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MEAN PERFORMANCE , HETEROSIS AND COMBINING ABILITIES OF TOMATO CROSSES UNDER SALINE CONDITIONS

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ABSTRACT

Field trials were carried out at the Experimental Research Station of Desert Research Center at Ras Sudr , South Sinai Governorate during 2003 and 2004 seasons . This investigation aimed to improve tomato genotypes for salinity tolerance in SuperMarmand and CastleRock and marketable characters in exotic genotypes LA1673 and LA1963 and Edkawy the results indicated that Edkawy genotypes was superior than the other tomato genotypes in plant height, number of fruits/ plant, number of locules / fruit and total soluble solids in fruit under saline condition. While, the two local genotypes of tomato SuperMarmand and Castle Rock were earlier and heavier than the other studied genotypes in early yield, average weight / fruit and total yield / plant . The crosses Edkawy × LA 1673 , SuperMarmand× LA 1963 and LA 1673 × LA 1963 recorded positive and significantly heterosis for average fruit weight . Both additive and non-additive gene actions were involved in the genetic control of each plant height, number of fruits/ plant, early yield , number of locules/ fruit, average fruit weight , total soluble of solids (TSS) and total yield/plant. Non-additive gene effects were more important than additive ones for all studied characters except average fruit weight and total yield/ plant, where additive gene effect was more important in the inheritance of both characters . Heritability in broad sense for all the studied characters were high and ranged from (64.55%) for total soluble of sugar in fruit to (88.4%) for average of fruit weight. Whereas, heritability in narrow sense was moderate (39.51%) for total soluble of solids (TSS) and high (> 50 %) for the remaining characters under study . Positive and highly significant GCA effects were recorded for plant height and number of locules / plant in Edkawy and LA1673 ; number of fruits / plant , early yield and TSS in Edkawy and castle Rock as well as average fruit weight and total yield / plant in castle Rock and SuperMarmand. The cross Castle Rock × LA 1963 was the heaviest average fruit weight and the followed that cross Edkawy × LA 1673 and Edkawy × Castle Rock were positive and significantly SCA effects. While, the crosses SuperMarMand with each of LA 1673 and LA1963 respectively were positive and significantly SCA effects for total soluble of sugar (TSS). The crosses Castle Rock × SuperMarmand and Castle Rock × LA 1673 were the heaviest grain yield/ plant and highly significant positive for combing ability SCA effect under saline condition in irrigation water at Ras Sudr region.

Keywords *:* Mean Performance – Heterosis – Combining Ability- Additive-Heritability-Salinity

INTRODUCTION

Tomato *, Lycoperscion esculentum* Mill . is one of the most important vegetable crops in Egypt . The use of tomato F_1 hybrids has been of greet important for maximizing tomato production to overcome production costs and to satisfy consumers demands . Production of such hybrids depends on the choice of suitable parents , Farag and Helal (2003).Breeding tomato for a

high yield and good quality are of the major goals of vegetable breeding programs in different places in Egypt . Tomato yield was decreased significantly when grown under salinity stress or under water deficit through growth life (Perez *et al* 1996 and Abd Allah 1999)

Diallel analysis provides rapid evaluation of the genetic relationship among several parental lines , heterosis , combing ability, heritability. Many researche studied the heterosis for some tomato growth, yield and yield quality, of them Hassan *et al*. (2000) registered the high heterosis for total yield which reached 200%. Also, Abdel-Ati *et al* (2000 b) deducted a highly pronounced hybrid Vigor plant height, number of fruits /plant and total yield plant . Heterosis over the better parent of total yield was deducted in some crosses. Whereas Lei *et al*. (1998) , AbdAllah (1999), and Farag and Helal (2003) found that all of the 21 F_1 hybrids studied exhibited negative heterosis for these characters.

