63	11.49	2.13	-10.02**	15.79**	6.76**	4.70**	43.23**

* - Significant at 5 % level, and ** - Significant at 1% level.

Table (3): Estimates of mid parent (MP), better parent(BP) and standered(ST) heterosis for fruit shape index, fruit firmness and pericarp thickness.

Hybrids	Fruit shape index.			Fruit firmness			Pericarp thickness		
	Heterosis (%)		ST	Heterosis (%)		ST	Heterosis (%)		ST
	MP	BP		MP	BP		MP	BP	
1 x 2	6.79**	2.91	-11.56**	-26.13**	-38.91**	-37.98**	9.09	5.88	-14.29*
1 x 3	-27.99**	-43.86**	-20.00**	-0.13	-0.38	-33.87**	3.03	0.00	-19.05**
1 x 4	2.02	-0.784	-20.94**	-3.04	-8.25*	-31.76**	13.51*	0.00	0.00
1 x 5	-11.36**	-14.26**	-26.88**	10.66**	-2.23	-15.38**	-2.56	-17.39**	-9.52
1 x 6	-8.98**	-9.34*	49.99**	-0.33	-12.31**	-23.36**	5.56	-5.00	-9.52
2 x 3	-21.75**	-37.28**	-10.63**	-30.29**	-42.47**	-41.60**	11.76	11.76	-9.52
2 x 4	-0.78	-6.91**	-20.00**	-0.14	-13.49**	-12.18**	10.53	0.00	0.00
2 x 5	-13.50**	-13.82**	-25.94**	-30.29**	-35.43**	-34.45**	-10.00	-21.74**	-14.29*
2 x 6	5.26*	1.82	-12.50**	-26.25**	-31.37**	-30.34**	-8.11	-15.00*	-19.05**
3 x 4	-25.11**	-42.76**	-18.44**	14.18**	7.80*	-19.83**	-21.05**	-28.57**	-28.57**
3 x 5	-22.63**	-38.16**	-11.88**	-3.30	-14.76**	-26.22**	0.00	-13.04*	-4.76
3 x 6	-41.09**	-53.95**	-34.38**	6.571	-6.44*	-18.24**	-2.70	-10.00	-14.29*
4 x 5	-10.12**	-15.38**	-27.81**	5.27	-2.14	-15.29**	-13.64*	-17.39**	-9.52
4 x 6	2.41	-0.78	-20.31**	16.47**	7.79	-5.80*	-12.20*	-14.29*	-14.29*
5 x 6	-4.91*	-7.69**	-21.25**	-15.65**	-16.06*	-26.64**	-11.630*	-17.39**	-9.52

* - Significant at 5 % level, and ** - Significant at 1% level.

For pericarp thickness, as shown in Table 3, none of the studied crosses showed hybrid vigour for thick pericarp. Only the cross Super Beef Steak x Bl.5 which gave insignificant BP value reflected complete dominance for thick pericarp. On the other hand, four crosses showed incomplete dominance for the trait. Significant negative MP heterosis values were observed in four crosses, suggesting dominance towards the thin pericarp. All crosses gave significant or insignificant negative standerd heterosis values, indicating that the Super Badr cultivar was better than the studied crosses in this respect. These results were in accordance with those of Khalil *et al*., (1987) and Hatem (2003) who found complete dominance for the thick and thin pericarp, in addition to, the absence of dominance.

4- Total soluble solids (TSS), ascorbic acid (V.C) and titratable acidity (T.A):-

Significant positive MP heterosis values (23.4, 16.2 and 12.4%) were found for the crosses Endless Summer x Bl.5, Roma x Bl.5 and Roma x Bl.18.The first two crosses showed significant positive BP heterosis (21.8 and 13.2%) suggesting over dominance for the high TSS content, while the third one (Roma x Bl.18) showed complete dominance. The most crosses exhibited incomplete dominance for the trait, since the estimated MP heterosis values were not significant as shown in Table (4). With regarding to standard heterosis, all crosses without exception, showed significant positive values, indicating that these crosses have higher TSS content. The hybrid vigour was also reported, for high TSS content, by Youssef (1997) and Hassan *et al*., (2000). The no-dominance was reported by Sekar (2001) and Bayomy (2002). Standard heterosis was also reported by Makesh *et al*., (2003).

