

**CHAPTER 4**  
**RESULTS AND DISCUSSION**

## 4.1 The first experiment (Selfing and selection)

### 4.1.1 Selection index values

Data presented in Table (4. 1) showed the mean performances for lines which selected to get the first selection generation, the individuals "lines" of each population were arranged descendingly in the order to the selection index value. In line 1<sub>orange flesh</sub>, values of the different characters ranged from 6.5 to 9.5 in netting, 6.5 to 8 in placenta hardness, 51.5% to 58% in flesh thickness, 92.5 to 94 in net weight and 9.5 to 12.5 in T.S.S. The name of strains which selected in this genotypes were (3, 20, 30, 45 and 32) and selection index values ranged from 363.88 to 367.47. In line 2<sub>Sandafa</sub> characters ranged from 6.5 to 7 for netting, 7 to 8.5 in placenta hardness, 52.5% to 57% in flesh thickness, 92.6% to 94.4% in net weight and 7 to 9.5 in TSS. The name of Strains which selected in this genotypes were (4, 13, 20, 42 and 3) and selection index values ranged from 348.75 to 454.38.

Table (4. 2) showed the mean performances for lines which selected to get the second selection generation, the individual lines of each population were arranged descendingly in the order to the selection index value. In line 1<sub>Orange flesh</sub> values of the different characters ranged from 9 to 10 for netting, 5.8 to 10 for placenta hardness, 55% to 61% for flesh thickness, 93.5% to 95.5% in net weight and 9.1 to 13.9 for T.S.S. The name of strains which selected for this genotypes was (17, 14, 32, 1 and 26) and selection index values ranged from 196.46 to 181.23. In line 2<sub>Sandafa</sub> values of different characters ranged from 6 to 7.5 for netting, 6 to 8.5 for placenta hardness, 56% to 59.5% for net weight and 7.1 to 9.5 for T.S.S. The name of strains which selected in this genotypes were (1, 22, 12, 49 and 8) and selection index values ranged from 112.44 to 119.04.

From these results we can conclude that the mass selection and selection index method could be useful in improving all studied characters which selected rely on it, because most of characters became higher in magnitude in second selection generation. The same trend of these results was discussed by El-Adl *et al.* (1991), Abd-El-Salam and Marie (2002), El-Shimi *et al.* (2003) and Antonio (2004) stated that the self-pollination with selection will be useful in improving of the important quality traits. Similar results were found by Muhammad and Sayd, (2010) who reported that the high values of selection index mean that these genotypes had strong correlation between genetic worth and phenotypic performances as explained by smith (1936). The later author, also, found that the several cycles of inbreeding using mass selection and selection index method, reduced the variability among individuals. Generally, the data prove that all studied traits could be improved through mass selection method and selection index, but with different degrees depending upon the amount of variation present in each population.

**Table (4. 1) Mean performance for selected genotypes, to obtain the first selection generations of 5 traits which selection rely on it, and selection index values for this genotypes, of two lines under study, (autumnal season of 2011).**

Line 1 <sub>Orange flesh</sub>						
Genotypes number	Netting (1-10)	Placenta hardness (1-10)	Flesh thickness%	Net weight%	TSS	Selection index values
3	8.5	6.5	56.5	92.5	12.1	367.47
20	9.5	7.5	51.5	93.5	12.5	366.28
30	9.5	7	54.5	94	9.5	366.21
45	6.5	8	57.5	94	11.1	364.45
32	8.5	8	58	92.5	11.9	363.88
Line 2 <sub>Sandafa</sub>						
4	6.5	7.5	54	92.615	9.5	454.38
13	7	8.5	57	94.4	9.5	434.28
20	6.5	7	56	93.5	7.6	394
42	6.5	8	54	93.43	7	373.33
3	6	7.5	52.5	92.745	7.5	348.75

**Table (4. 2) Mean performance for selected genotypes to obtain the second selection generation of 5 traits which selection rely on it, and selection index values for this genotypes, of two lines under study, (summer season of 2012).**

Line 1 <sub>Orange flesh</sub>						
Genotypes number	Netting (1-10)	Placenta hardness (1-10)	Flesh thickness%	Net weight%	TSS	Selection index values
17	10	10	59	94.5	13	196.46
14	10	9.5	60.5	94	12.7	187.27
32	9	8.5	61	93.5	9.1	183.21
1	10	9.5	55	95.5	13.9	182.72
26	10	9	57.5	94	12.6	181.23
Line 2 <sub>Sandafa</sub>						
1	7.5	6	58.5	94.31	9	119.04
22	7	8.5	56	92.865	8.5	115.05
12	6.5	7	59.5	93.735	9.5	113.93
49	6	8	56.5	92.47	7.1	112.71
8	5.5	6.5	59	91.025	9	112.44

## **4.1.2 Analysis of variance of evaluation experiments for selection generations (S0, S1, S2 and shahd el-doki as a check cultivar)**

### **4.1.2.1 Vegetative measurements, yield and its components**

Data presented in Table (4. 3) showed that there were significant differences between genotypes in plant length, flowering (days), maturity duration (days) and total yield in two lines under studied. But significant differences among selection genotypes were in average fruit weight for line 1<sub>Orange flesh</sub> only. Significant differences among selection generations were in average fruit number and branches number of line 2<sub>Sandafa</sub>. The significant differences between seasons were in maturity duration character. This may be indicated that this trait was affected by environmental conditions. Same results was reported by Abd El-Rahman *et al.* (2011) and Ibrahim (2012) who stated that the insignificant effects of seasons on the traits indicated that selection may be effective on it.

Mean performances, showed in Table (4. 5) that plant length, flowering (days), maturity duration, average fruit weight decreased by inbreeding, this may reveal that these traits affected by inbreeding depression which occurred from one generation to another. These results were in agreement with those found by El-Mahdy (1989), Helmy (1993), Antonio (2004) on summer squash, El-Gazar *et al.*, (1991) on carrot, E-Shimi (2003) on melon and Fatema *et al.* (2014) on snakegourd, stated that the reduction in plant length may relate to the inbreeding depression which happened by inbreeding. Control cultivar (shahd El-Doki) scores the highest values for plant length, branches number, average fruit number, average fruit weight and total yield / plant compared with the two lines under studied

Range values decreased in second selection generation and control cultivar (shahd el-doki) for most vegetative measurements and yield component characters. This may reveal that the second selection generation and the check cultivar were more homogeneous than original population and the first selection generation. These results are in parallel with those found by Olaniyi *et al.*, (2011) who reported that the inbreeding program and mass selection make the population more homogenous from generation to another. El-Adl *et al.* (1991) stated that the continues selection, mean performance of the studied traits were changed every cycle and reached a certain degree of uniformity with less amount of variation due to inbreeding.

