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Combining Ability and Sensory Evaluation for Some Hybrids of Melon (*Cucumismelo*L.)

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ABSTRACT

Five locally produced parental pure lines of melon (*Cucumismelo*L.)*i.e*. Line 1 $_{\text{Kos-El-Asal}}$, Line 2$_{\text{Charantais}}$, Line 3$_{\text{green flesh}}$, Line 4$_{\text{Matroh}}$ and Line 5$_{\text{primal}}$were planted in the green house and all possible crosses (diallel) were done in the autumn season of 2011, and evaluated the hybrids which produced in summer seasons of 2012 and 2013 respectively. The objectives of the study were to determine the effects of different types of genes, in terms of general and specific combining abilities in melon.Regarding some plant characters and fruit traits, and evaluate the exterior properties (fruit skin color, fruit skin texture, fruit odor, fruit firmness and general acceptable) and interior prosperities (flesh color, flesh sweetness, flesh flavor, flesh texture and flesh odor). Sensory evaluation was assessed by the panel taste, using Hedonic Scale. This knowledge about the genetics breeder before and consumer's palate of particular characters is helpful to plant planning in a successful breeding program. The obtained results showed thatthe differences were significant or highly significant among all genotypes (5 parents, 10 hybrids, 10 reciprocals, and ananasmonanasa as a check variety) for all characters of the study. The values of GCA effects for all studied traits in each of the studied parental cultivars showed that L 4$_{\text{Matroh}}$ is the best of all since it showed significant general combining ability in 8 characters. A critical examination of data obtained on specific combining ability (SCA) and reciprocals effects for F1 hybrids showed certain crosses had significant SCA effect ts values for certain traits, but not for all of them. Accordingly these superior and prospective materials can be used in melon improvement through breeding programs. The additive genetic variance values (δ^2A) were larger in magnitude than the dominance variance (δ^2 D) for netting, fruit shape index, TSS, moisture content, β-carotene and total sugars, this finding could be verified by the (A / D ratio) values which was more than one for these characters, indicating that additive gene action played a major role in the inheritance of these characters. sensory scores values of exterior prosperities for 5 parents, 10 hybrids and 10 reciprocals. From data it can be conclude that the differences were significant between all crosses, and most of crosses scored the highest value compared with their parents. The best genotypes according to values of the consumers preferring L1×L5 followed by L3×L5, L1×L2, L2×L4 and L2×L5.

Key words:*Cucumismelo*, general and specific combining ability, gene action, sensory attributes.

Introduction

Melon. *Cucumismelo* L., is one of the most important economic species of family *Cucurbitacea*, fruit are consumed in the summer period and are popular because the pulp of the fruit is very refreshing, high nutritional and sweet with a placenta aroma (Melo *et al*., 2000). To improve quantitative characters information's about the nature of gene action of these traits should be investigated with genetic effects (Fatema*et al.*, 2014). When additive gene action represents the major components of the total genetic variation a maximum progress would be expected in selection program(Hatem*et al.*,1995).

Additive and non-additive genetic effects could be determined from the estimates of combining ability as general (GCA) and specific (SCA). The general combining ability (GCA) of an inbred lines is defined as the average performance of the hybrids which this lines produces with other lines chosen from a random mating population(Akrami *et al*., 2014). The specific combining ability (SCA), on the other hand, refers to a pair of inbred lines involved in a cross, indicates cases in which certain combination do relatively better or worse than would be expected on the basis of the average performance of the two lines involved (Anne *et al*., 2011). In the other words, it is defined as the deviation on the performance of the cross from the expectation on the basis of the average GCA effects of the two lines involved, and the GCA allows the identification of parents with higher frequency of favorable alleles, while the SCA indicates the most promising hybrid combinations (Ferreira *et al*., 2004 and Valério*et al*., 2009). In addition, the diallel scheme helps analyze the nature and magnitude of gene effects that control traits of economic importance.

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Knowledge on the trait inheritance is useful to define the strategy of a breeding program (Feyzian*et al*., 2009). Several studies were conducted on general and specific combining abilities for different characteristics for example,Kamooh (2002),Abd El-Hadi*et al*. (2005), Obiadalla(2006) and El-Mighawry *et al*. (2008) on summer squash andSoliman *et al*., (2008) on water melon and Hatem *et al.* (1995), Abd El-Hadi *et al.* (2006),Feishi *et al*. (2010),Abd-El-Rahman *et al*.,(2011),Anne *et al*., (2011)on melon and Mohammadi *et al*. (2014) on cantaloupe.The diallel scheme helps analyze the nature and magnitude of gene effects that control traits of economic importanceand add that The estimates of GCA and SCA obtained in diallel analysis provide important information for breeding on the potential of parents for intra-population improvement and the utility for inter-population programs as well as use of lines for hybrids (Garcia *et al*., 2012).

Quality of melon fruits is determined by several external and internal features. Sensory attributes are considered of great importance in determining the fruit quality of melon. Flavor and texture of some Egyptian sweet melon cultivars were pleasant and varied among different genotypesRadwan and Hassan (1984). Major changes in texture, odor and flavor in fruits of Charantaise melon compared with five reference cultivars (Guerineau *et al*., 2000). The consumers distinctly preferred the overall eating quality of melon pieces from hybrid fruit compared to those from male and female line fruit, and also the overall eating quality was most highly correlated with flavor acceptability (r=0.88**),(Robert *et al*., 2006). Eating quality was also highly correlated with sensory scores for textural acceptability (r=0.79**), sweetness intensity (r=0.75**) and melon – like flavor intensity (r=0.73**). Sweetness intensity was correlated to flavor intensity (r=0.79**) and flavor acceptability (r=0.8**), so flavor-related characteristics best predict consumer preferences overall eating quality, through textural quality contributes(Aragao *et al*.,2013).

The panelists prefer orange flesh melon compared with any other color and also prefer the selection generations than the original populations(Mohamed *et al*., 2011). Many workers studied fruits of F1 hybrids, among sweet melon cultivars, possessed grater orange color, flesh flavor and aroma than their parents and consumer prefer netted melon than non netted melon(Abak *et al*., 2000; Bonomi *et al*., 2002; Dumavlin and Odet, 2002; Prado *et al*., 2002; Amy *et al*., 2003; Robert *et al*., 2006and Mohamed *et al*., 2011).

Therefore, the objectives of this studywere to investigate the different type of gene action (general and specific combining abilities) by evaluating a diallel cross matting design, to identify the best hybrid combinations and study the gene effect on yield and quality-related traits of melon fruits. and make sensory evaluation for hybrids produced to detect the best hybrids in the investigation and predict the direction of the consumer's palate.

