HETEROSIS AND COMBINING ABILITY IN CUCUMBER HYBRIDS

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Abstract

Yield and quality are a major focus of cucumber improvement. F_1 hybrids in cucumber have several well known advantages over open–pollinated cultivars. The genetic materials used in the present study included 3 cultivars as testers (7K83, 7K396 and Beit alpha) and 7 lines (L.10, L.17, L.18, L.26, L.H1, L.MG 100 and MG 6) of cucumber (*Cucumis sativus* L.) were used as female parents using a factorial mating design. All possible crosses were executed in a factorial mating design in the summer season of 2013 to produce seeds of 21 F_1crosses. Data were recorded on some vegetative and yield and its components, were recorded at 2014. The obtained results could be summarized as follow: Results indicated that the genetic differences among genotypes were significant or highly significant for all studied traits, indicating the presence of adequate genetic variability. The genetic differences among the genotypes (parents, crosses and parents vs. crosses) were highly significant for all studied traits. Heterosis over the better-parents were significant or highly significant with positive values in most crosses for stem length ,number of brunches, fruit number/plant, fruit weight, fruit length, total yield/plant and days to harvest. The mean squares of general combining ability and specific combining ability were highly significant for most traits indicated that both additive and non-additive gene effects were important in the inheritance of these traits. Both general and specific combining abilities were significant or highly significant for all studied traits. Additive genetic effects were more important than non-additive genetic ones in the inheritance of stem length and branches number /plant. Whereas, additive and non-additive genetic play the same role and effects in the inheritance of number fruits /plant, average fruit weight , fruit length , total yield /plant and day to first harvest. Line No.4 were good combiners for stem length , branches number/plant and average fruit weight .Tester No.1 and line No.7 were good combiners for fruit number/plant. Tester 2 and line 8 had good combiners for fruit length. While tester No.1 and line No.5 were good combiners total yield /plant. Concerning specific combining ability effects it was found that the best crosses were 8x3 for stem length, 9x3 for number of branches, 4x1 for number of fruits/plant,5x1 for average fruit weight , 9x1 for fruit length ,6x3 for total fruit yield per plant and 4x2 for days to harvest. Heritability estimates in broad sense were high for all studied traits, while heritability estimates in narrow sense were high for most studied traits.

Key words:- Cucumber (*Cucumis sativus* L.) , heterosis , combining ability and heritability .

1. INTRODUCTION

F1 hybrid in cucumber, as in many vegetable crops, have several well known advantages over open–pollinated cultivars and hence, provide a scope for the breeder to find out more appropriate combination to develop superior hybrids . The hybrids are early, vigorous, high yielding, tolerant to diseases and insect- pests and more efficient in the use of water and fertilizers .Currently, the farmers are purchasing hybrid seeds from the private firms, who are charging exorbitantly (Dogra and Kanwar, 2011).

Delaney and lower (1987) reported that cucumber that heterosis of F1 over the better parents was highly significant for main stem length, indicating partial to complete dominance. Metwally *et al.* (1992) found on cucumber that heterosis measured as departure from the average mid-parents values was highly significant with positive value while, it was significant with negative value when it was measured relative to the better parent. However, inbreeding depression was highly significant with a value of 18.9 %. The mean squares of SCA were larger in magnitude than that of the GCA therefore, it controlled by genes having dominant effects. Balliu and Hallidri (2000) illustrated that the statistical significance of GCA for cucumber plant height indicates that genetic differences exist among the lines, and suggests the importance of additive effects in determining F1 hybrid growth rate. Omran (2003) found, on watermelon, that heterosis over both mid and better parents were highly significant with positive values. The GCA mean square of stem length was not significant for parental lines and testers. SCA mean squares were highly significant, also the heritability values were high in both broad and narrow senses, Too he found that heterosis over the mid-parents and better parent were highly significant with positive effects over mid and better-parents for number of branches /plant.

