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HETEROSIS AND NATURE OF GENE ACTION IN EGG-PLANT (*Solanum melongena* L.)

M. K. Hatem[(1)] and Mona R. Khalil[(2)]

(1) Veg. Res. Dep., Hort. Res. Inst., Agric. Res. Center.
(2) Dep. Horticulture, Faculty of Agric., Minufya Univ. Shibin El-Kom , Egypt.

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ABSTRACT: *This investigation was carried out during two summer seasons; i.e., 2010 and 2011 to study the heterosis and combining ability (GCA and SCA) in egg-plant at Barrage Experimental Station of Hort. Res. Institute. Six parental lines viz., K-3-2, K-9-1, CLW-4-2, L.B6-1, CH78-4 and CH79-k were used in this study. In 2010, the parental lines were planted in the field during the summer season, all possible crosses, without reciprocals, were made to produce the F_1,s. In 2011, F_1 crosses and their parents were evaluated for some characters. The objective of this study was to determine the different types of gene effects in terms of general and specific combining abilities effect (GCA and SCA), in addition to average degree of heterosis regarding some traits, i.e., plant height, number of branches, earliness, fruit length , fruit diameter, average of fruit weight, and total fruit yield as fruit numbers and weights . Combining ability and heterosis were also measured for all studied traits .The obtained results could be summarized as follows:*

[1] Highly significant differences for general and specific combining abilities for all studied characters were found. These results indicated that genes with additive and non-additive effects are involved in the inheritance of these traits.

[2] The high estimated ratio between GCA and SCA mean squares suggested that the additive gene effects have the main role in the inheritance of all traits.

[3] Obtained values of GCA for parental lines showed that the line CLW-4-2 is the best of all since it showed significant GCA values for most studied characters, followed by the lines CH78-4 and L.B6-1.

[4] A critical examination of the obtained data on SCA effects for F_1 hybrids showed that certain crosses had high SCA effect values for certain traits, but not for all of them. The best crosses were " K-3-2 x CH78-4", " K-3-2 x L.B6-1", " K-3-2 x CH79-k " , " K-9-1 x CLW-4-2" and " K-9-1 x L.B6-1", since they showed significant SCA effect values for most evaluated traits. In general, the best combinations concerning yield as fruit number and weight, which gave significant positive SCA values, had at least one parent with high GCA value. Accordingly, these superior and prospective materials can be used in egg-plant improvement through breeding programs.

[5] Different degrees of dominance (hybrid vigour, complete and partial dominance) were found in most studied characters in the evaluated materials. The hybrid vigour was detected in many crosses regarding total yield indicating that using F_1 hybrids in commercial production is very important.

Key words: *Egg-plant, General and specific combining ability, average degree of heterosis, hybrid vigour, potence ratio.*

INTRODUCTION

Eggplant (*Solanum melongena* .L) is a favorite vegetable used as fresh , pickled , fried or cooked food. According to the statistics of the ministry of Agriculture the acreage of eggplant in Egypt* in 2010 reached 58647 feddan which produced 641965 tons with an average 10.946 tons per feddan. Yielding ability and fruit characters are important in choosing cultivars for planting in certain area. The modern cultivars have higher crop indices than the older ones (PraKash *et al*., 2008). Therefore, attention must be given to the development of new high yielding cultivars or hybrids through breeding programmes. The

knowledge of types of gene action (additive and non-additive) not only provides information on inheritance mode of characters, but also serves in selection of suitable parents for hybridization to produce the hybrid cultivars. Additive and non-additive genetics effects could be determined from the estimates of combining ability. Also, the subject of heterosis has been continued to be the primary importance to plant breeders. Several studies have been conducted concerning combining ability and heterosis on egg-plant. Variance due to GCA and SCA were highly significant, indicating that both additive and non –additive gene effects were involved in the inheritance of different character reported by patil *et al*., (2006) and Mostafa (2011) for plant height and number of branches per plant ; Kaur *et al*., (2001) and Umaretiya *et al*., (2008) for number of days to first harvest ; Biradar *et al*., (2005) and Umaretiya *et al.*, (2008) for fruit length and average fruit weight ; Patil *et al.*, (2006) and Mostafa (2011) for number of fruit per plant) ; Suneetha *et al*., 2006 , Umaretiya *et al*., (2008) and Mostafa (2011) for total fruit yield . Suneetha and Khathiria (2006) and Mostafa (2011) for fruit diameter). According to Suneetha *et al*., (2006); Zyada (2009) and Mostafa (2011), the plant height was mostly controlled by additive gene effects, since the estimated ratio between GCA and SCA mean squares was high. On the other hand, the non-additive gene effect was more important than the additive one , since the estimated ratio between GCA and SCA was low, regarding days to first harvest and total fruit yield (Mostafa, 2011).