GCA and SCA variance were significant for plant height, total yield and TSS content, indicating the importance of both additive and non additive gene effects with equal importance have been recorded by (Abdel-Ati *et al*. 2000 and Khalf-Allah *etal* 2005). With Predominant of Additive gene action in the genetic control of preicarp thickness. Abd Allah (1999), pratta and picardi (2003), and Wahb-Allah (2008) they found that of GCA effects in some tomato cultivars and SCA in their possible hybrid combinations for some important traits were highly significant number of fruit / plant, number of locules/fruit and TSS for all studied characters.

High heritability in broad sense estimates were found by (Abdel-Ati *et al*. 2003 and Farag and Helal 2003) and Wahb-Allah (2008) for plant height , number of fruits / plant , early yield and total yield / plant .While, heritability in narrow sense estimates for average of fruit weight , number locueles/fruit and TSS as well as total yield / plant were high or moderately high as estimated by Abdel-Ati *et al*.(2000 a) , Badr (2003) . Pratta and Picardi (2003) and Khalf-Allah *etal* (2005) .

The objective of the present study was to improve salinity tolerance for local tomato genotypes i.e SuperMarmand and Castle Rock imported from USA which were good marketable characters and productivity by hybridization with the two exotic tomato genotypes i.e. LA 1973 and LA 1963 and local genotype Edkawy tolerant and resistant to salinity, but it had not marketable characters and up non preference for Egyptian consumer in Egyptian consumers. So, this work was investigated to determine mean performance, heterosis, combining ability and heritability for tomato genotypes and their crosses under saline condition at Ras Sudr, South Sinai, Egypt to select and produce F_1 more adapted .

MATERIALS AND METHODS

This study was carried out at Ras Sudr Research Station, Desert Research Center (DRC), South Sinai Gov., Egypt, during two summer late seasons of 2003 and 2004 to evaluate five tomato genotypes table (1) for yield components .

Table (1): common name, origin, Reaction to salinity and references for tomato genotypes.

No	Name	Origin	Recorded Reaction to salinity	References
1	Edkawy	Egypt- Local	Tolerant	Local variety , seed
2	Castle Rock	USA	Susceptible	Rick 1982
3	SuperMarmand	U.S.A	Suscepl	Rick 1982
4	LA 1673	Peru	Tolerant	Richards et al. (1979)
5	LA 1963	Peru	Resistant	Rick (1969)

Seeds of the investigated genotypes were sown in the nursery on the first of August (2003) . Seedling were transplanted after 35 days from sowing and evaluated under salinity of water irrigation (7000 ppm) during the 2003 season August 2003. in a randomized complete block design with three replicates in the open field at Ras Sudr Research Station, DRC .

Each plot consisted of two ridges 3.6m long and 1.0 m width , with 30 cm within plants. Hence the plot area was 7.2 m^2 and contained 24 plants. Each square meter contains 3.3 plant. five tomato genotypes were crossed to obtain 10 F_1 crosses of half diallel without reciprocals as follows :

1-Edkawy × CastleRock 2-Edkawy × SuperMarmand
3-Edkawy × LA1673 4-Edkawy × LA 1963
5- CastleRock × SuperMarmand 6-CastleRock × LA 1673
7-CastleRock × LA 1963 8- SuperMarmand × LA 1673
9- SuperMarmand× LA 1963 10-LA 1963 × LA 1673.

In the second season (2004), seeds of 10 F_1 crosses and their 5 parents were sown in the first August under green house and transplanted after 35 days in the open field and selfing to produce F_2 seeds to complete tomato breeding program . In the second season (2005). Seed of 5 tomato cvs and their 10 F_1 crosses were sown on 10 August (2004). The plot area was 3.6m and it consisted of three ridges every ridge on 12 plants, the first ridge for P_1 and the second ridge for F_1, hence the third ridge for P_2, 36 plants in plot unit and the distance between plant to plant in the same row 30cm apart. In this study, using the F_1 crosses to evaluate and estimating for mean performance, heterosis, heritability and combining ability. Irrigation, fertilization and pest control were carried out as the usual with tomato management under the same respect.