Lobez-sese and Staub (2002) found on cucumber that number of nodes to first male and female flower mean squares for GCA and SCA were significant, relative importance of GCA/SCA was very high. Abd El-Hafez *et al.* (1997) showed on cucumber that heterosis over the better parent was absent for number of days to first female flower. The ratio of GCA/SCA mean squares revealed that additive and non additive gene effects were of the same magnitude in the inheritance of this character. Ananthan and Pappiah (1997) found on cucumber that general combining ability and specific combining ability were significant for days to first male flower opening. Evidence of dominant gene effects was found. Metwally *et al.* (1992) reported on cucumber that heterosis over the better parent were highly significant for the number of male and female flowers per plant, also inbreeding depression was highly

significant. Estimates of the mean squares of both general and specific combining abilities were highly significant. The GCA/SCA ratio was more than one, these results indicated that additive genetic variance was more important than the non-additive one. Lobez-sese and Staub (2002) who worked on cucumber, measured the number of female flowering nodes of cucumber and stated that mean squares for GCA and SCA were significant, relative importance of GCA versus SCA was very high. Ahsan *et al.* (2011) who studied the analysis of variances which showed significant differences among the parents and hybrids of *snake gourd* for most of characters, and they found that the hybrid SG-04 x SG-26 took minimum 81-83 days to produce female flower.

Lobez-sese and Staub (2002) calculated the number of cucumber fruits after 50 days in two seasons and stated that mean squares for GCA and SCA were significant, relative importance of GCA versus SCA was less than one in both seasons. Singh *et al.* (1999) found pronounced heterosis over better parent and standard parent in cucumber F1 hybrid for yield of edible fruits per plant. Dogra and Kanwar (2011) studied the exploitation of combining ability in cucumber . They noted for yield that K-90 was the best general combiner in addition to Gyn1 and G2. The SCA effect were high for K – 90 x G2 (high x high), K-90 x Gyn1 (high x high) and Lc-11 x Gyn1 (poor x high) .

Metwally *et al.* (1992) reported on cucumber that heterosis over the better parent had negative and highly significant value for average fruit weight, also inbreeding depression was highly significant. GCA and SCA mean squares were highly significant the additive effects were more important because GCA/SCA ratio was more than one. Feyzian *et al.* (2009) investigated yield and acceptable yield in cucumber plant and found that additive gene effects were most important with respect to average fruit weight . Dogra and Kanwar (2011) stated in cucumber that the best general combiners for TSS were EC173934 and LC-40. Among 28 specific combinations, 14 crosses exhibited positive SCA effects being maximum in LC-40 x Gyn1 followed by K-90 x Poinsette and K-75 x LC-40. The aim objective of this study was to produce cucumber hybrids suitable for open field and cultivation determining some genetic parameters, such as heterosis, GCA and SCA.

2. MATERIALS AND METHODS

These experiments were conducted during the summer seasons of year 2013 to 2014. The genetic materials used in the present study included 3 cultivars as testers (7K83 ,7K396 all female from zayintec co. from Spain and Beit alpha moncious) and 7 lines

(L.10, L.17 ,L.18, L.26 , L.H1, L.MG 100 and MG 6) of cucumber (*Cucumis sativus* L.) from my breeding program ,were used as female parents using a factorial mating design. All possible crosses were executed in a factorial mating design in the summer season of 2013 to produce seeds of 21 F_1 crosses and sprayed 2 testers 7K83 and 7K396 with Gibrellic acid (GA3) at the concentration of 250 ppm at the first and second leave to produce male flowers.

All these genotypes were cultivated and evaluated under Egyptian cultivation in a preliminary experiment in summer season of 2014.All genotype were selected visually according to their good performance levels and quality traits to be continued in the breeding program as parents.

2.1.Experimental design:

The experimental design used was a randomized complete block design with three replications each replicate consisted of 32 plots (3 Testers and 7 Lines as parents, 21 F_1 hybrids + one check hybrid Prince F1) each plot was one ridge of 5 meters in length and 2 meters width so the plot area was 10 m^2, the distance between plants was 0.5 m. apart, each plot contained 20 plants (one plant per hill). The seeds were sown on April 1^{th} 2014 to evaluation trial at El-Nubaria region, Egypt.

2.2.Data recorded

The following characters were recorded on 5 plants in each plot:

1- Stem length (cm), Number of branches / plant .

2- Number of fruits per plant, average fruit weight (kg), fruit length (cm.), total fruit yield kg/plant and days to harvest (after 40 day from sowing).