The average degree of heterosis was studied in eggplant by many researchers. Hybrid vigour was observed in many characters , such as plant hight (Biswajet *et al*., 2005 and Prabhu *et al*., 2005) ; branch number (Prabhu *et al*., 2005) ; days to first set (Ahmed *et al*., 1998) ; fruit length , fruit diameters , fruit number and total yield per plant (Prakash, 2007) . According to João and Wilson (1998) , all studied hybrids also showed hybrid vigour for total yield . They added that the heterosis values obtained in the studied hybrids depended on the parents involved in the crosses. Meanwhile, heterosis for plant height, number of branches and days to 50% percent flowering was low in magnitude as reported by Prakash (2007). On the other hand, according to Peter and Sing (1973) and Mostafa (2011) the mean of plant height in studied F_1 crosses were statistically similar to the mid-parental value, indicating no-dominance for this character. They added that estimated heterosis for plant height, number of branches per plant and number of days to 50% percent flowering was low in magnitude. Negative and significant heterosis over the better parent was found for fruit yield per plant as reported by Aswany and Khandewal (2003). The purpose of this study was to determine and compare the general and specific combining ability effects in diallel cross mating design and studying the heterosis of some plant and fruit characteristics since this information are important to planning breeding programs of eggplant.

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MATERIALS AND METHODS

The present investigation was carried out at the Experimental Farm of Hort. Res. Station, El-Kanater El-Khyria during two the successive summer seasons of 2010 and 2011. Six parental lines of egg-plant (*Solanum melongena* L.) were used in this study. These lines are K-3-2 (1), K-9-1 (2), CLW-4-2 (3), L.B6-1 (4) , CH78-4 (5) and CH79-k (6), belong to *Solanum melongena L.* and were obtained from Dr. Kansouh , A. M., , Horticulture Research Institute , Giza , Egypt . The fruit color is white in the first three lines and black in the remaining three lines. All lines have long fruits. These parental lines were at a high degree of homozygosity and significantly differ in most traits.

In the summer season of 2010, the six parents were planted in the field and all possible crosses, without reciprocals, were made to generate the F_1 crosses. In the summer season of 2011, the plants of parental lines and F_1 crosses were transplanted in the field in ridges at 50 cm. apart on March, 7th. Each plot was contained

three rows each of 5.0 meters in length and 70 cm in width. A randomized complete block design with three replicates was used. The other normal agricultural practices for eggplant production, i.e., irrigation, fertilization, weeding, and pests control were practiced as recommended in the area.

The studied characters were:

1. Plant height and number of branches / plant: The plant height was measured in cm. from the ground level to the tip of the plant and the number of branches / plant was counted for five plants per plot at final harvest for the two traits.

2. Days to 50 percent flowering and first harvest: Number of days from transplanting to first flowering in 50 percent of the plants in each row was recorded. Number of days from transplanting to first harvest in each row was recorded and the averages were computed for the two characters.

3. Fruit length and diameter (cm.): Length and diameter of five mature fruits at fourth harvest were measured individually from the base of calyx to tip of fruit for length and at the widest point of fruits using Venire calipers, the averages were computed.

4. Average fruit weight (g): The fresh weights of five fruits were randomly selected at fully mature stage at marketable stage from each replicate were weighed recorded in grams and the average was calculated.

5. Total yield as fruit number and weight: Total number and weight of fruits from different pickings during the cropping season were recorded for each plant, and the average was calculated.