Materials and Methods

The present investigation was carried out during three successive years of the 2011, 2012 and 2013,to study general and specific combining ability and sensory evaluation for 5 parents 10 hybrids 10 reciprocals. The experimental site was the green house and the experimental field of Sabahya Horticulture Research station, Alex, Egypt.

Experimental details:

1- Plant materials

- Line 1 $_{\text{Kos-El-Asal}}$: Originated as a result of planting Koz El-Asal (local cultivar cultivated in Assut governorate) and applied selfing technique for 20 generations.
- Line 2$_{\text{Charantais}}$: Charantaise (European cultivar) pure line.
- Line 3$_{\text{green flesh}}$: Improved line selected from F1 hybrid (Charantaise *one of the landraces cultivated in Matroh governorate), F1 plants was individually selfed for six generations, then only one line was selected and selfed for another fourteen generations until arrived to homogeneity.
- Line 4$_{\text{Matroh}}$: originated after applying the selfing technique on local landraces from Matroh governorate for twenty generations and arrived to homogeneity.
- Line 5$_{\text{primal}}$: originated from the primal F1 hybrid, by selfing program for twenty generations, till the selected individual line arrived to homogeneity.
- Ananasmonanasa (commercial cultivar) as control variety.

2- Genotypes (parents) were planted in the green house at the end of August 2011 in foam plats and transplanted after one month on ridges 80 cm wide and 30 cm between plants. Crossing technique was described as follows:

A day before anthesis fully matured male flower buds of male parents covered by cotton and on the next day this flowers were taken to female emasculated flower and dusted it by pollen grain from this male flower. The pollinated flower were labeled and covered with cotton until complete set.

3- The parents, hybrids, reciprocals and Ananasmonanasa (26 genotypes) were sown in separated experiments for evaluation during two successive summer seasons of 2012 and 2013 in first of March. The experimental design used was randomized complete block design with three replicates (RCBD). Each replicate contained 52 rows, 2 rows for each genotypes, rows were 5m long and 130cm wide approximately. The hills were thinned to one plant each 35 cm a part three weeks later.

All of these lines were provided by "The Project of development of main vegetable crops" Horticulture Research Institute, Agriculture Research Center

RecordedObservations:

Normal agriculture practices used for sweet melon production were done as normal in the area. Data were recorded on 5 plants per plot as follows:-

1- Vegetative measurements
- Plant length (cm): measured from soil surface to the terminal buds of the main stem.
- Branches number: Number of branches at the end of fruit picking.

2- Yield and its components
- Flowering date: Days from planting to the first full flower (Hermaphroditic flower)
- Maturity duration: Days from planting to the first mature fruit.
- Average fruit number/plants.
- Average fruit weight(kg)
- Total yield/plant(kg)

3- Fruit characteristics
- Net weight%: According to the following equation:

$$\frac{\text{Fruit weight} - \text{Placenta weight}}{\text{Fruit weight}} * 100$$

- Flesh thickness%: A ratio between flesh thickness and fruit diameter
- Placenta hardness: was rating from 1to10, 1 denoted the juicy placenta tissues and 10 is the hard placenta.
- Netting degree: was rating from 1 to 10, 1 denoted the extreme smooth fruit skin and 10 the heavily rough fruit.
- Fruit shape index: Determined by dividing fruit length by fruit diameter according to Winger and ludwing (1974).

4- Tss% , Moisture content% and Chemical analysis
- Total soluble solids (TSS)%: Determined using the Zeiss hand refract meter.
- Fruit moisture content: Determined by weighting 100 gm of fruit flesh then chopped and dried at 70 °c for 5 days until constant weight.
- Chemical analysis:

1- Total carotenoids (mg/100gm fresh weight): Determined as B-carotene using the method which described by Nakdiman and Gabelman (1971). using A Milton Roy, Spectrophotometer 601 at 40 nm, using the

2- Vitamin C content (mg/100 ml juice): Determined by titration the 2.6 dichlorophenol, endophenol on fruit juice which described by Jacob (1951).

3- Total sugars (gm/100 ml juice): Determined using the phenol, sulphoric acid method according to the method of Dubis *et al*., (1972).

Sensory evaluation (Taste panel):

Healthy fruit were taken from each genotypes (S0, S1, S2 and check cultivar "Shahd El-Doki") and parents, hybrids, reciprocals and control type "Ananasmonanasa" to evaluate the exterior properties (fruit skin color, fruit skin texture, fruit odor , fruit firmness and general acceptable) and interior prosperities (flesh color, flesh sweetness, flesh flavor, flesh texture and flesh odor). Sensory evaluation was assessed by the panel taste, using Hedonic Scale. Taste panel was scaled from 1 to 10 (1,2 poor; 3,4 fair; 5,6 moderate; 7,8 good; 9,10 very good). The experimental design was Randomized complete design with 20 samples, as well as analysis of variance according to Stell and Torrie (1980). Sensory evaluation was done on the average of two seasons.

Statistical Analysis:

All the collected data were statistically analyzed according the following:

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1- Analysis of variance individual character was done on the basis of the mean values as suggested by Sendecor and Cochran (1980).
2- Combining ability analysis for the F1 hybrid was based on the Griffing (1956) using diallel analysis, which was computed on all crosses, reciprocal and their parents (parents + F_1's + reciprocals = full diallel)

Results and Discussion

Analysis of variance:

Data presented in table (1) showed that there were significant or highly significant differences among genotypes (5 parent, 10 hybrids, 10 reciprocals, and ananasmonanasa as a check variety) in all characters under studied. Mean squares of genotypes were found to be highly significant for all studied traits,this provides evidence for presence of considerable amount of genetic variation among studied genotypes. These results are in harmony with those obtained by El-Shimi *et al.* (2003) and Hatem *et al.* (2009) on melon. All of the studied characters reflected insignificant effects of the genotypes × seasons interaction and seasons, with exception of total sugars which explained significant differences between seasons, this may be revealed that these character was affected by environmental condition.

Table 1: Mean squares and degrees of freedom for the 5 parents, 10 hybrids and 10 reciprocals and ananasmonanasa (Check variety), in all characters under studied of melon over tow summer seasons of 2012 and 2013.