### **4.1.2.2 Fruit characters**

Data presented in Table (4. 4) showed that the significant or highly significant differences between genotypes were in netting and fruit shape index in line 1<sub>Orange flesh</sub>. All fruit characters showed significant differences among genotypes with the exception of flesh thickness %, in line 2<sub>Sandafa</sub>. Mean performance, values presented in Table (4.6) showed increases magnitude in the second selection generation S<sub>2</sub> and control cultivar (shahd Eldoki) for all fruit characters in two lines under studied. Range values were decreased in second selection generation and control cultivar (shahd el-doki) for all fruit characters; these may be due to inbreeding and selection which as a main reason to the homogeneity within lines.

### **4.1.2.3 TSS, moisture content and chemical analysis.**

From data presented in Table (4. 4) for line 1<sub>Orange flesh</sub> highly significant differences showed among genotypes in total sugars. In line 2<sub>Sandafa</sub> the highly significant differences

among genotypes were in TSS%, moisture content%,  $\beta$ -carotene and total sugars. Mean performance presented in Table (4. 7) showed that the TSS%,  $\beta$ -carotene content and total sugars were increased in the second selection generation  $S_2$  and control cultivar (shahd el-doki) compared with original population. On the other hand, rang values decreased in second selection generation  $S_2$  and control cultivar (shahd el-doki) this may be due to the homogeneity in this genotypes became more than that of original population. Also moisture content% decreased in second selection generation This may be a reason for selection to the hard placenta and high netting, the same results stated by Ibrahim and Ramadan., (2013) who found highly significant negative correlation among moisture content% with each of; netting degree and placenta hardness and they added that the selection for high netting and hard placenta have a great effect in decreases the moisture content.

All of the studied characters reflected insignificant effects of the genotypes X seasons interaction, with exception of maturity duration in line 1<sub>Orange flesh</sub>. Such a result, generally, suggested that the evaluated population (genotypes) showed the similar responses when grown under different environments. In this respect, Kulture *et al.* (2001) reported that the environmental conditions and the genotype X environment interaction may have dramatic effects on most melon characters. Abd-El-Salam and Marie (2002) revealed that the fruit dray matter, fruit length and fruit thickness were not affected by the environmental conditions.

It could be concluded from Tables (4. 6) and (4. 7) that the data of mean performances of the five characters which selection rely on them, that they recorded such increments after two cycle of inbreeding and selection were 1.08% and 3.19%; 3.39% and 5.26%; 22.22% and 25%; 28% and 29%; 10% and 21% for net weight, flesh thickness, placenta hardness, netting and TSS of line 1<sub>Orange flesh</sub> and line 2<sub>Sandafa</sub>, respectively, relative to that of their two original populations. These results are, generally, in agreement with those obtained by Abd-El-Salam and Marie (2002) on Ismaellawy sweet melon, and Priva *et al.* (2006) and Rasoul *et al.* (2014) on melon who demonstrated that selection cycles possessed differences in flesh color, total soluble solids (TSS),  $\beta$ -carotene and flesh firmness among the selective generation cycle and the control.

**Table 4. 3 Mean squares and degrees of freedom for original population (So), selection generations (S1 and S2) and Shahd-El-Doki (check cultivar) of two lines under study, of vegetative characters and yield components, over two seasons of the studied, (early and late summer seasons of 2012).**

		Line 1 <sub>Orange flesh</sub>						
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	560.67	0.62	0.09	2.2	0.15	0.01	0.03
Genotypes	3	1056.83**	0.25	61.48**	170.51**	0.26	0.31**	2.91**
Seasons	1	1.19	0.005	0.41	129.12*	0.03	0.003	0.002
G x S	3	66.6	0.5	1.4	73.55	0.02	0.01	0.09
Error	14	172.87	0.39	3.08	24.65	0.4	0.01	0.04
		Line 2 <sub>Sandafa</sub>						
Blocks	2	989.04	0.5	1.64	5.38	0.12	0.01	0.12
Genotypes	3	2332.61**	1.06*	114.35**	349.15**	0.6*	0.01	2.84**
Seasons	1	1.5	0.17	0.01	2.04	0.02	0.002	0.34
G x S	3	34.83	0.17	0.45	13.38	0.06	0.007	0.43
Error	14	283.99	0.26	0.99	19.09	0.13	0.05	0.23

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

G x S = interaction between genotypes and seasons

**Table 4. 4 Mean squares and degrees of freedom for original population (So), selection generations (S1 and S2) and Shahd-El-Doki (check cultivar) of two lines under studied, in fruit characteristics, moisture contents, TSS and chemical analysis over two seasons of the study, (early and late summer seasons of 2012).**

		Line 1 <sub>Orange flesh</sub>									
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	0.65	69.02**	1.45	1.2	0.01	2.37	2.37	0.3	1.07	0.12
Genotypes	3	1.12	12.36	4.65	8.11**	0.39**	2.91	2.91	0.51	3.41	1.61**
Seasons	1	0.05	0.21	0.67	3.63*	0.001	1.5	1.5	0.07	0.02	0.26
G x S	3	0.26	0.36	1.05	1.89	0.005	0.74	0.74	0.13	0.26	0.82
Error	14	2.5	6.87	1.53	0.69	0.03	2.8	2.8	0.28	1.51	0.13
		Line 2 <sub>Sandafa</sub>									
Blocks	2	0.71	61.08	1.63	0.79	0.01	1.55	1.55	0.04	1.65	0.35
Genotypes	3	11.21**	48.003	2.94*	6.71**	0.1*	50.87**	50.87**	4.56**	2.82	11.1*
Seasons	1	1.6	0.08	1.5	0.04	0.002	0.02	0.02	0.04	0.16	0.48
G x S	3	0.11	5.25	0.06	0.6	0.01	0.19	0.19	0.001	2.5	0.22
Error	14	1.45	19.13	0.63	1.17	0.03	0.7	0.7	0.05	2.57	0.24

\*, \*\* 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 (4. 5) Mean performances and ranges for original population (So), selection generations (S1 and S2) and Shahd-El-Doki (check cultivar) of two lines under study, of vegetative characters and yield components, over two seasons of the studied, (early and late summer seasons of 2012).**