Statistical procedures:

1- *Analysis of variance was made in order to test the significant of the differences among the means of tested populations according to Cochran and Cox (1957). Differences among means for all characters were tested for significant according to the least significance differences (L.S.D.). (Snedecor and Cochran, 1990).*

2- *The analysis of general and specific combining abilities was done according to method (2) model (1) of Grffing (1956).*

3- *Average degree of heterosis (ADH %): Was calculated as percent increase or decrease of the $\overline{F_1}$ performance above the mid-parents ($\overline{MP}$) value and the better parent ($\overline{BP}$) value (Sinha and Khanna, 1975).*

based on MP $\frac{\overline{F_1} - \overline{MP}}{\overline{MP}} \times 100$ based on best parent (BP)= $\frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$

Potence ratio (P.R. %) = $\frac{\overline{F_1} - \overline{MP}}{\frac{1}{2} \times (\overline{P_2} - \overline{P_1})} \times 100$ (Smith, 1952).

Where, $\overline{MP}$, $\overline{BP}$, $\overline{F_1}$, $\overline{P_1}$ and $\overline{P_2}$ are the mid-parents, mean of best parent in the trait, $\overline{F_1}$ hybrids and the means of the low and high parents, respectively.

RESULTS AND DISCUSSION

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Combining ability:

The analysis of variance for combining ability effects on various studies traits for the six parental lines and their F_1 crosses are shown in Table (1). Highly significant effects were observed for both general and specific combining ability in all studied traits. This result indicates the importance of both additive and non-additive gene effects in the inheritance of the studied characters. The estimated GCA/SCA mean squares ratio indicated that the additive genetic variance played the main role in the inheritance of all studied traits. The same results were found by other investigators , among them were :

Patil *et al*. (2006) and Mostafa (2011) for plant height and branch number, Kaur *et al*. (2001) and Umaretiya *et al*. (2008) for earliness , fruit length and average fruit weight ; Suneetha *et al*. (2006) and Mostafa (2011) for total yield as fruit number and weight.

To follow up the effect of GCA for the parental lines and SCA for the F_1 crosses, the estimated values are presented in tables (2 and 3, respectively) for the various characters. Regarding GCA effects , the following parental lines showed highly significant positive effect values for different traits and could be considered as the best combiners : K-9-1 , L.B6-1 , and CH78-4 (for plant height) ; K-3-2, CLW-4-2 and CH79-K (for branch number); K-9-1 and CH78-4 (for average fruit weight) ; CH78-4 (for fruit length) ; K-3-2 , L.B6-1 and CH79-K (for fruit diameter) ; CLW-4-2 , LB6-1 (for fruit number) and K-9-1 , CLw-4-2 , L.B6-1 and CH78-4 (for total fruit yield) . On the other hand, the following lines showed significant negative effects for earliness as number of days to flowering and fruit harvest: K-3-2, CLW-4-2 and CH79-K (for flowering) and K-3-2 and CLW-4-2 for first harvest). These lines could be considered as good combiners for breeding to these characters. The production of superior hybrids was realized when high GCA parents was used as reported by Chaudhary & Malhotra, (2000).

Table (1): Mean squares for combining ability (GCA and SCA) for some characters in egg-plant.

Characters / Source of variation	Plant height	No. of branches /plant	Days to flowering	Days to 1st picking	Average fruit weight	Fruit Length	Fruit diameter	No. of fruit / plant	Fruit yield / Plant
	MS	MS	MS	MS	MS	MS	MS	MS	MS
GCA	866.07**	24.44**	164.42**	258.20**	1492.76**	30.24**	00.68**	49.61**	526442.19**
SCA	10.75**	5.34**	28.27**	77.10**	97.41**	1.83**	00.06**	38.82**	86545.30**
GCA / SCA	80.59	4.55	5.82	3035	15.32	16.75	11.97	1.28	6.08

* Significant at 0.05 level of probability.
** Significant at 0.01 level of probability.

Table (2): Estimated general combining ability (GCA) effects on the studied characters in egg-plant.

Source of variation	Plant height	No. of branches	Days to flowering	Days to 1st picking	Average fruit weight	Fruit Length	Fruit diameter	No. of fruits / plant	Fruit yield / Plant
K-3-2	-9.00**	1.83**	-4.00**	-10.63**	-11.96**	-1.58**	0.50**	-3.58**	-404.21**
K-9-1	16.00**	-2.04**	11.00**	11.13**	9.92**	0.17	-0.38**	-2.08**	95.17**
CLW-4-2	-23.25**	3.9**	-10.25**	-12.88**	-14.33**	-2.96**	-0.10**	7.79**	154.67**
L.B6-1	21.55**	-2.9**	5.75**	8.63**	-3.08**	-0.71**	0.32**	2.29**	99.04**
CH78-4	9.75**	-3.04**	2.63**	1.50	42.54**	6.54**	-0.77**	-2.46**	651.92**
CH79-k	-14.50**	2.21**	-5.13**	2.25	-23.08**	-1.46**	0.43**	-1.96**	-596.58**

* Significant at 0.05 level of probability.
** Significant at 0.01 level of probability.