SOV	DF	Vegetative measurements		Yield and its components				
		Plant Length (cm)	Branches Number	Flowering (days)	Maturity duration (days)	Average fruit number / plant	Average fruit weight(kg)	Total yield / plant(kg)
Blocks	2	808.33	0.197	38.042	53.866	0.385	0.0184	0.175
Genotypes	25	12687.8**	0.521*	52.51**	171.28**	0.681**	0.253**	1.505**
Seasons	1	2082.69	0.231	1.907	72.935	0.004	0.0002	0.004
G x S	25	1827.42	0.382	9.613	60.564	0.153	0.0165	0.047
Error	102	1209.59	0.287	24.224	60.287	0.28	0.012	0.101

SOV	DF	Fruit characters					TSS %	Moisture content %	Chemical analysis		
		Net weight %	Flesh thickness %	Placenta hardness (1-10)	Netting (1-10)	Fruit shape index			β-Carotene	Vitamin C	Total sugars
Blocks	2	6.786	10.549	0.518	1.048	0.023	0.212	0.115	0.001	2.238	0.126
Genotypes	25	12.263**	46.411**	2.252**	1.695**	0.189**	5.6**	10.545**	4.626**	14.757**	0.58**
Seasons	1	8.787	0.061	1.256	0.0017	0.028	0.050	1.536	0.086	1.861	0.0148
G x S	25	2.745	17.637	0.568	0.315	0.014	0.730	1.533	0.071	4.057	0.125*
Error	102	4.590	22.173	0.971	0.600	0.016	0.644	1.133	0.077	1.799	0.073

**, ** Significant at 5% and 1% levels of probability, respectively.*
G x S = interaction between genotypes and seasons
β-carotene measured by mg / 100 gm fresh weight, Vitamin C measured by mg / 100 ml juice and Total sugars measured by gm / 100 ml juice.

Combining Ability:

Mean squares of general and specific combining abilities and reciprocals for all studied traits are given in table (2). The results showed that mean squares of general combining ability (GCA) were highly significant in all studied traits with the exception of the branches number, flowering (days) and placenta hardness, these results revealed that good general combining ability and profitable hybrids were present. The mean squares of specific combining ability (SCA) were significant or highly significant in all traits under studied with the exception of branches number and netting. Reciprocals means squares were highly significant in plant length, maturity duration, average fruit number / plant, average fruit weight (kg), total yield / plant, moisture content, β-carotene, vitamin C and total sugars. These results indicated that the GCA, SCA and reciprocals were important in the inheritance of these traits. Thesame trend of these traits were found by Abd El-Rahman *et al*., (2011). However, the magnitudes of SCA were larger than those of GCA for plant length, branches number, flowering, average fruit number / plant, total yield / plant (kg) and placenta hardness, but remain characters, the GCA higher in magnitudes, these results pointed to predominant role for additive variance of these traits. Regarding, results disagreement with those found by Abd El-Hady *et al*., (2005) and in agreement with Obiadalla (2006) in (*Cucurbitapepo* L.), who reported that mean squares of GCA were more important than these of SCA for earliness and average fruit weight.

General Combining Ability Effects:

Values of general combining ability effects (g_i) of each parent for all studied characters presented in table (3). Highly significant positive general combining ability (GCA) effects were observed in the parents, L1 for;

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average fruit weight, fruit shape index, moisture content, vitamin C and β-carotene, L2 for; net weight, netting, TSS, vitamin C and total sugars, L3 for; average fruit number / plant, TSS, β-carotene and total sugars, L4 for; maturity duration, average fruit weight, total yield / plant, flesh thickness %, fruit shape index, moisture content, vitamin C and β-carotene and L5 for; TSS and total sugars.

Table 2: Analysis of variance for general and specific combining abilities and reciprocal effects on the different studied characters of the five parental cultivars and their F'$_1$s and 10 reciprocals F'$_1$s of melon, over tow summer seasons of 2012 and 2013.

SOV	DF	Vegetative measurements		Yield and its components				
		Plant Length (cm)	Branches Number	Flowering (days)	Maturity duration (days)	Average fruit number / plant	Average fruit weight(kg)	Total yield / plant(kg)
GCA	4	580.55**	0.09	4.25	34.97*	0.13*	0.07**	0.08**
SCA	10	3119.78**	0.12	12.76*	26.46*	0.15**	0.05**	0.21**
Reciprocals	10	1533**	0.06	6.41	21.63*	0.08*	0.03**	0.36**
Error	48	212.91	0.06	5.65	10.29	0.4	0.001	0.02

SOV	DF	Fruit characters					TSS %	Moisture content %	Chemical analysis		
		Net weight %	Flesh thickness %	Placenta hardness (1-10)	Netting (1-10)	Fruit shape index			β – carotene	Vitamin c	Total sugars
GCA	4	5.13**	19.47**	0.13	0.93**	0.15**	4.08**	7.46**	3.05**	6.89**	0.35**
SCA	10	1.96*	8.39*	0.52**	0.14	0.01**	0.54**	0.79**	0.56**	2.29**	0.05**
Reciprocals	10	0.82	3.15	0.29	0.18	0.005	0.16	0.62**	0.09**	0.87**	0.06**
Error	48	0.73	3.37	0.18	0.1	0.003	0.09	0.17	0.01	0.16	0.01

**, ** Significant at 5% and 1% levels of probability, respectively.*
β-carotene measured by mg / 100 gm fresh weight, Vitamin C measured by mg / 100 ml juice and Total sugars measured by gm / 100 ml juice.

Table 3: Values of general combining ability (GCA) effects on the different studied characters of five parental cultivars of melon, over tow summer seasons of 2012 and 2013.

Genotypes	Vegetative measurements		Yield and its components				
	Plant Length(cm)	Branches Number	Flowering (days)	Maturity duration(days)	Average fruit number / plant	Average Fruit weight(kg)	Total yield / plant(kg)
L 1	2.8	-0.03	-0.31	-2.67**	-0.05	0.09**	0.04
L 2	-12.58**	0.07	-0.74	1.12	-0.15**	0.01	-0.14**
L 3	6.09	-0.15*	0.25	-0.54	0.13*	-0.09**	-0.03
L 4	-1.48	0.04	0.98	2.29*	-0.02	0.07**	0.11**
L 5	5.17	0.07	-0.19	-0.21	0.09	-0.08**	0.02
C.D. (G_i) 0.05	8.29	0.14	1.35	1.8	0.11	0.02	0.07
C.D (G_i) 0.01	11.06	0.19	1.8	2.43	0.14	0.03	0.09
C.D. (G_i-G_j) 0.05	13.12	0.22	2.14	2.88	0.17	0.03	0.12
C.D.(G_i-G_j) 0.01	17.49	0.29	2.85	3.84	0.23	0.05	0.15