2.2.1. Vegetative traits:

For studying the differences between genotypes in the plant performance, 5 plants were uprooted from each plot after 60 days from sowing and the following data were recorded: Main stem length (cm). and Number of branches /plant.

2.2.2. Yield and its components:

This trait was calculated as the average number of fruits counted on the plants. Number of fruits/plant ,average fruit weight (kg.) ,total fruit yield (kg.) /plant and No. of days to harvest.

2. 3. Statistical analyses:

3.3.1. The estimates of heterosis:

A regular analysis of variance of a Complete Randomized Block Design was conducted. LSD was used for the comparison between all genotypes means. Line x tester analysis was done to provide the information about general and specific combining ability effects (Kempthorne 1957).

Estimates of heterosis:

The amount of heterosis was expressed as the percentage deviation of F_1 mean performance from better parent (BP%) average values as follows:

1-Heterosis over the better parent ($\overline{B.P.}$) % = $\frac{\overline{F_1}-\overline{B.P.}}{\overline{B.P}} \times 100$

2-Appropriate L.S.D. values were calculated to test the significance of these heterotic effects according to the following formula:

L.S.D for the better parent heterosis =× $t_{0.05}$ and $t_{0.01}t \times \frac{\sqrt{2MS_e}}{r}$

Where: **t :** the tabulated value at a stated level of probability for the experimental error degrees of freedom.

MS_e : the mean squares of the experimental error from the analysis of variance.

R : is the number of replications.

3. RESULTS AND DISCUSSION

3. 1.The performance of parents and their F1 hybrids

3.1.1.Vegetative traits:

3.1.1.1 Stem length :-

Data presented in Table (1) show that the crosses 5x3 and 4 x3 gave the tallest plants.

3.1.1.2. Branches number :-

Data presented in Table (1) indicate that number of branches of the crosses 6x2 had the highest number.

3.1.2. Yield and its components

3.1.2.1.Number of fruits:

Data (Table, 1) show that crosses 4x1 (30 fruit / plant) had the highest number of fruits /plant .The tester No.1 (21.7 fruit / plant) , and line No.4 (20 fruit / plant) had the highest number of fruits /plant .Therefore crosses including its had the highest number of fruits / plant.

3.1.2. 2 . Fruit weight

Data in Table (1) show that the crosses 5x1 and 4 x3 the heaviest fruit (180 gm.

3.1.2.3. Fruit length

It is evident from Table (2) that the crosses 7x2 and 8x2 had the longest fruits .

Table (1): Mean performance of parents and hybrids for various characters in cucumber (2014).

Genotypes	Steam Length (cm.)	No. of branches / plant	No .of fruits / plant	Fruit weight (gm.)	Fruit length (cm.)	Total fruit yield / plant (Kg.)	No. of days to harvest
Testers							
1	90	4.0	21.7	150	15	2.5	40
2	110	4.0	24.0	180	20	3.0	38
3	120	1.6	8.0	110	13	1.2	50
Lines							
4	180	4..6	20.0	146.7	17	2.2	41
5	160	4.3	18.0	140.0	15	3.0	44
6	170	3.6	23.7	126.7	15	2.4	45
7	200	3.6	27.0	156.7	20	2.5	42
8	230	1.6	24.3	146.7	20	2.2	45
9	180	4.3	22.3	126.7	17	2.2	48
10	160	5.0	17.3	116.7	14	2.3	46
Hybrids							
4X1	235.7	5.0	30.0	143.3	16.0	4.2	44.7
5X1	228.3	5.0	27.0	180.0	15.0	4.9	40.3
6X1	225.0	5.0	25.0	110.0	15.0	2.8	41.3
7X1	226.7	4.7	29.7	146.7	17.0	4.4	43.3
8X1	205.0	4.0	23.7	140.0	17.0	3.3	44.3
9X1	228.3	4.7	24.0	130.0	16.0	3.1	47.3
10X1	235.0	4.3	22.0	160.0	14.3	3.5	45.7
4X2	235.3	6.0	16.7	150.0	19.3	2.5	40.0
5X2	230.0	5.0	18.3	126.7	17.3	2.3	40.0
6X2	215.0	4.3	17.7	120.0	18.0	2.1	48.0
7X2	220.0	4.7	19.7	150.0	20.3	3.0	41.0
8X2	201.7	5.0	17.3	128.3	20.7	2.2	42.0
9X2	213.3	4.3	15.3	116.7	18.3	1.8	46.0
10X2	206.7	4.3	15.7	150.0	16.0	2.4	48.0
4X3	240.0	3.7	17.3	180.0	15.0	3.1	50.0
5X3	241.0	4.0	19.7	160.0	14.3	3.2	51.0
6X3	221.3	1.3	21.7	150.0	13.0	3.3	52.0
7X3	227.3	1.7	18.3	130.0	16.0	2.4	49.0
8X3	220.0	2.3	20.7	118.3	17.3	2.5	42.7
9X3	214.0	4.7	21.3	148.3	12.0	3.2	44.7
10X3	216.7	4.0	17.3	128.3	12.7	2.2	40.3
Prince hybrid	220.0	4.8	24.3	140.6	16.5	3.42	45.3
L.S.D 0.05	2.2	1.9	1.9	2.3	2.0	1.6	1.7
0.01	2.9	2.5	2.5	3.0	2.6	2.1	2.3