Table (3): Estimates of specific combining ability (SCA) effects on the studied characters in egg-plant.

Character / Crosses	Plant height	Number of branches	Days to 50 percent flowering	Days to first picking	Fruit length	Fruit diameter	Fruit weight	Number of fruits per plant	Total yield per plant
1 × 2	2.86	2.88**	-17.71**	2.79	2.32**	-0.04	3.664	3.86**	199.52**
1 × 3	-0.89	-0.13	0.54	2.79	1.45*	0.09	-1.09	-14.02**	-544.98**
1 × 4	6.86**	-2.25**	-8.46**	3.29	0.20	-0.04	-2.34	6.48**	286.64**
1 × 5	5.11**	-3.13**	-7.34**	-37.59**	-2.05**	-0.75**	-3.96*	8.23**	408.77**
1 × 6	993.36**	161.63**	646.41**	1205.66**	179.95**	68.75**	824.66**	304.73**	16580.27**
2 × 3	0.11	4.75**	-11.46**	-11.96**	-2.30**	0.16*	-3.96*	24.48**	1328.64**
2 × 4	5.86**	7.63**	7.54**	8.54*	-0.55	0.04	0.79	-0.02	144.27**
2 × 5	0.11	-3.25**	4.66**	-7.34*	-3.80**	-0.07	-10.84**	-1.27**	-254.61**
2 × 6	-14.64**	-3.50**	-5.59**	-10.09**	-0.80	-0.37**	-11.21**	0.23	-108.11**
3 × 4	-1.89	-1.38*	-5.21**	-15.46**	-1.43*	-0.14	3.04	1.11	26.77
3 × 5	0.36	-3.25**	-1.09	-2.34	-0.68	-0.15	-22.59**	0.86	-319.11**
3 × 6	1.61	-1.50**	-0.34	-1.09	1.32	-0.35**	10.04**	8.36**	526.39**
4 × 5	-5.89**	0.63	1.91	-0.84	-2.93**	-0.17*	-12.84**	2.36*	14.52
4 × 6	-0.64	-5.63**	-3.34	-5.59	0.07	-0.57**	-0.21	6.86**	223.02**
5 × 6	1.61	1.50*	3.79**	-0.46	-0.18	-0.09	-32.84**	9.61**	-324.86**

* Significant at 0.05 level of probability.
** Significant at 0.01 level of probability.
1 = K-3-2 2 = K-9-1 3 = CLW-4-2 4 = L.B6-1 5 = CH78-4 6 = CH79-k

For specific combining ability effects of the F_1 crosses, the best combinations were : 1×4 , 1×5 , 1×6 and 2×4 (for plant height) ; 1×2 , 1×6, 2×3 and 2×4 (for branch number) ; 1×2, 1×3 and 1×6 (for fruit length) ; 1×6 (for fruit diameter) ; 1×6 and 3×6 (for average fruit weight) ; 1×2 ,1×4 , 1×5 , 1×6, 2×3 , 3×6, 4×5 , 4×6 and 5×6 (for fruit number) . Most of these crosses were the best in fruit yield. This could be explaining by the effect of number of fruit per plant on the total fruit yield. All mentioned F_1 crosses exhibited significantly positive SCA effect values. Meanwhile, the best combinations for early flowering and ripening were 1×2 ,1×4 , 1×5 , 2×3 , 2×6 and 3×4, these combination gave negative SCA value. Prakash (2007) found positive and negative SCA effects concerning flowering date. Shafeeq A. (2005) found also significant negative SCA effects for days to first picking in some crosses.