Data were recorded on 5 individual plants from each ridge in plot, Red ripe fruits were harvested every 5 days, plant height and some growth characters were measured before harvesting by about 10 days. Data were also recorded on plant height/cm number of fruits / plant, early yield / plant, total yield/ plant (gm) , average fruit weight (gm), number of locules / fruits and total of soluble solids (TSS) .

Data were statistically analyzed according to Griffing (1956) model I method II for estimating GCA and SCA.

Heterosis was estimated on the high- parent values [Sinho and Khanna (1975)].

HP % = [MF1 – HP/ HP] × 100

Heritability in the broad and narrow sense were calculated according to Singh and Chaudhary (1979) .

$$h_2\, b_s = \frac{2\,\delta^2 gca + 2\,\delta^2 sca}{2\,\delta^2 gca + 2\,\delta^2 gca + \delta^2 e} \times 100$$

$$h_2\, n_s = \frac{2\,\delta^2 gca + 2\,\delta^2 sca}{2\,\delta^2 gca + 2\,\delta^2 sca + \delta^2 e} \times 100$$

Where:

h2 bs = broad sense heritability
h2 ns = narrow sense heritability
$\delta^{2\ gca}$ = general combing ability variance
$\delta^{2\ sca}$ = Specific combining ability variance
$\delta^{2\ e}$ = environmental variance

RESULTS AND DISCUSSION

Mean performance of the five parental genotypes and their F_1 hybrids for the studied characters are presented in Table (2).

Table (2): Mean performance of the five parental tomato genotypes and their 10 F_1 hybrids for various characters studied under saline conditions at Ras Sudr.

Genotypes		Plant height (cm)	No. of fruits / plant	Early yield/days	No. of locules/ fruits	Average fruits weight gm	TSS	Total yield/ plant kg
Edkawy	P_1	71.5	31.6	0.61	5.0	41.51	6.0	2.14
Castle Rock	P_2	41.6	11.5	3.4	3.0	87.52	4.7	3.14
SuperMarmand	P_3	48.7	16.4	2.6	4.7	91.05	4.7	5.31
LA 1673	P_4	67.4	30.6	0.8	3.0	40.54	5.7	2.67
LA 1963	P_5	66.4	16.6	0.7	4.0	40.41	4.6	2.00
Edk×cast	$P_1 \times P_2$	61.5	21.9	2.3	4.3	66.31	4.9	2.93
Edk×super	$P_1 \times P_3$	56.4	23.5	1.8	5.0	67.45	5.5	4.01
Edk×LA1673	$P_1 \times P_4$	68.3	32.3	0.8	3.7	42.00	6.0	2.50
Edk×LA1963	$P_1 \times P_5$	70.3	29.5	0.7	4.1	39.31	5.7	2.75
Cast×super	$P_2 \times P_3$	45.1	13.7	2.9	3.4	79.3	5.0	4.41
Cast×LA1673	$P_3 \times P_4$	55.1	22.5	2.1	3.1	68.4	4.7	2.88
Cast×LA1963	$P_3 \times P_5$	51.7	14.3	1.9	3.0	67.9	5.5	1.99
Super×LA1673	$P_3 \times P_4$	57.1	24.8	1.7	2.9	61.3	5.0	3.31
Super×LA1963	$P_3 \times P_5$	61.7	19.1	1.6	3.5	58.4	5.3	3.00
LA1673×LA1963	$P_4 \times P_5$	59.3	27.1	0.8	3.5	41.0	6.0	2.07
L.S.D ^{05}		9.5	4.7	1.0	1.8	17.11	0.54	0.55
L.S.D ^{01}		12.7	5.1	1.4	2.4	22.16	0.74	0.76