Testers , 1 =7K83 , 2- 7K396 ,3- Beit alpha , and Lines, 4 - L.10, 5- L.17 , 6- L.18,7- L. 26 , 8- L.H1, 9- L. MG 100 and 10 - L. MG 6).

3.1.2.4 Total fruit yield / plant :-

Data (Table,1) show that the highest yield was produced by the crosses 5x1 and 7x1 was high yielded (4.9 and 4.4kg. /plant) than the check hybrid Prince (3.4 kg./plant) for total yield /plant .

3.1.2.5. No. of days to harvest:

Data (Table,1) show that, Tester No.1 (38 day) had earlier than the parents and crosses .The crosses 4x2 and 5x2 (40 day) had earlier than the other crosses and check hybrid (Prince) .

4. Heterosis

Heterosis was expressed as percent increase or decrease of F1 performance over the better parent (B.P) value. It is a known fact that the phenomenon of heterosis is of common occurrence in both cross and self-pollinated crops. The amount of heterosis depends upon the origin of parents involved in hybridization. When the parents are not closely related a fairly large amount of heterosis would be obtained. On the other hand, hybrids between closely related cultivars, which are developed from very narrow germplasm, usually, yield little or no heterosis. In the present study, the cultivars used are not closely related. This implication suggests that choice of parents is very important and should be considered. These cultivars were introduced from different countries.

4.1 .Vegetative traits

4.1.1. Stem length

Data (Table, 2) show that 18 crosses from 21 ones exhibited highly significant positive heterotic effects over the better parent, while the other crosses had negative values of heterosis over the better parent. El-Meghawry *et al.* (2001), Omran (2003) on watermelon and Obaidalla (2006) on summer squash reported positive significant heterosis over the better parent for main stem length.

4.1.2. Number of branches / plant

Data in Table (3) show that heterosis over the better parent, that 12 cross from 14 ones showed highly significant positive values of heterosis over the better parent, these crosses were 10x1. The average heterosis over the better parents was absent (45.8%).

4.2.1. Yield and its components : -

4.2.1.1. Number of fruits: -

Data (Table, 2) show that 8 F_1 crosses were superior to their better parent for number of fruits / plant . Therefore, heterosis over the better parent was positive with highly significant values. The highest value was 38.2 % resulted from the cross 4x1.In this concern Al-Ballat (2008) on summer squash and Dogra *et al.* (1997) on cucumber, found that the better parent was superior for this trait than F1hybrids.

4.2.1.2. Fruit weight : -

Data presented in Table (2) show that heterosis measured over the better parent was highly significant with positive values in 6 crosses ,while the cross 8x3 had the largest one (22.7%). Metwally *et al.* (1992) on cucumber found highly significant negative heterosis over the better parent, while Cramer and Wehner (1999) on pickling cucumber did not observe heterosis over the better parent for this trait.

4.2. 1.3. Fruit length

Data listed in Table (2) show that over the better parent, all crosses had highly significant negative value .In this concern, Metwally and Etman (1985) .While Singh *et al.* (1999) on cucumber found pronounced heterosis over the better parent.