A critical examination of the obtained GCA and SCA effect values for total yield as fruit number and weight appear that the lines K-9-1 (2) , CLW-4-2 (3) , L.B6-1 (4) and CH78-4 (5) are good combinations for the fruit weight and CLW-4-2 (3) , Lb6-1 (4) for fruit number . The best studied F_1 combinations were 1×2, 1×4, 1×5, 2×3, 2×4, 3×6, 4×5 and 4×6, since they showed significant positive SCA values. It is noticed that most combinations, had at least one parent with significant GCA value. Therefore, the lines K-9-1 (2), CLW-4-2 (3), L.B6-1 (4) and CH78-4 (5) could be used in improvement of eggplant productivity through breeding programs.

II - Average degree of heterosis:

Plant height and number of branches:

Regarding plant height all hybrids showed insignificant heterosis values in relation to the mid parents, except the F_1 crosses 1×4 and 2×6, which showed significant positive

and negative values, respectively .This result suggests that this character is mostly controlled by incomplete dominance genes. This conclusion is verified by the low estimated potence ratio. As expected, the estimated ADH values based on the better parent were significantly negative. On the other hand, four crosses i.e. 1×3, 1×6, 2×4 and 2×5 showed insignificant values due to the means of their parents were not widly different in plant height. This results disagree the findings of Biswajet *et al*. (2005) and Prabhu *et al*. (2005), who detected positive heterosis for plant height . The average degree of heterosis (ADH%) as percent based on the mid-parents (MP) and beast parent (BP), in addition to potence ratio for the studied trait are tabulated in Tables (4 - 6).

Table 4. Magnitude of heterosis for Plant height, No. of branches, and Days to 50 percent flowering in 15 F_1 hybrids in egg-plant.

Hybrids	Plant height			No. of branches			Days to 50 percent flowering		
	Heterosis (%)		PR	Heterosis (%)		PR	Heterosis (%)		PR
	MP	BP		MP	BP		MP	BP	
1x2	2.65	-10.50**	0.18	13.33*	-8.12	0.57	-20.38**	-13.79**	-2.67
1x3	1.80	-3.95	0.30	-3.90	-7.50	-1.00	-9.29**	-1.61	-1.19
1x4	5.71*	-8.64**	0.36	-11.11*	-24.32**	0.64	-12.84**	-11.03**	-6.33
1x5	4.76	-5.86*	0.42	-18.18**	-27.03**	-1.50	-10.88**	-9.29**	-6.20
1x6	2.25	1.68	3.99	-12.82**	-17.07**	-2.50	-8.76**	-3.10*	-1.50
2x3	-0.76	-17.65**	-0.04	20.63**	-5.00	0.76	-14.68**	0.81	-0.96
2x4	2.29	1.23	2.20	38.78**	30.77**	6.33	00.00	5.96**	0.00
2x5	-0.43	-3.78	-0.13	-11.54	-20.69**	-1.00	-0.32	10.00**	-0.03
2x6	-8.87**	-20.17**	-0.63	-12.50*	-31.71**	-0.44	-8.72**	5.43**	-0.65
3x4	-0.50	-18.11**	-0.02	-6.06	-22.50**	-0.29	-8.36**	1.61	-0.85
3x5	0.26	-14.41**	0.02	-15.94**	-27.50**	-1.00	-3.79*	2.42	-0.63
3x6	-0.60	-6.70*	-0.09	-11.11**	-12.20**	-9.00	-5.14**	-3.23*	-2.60
4x5	-1.94	-6.17**	-0.43	-5.45	-10.00	-1.00	0.34	4.29**	0.09
4x6	-0.95	-13.99**	-0.06	-25.37**	-39.02**	-1.13	-5.00**	3.10*	-0.64
5x6	-0.25	-9.91**	-0.02	-8.57	-21.59**	-0.50	1.86	6.20**	0.45

* - Significant at 5 % level, and ** - Significant at 1% level.
1 = K-3-2 2 = K-9-1 3 = CLW-4-2 4 = L.B6-1 5 = CH78-4 6 = CH79-k

For branch number, of the studied 15 F_1 crosses, three, seven and five ones reflected significant positive, significant negative and insignificant heterosis values based on the MP, respectively. From the three crosses which showed positive heterosis , the hybrid vigour was observed only in the cross 2×4 , while the other tow ones showed complete dominance for the high branch number . The obtained potence ratios were in accordance with the degree of dominance postulated. The hybrid vigour was previously found by Prabhu *et al.* (2005).