Genotypes	Fruit characters					TSS %	Moisture content %	Chemical analysis		
	Net weight %	Flesh Thickness %	Placenta hardness(1-10)	Netting (1-10)	Fruit shape index			Vitamin C	β-Carotene	Total sugars
L 1	0.48	0.06	-0.14	-0.05	0.16**	-0.18*	0.59**	0.19**	0.58**	-0.09**
L 2	0.74**	0.93	0.15	0.28**	-0.05**	0.52**	-0.82**	0.67**	-0.13	0.19**
L 3	-1.02**	-2.22**	0.003	0.14	-0.01	0.52**	-0.48**	-0.53**	0.57**	0.12**
L 4	0.22	1.4**	-0.79**	-0.5**	0.09**	-1.02**	1.21**	0.27**	0.37**	-0.28**
L 5	-0.43	-0.17	0.06	-0.14	-0.11**	0.17*	-0.51**	-0.61**	-1.39**	0.06*
C.D. (G_i) 0.05	0.49	1.04	0.24	0.18	0.03	0.17	0.23	0.06	0.23	0.06
C.D (G_i) 0.01	0.65	1.39	0.32	0.24	0.04	0.23	0.31	0.08	0.3	0.08
C.D. (G_i-G_j) 0.05	0.77	1.65	0.38	0.28	0.05	0.27	0.37	0.09	0.36	0.09
C.D. (G_i-G_j) 0.01	1.03	2.19	0.5	0.38	0.07	0.36	0.49	0.12	0.48	0.13

**, ** Significant at 5% and 1% levels of probability, respectively.*
C.D. (G_i) = critical differences of (GCA) values. C.D.(G_i – G_j) = Critical differences between two (GCA) values of two parental cultivars

β-carotene measured by mg / 100 gm fresh weight, Vitamin C measured by mg / 100 ml juice and Total sugars measured by gm / 100 ml juice. L1 = Line 1_{Koz-El_Asal}, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal}.

The results indicated that the parents were the best combiner for these traits, and could be utilized in breeding programs to improve previous characters. El-Shimi *et al*., (2003) reported that the parents which gave high significant positive values for GCA, seems better suited for a breeding program concerned with commercial production in musk melon.Highly significant negative general combining ability effects (GCA) were observed in parents, L1 for; maturity duration, TSS, and total sugars, L2 for; plant length, average fruit number / plant, total yield / plant (kg), fruit shape index, moisture content, L3 for; branches number, average fruit weight (kg), net weight, flesh thickness, moisture content % and vitamin C, L4 for; placenta hardness, netting, TSS and total sugars and L5 for; average fruit weight, fruit shape index, moisture content, vitamin C and β-carotene. These results suggested that these parents were the worst combiner for these traits.

Specific Combining Ability Effects:

Values of specific combining ability effects (sij) for the 10F_1 hybrids with reciprocals regarding vegetative characters and yield components presented in Table (4) crosses L1×L2, L1×L4, L2×L5, L3×L5, L4×L5, L3×L1, L3×L2, L4×L3 and L5×L1 have high significant positive values for plant length, these results maintained that these hybrids were good in combinations for this character. On the other hand, high significant negative SCA values were shown by the crosses L4×L1, L5×L1, L5×L3 and L5×L4.These results stated that these crosses were poor for this character. The values of specific combining ability effects (sij) for the tested F_1 hybrids for number of branches per plant revealed that the crosses L1x L2, L1x L4, L1x L5, L2x L3, L2x L4, L3x L4 and reciprocals cross L5x L3 gave high significant positive SCA effect values. This result suggested that this cross was good combiner for number of branches per plant. On the other hand, the cross L3 x L5 possessed high significant negative SCA effect value, indicating that this cross was the poorest hybrid in this respect. Maturity duration character, in case of SCA effects (ŝij) appeared that the two crosses L1x L3, and L1x L2 had high significant negative SCA effect values. This result means that these two F_1 hybrids were good combinations for reducing maturity duration, where the hybrids L1x L3 and L5x L1 where earlier mature compared with the remains hybrids which gave late maturing fruits.

Table 4: Values of specific combining ability (SCA) effects and reciprocal effects on the vegetative measurements and yield components traits, of the 10 F'_1s and their reciprocals F'_1, over the tow summer seasons of 2012 and 2013.

G	Vegetative measurements		Yield and its components				
	Plant Length (cm)	Branches number	Flowering (days)	Maturity duration (days)	Average Fruit number / plant	Average fruit weight (kg)	Total yield /plant (kg)
L1×L2	25.17*	0.04*	-1.84	0.35	0.20	-0.16**	0.05
L1×L3	15.88	0.02	0.67	-5.85*	0.25	-0.15**	0.05
L1×L4	39.78**	0.04*	1.33	-1.02	0.15	-0.08**	0.24*
L1×L5	-0.37	0.34*	-0.36	-0.81	-0.04	-0.01	-0.01
L2×L3	1.44	0.28*	-3.65	-4.03	-0.14	-0.08**	-0.33**
L2×L4	-11.55	0.17*	-2.29	-1.003	0.17	-0.05	0.19
L2×L5	28.19*	-0.03	0.85	0.20	-0.02	-0.01	0.04
L3×L4	-9.03	0.11*	-1.34	0.18	-0.19	0.15**	0.22*
L3×L5	27.46*	-0.15*	1.35	0.86	0.36*	-0.05	0.14
L4×L5	33.97**	0.03	-0.92	-0.17	0.18	0.03	0.33**
L2×L1	-2.42	-0.25	-0.08	-3.75	0.17	-0.09**	-0.2*
L3×L1	25.75*	-0.01	1.31	-3.83	0.17	-0.13**	-0.39**
L4×L1	-31.36**	0.11	-1.03	-4.11	-0.25	0.07**	-0.22*
L5×L1	-23.64*	0.17	1.06	-5.97*	-0.17	0.09**	-0.03
L3×L2	33.03**	0.08	1.44	0.28	-0.001	0.07**	0.15
L4×L2	-19.47	0.06	2.19	2.47	-0.001	0.19**	0.6**
L5×L2	-11.75	-0.06	-3.06	-1.78	0.08	0.09**	0.85**
L4×L3	39.17**	-0.17	1.25	2.89	0.42**	0.17**	0.67**
L5×L3	-38.19**	0.39*	-2.22	-2.72	-0.08	0.05*	-0.14
L5×L4	-29.25**	-0.08	-2.33	1.31	-0.25	0.12**	-0.02
C.D.(S_{ij}) 0.05	23.46	0.04	3.82	5.16	0.31	0.06	0.21
C.D.(S_{ij}) 0.01	31.28	0.54	5.09	6.88	0.41	0.08	0.28
C.D.(S_{ij}-S_{ik}) 0.05	26.23	0.45	4.27	5.77	0.34	0.07	0.23
C.D.(S_{ij}-S_{ik}) 0.01	34.99	0.59	5.69	7.69	0.46	0.09	0.31
C.D.(r_{ij}) 0.05	20.74	0.36	3.38	4.56	0.27	0.05	0.18
C.D.(r_{ij}) 0.01	27.65	0.47	4.51	6.08	0.36	0.07	0.24
C.D.(r_{ij}-r_{ik}) 0.05	29.33	0.5	4.78	6.45	0.38	0.08	0.26
C.D.(r_{ij}-r_{ik}) 0.01	39.1	0.67	6.37	8.59	0.51	0.10	0.34

**, ** Significant at 5% and 1% levels of probability, respectively.*

C.D. (S_{ij}) = critical differences of (SCA) values. C.D.($S_{ij} – S_{ik}$) = Critical differences between two (SCA) values of two parental cultivars. C.D.($r_{ij} – r_{ik}$) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line $1_{Koz\text{-}El\_Asal}$, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal}.