		Line 1 <sub>Orange flesh</sub>													
		Vegetative measurements				Yield and its components									
G	Plant length(cm)		Branches number		Flowering (days)		Maturity duration (days)		Average Fruit number / plant		Average fruit weight (kg)		Total yield /plant (kg)		
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	
So	188 <sub>a</sub>	175-210	3.06 <sub>a</sub>	2-4	41 <sub>a</sub>	38-42	78 <sub>a</sub>	71-85	2.89 <sub>a</sub>	2-4	0.90 <sub>b</sub>	0.63-1.00	2.30 <sub>c</sub>	1.95-2.57	
S1	171 <sub>b</sub>	150-198	3.33 <sub>a</sub>	2-4	39 <sub>ab</sub>	37-42	69 <sub>bc</sub>	60-84	3.28 <sub>a</sub>	2.7-4	0.77 <sub>b</sub>	0.63-0.92	2.57 <sub>b</sub>	2.31-3.07	
S2	162 <sub>b</sub>	149-191	3.56 <sub>a</sub>	3-4	38 <sub>b</sub>	36-39	66 <sub>1c</sub>	58-64	3.33 <sub>a</sub>	3-4	0.77 <sub>b</sub>	0.67-0.93	3.13 <sub>c</sub>	1.86-2.27	
Control	188 <sub>b</sub>	185-192	3.33 <sub>a</sub>	3-4	33 <sub>c</sub>	32-35	74 <sub>ab</sub>	70-77	3.03 <sub>a</sub>	3-3.2	1.26 <sub>a</sub>	1.19-1.30	3.68 <sub>a</sub>	3.59-3.72	
		Line 2 <sub>Sandafa</sub>													
So	228 <sub>a</sub>	204-254	2.33 <sub>b</sub>	2-3	44 <sub>a</sub>	43-45	92 <sub>a</sub>	91-94	2.83 <sub>a</sub>	2-3	1.22 <sub>a</sub>	1.01-1.55	3.1 <sub>a</sub>	2.23-4.230	
S1	232 <sub>a</sub>	207-254	2.67 <sub>b</sub>	2-3	42 <sub>b</sub>	40-43	86 <sub>b</sub>	80-92	2.33 <sub>b</sub>	2-3	1.19 <sub>a</sub>	0.84-1.60	2.27 <sub>b</sub>	1.60-3.00	
S2	214 <sub>a</sub>	191-250	2.67 <sub>b</sub>	2-3	40 <sub>c</sub>	39-41	85 <sub>b</sub>	80-90	2.97 <sub>a</sub>	2.8-3	1.16 <sub>a</sub>	0.9-1.35	3.23 <sub>b</sub>	1.75-3.59	
Control	188 <sub>b</sub>	185-192	3.33 <sub>a</sub>	3-4	33 <sub>d</sub>	32-35	74 <sub>c</sub>	70-77	3.03 <sub>a</sub>	3-3.2	1.26 <sub>a</sub>	1.19-1.30	3.65 <sub>a</sub>	3.51-3.72	

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

Control = Shahd El-Doki (check cultivar).

**Table (4. 6) Mean performances and ranges for original population (So), selection generations (S1 and S2) and Shahd-El-Doki (check cultivar) of two lines under study, of fruit characteristics over two seasons of the studied, (early and late summer seasons of 2012).**

Line 1 <sub>Orange flesh</sub>										
Fruit characters										
G	Net weight %		Flesh thickness %		Placenta hardness (1-10)		Netting (1-10)		Fruit shape index	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
So	92 <sub>a</sub>	90-95	57 <sub>a</sub>	50-62	7 <sub>b</sub>	6-9	7 <sub>b</sub>	5-9	1.14 <sub>b</sub>	0.9-1.24
S1	93 <sub>a</sub>	92-94	58 <sub>a</sub>	53-62	9 <sub>a</sub>	7-10	8 <sub>b</sub>	7-9	1.01 <sub>b</sub>	0.8-1.21
S2	93 <sub>a</sub>	92-94	59 <sub>a</sub>	56-62	9 <sub>a</sub>	7-10	9.7 <sub>a</sub>	9-10	0.97 <sub>b</sub>	0.73-1.1
Control	92 <sub>a</sub>	92-93	60 <sub>a</sub>	60-61	8 <sub>ab</sub>	7-8	8 <sub>b</sub>	7-8	1.53 <sub>a</sub>	1.46-1.62
Line 2 <sub>Sandafa</sub>										
So	91 <sub>c</sub>	90-91	54 <sub>b</sub>	45-61	6 <sub>b</sub>	5-8	5 <sub>b</sub>	4-7	1.62 <sub>a</sub>	1.45-1.8
S1	93 <sub>ab</sub>	91-95	56 <sub>ab</sub>	48-61	7 <sub>ab</sub>	6-8	7 <sub>a</sub>	6-9	1.48 <sub>ab</sub>	1.26-1.7
S2	94 <sub>a</sub>	93-95	57 <sub>ab</sub>	49-61	8 <sub>a</sub>	7-9	7 <sub>a</sub>	5-8	1.31 <sub>b</sub>	1.12-1.51
Control	92 <sub>b</sub>	92-93	60 <sub>a</sub>	60-61	8 <sub>a</sub>	7-8	8 <sub>a</sub>	7-8	1.53 <sub>a</sub>	1.46-1.62

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

Control = Shahd ElDoki (check cultivar)

**Table (4. 7) Mean performance and ranges for original population (So), selection generations (S1 and S2) and Shahd-El-Doki (check cultivar) for two lines under study, of TSS, Moisture content and chemical analysis traits over two seasons of the studied, (early and late summer seasons 2012).**

G	Line 1 <sub>Orange flesh</sub>									
	TSS%		Moisture content%		Chemical analysis					
					β-carotene		Vitamin C		Total sugars	
	Mean	Range	Mean	Range	mg / 100 gm fresh weight		mg / 100 ml juice		mg / 100 ml juice	
So	11.70a	9.0-14.0	93b	92-95	2.59a	2.16-3.14	23.61b	21.67-25.22	6.71b	6.35-7.23
S1	11.60a	9.8-14.2	92b	91-93	2.97a	2.42-3.51	24.22a	22.73-25.67	6.67b	6.13-7.54
S2	12.99a	11-14.6	92b	91.6-91	2.83a	1.46-3.44	22.45b	21.42-24.12	7.48a	7.11-7.88
Control	12.63a	12.2-12.8	95a	94-95	2.30a	1.93-2.75	23.79ab	23.32-24.32	7.67a	7.2-7.89
Line 2 <sub>Sandafa</sub>										
So	6.13c	5-7	95a	93-97	0.5b	0.34-0.67	23.18a	20.47-25.41	4.84bc	4.05-5.87
S1	6.97bc	5-8	94ab	93-96	0.49b	0.26-0.83	24.01a	22.18-26.12	4.77c	4.30-5.73
S2	7.83b	7-12.8	94b	92-95	0.73b	0.46-0.88	22.48a	20.67-24.59	5.44b	5.22-7.62
Control	12.63a	12.2-12.8	95ab	94-95	2.3a	1.93-2.75	23.79a	23.32-24.32	7.67a	7.20-7.89

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.

Control = Shahd ElDoki (check cultivar).