Number of days to flowering and picking:

Regarding number of days to flowering, ten crosses gave high significant negative heterosis values from the MP, indicating dominance towards the early flowering parent. The remaining four ones were statistically similar to MP, indicating no-dominance for the character. Over dominance for short period to flowering was shown in five crosses, i.e. 1×2, 1×4, 1×5, 1×6 and 3×6. Their estimated ADH values, from the early parent (BP) were significant or highly significant and the potence ratios for

these crosses were -2.67, -6.33, -6.20, -1.50 and -2.60, respectively.

For day to picking, when the ADH% was estimated from the MP, none of F_1 crosses had positive values. In other words, all crosses gave insignificant or significant negative values, indicating no dominance or dominance toward the early parent. This suggestion was supported by the calculated ADH values, based on the better parent, which was insignificant in all crosses, except two ones, (1×5 and 2×5) showed hybrid vigour for the character. According to Ahmed *et al*. (1998), desirable heterosis was observed in earliness.

Table 5. Magnitude of heterosis for Days to 1st picking, Average fruit weight, and Fruit Length in 15 F_1 hybrids in egg-plant .

Hybrids	Days to 1st picking			Average fruit weight			Fruit Length		
	Heterosis (%)		PR	Heterosis (%)		PR	Heterosis (%)		PR
	MP	BP		MP	BP		MP	BP	
1x2	-3.90	2.78	-0.60	0.29	-14.36**	0.02	4.11	-5.00	0.42
1x3	-5.24	-3.69	-3.25	-1.70	-4.00	-0.71	4.62	3.03	3.00
1x4	-3.02	1.98	-0.62	-1.91	-9.94**	-0.21	-1.40	-7.89	-0.20
1x5	-21.87**	-17.06**	-3.77	-10.20**	-33.56**	-0.29	-9.09*	-27.27**	-0.36
1x6	-8.02*	-4.37	-2.10	6.81	4.20	2.71	1.49	0.00	1.00
2x3	-8.85*	-0.82	-1.09	-7.38*	-19.31**	-0.50	-11.11*	-20.00**	-1.00
2x4	0.53	2.16	0.33	-4.02	-11.39**	-0.48	-7.69	-10.00*	-3.00
2x5	-8.42*	-7.77*	-12.0	-14.80**	-28.52**	-0.77	-15.79**	-27.27**	-1.00
2x6	-7.33*	-4.78	-2.73	-13.02**	-27.23**	-0.67	-5.41	-12.50**	-0.67
3x4	-9.58*	-3.28	-1.47	-2.18	-8.19**	-0.33	-8.57	-15.79**	-1.00
3x5	-8.16*	-0.82	-1.10	-20.98**	-40.60**	-0.63	-8.05*	-27.27**	-0.30
3x6	-5.43	0.00	-1.00	0.70	-4.00	0.14	3.03	0.00	1.00
4x5	-5.53	-4.68	-6.20	-15.57**	-33.56**	-0.57	-13.98**	-27.27**	-0.76
4x6	-5.09	-4.04	-4.67	-5.54	-15.20**	-0.49	-2.78	-7.89	-0.50
5x6	-6.67	-4.78	-3.36	-27.19**	-46.98**	-0.73	-5.62	-23.64**	-023

* - Significant at 5 % level, and ** - Significant at 1% level.
1 = K-3-2 2 = K-9-1 3 = CLW-4-2 4 = L.B6-1 5 = CH78-4 6 = CH79-k

Average fruit weight, fruit length and diameter :

For average fruit weight, none of the studied F_1 crosses showed dominance or over dominance for the heavy fruit. Most crosses showed significant negative heterosis value from the better parent. On the other hand, insignificant, significant or highly significant negative heterosis values were calculated based on MP, indicating no-dominance or dominance for the small fruit.

Regarding fruit length, ten crosses reflected insignificant ADH values, in relation to MP, while five ones showed significant negative values. This means that the short fruit (Low length) is controlled by no-dominance or dominance gene. Accordingly none of the F_1 crosses exceeded the better parent in length, so no significant positive values were obtained in relation to the better parent.

For fruit diameter, highly significant negative ADH values from (BP) were found in all crosses, indicating dominance towards the mid parents or small parent. The obtained ADH values based on MP showed no-dominance for the character in four crosses (1×2, 1×3, 2×3 and 2×4), while, it showed dominance towards the thin diameter in the remaining crosses. The ADH

values were insignificant in the first group and significantly negative in the second one.