The cross L3 x L5 gave high significant positive SCA effect value with regard to fruit number character. It is obvious that this hybrid was the best hybrids for producing high fruit number. With regard to SCA for average fruit weight /plant, L3 x L4 and the reciprocal crosses L4 x L1, L5 x L1, L3 x L2, L4 x L2, L5 x L2, L4 x L3, L5 x L3 and L5 x L4 had significant positive values for SCA. On the other hand, the cross L1 x L2, L1 x L3, L2 x L3 and reciprocals crosses L2 x L1 and L3 x L1 possessed highly significant negative SCA effect value so, it could be considered the worst crosses regarding this trait. Total fruit yield per plant character, the crosses L1x L4, L3x L4, L4 x L5 and reciprocals L4 x L2, L5 x L2 and L4 x L3 were the best crosses for producing high fruit yield /plant since they revealed highly significant positive SCA effect values. On the other hand, crosses L2x L3 and reciprocals L2x L1, L3x L1 and L4 x L1 showed significant or highly significant negative SCA effects values indicating that these crosses were the poorest crosses for total fruit yield per plant. Similar results were reported byMohammadi *et al.* (2014).

With reference to specific combining ability effects for each of 10 F_1 hybrids with reciprocal for fruit characters are shown in Table (5). The cross L1 x L4 practiced significant positive SCA effect value for flesh thickness character. These results demonstrated that this hybrid was the best hybrid for producing fruits with thicker flesh. In placenta hardness the reciprocal cross L2×L1 gave significant positive SCA effect so, this cross the best combiner for this character, but the worst hybrids was the reciprocals L5×L4 which explained significant negative SCA effects. In netting degree, the reciprocals L4×L3 gave significant positive value for SCA effect so, this cross considered the best combiner in improving these characters. In fruit shape index the reciprocals L4×L3 possessed high significant positive value for SCA effectso, this cross is the best combiner for making the fruit more oblong and negative value explained by cross L3×L4 so, this cross is the best combiner for making the cross more roundish. The same results were found by Shamil (2013).

Table 5: Values of specific combining ability (SCA) effects and reciprocal effects on the fruit characters, of the 10 F'_1s and their reciprocals F'_1, over the tow summer seasons of 2012 and 2013.

G	Fruit characters				
	Net weight %	Flesh thickness %	Placenta hardness (1-10)	Netting (1-10)	Fruit shape index
L1×L2	-0.07	-0.78	-0.49	0.09	0.03
L1×L3	-0.03	-0.09	-0.34	0.25	0.04
L1×L4	1.19	3.36*	0.66	0.05	-0.06
L1×L5	0.48	1.36	0.32	-0.06	0.02
L2×L3	0.08	1.43	-0.19	0.09	0.02
L2×L4	1.19	1.4	0.31	0.03	0.02
L2×L5	0.01	-1.2	0.34	0.13	-0.02
L3×L4	-0.31	-1.75	-0.48	-0.41	-0.16**
L3×L5	1.29	2.23	0.55	0.33	-0.01
L4×L5	-0.45	-0.47	-0.04	-0.19	-0.03
L2×L1	1.04	1.18	0.64*	-0.03	-0.01
L3×L1	-0.09	1.01	0.14	-0.25	-0.05
L4×L1	0.31	-1.89	0.06	-0.53	-0.04
L5×L1	0.11	0.66	-0.36	0.13	0.08*
L3×L2	0.74	-0.66	0.53	0.08	-0.03
L4×L2	0.42	2.09	0.44	0.39	-0.002
L5×L2	-1.04	0.72	-0.06	-0.14	-0.03
L4×L3	-0.32	-0.59	-0.22	0.58*	0.11**
L5×L3	-0.37	-0.25	0.01	0.02	0.02
L5×L4	-0.9	-1.89	-0.61*	0.03	-0.01
C.D.(S_{ij}) 0.05	1.38	2.95	0.68	0.51	0.09
C.D.(S_{ij}) 0.01	1.84	3.93	0.9	0.68	0.12
C.D.(S_{ij}-S_{ik}) 0.05	1.54	3.29	0.76	0.57	0.09
C.D.(S_{ij}-S_{ik}) 0.01	2.05	4.39	1.01	0.76	0.13
C.D.(r_{ij}) 0.05	1.22	2.61	0.59	0.44	0.08
C.D.(r_{ij}) 0.01	1.62	3.48	0.79	0.59	0.11
C.D.(r_{ij}-r_{ik}) 0.05	1.72	3.69	0.85	0.64	0.11
C.D.(r_{ij}-r_{ik}) 0.01	2.29	4.92	1.13	0.85	0.15

**, ** Significant at 5% and 1% levels of probability, respectively.*
C.D. (S_{ij}) = critical differences of (SCA) values. C.D.($S_{ij} – S_{ik}$) = Critical differences between two (SCA) values of two parental cultivars. C.D.($r_{ij} – r_{ik}$) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line $1_{Koz\text{-}El\_Asal}$, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal}.

Values of specific combining ability effects for each of 10 F_1 hybrids with reciprocal for; TSS, flesh thickness and chemical analysis are shown in Table (6). T.S.S. %, only one hybrid of the reciprocal crosses L4x L1 gave high significant negative SCA effect value. These results decleared that this cross were bad combination for produce sweety fruits. Calculated SCA values for the moisture content showed that the crosses L1x L4 and reciprocals L2x L1 were the best combinations, where these two crosses gave highly significant negative SCA effect values. The results showed that these two hybrids gave fruits lower moisture percentages compared with the other studied crosses. On the other hand, the reciprocal crosses L4x L1 and L5x L2 were the worst in this respect, where they exhibit highly significant positive SCA values. Similar results and conclusion were reported by (Fatema *et al.,* 2014).