4.2.1.4. Total fruit yield / plant : -

Data presented in Table (4) show that regarding heterosis over the better parent, 11 cross from 13 ones , i.e. 4x2 had highly significant positive value (96.0 %), while the remaining crosses had negative values. In this concern Al-Ballat (2008) on summer squash and Dogra *et al.* (1997) on cucumber, found that the better parent was superior for this trait than F1hybrids.

4.2.1.5. No. of days to harvest:

Data (Table, 2) show that all hybrids highly significant positive heterosis over better parent for earliness .These desirable estimates ranged from 0.8 to 24.6 % .

Table (2): Heterosis (%) over the best parent for various traits in cucumber.

Genotypes	Steam Length (cm.)	No. of branches / plant	No .of fruits / plant	Average Fruit weight (gm.)	Average Fruit length (cm)	Total fruit yield / plant (Kg.)	No. of days to harvest
Crosses							
4X1	30.9	8.7	38.2	-4.4	-83.9	68.0	0.8
4X2	42.7	16.3	24.4	20.0	-83.0	96.0	10.0
4X3	32.4	25.0	5.5	-26.7	-79.5	12.0	11.7
5X1	13.3	16.7	9.9	-6.4	-74.5	76.0	0.8
5X2	-10.9	0.0	-2.6	-6.7	-75.3	32.0	3.3
5X3	26.9	8.5	7.6	-13.3	-81.6	24.0	8.3
6X1	46.9	-13.3	1.4	6.7	-81.3	40.0	10.8
6X2	30.7	30.4	-30.6	-16.7	-80.5	-16.7	24.6
6X3	43.8	16.3	-23.6	-29.6	-80.4	-23.3	20.2
7X1	26.5	8.3	-26.4	-33.3	-75.3	-30.0	5.3
7X2	10.0	16.7	-27.2	-16.7	-69.5	0.0	5.3
7X3	-12.3	25.0	-28.7	-28.7	-69.9	-26.7	26.3
8X1	18.5	0.8	-36.1	-35.2	-78.9	-40.0	7.9
8X2	29.2	-13.3	-34.7	-16.7	-79.1	-20.0	10.5
8X3	33.3	-20.3	-13.3	22.7	-84.9	40.9	12.2
9X1	50.6	-7.0	9.3	14.3	-83.8	6.7	9.1
9X2	30.2	-63.0	-8.6	18.4	-82.2	37.5	11.1
9X3	13.7	-53.7	-32.1	-17.0	-76.0	-4.0	21.4
10X1	-4.3	45.8	-15.0	-19.3	-74.8	13.6	15.6
10X2	18.9	8.5	-4.3	17.1	-86.2	45.5	2.1
10X3	35.4	-20.0	0.2	10.0	-83.5	-4.3	-7.2
LSD 5%	5. 4	1.2	1.0	7.0	1.7	0.2	0.5
1%	7.1	1.6	1.4	9.3	2.2	0.3	0.7

Testers ,1 =7K83 , 2- 7K396 ,3- Beit alpha , and Lines, 4 - L.10, 5- L.17, 6- L.18,7- L. 26 , 8- L.H1, 9- L. MG 100 and 10 - L. MG 6).

5. Combining ability :-

The results of analysis of variance and mean squares of all genotypes (parents and crosses) are presented in Tables 3.Tests of significance indicated that the mean squares of genotypes (parents and crosses) were significant or highly significant for most studied traits .The variance of crosses was partitioned into the main effect of lines and testers as the indicators of general combining ability, and interaction of line x testers as indicators of specific combining ability (Bond 1967).

5.1 Vegetative traits.

5.1.1 Stem length.

Data in Table (4) show that estimates of gca effects for parents and sca effects for crosses .The results show that lines No.4 and No.4 had the greatest gca effects (13.84 and 9.96 ,respectively), followed by tester No.1 (3.13), indicating that these parents were good combiners for stem length.

Regarding to crosses in Table (5) show that Five cross had highly significant positive of SCA effects .The cross 10x1 had the greatest SCA effects (12.4). On the other hand, the other cross had negative or insignificant values of SCA effect.

5.1.2 Number of branches / plant

Data in Table (4) show that tow parents, line No.4 and tester No.2 could be considered as good combiners for this trait. They exhibited significant or highly significant GCA effect with values of 0.70 and 0.62, respectively. Concerning crosses, data in Table (5) show that 3 crosses from 8 ones exhibited highly significant values for SCA effects. The cross 9x3 reflected the highest value (1.21).