Total yield as fruit number and weight :

The dominance of high fruit number was observed in all studied F_1 crosses, except the cross 1×3. They reflected highly significant positive heterosis values in relation to MP. Comparing with BP, eleven crosses gave significant or highly significant positive values, indicating hybrid vigour for the trait. On the other hand, complete dominance for the high number was observed in the remaining three crosses. The estimated potence ratio was in accordance with the postulated theory, it was more than one.

For fruit weight, five crosses, viz. 1×2, 2×3, 2×4, 3×4 and 3×6 showed hybrid vigour for total yield / plant. The calculated ADH values were highly significant from BP and the potence ratios were high in these crosses. The hybrid vigour observed in these crosses is due to the increment of number of fruits / plant. Four crosses (1×4, 1×6 , 2×6 and 4×6) reflected complete dominance for the high yielding parents, since they gave insignificant ADH values based on BP, and the potence ratio values were near to one. Partial dominance was shown by the cross 1×5, since it gave highly significant positive and negative ADH values based on MP and BP, respectively. João and Wilson (1998), Singh *et al.* (2003), Kumar and Pathania (2003) and Prabha *et al.* (2005) also reported hybrid vigour for fruit yield and its contributing traits in brinjal (egg-plant). On the other hand, no-dominance for the character was found two crosses (2×5 and 4×5), they showed insignificant ADH values, based on MP, and the estimated potence ratio was about zero. It is noticed that all degree of dominance were found in total yield character. The presence of hybrid vigour in some crosses lead to suggest that F_1 hybrid could be recommended for commercial production in egg-plant.

Table 6. Magnitude of heterosis for Fruit diameter, No. of fruit / plant, and Fruit yield / Plant in 15 F_1 hybrids in egg-plant .

Hybrids	Fruit diameter			No. of fruit / plant			Fruit yield / Plant		
	Heterosis (%)		PR	Heterosis (%)		PR	Heterosis (%)		PR
	MP	BP		MP	BP		MP	BP	
1x2	-2.17	-8.78**	-0.30	22.77**	12.73*	2.56	21.21**	11.43**	2.42
1x3	-1.42	-6.08**	-0.29	-12.90**	-21.73**	-1.14	-7.09**	-17.66**	-0.55
1x4	-3.07*	-4.05**	-3.00	20.00**	15.00**	4.60	17.9**	3.83	1.32
1x5	-9.16**	-16.21**	-1.09	26.92**	20.00**	4.67	9.55**	-17.32**	0.29
1x6	-4.03**	-4.67**	-6.00	10.68*	3.64	1.57	4.67	-2.73	0.61
2x3	0.00	-2.23	0.00	63.48**	36.23**	3.17	59.01**	52.76**	14.41
2x4	-1.83	-7.58**	-0.29	20.75**	6.67	1.57	19.80**	14.27**	4.10
2x5	-3.56*	-4.69**	-3.00	22.11**	18.37**	7.00	-1.12	-20.52**	-0.05
2x6	-5.76**	-12.67**	-0.72	27.66**	25.00**	13.00	10.84**	-4.67	0.67
3x4	-3.23*	-6.90**	-0.82	16.28**	8.70*	2.33	13.40**	12.57**	18.2
3x5	-4.25**	-7.46**	-1.22	18.64**	1.45	1.10	-4.32*	-20.62**	-0.21
3x6	-5.63**	-10.67**	-1.00	33.33**	13.04**	1.86	30.36**	8.43**	1.50
4x5	-5.19**	-11.72**	-0.70	21.10**	10.00*	2.09	1.63	-15.18**	0.08
4x6	-7.79**	-9.33**	-4.60	31.48**	18.33**	2.83	16.51**	-3.65	0.79
5x6	-5.45**	-13.33**	-0.60	42.27**	40.82**	41.00	-10.17**	-35.43**	-0.26

* - Significant at 5 % level, and ** - Significant at 1% level.
1 = K-3-2 2 = K-9-1 3 = CLW-4-2 4 = L.B6-1 5 = CH78-4 6 = CH79-k

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قوة الهجين والتفاعل الجينى فى الباذنجان

محمود قطب حاتم [١] ، منى رشدى خليل [٢]

[١] أقسام بحوث الخُضر . معهد بحوث البساتين . مركز البحوث الزراعية

[٢] قسم البساتين – كلية الزراعة – جامعة المنوفية .