Analysis of variance revealed highly significant differences regarding entry mean performance for all studied characters indicating the existence of considerable differences under saline conditions. The results indicated that Edkawy (P_1) was superior than the other tomato genotypes in plant height, number of fruits/ plant, number of locules / fruit and total soluble solids in fruit where it recorded (71.5cm), (30.1), (5.0) and (6.0%) for mention characters respectively. The exotic tomato LA 1673 was followed in plant height, (67.4

cm), number of fruits/ plant (30.6) and total soluble sugar TSS (5.7%).While, the two local genotypes of tomato SuperMarmand and Castle Rock were earlier and heavier than the all studied genotypes in early yield, average fruits weight / plant and total yield / plant. These results are excepted under saline conditions because of the local genotypes were sensitive to salinity of irrigation water. On other hand the exotic tomato genotypes LA 1673 and the local genotype . Edkawy were more adapted to saline irrigation water. While, LA 1963 genotypes was not superior in any character under these condition. These results are in harmony with those obtained by Singh *et al*. (1998), Abd-Allah (1999), Hassan *et al*. (2000), Farag and Helal (2003) and pratta and picardi (2003) .

Comparison among the F_1 hybrid values (Table 2) illustrated that the crosses were differed in mean performance for the studied characters under saline conditions. The cross Edkawy × LA 1673 and Edkawy × LA 1963 were taller in plant height and exhibited greater number of fruits /plant than the other crosses. Whereas, for early yield/ plant , Edkawy × Castle Rock (2.3%) and Castle Rock × SuperMarMand (2.9%) were earlier than other crosses. The cross Edkawy × SuperMarmand (5.0%) was superior than the other crosses in number of locules / fruits. However, the crosses Castle Rock × SuperMarmand (79.3 gm) and Castle Rock × LA 1963 (67.9 gm) were heaviest in average fruit weight. The cross Edkawy × LA 1673 (6.0%) and LA 1673 × LA 1963 (6.0%) give higher total of soluble solids percent TSS in fruit than the other crosses. The cross Castle Rock × SuperMarmand give the largest fruit weight (79.3 gm) with an average total yield / plant of (4.41Kg) followed by the cross Edkawy × SuperMarmand (4.01Kg) in total yield /plant. These results indicated that the previous crosses could be considered as promising crosses, which surpassed the standard genotypes Castle Rock and SuperMarmand for average fruit weight and total yield / plant under saline conditions throughout the hybridization with the wild and exotic genotypes which were tolerant to salinity stress. Similar trends were recorded by Hassan *et al*. (2000) , Okasha *et al*. (2001 a), pratta and picardi (2003) , Khalf-Allah etal (2005) and Wahb-Allah (2008). Generally, all the studied characters were decreased by using saline irrigation water salinity throughout crosses of tomato life growth with about 10 to 24 % when compared with the best parents LA1963 and Castle Rock under this study.

Heterosis effects:

Heterosis values for the crosses respecting growth, yield and some yield qualities of tomato genotypes under saline conditions were measured and presented in (Table (3).

Heterosis of F_1's relative to their higher parents showed that most of the evaluated crosses exhibited significantly negative heterosis for the studied character. Whereas, significantly positive heterosis was recorded for number of fruits/ plant in Edkawy × LA 1673 and SuperMarmand× LA 1963, as well as for average fruit weight/gm in crosses Edkawy × LA 1673 and LA 1673 × LA 1963 . Moreover useful heterosis was recorded for total yield / plant by the cross Edkawy × LA 1963.

Table (3): Heterosis of F_1's relative to their higher parents for various characters under saline conditions at Ras Sudr.