Table (3): Analysis of variance and mean squares of factorial mating design (Line x Tester analysis) for various characters in cucumber.

Sources	Df.	Stem length (cm)	No. of branches	No. of fruits/ plant	average fruit weight	Fruit length	Total yield /plant	No. of days to harvest
Treatments	30	4597.9	3.9	63.1	1133.3	17.7	1. 8	42.0
Crosses	20	383.5	3.9	56.1	1118.3	16.5	1.92	43.8
Barents	9	5466.7	4.0	85.5	1288.9	20.8	0.76	41.0
B.vs.cr	1	81067.3	4.9	1.2	32.8	2.9	7.76	16.8
Lines	2	518.6	19.0	425.1	719.4	97.6	10.76	204.3
Tester	6	808.3	2.6	16.5	1439.6	18.9	1.07	16.5
LXT	12	148.5	2.0	14.5	1024.1	1.9	0.87	30.7
Error	60	10.7	0.5	0.4	18.4	1.0	0.02	0.1

5.2. Yield and its components.

5.2.1. Number of fruits/plant :-

Data presented in Table (4) show that 5 parents gave significant or highly significant positive values. Tester No.1 and line No.7 could be considered the best combiners since it they gave the highest value of GCA effect. Concerning crosses , 7 crosses gave significant or highly significant positive values of SCA effects. (Table ,5).

5.2.2. Fruits weight: -

Data presented in Table (4) show that line No.4 and tester No.3 had highly significant positive values of GCA effects . since they gave highly significant positive values with 16.51 and 3.73, respectively, so they could be considered good combiners for this trait.

As regard to SCA effects, the crosses in Table (5) show that 11 cross significant or highly significant positive values. The cross 5x1 and 6x3 had highly significant positive values,(21.43 and 19.60 ,respectively).

5.2.3. Fruit length

Data presented in Table (4) show that 3 parents, (Tester No.2 , Line No.8 and Line No.7) had highly significant positive values of GCA effects viz., 2.35, 2.11 and 1.56, respectively, so it could be suggested that this parents could be considered as good combiners for fruit length. The other parents were poor combiners. Regarding SCA effects, 10 crosses, had positive values and insignificant (Table,4).

Table (4): Estimation of general combining ability effects for various characters in cucumber.

Genotypes	Steam Length (cm.)	No. of branches / plant	No .of fruits / plant	Fruit weight (gm.)	Fruit length	Total fruit yield / plant (Kg.)	No. of days to harvest
Testers							
1	3.13	0.48	5.03	3.02	-0.46	0.77	-2.19
2	-5.73	0.62	-3.64	-6.75	2.35	-0.64	-1.38
3	2.60	-1.10	-1.40	3.73	-1.89	-0.13	3.57
L.S.D 0.05	1.43	0.32	0.27	1.87	0.44	0.06	0.14
0.01	1.90	0.43	0.36	2.49	0.59	0.08	0.18
Lines							
4	13.84	0. 70	0.46	16.51	0.56	0.30	-0.25
5	9.95	0.48	0.79	14.29	-0.67	0.50	1.08
6	-2.71	-0.64	0.57	-14.60	-0.89	-0.24	0.08
7	1.51	-0.52	1.68	0.95	1.56	0.30	-1.03
8	-14.27	-0.41	-0.32	-12.38	2.11	-0.30	2.30
9	-4.60	0.37	-0.65	-9.60	-0.78	-0.27	-0.37
10	-3.71	0.03	-2.54	4.84	-1.89	-0.27	-1.81
L.S.D 0.05	2.19	0.49	0.42	2.86	0.68	0.10	0.21
0.01	2.90	0.65	0.56	3.80	0.90	0.12	0.28

Testers , 1 =7K83 , 2- 7K396 ,3- Beit alpha , and Lines, 4 - L.10, 5- L.17 , 6- L.18,7- L. 26 , 8- L.H1, 9- L. MG 100 and 10 - L. MG 6).