المُلخص العربي :

أُجريت التجارب الخاصة بهذه الدراسة بمزرعة مَحطة بحوث البسَاتين بالقناطر الخَيرية خِلال المُوسم الصَيفي لِعَامَي ٢٠١٠ ، ٢٠١١ ، وكان الهدف من هذا البَحث هو تقييم مَدى قُدرة هذهِ السُلالات على الائتلاف وكذلك دراسة درجة قُوة الهَجين للحُصول على مزيد من المَعلومات الخاصة بوراثة بعض الصفات لمُساعدة المُربى على وضع وتنفيذ برامج التربية لتحسين محصول الباذنجان والذي يُعتبر من محاصيل الخُضر الهامة في مصر .

وأُستخدم في هَذه الدراسة ٦ سُلالات من الباذُنجان نَقية وراثياً ذات ثِمار طويلة هي (K-3-2 ، K-9-1، CLW-4-2 ، L.B6-1، CH78-4، CH79-k) ، وأُجرى التَهجين فيما بينها في مُوسِم ٢٠١٠ للحُصول على بُذور الجيل الأول اللازمة للدراسة ، وفي موسِم ٢٠١١ زُرعت الآباء والهُجُن الخمسَة عشر في تجربة مُصَمَّمَه بطريقة القِطاعات الكاملةُ العَشوائية في ثلاث مُكررات . وكانت الصِفات التي تناولتها الدراسة هى. إرتفاع النبات . عدد الأفرع للنبات . التبكير فى الإزهار . التبكير فى جمع المحصول . طول الثمرة . قُطر الثمرة . وزن الثمرة . مُتوسط عَدد الثِمار على النبات . مَحصُول الثمار الكُلى للنبات.

وكانت أهم النتائج المُتحصل عليها هي :

[١] كان التباين لكلٍ من القُدرة العامَّة والخاصَّة على الائتلافِ مَعنوياً لكُل الصِفات التي تم دراستها . وهذا يوضح أهمية كل من الفعلِ المُضيف والغير مُضيف للجينات في وراثةِ هذه الصِفات .

[٢] أظهرت النسبة المحسوبة بين مُتوسط مُربع الانحرافات للقُدرة العامَّة والخاصَّة على الائتلاف أن الفعل المُضيف يَلعب دوراً أكثر أهمية من الفِعل الغير مُضيف في الصِفات تحت الدراسة . وهذا يُشير إلى فعالية الإنتخاب كَطريقة تربية فى تَحسين مُعظم الصِفات .

[٣] اختلفت الآباء في تأثيرات القُدرة العامَّة على الائتلاف فكل سُلالة أبَوية أظهرت قُدرة عالية ومَعْنَوِيَة لعَدَد من

الصِفات . واتضح مِن الدراسة أن السُلالة CLW-4-2 كانت أفضَل السُلالات الأبوية مِن حيث قِيم المَعنوية العالية لمُعظم الصِفات المَدروسَة ، يَليه السُلالتين CH78-4 ، L.B6-1 .

[٤] أوضَحت دِراسة تأثيرات القُدرة الخاصَّة على الائتلاف أن الهُجن التي يَدخل في تكوينُها أحد هذه الآباء (CLW-4-2، CH78-4 ، L.B6-1) أعْطت قِيم عالية ومَعنوية للقُدرة الخاصَّة على الائتلاف في مُختلف الصِفات المَدروسَة وعلى هذا يُمكن استخدام هذه السُلالات لِلاستفادة مِنها في بَرامِج تربية وتَحسين الباذُنجان .

[٥] ظهرت كل نُظُم السيادة (إنعدام سِيادة ، سِيادة جُزيئية ، سيادة تامة ، قُوه الهَجين) للهُجُن تحت الدراسة في الصِفات المُختلفة . فى الهُجن التى تم إنتاجها وتقييمها – وظهور قوة الهَجين فى صِفة كمية المحصول كَعدد ووزن الثمار/ للنبات مما يُشجع على إنتاج الهُجن محلياً فى الباذنجان وزراعتها على النطاق التُجارى لزيادةِ الإنتاج .