Crosses		Plant height/cm	No. of fruits/ plant	Early yield/day	No. of locules/ fruit	Average fruit weight gm	T.S.S%	Total yield / plant/kg
Edkawy ×Cas	$P_1 \times P_2$	-13.99**	-27.24**	-32.35**	14.00**	-24.23**	-18.33**	-6.69**
Edk×super	$P_1 \times P_3$	-21.28**	-21.93**	-30.77**	0.00	-25.92**	-8.33**	-24.48**
Edk×LA1673	$P_1 \times P_4$	-4.48*	7.31**	0.00	-26.00**	1.18*	0.00	-6.37**
Edk× LA1963	$P_1 \times P_5$	-1.68*	-1.99**	0.00	-18.00**	-5.30*	-5.00**	28.50**
Cast× super	$P_2 \times P_3$	-7.40**	-16.46**	-14.71**	-27.66**	-12.90**	63.83**	-16.95**
Cast× LA1673	$P_3 \times P_4$	-18.25**	-28.80**	-38.24**	3.33**	-21.85**	-17.54**	-8.28**
Cast× LA1963	$P_3 \times P_5$	-22.14**	-13.86**	-44.12**	-25.00**	-22.42**	17.02**	-36.62**
Super × LA1673	$P_3 \times P_4$	-15.28**	-21.52**	-34.62**	-3.33**	-32.67**	-12.28**	-37.66**
Super × LA1963	$P_3 \times P_5$	-7.08**	15.06**	-38.46**	-25.53**	-35.85**	12.76**	-43.5**
LA1673× LA1963	$P_4 \times P_5$	-12.02**	-14.24**	0.00	-12.50**	1.13*	5.00**	-22.47**

***and** mean that values are significantly from their respective higher parents at the 5% and 1% levels, respectively.**

P_1= Edkawy P_2 = Castle Rock P_3= Super Marmand

P_4 = LA 1973 P_5 = LA 1963

Furthermore, four crosses Castle Rock × SuperMarmand, Castle Rock × LA 1963, SuperMarmand× LA 1963 and LA 1963 × LA 1673 registered positive and highly significant heterosis for total of soluble solids (TSS). However, plant height recorded negative and highly significant heterosis for all the studies crosses. Therefore these crosses are the promising ones.

These results showed that parents Edkawy, LA 1673 and LA 1963 could be used as source of salinity tolerance. While, Castle Rock and SuperMarmand genotypes were sensitive salinity and the best marketing characters. Thus, the hybridization practice between the mentioned parents would be improved tomato yield under saline conditions.These results are in harmony with this obtained by Hassan *etal* (2000), Badr (2003), Paratta and Picardi (2003) , Khalf-Allah *etal* (2005).

Genetic Variance :

Table (4) showed that analysis of variance for general and specific combining abilities for the studied characters of tomato genotypes under saline conditions. The results indicated that both additive and non-additive gene actions were involved in the genetic control of each of plant height, number of fruits/ plant, early yield , number of locules/ fruit, average fruit weight , total soluble of solids and total yield/plant.

Table(4): Analysis of variance for general GCA and specific SCA combing ability for various characters studied of tomato under saline condition at Ras Sudr, South Sinai, Egypt.

	d .f	Plant height	No. of fruit/ plant	Early yield	No. of locules / plant	Average fruit weight	T.S.S	Total yield / plant
GCA	4	117.1**	45.71**	66.76**	37.37**	3541.81**	4573.71**	1.354**
SCA	10	147.1**	13.51**	11.11**	4.111**	288.51**	0.176**	0.199**
Error	50	10.5	0.41	9.51	0.391	39.45	0.040	0.047

*** = Significant at the 5% level**

GCA = General combining ability SCA = Specific combining ability

Regarding genetic variance and heritability

Table (5): Genetic variance and heritability for the studied characters and gene action for yield and its attributes of tomato genotypes under saline condition at Ras Sudr .

Genotypes	Plant height	No. of fruit/ plant	Early yield	No. of locules / plant	Average fruit weight	T.S.S	Total yield / plant
A-Additive variance	39.15	16.71	4.61	3.7	146.7	1.51	61.1
Non Dominance variance	45.30	30.51	5.71	7.81	117.5	2.14	45.0
Environment variance	3.67	0.66	0.05	0.416	1.67	6.0	0.45
H_{bs} variance	77.16	75.17	71.60	78.16	88.4	64.55	81.0
H_{ns} variance	60.51	61.67	60.51	56.71	65.7	39.51	65.0

H bs = broad sense heritability **H ns = narrow sense heritability**
δ^2 A = additive variance **δ^2 D = non-additive variance.**

These results indicated that non-additive gene effects were more important than additive ones for all studied characters except average fruit weight and total yield/ plant where additive gene effects controlling inheritance of both this characters under saline condition . These results are in accordance with those obtained by Hassan *et al*. (2000), Abdel-Ati *et al* (2003), Badr (2003) and Wahb-Allah (2008).