### 4.1.3 Variability, heritability, genetic advance and inbreeding depression

#### 4.1.3.1 Variability

Genotypic and phenotypic variance values presented in Table (4.8) revealed that the large portion of genotypic variance for the following characters: plant length, flowering, flesh thickness, netting and total sugars would be attributed to the genotypes of line 1<sub>Orange flesh</sub>. While data in Table (4.9) showed that the following characters; flowering (days), maturity duration, average fruit number / plant, total yield / plant (kg), net weight, placenta hardness, netting, fruit shape index, TSS, moisture content% and  $\beta$ -carotene have the higher portion of the genotypic variance for line 2<sub>Sandafa</sub>. The coefficient of genotypic (GCV) and phenotypic (PCV) variability may serve as a reference point for breeders who try to detect genotypic difference of the most important economic characters. It also makes selection of forms with valuable genotypes more effective (Abd El-Salam and Marie 2002). Values of genotypic and phenotypic coefficient of variance (GCV and PCV) were presented in Table (4. 8) and Plate (4. 1) showed that the genotypic and phenotypic coefficient of variance in line 1<sub>Orange flesh</sub>, the characters; plant length, flowering, flesh thickness, netting and total sugars explained low differences between values of GCV and PCV. Table (4. 9) and fig (4. 3) showed the values of genotypic and phenotypic coefficient of variance for line 2<sub>Sandafa</sub> from data it can be observed that the characters which explained narrow range between GCV and PCV were flowering, maturity duration (days), average fruit number / plant, total yield / plant (kg), net weight, placenta hardness, netting, fruit shape index, TSS%, moisture content and  $\beta$ -carotene. The differences between GCV and PCV were large for the other remains studied characters for the two lines under studies (line 1<sub>Orange flesh</sub> and line 2<sub>Sandafa</sub> indicating that these characters are affected by the environmental conditions.

Similar trend, more or less, of these results were noticed by Abd El-Salam and Marie (2002) on melon when found that the values of (GCV) and (PCV) were nearly equal for fruit diameter, fruit shape index and flesh thickness. Differences between (GCV) and (PCV) values were low for fruit weight and total yield / plant Mohamed *et al.* (2011) found that characters which explained nearly equal values for GCV and PCV; plant length, flowering and fruit shape index. But the differences between GCV and PCV values were low for net weight and placenta weight, and They, also, reported that these results make selection for quantitative characters more effective because these characters have large dependent on ratio between the levels of the genotypic and phenotypic variability within the population, so the characters which have equal or approximate ratio for GCV and PCV values, selection would be effective.

#### 4.1.3.2 Heritability

Heritability percentage in the broad sense is presented in Table (4. 8) and Plate (4. 2) for line 1<sub>Orange flesh</sub>, and in table (4. 9) and Plate (4. 4) for line 2<sub>Sandafa</sub>. Heritability percentage in the broad sense, which specifies the proportion of the total variability that is due to genetic variance, were found high in plant length, netting and total sugars. Moderate value for flowering (days), maturity duration, total yield / plant, flesh thickness, placenta hardness and vitamin C content. While low values were existed in the remain characters in line 1<sub>Orange flesh</sub>. High heritability values of line 2<sub>Sandafa</sub> were found in flowering, maturity duration, average fruit number / plant, net weight, placenta hardness, netting, fruit shape index, TSS, moisture content% and  $\beta$ -carotene. The moderate values were in plant length, branches number and total yield / plant.

Similar results more or less were found by many researcher as Elshimi *et al.* (2003); Rakhi and Rajamony (2005) and Chamnan and Kazem (2006) on melon, who found high heritability values for fruit number and weight, total yield / plant, total soluble solids, vitamin C and reducing sugars content. Hatem *et al.* (1997) found high broad-sense heritability in flesh thickness and moderate values in average fruit weight, TSS and fruit dry matter and reported that the low broad-sense heritability may be reflect the high effect of the environmental conditions. The results of El-Shimi *et al.* (2003) illustrated that the highest values of heritability were on average number of fruits / plant, fruit yield / plant, total yield / plant, average fruit weight, TSS and flesh thickness. However, it should be mentioned that in stating any value of heritability of a character, it must be related to the particular population in which it was estimated and under what particular condition, as illustrated by Ibrahim (2012).

#### 4.1.3.4 Genetic advance

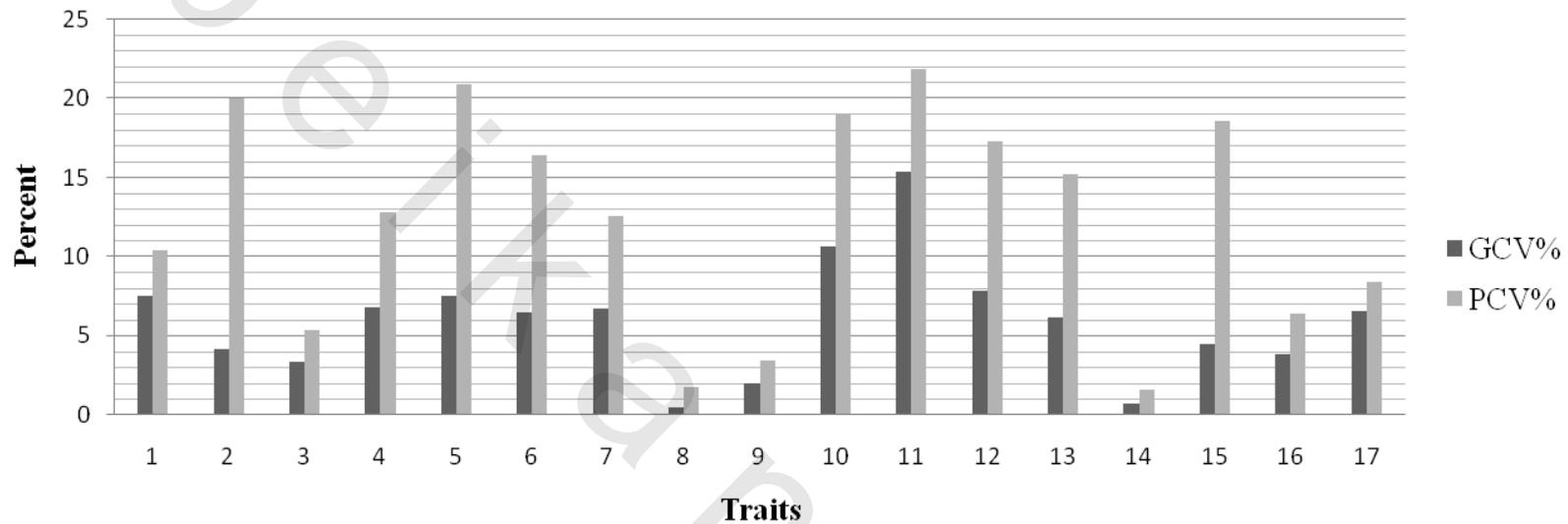
Genetic advance values presented in Table (4. 8) and Plate (4. 2) for line 1<sub>Orange flesh</sub>, and table (4. 9) and Plate (4. 4) for line 2<sub>Sandafa</sub>. Genetic advance values for line 1<sub>Orange flesh</sub> were in the favorable direction and were larger in the second selective generation than in the first selective generation in plant length, flowering, maturity duration, average fruit weight, total yield / plant, fruit shape index,  $\beta$ -carotene and vitamin C content. Genetic advance values was identical for moisture content. In line 2<sub>Sandafa</sub> genetic advance value were larger in second selected generation than in the first selected generation in plant length, flowering, maturity duration, average fruit weight, total yield / plant, netting, fruit shape index, moisture content and vitamin C content. Genetic advance value was identical for branches number. So it can be concluded from data as shown in Tables (4.8) and (4. 9) that the character which possessed high broad sense heritability combined with relatively high ratio for genetic coefficient of variability and genetic advance might be rapidly improved by selection Ibrahim (2012).