Concerning to β- carotene indicated that five crosses, L1x L3, L1x L5, L2x L5, L3x L4 and L4x L5, and five reciprocals, L2x L1, L4x L1, L3x L2, L4x L2 and L5x L4 exhibited highly significant positive SCA effect values, suggesting that these ten hybrids were good combinations for high concentration of β- carotene. On the other hand, five hybrids L1x L2, L1x L4, L2x L4, L3x L5 and reciprocal L5x L1 reflected significant or high significant negative SCA effect values. The results cleared that these hybrids the worst combination for high β-carotene concentration. The four crosses L1 x L4, L2x L3, L2x L4, L2 x L5 and L3x L5 and one reciprocals L2x L1 possessed significant and high significant positive SCA effects with vitamin C, indicating that these crosses were good combiner for this character, On the other hand, four hybrids L1x L5, L3x L4, L4x L5 and reciprocal L5x L4 reflected significant or high significant negative SCA affect values. The results divulged that these hybrids were the worst combination for high vitamin C concentration. One reciprocals L2 x L1 possessed significant positive SCA effect with total sugars, indicating that this cross was good combiner for this character. On the other hand, four hybrids L4x L1, L3x L2, L5x L2 and L5x L3 reflected significant or highly significant negative SCA affect values. Therefore, these hybrids were the worst combination for high total sugars concentration. Similar findingswere observed by Akrami *et al.* (2014).

Table 6: Values of specific combining ability (SCA) effects and reciprocal effects on TSS, moisture content and chemical analysis of the 10 F'_1s and their reciprocals F'_1 of five melon cultivars, over the tow summer seasons of 2012 and 2013.

G	TSS %	Moisture content %	Chemical analysis: β-carotene mg / 100 gm fresh weight	Vitamin C mg / 100 ml juice	Total sugars gm / 100 ml juice
L1×L2	0.18	-0.3	-0.19*	-0.44	0.13
L1×L3	0.37	-0.35	0.5**	0.09	-0.03
L1×L4	0.39	-0.81*	-0.34**	0.75*	0.13
L1×L5	-0.01	-0.26	0.37**	-0.67*	0.01
L2×L3	0.16	0.22	0.14	1.5**	-0.01
L2×L4	0.19	-0.43	-0.58**	0.93**	0.04
L2×L5	0.5	-0.31	0.59**	0.28	0.2
L3×L4	-0.72	0.47	0.69**	-1.24**	-0.13
L3×L5	0.41	0.21	-0.65**	0.67*	0.08
L4×L5	-0.38	0.63	0.36**	-1.14**	-0.11
L2×L1	0.4	-0.95**	0.18*	1.73**	0.15*
L3×L1	-0.13	0.06	-0.12	-0.2	-0.08
L4×L1	-0.58**	1.03**	0.16*	0.08	-0.18*
L5×L1	0.3	-0.33	-0.32**	-0.19	0.08
L3×L2	-0.19	0.73*	0.42**	0.39	-0.34**
L4×L2	0.23	-0.03	0.21**	0.53	0.13
L5×L2	-0.001	0.64*	0.06	-0.49	-0.19**
L4×L3	0.1	-0.04	-0.03	0.19	0.01
L5×L3	0.09	0.22	0.02	0.37	-0.21**
L5×L4	-0.28	0.08	0.25**	-0.61*	-0.02
C.D.(S_{ij}) 0.05	0.48	0.66	0.17	0.64	0.17
C.D.(S_{ij}) 0.01	0.64	0.88	0.22	0.85	0.22
C.D.(S_{ij}-S_{ik}) 0.05	0.54	0.74	0.19	0.72	0.19
C.D.(S_{ij}-S_{ik}) 0.01	0.72	0.99	0.25	0.96	0.25
C.D.(r_{ij}) 0.05	0.43	0.59	0.15	0.57	0.15
C.D.(r_{ij}) 0.01	0.57	0.78	0.19	0.76	0.19
C.D.(r_{ij}-r_{ik}) 0.05	0.60	0.83	0.21	0.80	0.21
C.D.(r_{ij}-r_{ik}) 0.01	0.80	1.10	0.28	1.07	0.28

**, ** Significant at 5% and 1% levels of probability, respectively.*
C.D. (S_{ij}) = critical differences of (SCA) values. C.D.(S_{ij} – S_{ik}) = Critical differences between two (SCA) values of two parental cultivars. C.D.(r_{ij} – r_{ik}) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line $1_{Koz\text{-}El\_Asal}$, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal}.

Concerns for crosses might be recommended for producing commercial hybrids seeds or for a promising breeding program to improve melon in Egypt. The estimates of reciprocals effects showed a good amount of differences between direct and reciprocals hybrids. The reciprocals differences may be attributed to maternal effects(Soliman *et al*., 2008). In our study no definite genetic mechanism could be ascribed for such reciprocals differences. It is evident from the foregoing results that the crossesshowing high SCA effects were not always involving the two parents with good GCA effects. In other cases, the high SCA effects were obtained from crosses involving one parent with good GCA effects, these crosses would indicate that selection program could be executed in order to select and develop superior varieties in the advanced segregating generations from promising F1 hybridsObiadalla (2006). However, some of the crosses including parents with high GCA did not exhibit high specific good combination in some traits, it may be due to the lack of genetic diversity of the

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parental lines of the crosses. Similar results were reported by Anne *et al*. (2011) on melon who reported that the best SCA is sometimes obtained in crosses between parents with good and poor or moderate GCA.
As for the Components of genetic variance, ratio between additive and dominance variance (A / D ratio), and ratio between general and specific combining ability variance (δ^2gca / δ^2sca) of all melon characters under studied presented in table (7). The additive genetic variance values (δ^2A) were larger in magnitude than the dominance variance (δ^2 D) for netting, fruit shape index, TSS, moisture content, β-carotene and total sugars, this finding could be verified by the (A / D ratio) values which was more than one for these characters, indicating that additive gene action played a major role in the inheritance of these characters. The same results were found by Chandrashekera (2006) who found the additive variance value higher in magnitude than dominance variance for moisture content character. Regarding A / D ratio total sugars explained the higher values followed by netting and fruit shape index. The highest values of δ^2gca / δ^2sca were in netting followed by fruit shape index and moisture content.

Table 7: Components of genetic variance, ratio between additive and dominance variance (A / D ratio), and ratio between general and specific combining ability variance (δ^2gca / δ^2sca) of all melon characters under study, over the tow summer seasons of 2012 and 2013.