Data of ascorbic acid content illustrated in Table 4 clearly reveal that most crosses exceeded the MP with significant positive MP heterosis values ranging from 2.8 to 20.5% suggesting dominance toward the rich parent. Hybrid vigour was detected in eight F_1 combinations; they gave significant positive BP heterosis values ranging from 3.3 to 9.4%. The trait was inherited as intermediate, in the cross Endless Summer x Bl.5, since insignificant MP heterosis was found. Estimated standard heterosis showed that most crosses gave significant positive values as observed for TSS content, this figure may be due to the strong correlation between TSS and V.C content. The obtained results are confirmed with those of many investigators, among them were Sharkawy, *et al*., 1997 Bhatt *et al*., 2001; Hatem 2003 and Khalil 2004.

Acidity, all crosses showed negative MP heterosis values, but it were significant in eight ones only, indicating dominance towards the low acidity. From these crosses, four ones reflected hybrid vigour for low content. On the other hand, complete and no-dominance were observed in other combinations (Table 4). The estimated standard heterosis revealed that all crosses gave significant or highly significant negative values ranging from -11.2 to -38.8 %. Our results are disagree with Hassan *et al*., (2000) and Sekar (2001), who reported heterosis or complete dominance for the high acidity.

The potence ratio was estimated to determine the nature of dominance and its direction. According to Smith (1952) complete dominance was considerd when potence ratio is equal ±1. Partial dominance is associated when it is between +1.0 and -1.0, but not equal zero. Absence of dominance is indicated when it is equal zero and over dominance is considered when it's exceeded ±1.0.

Table (4): Estimates of mid parent (MP), better parent (BP) and standered (ST) heterosis for total soluble solids, ascorbic acid (V.C) and titretable acidity.

Hybrids	Total soluble solids .			Ascorbic acid (V.C)			Titretable acidity		
	Heterosis (%)		ST	Heterosis (%)		ST	Heterosis (%)		ST
	MP	BP		MP	BP		MP	BP	
1 x 2	-4.09	-11.83**	32.26**	10.65**	0.44	9.07**	-24.00**	-10.59**	-34.48**
1 x 3	-0.60	-11.83**	32.26**	3.61**	3.28**	12.89**	-23.96**	-5.19*	-37.07**
1 x 4	-6.51	-15.05**	27.42**	8.10**	-6.48**	1.55	-1.44	9.57**	-11.21**
1 x 5	-15.43**	-16.32**	28.23**	13.55**	4.07**	13.01**	-2.02	16.87**	-16.38**
1 x 6	-9.20*	-15.05**	27.42**	12.79**	6.59**	15.75**	-9.74**	10.00**	-24.14**
2 x 3	8.00	3.85	30.65**	5.31**	-4.69**	4.18**	-12.35**	-7.79**	-38.79**
2 x 4	23.38**	21.79**	53.23**	0.11	-5.12**	-15.99**	-2.79	2.35	-25.00**
2 x 5	-1.73	-10.53**	37.10**	0.27	-0.79	-10.26**	-2.38	-1.20	-29.31**
2 x 6	1.89	0.00	30.65**	14.18**	9.38**	5.728**	-4.24*	-1.25	-31.90**
3 x 4	16.22**	13.16**	38.71**	20.47**	3.93**	13.60**	-9.94	0.00	-33.62**
3 x 5	-8.98*	-20.00**	22.58**	17.08**	6.99**	16.95**	-2.50	1.30	-32.76**
3 x 6	12.42*	6.17	38.71**	13.79**	7.21**	17.18**	-7.01**	-5.19*	-37.07**
4 x 5	4.097	-6.32	43.55**	6.43**	-0.13	-9.67**	-3.95*	2.41	-26.72**
4 x 6	-4.46	-7.41	20.97**	2.81**	-6.42**	-9.55**	-4.60*	3.75	-28.45**
5 x 6	-6.82	-11.83**	32.26**	12.76**	9.14**	5.49**	-3.07	-1.25	-31.90**

* - Significant at 5 % level, and ** - Significant at 1% level.

Generally, the estimated potence ratio values, which are presented in Table (5) were found to follow the same pattern of the heterotic effect for most studied traits. For example, over dominance, complete dominance, partial dominance was observed in the crosses Super Beef Steak x Endless Summer, Super Beef Steak x Roma, Endless Summer x Roma for number of fruit per plant. Estimated BP heterosis were 56.5, 0.0, -10.5 and the potence values were 4.9, 1.0, 0.39, respectively. No dominance was observed in the cross Super Beef Steak x Bl.18 with MP heterosis of -0.33 and potence of -0.02 for fruit firmness.

In general the observed wide range of heterosis for most studied characters in the present study may be attributed to the genetic diversity of the parents used (Asati, *et al.*, 2007).

Table (5): Estimates of potence ratio for the studied characters.