#### 4.1.3.5. Inbreeding depression

Inbreeding depression values% presented in table (4. 8) and (4. 9) showed that the inbreeding depression values was positive and low in magnitude in plant length, flowering, average fruit weight, fruit shape, moisture content and vitamin C in the tow lines under studied these results are agreement with Abd- El-Salam and Marie (2002), El-Shimi *et al.*, (2003) on melon, and Antonio (2004) on squash, who found low depression in vegetative measurement for selection generations compared with original population and stated that these depression may be due to inbreeding.

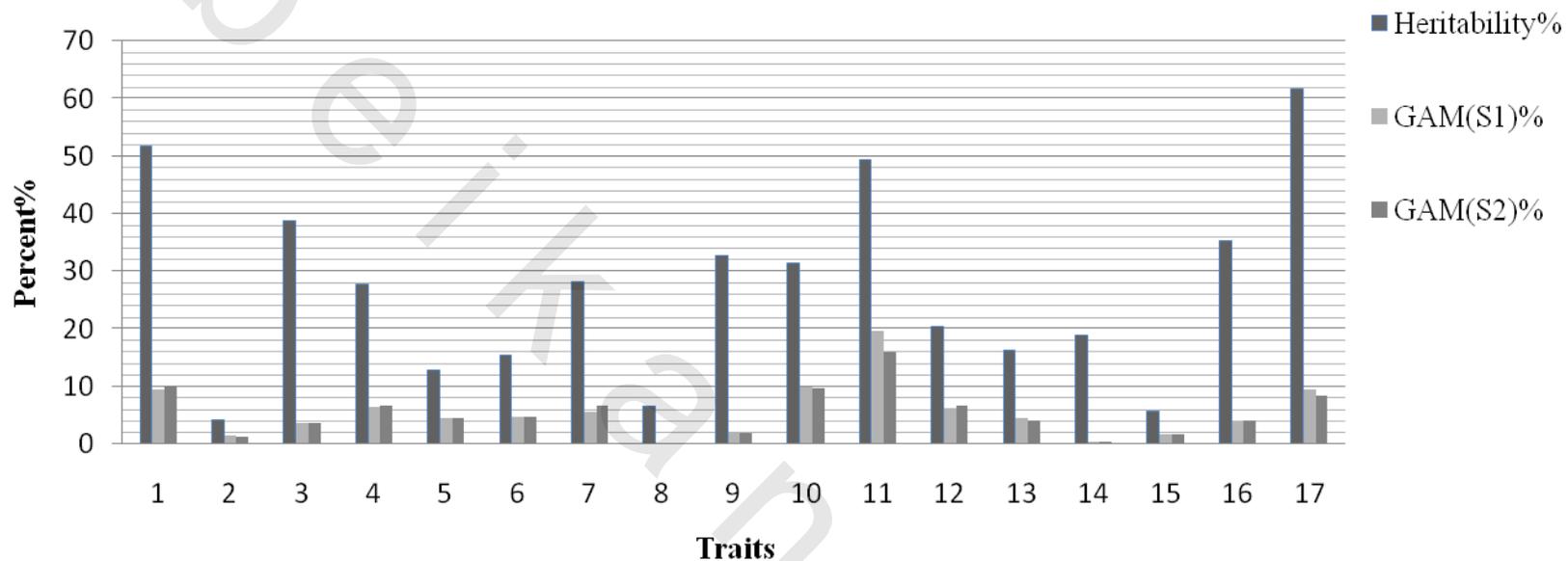
**Table (4. 8) Values of genotypic and phenotypic variances (GV, PV), genotypic and phenotypic coefficient of variability(GCV, PCV), heritability, genetic advance and genetic advance over mean (for first selection generation 'S1' and second selection generation 'S2') in 17 characters for line 1<sub>orange flesh</sub>, of melon.**

Traits	Variance		Coefficient of variability		Heritability %	Genetic Advance	Genetic Advance over mean (%)		Inbreeding depression %
	GV	PV	GCV	PCV			S1	S2	
Plant length(cm)	167.27	324.16	7.45	10.37	51.6	16.35	9.58	10.10	14.12
Branches number	0.02	0.44	4.11	20.04	4.2	0.05	1.47	1.38	-16.36
Flowering (days)	1.67	4.32	3.28	5.28	38.63	1.41	3.59	3.72	6.94
Maturity duration (days)	22.47	81.34	6.72	12.78	27.62	4.38	6.39	6.68	15.34
Average Fruit number / plant	0.06	0.44	7.44	20.92	12.66	0.15	4.5	4.43	-15.38
Average fruit weight (kg)	0.003	0.02	6.4	16.39	15.26	0.036	4.63	4.66	14.49
Total yield / plant (kg)	0.024	0.085	6.64	12.51	28.13	0.14	5.63	6.77	-36.14
Net weight %	0.16	2.51	0.44	1.71	6.56	0.18	0.197	0.196	-0.96
Flesh thickness %	1.24	3.81	1.91	3.36	32.53	1.12	1.92	1.89	-3.99
Placenta hardness (1-10)	0.77	2.45	10.65	19.01	31.37	0.86	9.85	9.79	-24.22
Netting (1-10)	1.56	3.16	15.34	21.86	49.28	1.54	19.67	15.94	-40.32
Fruit shape index	0.0066	0.0324	7.78	17.3	20.24	0.06	6.33	6.59	14.34
TSS%	0.55	3.38	6.11	15.22	16.12	0.52	4.5	4.02	-11.33
Moisture content%	0.35	1.89	0.65	1.49	18.71	0.45	0.49	0.49	1.44
$\beta$ -carotene (mg / 100 gm fresh weight)	0.015	0.27	4.41	18.6	5.61	0.05	1.73	1.81	-9.29
Vitamin C (mg / 100 ml juice)	0.78	2.22	3.77	6.36	35.17	0.92	3.81	4.12	4.89
Total sugars (mg / 100 ml juice)	0.21	0.34	6.55	8.35	61.49	0.63	9.43	8.4	-11.50



**Plate (4. 1) Genotypic and phenotypic coefficient of variances (GCV% and PCV%) for 17 traits in Line 1<sub>Orang</sub> of melon**

- |                                   |                                      |  |                             |
|-----------------------------------|--------------------------------------|--|-----------------------------|
| 1-Plant length (cm)               | 2- Branche9+s number                 | 3- Flowering (days)                              | 4- Maturity duration (days) |
| 5-Average Fruit number / plant    | 6- Average fruit weight (kg)         | 7- Total yield / plant (kg)                      | 8- Net weight %             |
| 9- Flesh thickness %              | 10- Placenta hardness (1-10)         | 11- Netting (1-10)                               | 12- Fruit shape index       |
| 13- TSS%                          | 14- Moisture content%                | 15- $\beta$ -carotene (mg / 100 gm fresh weight) |                             |
| 16- Vitamin C (mg / 100 ml juice) | 17- Total sugars (mg / 100 ml juice) |  |                             |