Traits	δ^2 additive	δ^2 dominant	A / D ratio	δ^2gca / δ^2sca
Plant length(cm)	480	1730.28	0.28	0.14
Branches number	0.01	0.03	0.19	0.09
Flowering (days)	1.63	4.2	0.39	0.19
Maturity duration (days)	1.86	9.63	0.19	0.09
Average Fruit number / plant	0.003	0.07	0.05	0.03
Average fruit weight (kg)	0.0055	0.0262	0.21	0.1
Total yield / plant (kg)	0.0244	0.118	0.21	0.1
Net weight %	0.64	0.73	0.88	0.44
Flesh thickness %	2.26	2.99	0.76	0.38
Placenta hardness (1-10)	0.07	0.2	0.36	0.18
Netting (1-10)	0.16	0.03	6.01	3.01
Fruit shape index	0.03	0.01	4.27	2.14
TSS%	0.71	0.27	2.65	1.32
Moisture content%	1.34	0.37	3.63	1.8
β-carotene (mg / 100 gm fresh weight)	0.5	0.33	1.53	0.76
Vitamin C (mg / 100 ml juice)	0.94	1.27	0.74	0.37
Total sugars (gm / 100 ml juice)	0.06	0.02	9.95	1.47

Sensory Attributes:

Sensory attributes are considered of a great impotence in determining the fruit quality of melon (Abd-El-Sayyed *et al*., 2003).Sweetness, aroma volatiles and carotenoids were importance sensory parameters in melon (Bernadac *et al*., 2003). Table (8) showed Mean sensory scores values of; exterior prosperities for 5 parents, 10 hybrids and 10 reciprocals.

Respecting, it can be observed that the differences were significant between all crosses, and most of crosses scored the highest value compared with their parents. Best genotypes in consumers preferring for exterior properties were L2×L3, L1×L2, L2×L1, L1 and L1×L5 and L3×L5 for fruit skin color, fruit skin texture, fruit odor, fruit firmness and general acceptability, respectively. The mean sensory analysis for interior properties presented in table (9) from values it can be mentioned that the hybrid scored the highest values in most characters, the best genotypes in interior characters were L4×L5, L1×L2, L1×L4, L2×L1, L2×L5 in flesh color, flesh sweetness, flesh firmness, flesh texture, flesh odor respectively. Macroscopically,it can be observed that the consumers prefer the hybrids than their parents. Mean performance for most quality characters confirmed these results. Pertaining the results could be refer to the effect of the hybridization on improving the quality characters, the results are in agreement with that obtained by Robert *et al*.(2006) who found that the consumers distinctly preferred the overall eating quality of melon pieces from hybrids fruit compared with those from male or female line fruit. The best genotypes according to values of the consumers preferring L1×L5 followed by L3×L5, L1×L2, L2×L4, L2×L5 the special features for these 5 genotypes presented in table (10).

Table 8: Mean sensory scores values of; exterior prosperities of 5 parents, 10 hybrids and 10 reciprocals under studies of melon over two seasons (early and late summer seasons2012 and 2013).

G	Exterior prosperities				
	Fruit skin color	Fruit skin texture	Fruitodor	Fruit firmness	General acceptability
L1	7.25j	7.6_{i}	9.35_{a}	9.5_{a}	8.55_{cdef}
L2	8.3_{defgh}	9.2_{abc}	9.4_{a}	7.7_{ijkl}	8.55_{cdef}
L3	7.65_{hij}	8.85_{bcdef}	7.25_{fg}	7.85_{ghijkl}	8.7_{bcde}
L4	9.05_{abc}	8.35_{efghi}	9.45_{a}	$8.55_{bcdefgh}$	7.55_{hi}
L5	7.85_{ghij}	8.15_{ghij}	7_{g}	7.2_{l}	7.85_{ghi}
L1×L2	8_{fgh}	9.55_{a}	8.95_{abc}	9.15_{abc}	9.3_{ab}
L1×L3	9.2_{ab}	9.4_{ab}	7.3_{fg}	7.45_{jkl}	8.85_{bcde}
L1×L4	7.3_{ij}	8.3_{fghi}	9.35_{a}	9_{abcde}	9.05_{abcd}
L1×L5	9.15_{ab}	8.85_{bcdef}	9.15_{abc}	9.3_{ab}	9.6_{a}
L2×L3	9.3_{a}	9.15_{abcd}	8.95_{abc}	$8.45_{cdefghi}$	7.35_{ij}
L2×L4	8.45_{cdefg}	9.35_{ab}	9.3_{ab}	7.1_{l}	9.65_{a}
L2×L5	8.2_{efgh}	9.4_{ab}	9.1_{abc}	8_{ghijk}	8.75_{bcde}
L3×L4	8_{fgh}	8.15_{ghij}	7.7_{ef}	8.8_{abcdef}	6.9_{j}
L3×L5	9.2_{ab}	9.25_{abc}	7.8_{ef}	9.1_{abcd}	9.6_{a}
L4×L5	8.15_{efgh}	8.85_{bcdef}	6.35_{h}	7.5_{jkl}	7.75_{ghi}
L2×L1	8.7_{abcde}	8.95_{abcde}	9.55_{a}	8.35_{defghi}	7.85_{ghi}
L3×L1	8.3_{defgh}	8.7_{cdefg}	8.25_{de}	7.8_{ijkl}	7.6_{hi}
L4×L1	8.2_{efgh}	9.25_{abc}	8.6_{cd}	8_{ghijk}	7.95_{fghi}
L5×L1	8.35_{defg}	8.2_{ghij}	8.7_{bcd}	7.75_{ijkl}	8.6_{bcdef}
L3×L2	8.55_{bcdef}	9.35_{ab}	7.5_{fg}	8.6_{bcdefg}	8.35_{defg}
L4×L2	7.8_{ghij}	8.05_{hij}	9.4_{a}	8.2_{fghij}	9.1_{abc}
L5×L2	8.9_{abcd}	9.5_{ab}	9.1_{abc}	7.4_{kl}	8.2_{efgh}
L4×L3	8.15_{efgh}	7.85_{ij}	7.6_{fg}	8.8_{abcdef}	7.5_{ij}
L5×L3	8.25_{defgh}	9.2_{abc}	8.55_{cd}	9.1_{abcd}	8.9_{bcde}
L5×L4	7.9_{fghi}	8.55_{defgh}	8.3_{de}	8.3_{efghi}	8.7_{bcde}
Control	9.15_{ab}	8.4_{efghi}	8.3_{de}	$8.55_{bcdefgh}$	9.15_{abc}

Means with the same alphabetical litter in the column are not significantly different from each other using Duncan's Multiple Range Test at 5% probability.

G = genotypes. L1 = Line $1_{Koz\text{-}El\_Asal}$, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal} and Control = Shahd El0Doki (check cultivar).

Table 9: Mean sensory scores values of; interior prosperities of 5 parents, 10 hybrids and 10 reciprocals under studies of melon over two seasons (early and late summer seasons 2012 and 2013).