Heritability in broad sense for all the studied characters were high and ranged from (64.55%) for total soluble of solids in fruit to (88.4%) for average of fruit weight. These results showed high heritability in broad sense and indicated that the environment had a small effect on the inheritance of the studied characters. Whereas, heritability in narrow sense was moderate (39.51%) for total soluble of solids and high (>50%) for the other yield and quality characters. Thus, selection could be effective for improving such characters.. These results are in harmony with those obtained by Abdel-Ati (1999), Hassan *et al*. (2000 a and b) Abdel-Ati *et al*. (2003) and Khalf-Allah *etal* (2005)and these results give the breeder courage for continues in breeding program for improving tomato under saline condition .

Combining ability effects

- General combining ability (GCA)

The general combining ability GCA effects of parental tomato genotypes for the studied traits under saline conditions at Ras Sudr region are shown in Table (6). General combing ability effects GCA for studied genotypes of tomato in all characters were highly significant for all parents character under this study. But, there are difference between the parental genotypes between positive and negative for all the studied traits. Positive and highly significant GCA effects were recorded for plant height and number of locules/plant in Edkawy and LA1673 , number of fruits/plant, early yield and total soluble of solids TSS in Edkawy and CastleRock as well as average fruit weight and total yield / plant in Castle Rock and SuperMarmand . These results indicated that these parents possess favorable additive genes for these characters .

Otherwise, negative and significant GCA effects were recorded in the remaining parental genotypes for the studied characters .These results confirmed that additive and non additive genes action were involved in the genetic mechanism controlling inheritance of all traits. Similar results were

reported by Omara *et al*. (1998), Abdel-Ati *et al*.(2000 and 2003), Badr (2003) , Khalf-Allah *et. al* (2005)and Wahb-Allah(2008) . The mentioned results for breeding program of tomato under stresses were showed the possibility improving these characters through selection method after the hybridization in the followed generation.

Table (6): Estimates and significance of general combining ability(GCA) effects for five tomato genotypes characters were studied under saline condition.

Parents	Plant height	No. of fruit/ plant	Early yield	No. of locules / plant	Average fruit weight	T.S.S	Total yield / plant
Edkawy	15.41**	1.39**	1.550**	2.715**	-14.517**	0.105**	-0.565**
Castle Rock	-7.51**	1.56**	3.000**	-0.763**	15.718**	0.114**	0.365**
Super Marmand	-17.00**	-0.75**	-4.530**	-0.555**	13.345**	-0.147**	0.717**
LA 1673	9.00**	-2.00**	-2.150**	2.791**	-11.771**	-0.195**	-0.316**
LA 1963	-6.57**	-0.20*	-2.121**	-3.177**	-3.177**	-0.170**	-0.200**
S.E. (g)	1.08	0.18	0.98	0.211	2.00	0.060	0.061
S.E. (g. g_1)	1.70	0.23	1.78	0.326	3.01	0.081	0.090

-Specific combining ability (SCA)

Estimates of specific combining ability (SCA) effects were presented in Table (7), positive and highly significant SCA effects were recorded for plant height , number of fruits / plant and total yield / plant in Castle Rock × SuperMarmand , Castle Rock × LA1673 and SuperMarmand × LA1673 as well as the cross Edkawy×LA1963 in early yield and number of locules / fruit . on the other hand , negative and significant SCA effects were recorded in the crosses Edkawy×LA1673 in plant height /cm , number of locules / fruits , early yield and average fruit weight. While , the cross Edkawy ×SuperMarmand was negative and significantly SCA effects in early yield , number of locules / fruits , average fruits weight and total yield / plant.