Crosses / Characters	Earliness to flowering	Earliness to ripening	Early fruit weight.	Total fruit number	Total fruit weight	Average fruit weight	L/D	Fruit firmness	Pericarp thickness	TSS	V.C	Titretable acidity
1x2	-1.23	71.00	3.66	4.89	5.15	-0.51	1.80	-1.25	.....	-0.47	1.05	-1.60
1x3	-2.45	-5.11	.....	1.00	.....	-0.50	-0.99	.....	.....	-0.05	.....	-1.21
1x4	-33.00	-1.14	-0.61	0.14	0.07	-2.33	0.71	-0.54	1.00	-0.65	0.52	-0.14
1x5	-2.40	-1.40	2.46	1.65	1.615	1.78	-3.33	0.81	-0.14	.....	1.492	-0.13
1x6	-3.33	-0.67	-0.12	0.63	1.28	-1.55	....	-0.02	0.5	-1.33	2.20	-0.54
2x3	-1.19	-0.70	1.87	0.39	1.057	-0.25	-0.88	-1.43	.....	.....	0.51	-2.50
2x4	.....	-0.29	-0.12	0.70	-0.04	-1.46	-0.12	-0.01	1.00	.....	0.02	-0.56
2x5	-1.10	-0.45	0.88	2.88	0.52	1.72	.....	-3.81	-0.67	-0.18	0.25	.....
2x6	-1.48	-0.45	0.43	0.50	0.68	0.13	1.56	-3.51	-1.00	.....	3.24	-1.40
3x4	-2.50	-1.75	1.28	.....	2.54	-0.29	-0.81	2.39	-2.00	.....	1.29	-1.00
3x5	.....	-1.14	1.97	6.41	1.33	-0.46	-0.90	-0.25	0.00	-0.65	1.81	-0.67
3x6	-1.00	-1.92	0.14	1.31	0.01	-0.65	-1.47	0.47	-0.33	2.11	2.253	.....
4x5	-1.18	.....	-2.08	2.06	-3.53	-9.47	-1.63	0.70	.....	0.37	0.98	-0.64
4x6	- 2.14	-3.50	-4.58	2.23	2.38	.....	0.75	2.05	.....	....	0.29	-0.57
5x6	- 0.50	.....	-0.37	.....	0.16	3.44	-1.63	-32.4	-1.67	-0.06	3.85	.....

Potence ratio was estimated only for the crosses whose parents differed significantly in the studied traits.
..... No significantly differences were found between the parents.
1= Super Beef Steak, 2=Endless Summer, 3=Roma, 4=Bl.5, 5=Bl.14 and 6=Bl.18.

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دراسات وراثية لبعض الصفات الهامة فى الطماطم
1- قياس قوة الهجين لمكونات المحصول وبعض الصفات الثمرية

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الملخص العربى

أجريت هذة الدراسة لقياس درجة قوة الهجين لصفات المحصول ومكوناته وكذلك بعض الصفات الثمرية فى الطماطم بهدف توفير بعض المعلومات الخاصة بإنتاج الهجن. استخدم لتحقيق ذلك ستة تراكيب وراثية (ثلاثة أصناف هى Super Beef Steak، Roma ، Endless Summer وثلاثة سلالات هى BL.5 ، Bl.14 ، Bl.18) كآباء لإنتاج عشائر الجيل الأول اللازمة للدراسة بإجراء كل التهجينات الممكنة فى اتجاه واحد و أجريت التجارب خلال موسمى (2012–2013) حيث زرعت الآباء فى العام الأول و أجرى التهجين بينها. فى العام الثانى زرعت عشائر الجيل الأول والآباء و معها الصنف (Super Badr) للمقارنة فى تجربة للتقييم للصفات تحت الدراسة فى تجربة حقلية.أوضحت النتائج وجود قوة الهجين فى معظم الصفات التى درست ، فظهر التفوق الهجينى فى صفات المحصول المبكر و المحصول الكلى و محتوى الثمار من المواد الصلبة الكلية و حمض الاسكوربيك حيث تفوقت بعض الهجن على الأب الأفضل و كذلك على صنف المقارنة. من الجدير بالذكر أن درجات السيادة الأخرى و هى (انعدام السيادة – السيادة الجزئية – السيادة التامة) قد ظهرت فى عدد من الصفات. و كانت قيم Potence ratio المحسوبة متوافقة مع درجات قوة الهجين المحسوبة لمعظم الصفات التى درست.

إن وجود ظاهرة التفوق الهجينى فى المحصول و مكوناتة يشجع على استخدام عشائرالجيل الأول فى الزراعة التجارية فى الطماطم والتى يمكن انتاجها محلياً والإستغناء عن استيراد كل أو جزء من تقاوى الهجن المرتفعة الثمن .