G	Interior prosperities				
	Flesh color	Flesh sweetness	Flesh firmness	Flesh texture	Flesh odor
L1	8.15_{gh}	8_{ij}	9.25_{abc}	8.75_{abcde}	9.3_{ab}
L2	7.55_{i}	9.15_{bcdef}	9.35_{abc}	9.3_{abc}	9.45_{a}
L3	9_{abcdef}	9.1_{bcdef}	7.95_{fgh}	9_{abcd}	8_{fg}
L4	9.55_{ab}	8.05_{ij}	9.4_{abc}	9_{abcd}	9.3_{ab}
L5	8.65_{efg}	8.8_{efgh}	7.55_{ghi}	7.5_{g}	7.25_{hi}
L1×L2	9.4_{abcd}	9.7_{ab}	8.8_{bcde}	8.45_{def}	8.9_{abcde}
L1×L3	9.25_{abcde}	8.55_{fghi}	7.65_{ghi}	9_{abcd}	7.85_{fgh}
L1×L4	9.4_{abcd}	8.4_{ghij}	9.65_{a}	9.35_{ab}	9.15_{abcd}
L1×L5	9.5_{abc}	9.85_{a}	9.55_{a}	9_{abcd}	8.55_{bcdef}
L2×L3	9.65_{a}	9.15_{bcdef}	9.05_{abcd}	8.9_{abcd}	8.85_{abcde}
L2×L4	9.1_{abcdef}	9.15_{bcdef}	9.45_{ab}	9.3_{abc}	9.25_{abc}
L2×L5	9.45_{abcd}	9.3_{abcde}	8.8_{bcde}	8.6_{cdef}	9.4_{a}
L3×L4	9.4_{abcd}	8.9_{defgh}	9_{abcd}	8_{fg}	8.05_{fg}
L3×L5	9.4_{abcd}	9.25_{abcde}	8.95_{abcd}	8.85_{abcd}	9.3_{ab}
L4×L5	9.85_{bcdef}	7.8_{j}	7.25_{i}	8.65_{bcdef}	8.1_{fg}
L2×L1	7.2_{i}	8.45_{ghij}	8.45_{def}	9.45_{a}	9_{abcd}
L3×L1	8.55_{fg}	8.25_{hij}	7.5_{hi}	7.6_{g}	8.5_{cdef}
L4×L1	8.45_{fg}	8.05_{ij}	8.2_{efg}	7.6_{g}	8.9_{abcde}
L5×L1	$8.8d_{ef}$	8.35_{ghij}	7.9_{fghi}	8.8_{abcde}	7.55_{ghi}
L3×L2	7.25_{i}	9.5_{abcd}	8.4_{def}	8.1_{efg}	8.95_{abcd}
L4×L2	9.1_{abcdef}	8.1_{ij}	9.3_{abc}	8.85_{abcd}	8.9_{abcde}
L5×L2	7.7_{hi}	9.55_{abc}	7.75_{bcde}	8.7_{bcdef}	8.2_{efg}
L4×L3	7.15_{i}	8.8_{efgh}	9.05_{abcd}	8.5_{def}	8.45_{def}
L5×L3	8.85_{cdef}	9.55_{abc}	8.8_{bcde}	8.6_{def}	7.15_{i}
L5×L4	8.7_{efg}	9_{cdefg}	8.4_{def}	8.1_{efg}	7.95_{fg}
Control	8.55_{fg}	8.85_{defgh}	8.7_{cde}	8.9_{abcd}	9.25_{abc}

Means with the same alphabetical litter in the column are not significantly different from each other using Duncan's Multiple Range Test at 5% probability.

G = genotypes. L1 = Line $1_{Koz\text{-}El\_Asal}$, L2 = Line $2_{Charantais}$, L3 = Line $3_{Green\ flesh}$, L4 = Line 4_{Matroh}, L5 = Line 5_{Primal} and Control = Shahd El0Doki (check cultivar).

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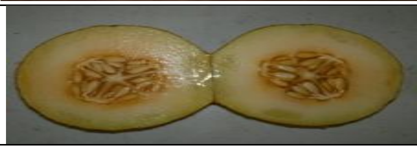
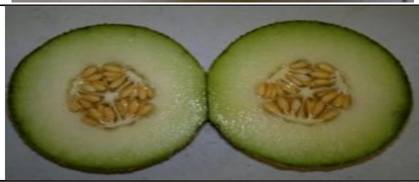
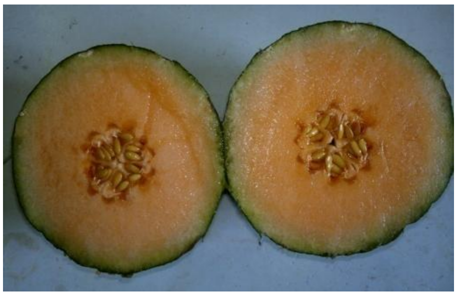
Table (10): Special features of the best crosses in hybridization experiment.

Genotypes	Characterization	Pictures
L1×L5	Have moderate vegetative growth and High yield production, was 3.033 kg / plant. Fruit skin has green copperish color with high netted, and the fruit shape was oval. Days to maturity: 70.67 days (very early yielding). Average fruit weight and number were 1.070 kg and 3.033 fruits / plant respectively. The flesh color was light orange and the placenta hardness was very hard, and moderate placenta diameter, sweetness was very good 12.83 TSS%, with good flavor.	 
L3×L5	Have moderate vegetative growth and high yield production, was 3.008 kg / plant. Fruit skin has yellow green color with high netted, and the fruit shape was roundish. Days to maturity: 77.72 days (very early yielding). Average fruit weight and number were 0.813 kg and 3.83 fruits / plant respectively. The flesh color was green and the placenta hardness was very hard, and moderateplacenta diameter, sweetness was very good 13.73.	 
L1×L2	Have moderate vegetative growth and moderate yield production 2.776 kg / plant. Fruit skin has yellow white color with high netted, and the fruit shape was oblong. Days to maturity: 75.39 days. Average fruit weight and number were 0.826 kg and 3.5 fruits / plant respectively. The flesh color was dark orange and the placenta hardness was very hard, sweetness was very good 13.47 TSS%, with good soft flavor.	 

L2×L4	Have moderate vegetative growth and High yield production, was 3.786 kg / plant Fruit skin has green yellow color with high netted, and the fruit shape was oblong. Days to maturity: 85.22 days. Average fruit weight and number were 1.217 kg and 3.33 fruits / plant respectively. The flesh color was dark orange and the placenta hardness was very hard, and very small placenta diameter, sweetness was very good 13.73 TSS%, with good flavor.	 
Genotypes	Characterization	Pictures
L2×L5	Have moderate vegetative growth and High yield production, was 3.800 kg / plant. Fruit skin has green yellow color with high netted, and the fruit shape was roundish. Days to maturity: 79.67 days (early yielding). Average fruit weight and number were 0.993 kg and 3..33 fruits / plant respectively. The flesh color was orange and the placenta hardness was very hard, and moderate placenta diameter, sweetness was very good 13.73 TSS%, with good flavor.	 

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