These results were according with those obtained by Abd-Allah (1999), Hassan *et.al*. (2000a), Gad *et.al*(2003) ,Pratta and Picardi (2003), Khalf-Allah *et.al* (2005), Rodriguez et.al (2005) and Wahb-Allah (2008).

Data in table (7) indicated that improving of some characters for the crosses of were produced hybridization between the exotic genotypes LA 1673 and LA 1963 with the local genotypes Edkawy, Castle Rock and SuperMarMand where improved some marketable characters for the exotic genotypes crosses such as average fruits weight and total yield/ plant (Castle Rock × LA 1963 and Castle Rock ×LA 1673) respectively. On the other hand improving in total soluble of sugar in Super Marmand by hybridization with LA 1963 and LA 1673. Also, the cross Castle Rock × LA 1673 for plant height.

Table (7): Estimates and significance of Specific combining ability SCA effects of 10 tomato crosses for various characters studied under saline condition at Ras Sudr. South Sinai, Egypt.

Crosses		Plant height	No. of fruit/ plant	Early yield	No. of locules / plant	Average fruit weight	T.S.S	Total yield / plant
Edk×cast	$P_1 \times P_2$	10.54**	1.55	0.177	-1.841**	20.817*	-0.146	-0.199*
Edk×super	$P_1 \times P_3$	4.65**	1.99*	-0.301	-1.760**	-17.44**	0.155	-0.171*
Edk×LA1673	$P_1 \times P_4$	-17.17**	4.51**	0.161	-1.951**	21.311**	-0.244*	0.300*
Edk× LA1963	$P_1 \times P_5$	1.51	3.61**	0.710**	1.151**	-11.415**	0.275*	0.176*
Cast× super	$P_2 \times P_3$	16.71**	4.11**	0.315	0.949**	2.317	-0.145	0.414**
Cast× LA1673	$P_3 \times P_4$	14.71**	2.76**	-0.176	0.716*	1.715	0.310*	0.517**
Cast× LA1963	$P_3 \times P_5$	-4.76*	3.16**	-0.147	0.446	21.717**	-0.167	-0.117
Super × LA1673	$P_3 \times P_4$	11.51**	4.11**	-0.716**	-2.781**	3.151	0.716**	0.333*
Super × LA1963	$P_3 \times P_5$	-1.67	2.71**	-0.517**	1.112**	7.14*	0.417	-0.471**
LA1673× LA1963	$P_4 \times P_5$	-2.77	1.31	0.111	1.411**	-11.51**	0.051	0.136
S.E. (S_{ij})		3.00	1.70	0.31	0.604	6.591	0.181	0.767
S.E. (S_{ij}- Si_k)		4.50	1.80	0.34	0.871	8.870	0.240	0.011
S.E. (S_{ij} - S_{ik})		4.31	1.99	0.35	0.784	8.811	0.231	0.233

These results in Table (7) noticed that the crosses Castle Rock × SuperMarMand (16.71cm) and Castle Rock × LA 1673 (14.71 cm) were positive and highly significant SCA effect for plant height / plant (cm). While, the positive and significant SCA effects for number of fruits/ plant were the crosses Edkawy × LA 1673 (4.51), Castle Rock × SuperMarMand (4.11) and SuperMarMand × LA 1673 (4.11). GCA effect was positive and highly significant for early yield was noticed in the cross Edkawy × LA 1963 (0.710). However, the crosses LA 1673 × LA 1963 (1.411) and Edkawy × LA 1963 (1.151) were positive and significant SCA effects for number of locules/ fruit. The cross Castle Rock × LA 1963 (21.717) was the heaviest average fruit weight and the followed that cross Edkawy × LA 1673 (21.311 gm) and Edkawy × CastleRock (20.817gm) were positive and significantly SCA effects. While, the crosses SuperMarMand with each of LA 1673 and LA1963 (0.716 and 0.417) respectively were positive and significantly SCA effects for total soluble of sugar (TSS). The crosses Castle Rock × SuperMarmand (0.414 kg) and Castle Rock × LA 1673 were the heaviest grain yield/ plant and highly significant positive for combing ability SCA effect under saline condition in irrigation water at Ras Sudr region.