**Plate (4. 2) Heritability values% and genetic advance over mean (S1 and S2)% for 17 traits in Line 1<sub>Orange flesh</sub> of melon**

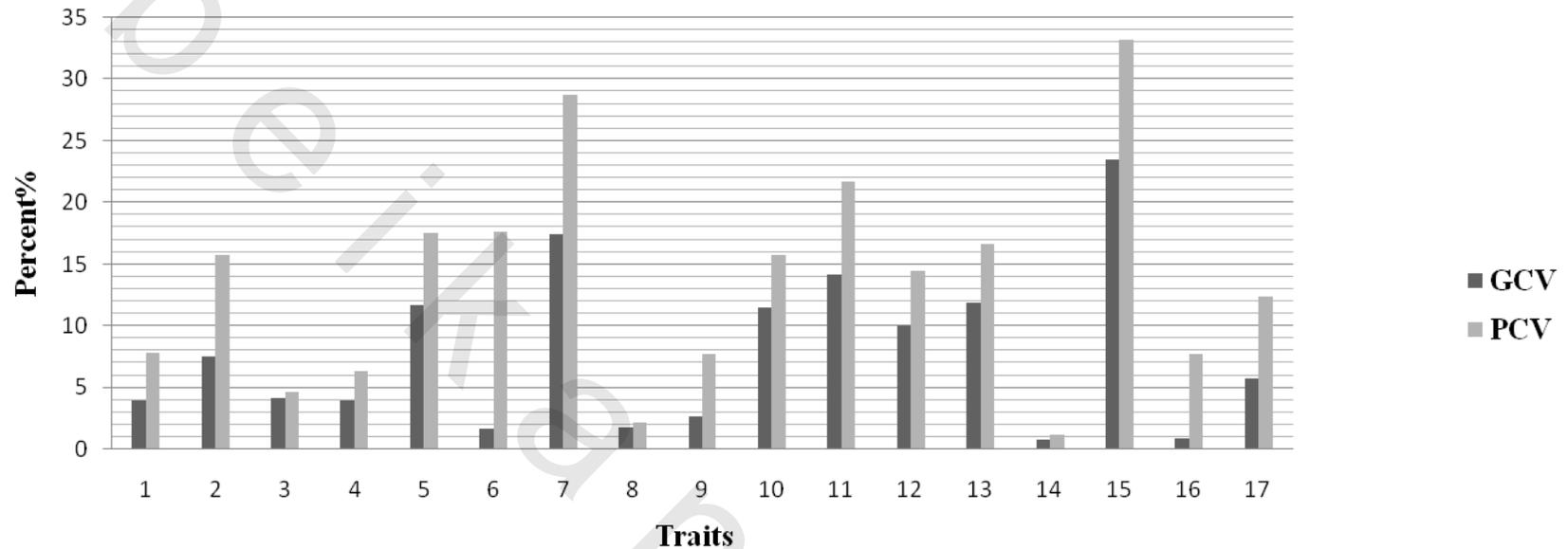
- |                                   |                                      |  |                             |
|-----------------------------------|--------------------------------------|--|-----------------------------|
| 1-Plant length(cm)                | 2- Branches number                   | 3- Flowering (days)                              | 4- Maturity duration (days) |
| 5-Average Fruit number / plant    | 6- Average fruit weight (kg)         | 7- Total yield / plant (kg)                      | 8- Net weight %             |
| 9- Flesh thickness %              | 10- Placenta hardness (1-10)         | 11- Netting (1-10)                               | 12- Fruit shape index       |
| 13- TSS%                          | 14- Moisture content%                | 15- $\beta$ -carotene (mg / 100 gm fresh weight) |                             |
| 16- Vitamin C (mg / 100 ml juice) | 17- Total sugars (mg / 100 ml juice) |  |                             |

**GAM (S1)** = Genetic advance over mean of the first selection generation

**GAM (S2)** = Genetic advance over mean of the second selection generation

**Table (4. 9) Values of genotypic and phenotypic variance, genotypic and phenotypic coefficient of variability, heritability, genetic advance and genetic advance over mean (for first selection generation 'S1' and second selection generation 'S2') in 17 characters for line 2<sub>Sandafa</sub>, of melon.**

Traits	Variance		Coefficient of variability		Heritability %	Genetic Advance	Genetic advance over mean (%)		Inbreeding depression %
	GV	PV	GCV	PCV			S1	S2	
Plant length(cm)	79.78	309.27	3.98	7.83	25.8	7.98	3.45	3.73	6.28
Branches number	0.037	0.16	7.53	15.796	22.73	0.16	6.06	6.06	-14.29
Flowering (days)	3.02	3.77	4.17	4.66	79.98	2.73	6.58	6.84	8.05
Maturity duration (days)	12.19	31.31	3.97	6.37	38.92	3.83	4.45	4.51	7.94
Average Fruit number / plant	0.1	0.23	11.66	17.59	43.97	0.37	15.82	12.44	-4.71
Average fruit weight (kg)	0.0085	0.044	4.67	17.62	19.22	0.003	0.279	0.288	5.11
Total yield / plant (kg)	0.197	0.54	17.42	28.71	36.84	0.47	20.92	21.31	-4.12
Net weight %	2.73	4.21	1.78	2.22	64.72	2.34	2.51	2.49	-3.42
Flesh thickness %	2.198	18.68	2.67	7.77	18.77	0.89	1.59	1.57	-6.75
Placenta hardness (1-10)	0.69	1.27	11.55	15.75	53.78	1.07	14.91	13.35	-26.32
Netting (1-10)	0.83	1.97	14.17	21.76	42.37	1.05	14.59	15.31	-28.13
Fruit shape index	0.022	0.045	10.04	14.51	47.92	0.18	12.17	13.68	18.68
TSS%	0.69	1.35	11.89	16.63	51.18	1.05	15.00	13.34	-27.72
Moisture content%	0.63	1.21	0.84	1.17	51.8	1.003	1.06	1.07	1.66
β-carotene (mg / 100 gm fresh weight)	0.0179	0.036	23.5	33.23	50.00	0.17	34.37	22.99	-45
Vitamin C (mg / 100 ml juice)	0.047	3.225	0.931	7.73	11.45	0.05	0.191	0.204	3.01
Total sugars (mg / 100 ml juice)	0.084	0.385	5.797	12.37	21.97	0.24	5.03	4.41	-12.35