Total fruit yield/plant :- 5.2.4

The analysis of variance for total yield per plant is presented in Table (3). Highly significant differences for GCA and SCA indicated that both additive and non-additive genetic variances are important in the inheritance of total yield. Data listed in revealed that Line No.5 had greatest GCA effect for total yield followed by tester No.1 . Therefore, these parents were good combiners for total yield. Concerning crosses, data in Table (5) show that 8 crosses from 10 ones exhibited highly significant values for SCA effects. The cross 6x3 and 5x1 reflected the highest value (0.70 and 0.66 ,respectively).

5.2.5. Number of days to harvest .

Data presented in Table (4) show that line No.1 and tester No.10 had highly significant negative values of GCA effects .Since they gave negative values with -2,19 and -1.81, respectively, so they could be considered good combiners for early. As regard to SCA effects, the crosses in Table (5) show that 11 cross significant or highly significant positive values. The cross 5x1 and 6x3 had highly significant positive values, (21.43 and 19.60 ,respectively).

6. Heritability

Heritability in broad and narrow sense is very important and should be recognized as a first step before starting any breeding program. Heritability measures are the portion of the total genetic variance that is due to hereditary factors. Heritability in broad sense includes all types of genetic variances, consequently plant breeder's count on the narrow sense heritability, which estimates the portion of genetic variance due to additive gene action.

- Stem length ,branches number and Yield and its components :-

Data illustrated in Table (6) show that heritability estimates in broad sense were high for stem length ,branch number /plant, fruit number /plant , Average fruit weight , Fruit length , total yield , days to harvest, and narrow sense had high for fruit number /plant, fruit length and total yield indicating that the major part of the total phenotypic variance of such traits is due to additive genetic effects. In this respect, Taha (1989) reported that heritability estimates in both broad and narrow senses were high. Also, Abd El-Hafez *et al.* (1997) on cucumber found that heritability estimates in both broad and narrow senses were high for weight of fruits per plot. Heritability values were moderate in broad sense for total fruits yield/plant and average fruit weight. Heritability estimate were generally low in narrow sense for stem length, No. of branches, average fruit weight and No. of days to maturity.

Table (5): Estimation of specific combining ability affects for some various characters in the F1 generation of cucumber

Genotype	Stem length (cm.)	No. of branches	No. of fruits/ plant	Fruit Weight (gm.)	Fruit length (cm.)	Total fruit yield /plant (kg.)	No. of days to harvest
Crosses							
4X1	-4.46	-0.37	3.64	-17.46	-0.32	0.16	-2.03
4X2	4.06	0.49	-1.03	-1.03	0.21	-0.12	4.16
4X3	0.40	-0.13	-2.60	18.49	0.11	-0.04	-2.13
5X1	-7.91	-0.14	0.30	21.43	-0.10	0.66	0.30
5X2	2.62	-0.29	0.30	-22.14	-0.57	-0.52	1.16
5X3	5.29	0.43	-0.60	0.71	0.67	-0.14	-1.46
6X1	1.43	0.97	-1.48	-19.68	0.13	-0.71	1.97
6X2	0.29	0.16	-0.14	0.079	0.32	0.01	-3.51
6X3	-1.71	-1.13	1.62	19.60	-0.44	0.70	1.54
7X1	-1.13	0.52	2.08	1.43	-0.32	0.36	-1.25
7X2	1.06	0.38	0.75	14.52	0.21	0.38	-2.40
7X3	0.06	-0.91	-2.83	-15.95	0.11	-0.74	3.65
8X1	-7.02	-0.25	-1.92	8.10	-0.87	-0.14	-3.59
8X2	-1.49	0.60	0.41	6.19	-0.02	0.18	2.27
8X3	8.51	-0.35	1.51	-14.29	0.89	-0.04	1.32
9X1	6.65	-0.37	-1.25	-4.68	1.02	-0.37	1.08
9X2	0.51	-0.84	-1.25	-8.25	0.54	-0.28	-2.06
9X3	-7.16	1.21	2.51	12.94	-1.56	0.63	0.98
10X1	12.43	-0.37	-1.37	10.87	0.46	0.03	3.52
10X2	-7.05	-0.51	0.97	10.64	-0.68	0.34	0.38
10X3	-5.38	0.87	0.40	-21.51	0.22	-0.37	-3.91
LSD (0.05)	3.78	0.85	0.72	4.95	1.17	0.16	0.36
LSD (0.01)	5.03	1.13	0.96	6.59	1.56	0.21	0.48

Testers , 1 =7K83 , 2- 7K396, 3- Beit alpha , and Lines, 4 - L.10, 5- L.17 , 6- L.18,7- L. 26 , 8- L.H1, 9- L. MG 100 and 10 - L. MG 6

Table (6): Estimates of heritability in broad sense (h^2bs) and heritability in narrow sense (h^2ns) for studied traits of cucumber .