These results showed that continuous hybridization between the local tomato genotypes with the exotic genotypes and it could be improved in marketable characters for the exotic genotypes. On the other hand the hybridization was improved the abilities salinity tolerance for the local genotypes i.e. SuperMarMand and Castle Rock with improved the marketable character for Edkawy genotypes under saline condition.

Finally, under saline condition, the hybridization and recurrent selection for the best crosses throughout later generation were favorable to improve tomato to produce best crosses were suitable and adapted for salinity with high yield and good marketable characters under this respect.

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تقدير قوة الهجين والقدرة على التألف والتباين الوراثى فى بعض هُجن الطمام تحت ظروف الملوحة

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أجريت هذه التجربة الحقلية بمحطة بحوث رأس سدر – جنوب سيناء التابعة لمركز بحوث الصحراء خلال المواسم الزراعية 2003 وحتى 2005 بهدف تحسين بعض أصناف الطماطم من خلال التهجين بين الأصناف المحلية مثل صنف سوبر مرماند وكاسيل روك والأصناف المستوردة مثل *LA 1673* و *LA1963* بالإضافة للصنف إدكاوى ذو القدرة العالية على تحمل الملوحة لنقل صفة تحمل الملوحة وتحسين الانتاجية تحت هذه الظروف وكانت النتائج كما يلى :

أدى التهجين بين الأصناف المحلية والمستوردة الى تحسين انتاجية الأصناف المستوردة كما ساهم فى تحسين قدرة الأصناف المحلية على تحمل الملوحة حيث لوحظ تفوق صنف إدكاوى فى كل الصفات المدروسة ماعدا صفة متوسط وزن الثمار والمحصول الكلى للنبات وعلى العكس تفوق الصنفان سوبر مارماند وكاسيل روك فى هذه الصفات

كانت قوة الهجين موجبة ومعنوية للهُجن السوبر مرماند × *LA1963* و إدكاوى × *LA1673* لصفات متوسط وزن الثمرة فى حين كانت قوة الهجين موجبة ومعنوية للهجين كاسيل روك × *LA1963* لصفات المحصول الكلى للنبات .

وكان للفعل الجينى المضيف والغير مضيف دورا هاما فى كل الصفات المدروسة حيث لوحظ أن الفعل الجينى الغير مضيف كان أكثر أهمية فى كل الصفات ماعدا متوسط وزن الثمار والمحصول الكلى للنبات حيث كان الفعل الجينى المضيف هو الأكثر أهمية

كانت درجة التوريث بالمعنى العريض عالية حيث تراوحت بين 64,55 % لصفة مجموع المواد الصلبة الذائبة فى الثمار الى 88,4 % لصفة متوسط وزن الثمار فى حين كانت درجة التوريث بالمعنى الضيق تتراوح بين 39,51 % لصفة مجموع السكريات الذائبة فى الثمار الى 65,7 % لمتوسط وزن الثمار.

كانت القدرة العامة على التألف لأصناف الادكاوى وكاسيل روك و*LA1963* موجبة ومعنوية جدا فى صفات التبكير فى المحصول فى حين كان كاسيل روك والسوبر مارماند موجب ومعنوى جدا لمتوسط وزن الثمار وقد أكد الصنف كاسيل روك والسوبر مارماند قدرتهما العالية على التألف فى صفة المحصول الكلى للنبات فى حين كان أحسن الهجن فى قدرته الخاصة على التألف هو التهجين بين كاسيل روك والسوبر مارماند حيث كانت موجبة ومعنوية جدا لكل الصفات ماعدا صفة مجموع المواد الصلبة الذائبة فى الثمار مما يشير الى ضرورة استمرارية عملية التهجينات والانتخاب لتحسين الصفات الإنتاجية والقدرة على تحمل الملوحة.

قام بتحكيم البحث

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