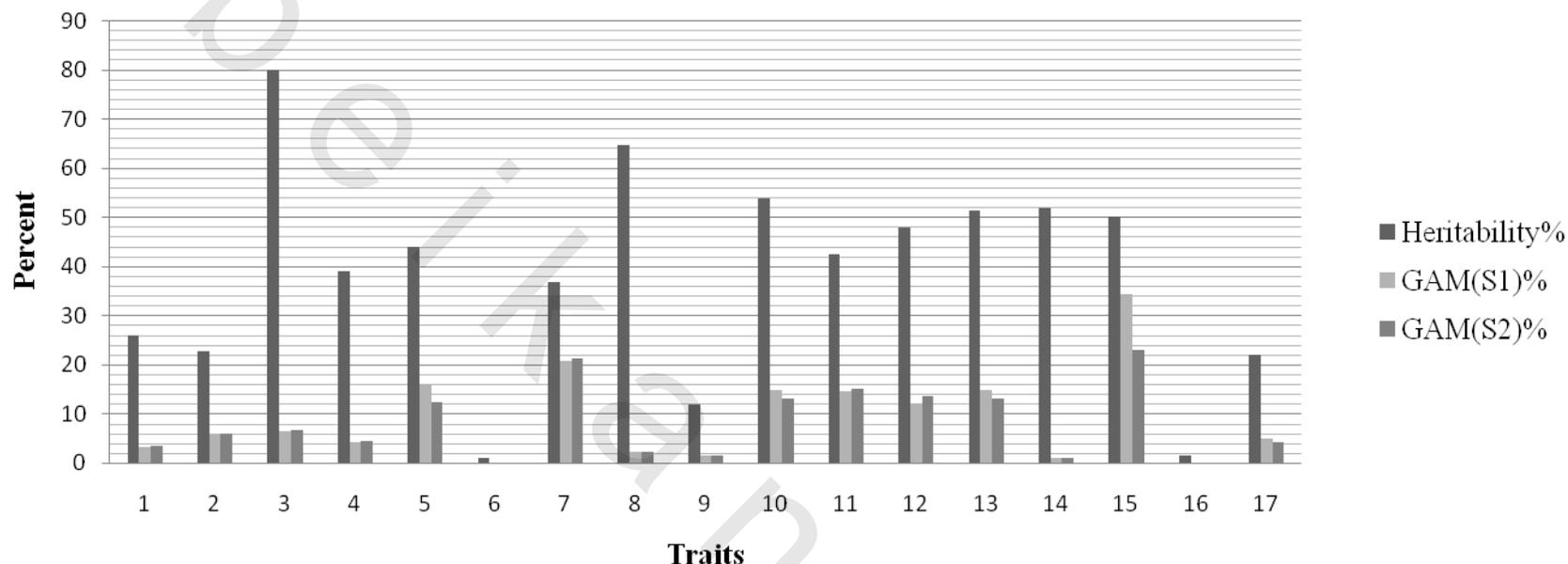


**Plate (4. 3) Genotypic and phenotypic coefficient of variances (GCV% and PCV%) for 17 traits in Line 2<sub>Sandafa</sub> of melon**

- |                                   |                                      |  |                             |
|-----------------------------------|--------------------------------------|--|-----------------------------|
| 1-Plant length(cm)                | 2- Branches number                   | 3- Flowering (days)                              | 4- Maturity duration (days) |
| 5-Average Fruit number / plant    | 6- Average fruit weight (kg)         | 7- Total yield / plant (kg)                      | 8- Net weight %             |
| 9- Flesh thickness %              | 10- Placenta hardness (1-10)         | 11- Netting (1-10)                               | 12- Fruit shape index       |
| 13- TSS%                          | 14- Moisture content%                | 15- $\beta$ -carotene (mg / 100 gm fresh weight) |                             |
| 16- Vitamin C (mg / 100 ml juice) | 17- Total sugars (mg / 100 ml juice) |  |                             |

**GAM (S1)** = Genetic advance over mean of the first selection generation

**GAM (S2)** = Genetic advance over mean of the second selection generation



**Plate(4. 4) Heritability% values and genetic advance over mean% (S1 and S2) for 17 traits in line2<sub>Sandafa</sub> of melon**

- |                                   |                                      |  |                             |
|-----------------------------------|--------------------------------------|--|-----------------------------|
| 1-Plant length(cm)                | 2- Branches number                   | 3- Flowering (days)                              | 4- Maturity duration (days) |
| 5-Average Fruit number / plant    | 6- Average fruit weight (kg)         | 7- Total yield / plant (kg)                      | 8- Net weight %             |
| 9- Flesh thickness %              | 10- Placenta hardness (1-10)         | 11- Netting (1-10)                               | 12- Fruit shape index       |
| 13- TSS%                          | 14- Moisture content%                | 15- $\beta$ -carotene (mg / 100 gm fresh weight) |                             |
| 16- Vitamin C (mg / 100 ml juice) | 17- Total sugars (mg / 100 ml juice) |  |                             |

**GAM (S1)** = Genetic advance over mean of the first selection generation

**GAM (S2)** = Genetic advance over mean of the second selection generation

#### 4.1.4 Correlation coefficient analysis

Correlation values presented in Table (4. 10). Values were positive and significant or highly significant among the following characters plant length with each of the; flowering (days), maturity duration (days) and average fruit weight / plant, branches number with each of the; total soluble solids (TSS),  $\beta$ -carotene and total sugars; flowering (days) with each of the; maturity duration (days), average fruit weight / plant and moisture content, maturity duration and average fruit weight, average fruit number with each of the; total yield / plant and  $\beta$ -carotene, total yield / plant (kg) with each of the; total soluble solids,  $\beta$ -carotene and total sugars, net weight with each of the; flesh thickness, placenta hardness, netting and fruit shape index, flesh thickness with each of the; placenta hardness, netting and fruit shape index, placenta hardness and netting, netting and fruit shape index, TSS with each of the;  $\beta$ -carotene and total sugars,  $\beta$ -carotene and total sugars.

Negative and significant or highly significant correlation values were found among the characters plant length with each of the; branches number, average fruit number / plant, total yield / plant, TSS% and  $\beta$ -carotene, branches number with each of the; flowering, maturity duration and average fruit weight / plant, flowering with each of the; total yield / plant, net weight %, flesh thickness%, placenta hardness, netting, TSS% and total sugars, maturity duration with each of the; total yield / plant, TSS%,  $\beta$ -carotene and total sugars, average fruit number and average fruit weight / plant, average fruit weight / plant with each of the; total yield / plant, TSS%,  $\beta$ -carotene and total sugars, net weight and moisture content, flesh thickness and moisture content, placenta hardness and moisture content, netting and moisture content, fruit shape index and moisture content.

Similar trend more or less of these results were showed by Reddy *et al.* (2007) as they found that high positive correlation between total yield / plant and fruit weight, negative significant correlation between average fruit number and average fruit weight. Feyzian *et al.* (2009) found highly significant positive correlation between average fruit weight and maturity duration, and significant negative correlation between average fruit number and average fruit weight. Dewan *et al.* (2014) on ash gourd found high positive correlation between total yield an each of number of fruit / plant, average fruit weight, vine length and fruit length. So, these characters were the important characters for varietal selection of ash gourd.