Characters	% (.b.s)h^2	% (.n.s)h^2
Stem length	96.76212	41.3954
No. of branches	88.87548	47.88093
No. of fruits/ plant	99.46977	74.19072
Average fruit weight	98.66121	1.075596
Fruit length	93.98494	87.58604
Total fruit yield	99.26186	53.85418
No. of days to harvest	99.84423	34.23412

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قوة الهجين والقدرة على التآلف فى هجن الخيار

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المحصول والجوده هدف اساسى فى تحسين الخيار. أجريت هذه الدراسة بهدف إنتاج هجن خيار عاليه الانتاجيه . أستخدمت فى هذة الدراسة ٧ سلالات بارقام (L.10, L.17 ,L.18, L.26 , L.H1,) L.MG 100 and L.MG6 كأمهات.و ٣ أصناف وهى (7K83 ,7K396 and Beit alpha) كأباء. تم إجراء التهجين بطريقة line x tester لإنتاج ٢١ هجين خلال الموسم الصيفى لعام ٢٠١٣ .

تم تقييم الهجن الناتجة والأباء بالإضافة الى هجين برنس للمقارنه خلال الموسم الصيفى لعام ٢٠١٤ فى تجربة حقلية بإستخدام القطاعات كاملة العشوائية فى ثلاث مكررات. إشتمل التقييم على صفات طول الساق ، عدد الأفرع وعدد الثمار لكل نبات ، متوسط وزن الثمرة ، طول الثمره ، عدد الأيام حتى حصاد أول ثمرة ، المحصول الكلى .

- أظهرت النتائج أن الأباء والهجن الناتجة بها إختلافات معنوية واضحة لمعظم الصفات المدروسة.

- كانت قوة الهجين عند حسابها على أساس الأب الأفضل معنوية أو عالية المعنوية للصفات المدروسه وهى طول الساق ، عدد الافرع للنبات ، عدد الثمار على النبات ، وزن الثمره ، طول الثمره ،المحصول الكلى للنبات وعدد الايام الى حصاد اول ثمره .

- كانت تأثيرات القدرة العامة والخاصة على التآ لف معنوية أو عالية المعنوية لمعظم الصفات المدروسة. كانت السلاله رقم 4 ذا قدرة تآلف عالية بالنسبة لصفه طول الساق، عدد الافرع للنبات ومتوسط وزن الثمره. و السلاله الام رقم ٧ والاب رقم ١ كان ذا قدرة تآ لف عالية بالنسبة لصفة عدد الثمار/ النبات . كانت السلاله الام رقم ٨ والاب رقم ٢ ذات قدرة تآلف عالية بالنسبة لصفة طول الثمره. كانت السلاله الام رقم 5 ذات قدرة تآ لف عالية بالنسبة لصفة للمحصول الكلى للنبات . كان الاب رقم ٢ ورقم ١ ذات قدرة تآ لف عالية بالنسبة لصفة .

- أما تأثيرات القدرة الخاصة على التآ لف فأظهرت تفوق الهجن 8x3 فى طول الساق و9x3 فى عدد الأفرع والهجين4x1 فى عدد الثمار على النبات والهجين 5x1 فى صفه متوسط وزن الثمره و الهجين 9x1 فى صفه طول الثمره والهجين 6x3 فى صفه المحصول الكلى للنبات . كانت قيم تأثيرات القدرة الخاصة على التآ لف للهجين 4x2 موجبة ومعنوية لصفة التبكير .

أوضحت قيم القدرة العامة والخاصة على التآلف أهمية كل من الفعل المضيف والغير مضيف للجين فى توريث معظم الصفات المدروسه.

ولقد كانت درجة التوريث عالية فى معناها العام لكل الصفات المدروسه بينما كانت عاليه فى معناها الضيق لمعظم الصفات المدروسه .