#### 4.1.5. Path coefficient analysis

Direct and indirect effects of flesh thickness, moisture content, netting, placenta hardness and fruit shape index on net weight % were tabulated in Table (4. 11). From the results of path coefficient analysis it could be noted that the direct effect of flesh thickness was strongly positive (1.2669) but the other direct effects were neglected, so, direct selection to high of flesh thickness may lead to increasing net weight. Netting, placenta hardness and fruit shape index had high indirect effect on net weight through their relations with flesh thickness (1.2289, 1.0853 and 0.9535 respectively), these results, may be indicate that selection to high value for these three characters may effective in increasing the net weight% .

Moisture content had indirect negative effect (-1.2468), so, direct selection for low moisture content% may be lead to increase in net weight through its negative relation with flesh thickness. Value of residual effects was too small, so, we could consider that the studied traits might be enough to study the factors affecting the net weight in melon.

Direct and indirect effects of average fruit number, average fruit weight (kg), plant length (cm), branches number and maturity duration on total yield / plant (kg) were tabulated in table (4. 12). It could be noted that from the results of path coefficient analysis that the direct effect was positive and large in average fruit number (1.1243) and branches number (3.6607), so, selection for high fruit and branches number may be effective in improving total yield (kg). Direct effects of average fruit weight and maturity duration were positive, so, there indirect effect should be considered. Indirect effects were highly positive in average fruit number through its relation with branches number (2.5764).

The large negative indirect effect were in average fruit number through its relation with each of the; average fruit weight (-1.8572) and maturity duration (-1.8808), so, selection to high number of fruit may be lead to increases total yield through its relation with average fruit weight and maturity duration, from these results it can be conclude that the total yield controlled with high average fruit number. Also, there were negative indirect effect on average fruit weight through its relation with each of the: fruit number (-0.9064) and branches number (-3.5306), and plant length through its relations with each of the; average fruit number (-0.8698) and branches number (-3.5149), and branches number through its relation with maturity duration (-2.5169) and maturity duration through its relations with each of the; average fruit number (-0.8365) and branches number (-3.6447), so, selection for high branches number may lead to increases the total yield through its relation with maturity duration. Values of residual effect were too small (0.0949) which means that the studied characters might be enough, as indices in the selection for total yield / plant in melon. Similar results were found by Feyzian *et al.* (2009) and Abd-Rahman *et al.*, (2011) on melon, they found direct positive effect for average fruit number on total yield / plant and indirect positive effect for branches number through its relation with average fruit number / plant on total yield. Dewan *et al.* (2014) found that the number of fruits plant and average fruit weight directly contributed to the yield of ash gourd accessions and the flesh thickness indirectly effected yield

**Table (4. 10) Correlation coefficient analysis among 17 traits under studied in melon.**

Traits	PL	BN	FL	MD	AFN/P	AFW/P	TY/P	NW%	F TH%	PH	N	F SH I	TSS	MC%	$\beta$ C	VC
BN	-0.96**															
FL	0.83*	-0.89**														
MD	0.97**	-0.99**	0.89**													
AFN/P	-0.77*	0.7	-0.37	-0.72												
AFW/P	0.99**	-0.96**	0.79*	0.97**	-0.81*											
TY/P	-0.86**	0.87	-0.68	-0.88**	0.89**	-0.86**										
NW%	-0.63	0.54	-0.76*	-0.57	0.08	-0.49	0.29									
F TH	-0.71	0.63	-0.81*	-0.65	0.19	-0.6	0.41	0.99**								
PH	-0.65	0.67	-0.91**	-0.69	0.13	-0.57	0.48	0.86**	0.86**							
N	-0.62	0.58	-0.93*	-0.59	0.08	-0.49	0.38	0.96**	0.97**	0.89**						
F SH I	-0.09	0.03	-0.43	-0.05	-0.46	0.06	-0.17	0.81*	0.75**	0.66	0.83**					
TSS	-0.97**	0.96**	-0.79*	-0.95**	0.74	-0.98**	0.81*	0.55	0.63	0.54	0.53	-0.003				
MC%	0.62	-0.53	0.77*	0.56	-0.11	0.49	-0.36	-0.98**	-0.98**	-0.87**	-0.98**	-0.82*	-0.51			
$\beta$ C	-0.97**	0.93**	-0.72	-0.93**	0.8*	-0.99**	0.8*	0.49	0.57	0.49	0.44	-0.1	0.98**	-0.45		
VC	0.09	-0.01	0.27	-0.004	0.17	-0.08	-0.04	-0.53	-0.56	-0.32	-0.65	-0.74	-0.03	0.61	0.12	
T SH	-0.12	0.94**	-0.80*	-0.93**	0.73	-0.97**	0.79*	0.63	0.71	0.57	0.6	0.09	0.99**	-0.59	0.97**	-0.12

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

PL = plant length (cm).

AFN = Average fruit number.

F TH% = Flesh thickness.

TSS% = Total soluble solids

T SH = Total sugars content

BN = Branches number.

AFW = Average fruit weight (kg).

PH = Placenta hardness(1-10).

MC = Moisture content%

FL = Flowering (days).

TY = Total yield / plant (kg).

N = Netting degree (1-10).

$\beta$  C =  $\beta$  Carotene content.

MD = Maturity duration.

NW% = Net weight.

F SH I = Fruit shape index.

VC = Vitamin C content.

**Table (4. 11) Path coefficient analysis among net weight%, flesh thickness%, moisture content%, netting, placenta hardness and fruit shape index of melon.**

Traits	Flesh thickness %	Moisture content %	Netting (1-10)	Placenta hardness (1-10)	Fruit shape index	Total effect
Flesh thickness %	<u>1.2669</u>	-0.0799	-0.5459	0.1372	0.2106	0.9890
Moisture content %	-1.2468	<u>0.0812</u>	0.5521	-0.1401	-0.2296	-0.9832
Netting (1-10)	1.2289	-0.0796	<u>-0.5628</u>	0.1434	0.2319	0.9618
Placenta hardness (1-10)	1.0853	-0.0710	-0.5038	<u>0.1602</u>	0.1846	0.8553
Fruit shape index	0.9535	-0.0666	-0.4665	0.1057	<u>0.2798</u>	0.8059

Residual effect = 0.0753

**Table (4. 12) Path coefficient analysis among traits total yield / plant (kg): average fruit number, average fruit weight (kg), plant length (cm), branches number and maturity duration (days) of melon.**

Traits	Average fruit number	Average fruit Weight (kg)	Plant length (cm)	Branches number	Maturity duration (days)	Total effect
Average fruit number	<u>1.1243</u>	-1.8572	0.9292	2.5764	-1.8808	0.8919
Average fruit weight (kg)	-0.9064	<u>2.3038</u>	-1.1832	-3.5306	2.4564	-0.8600
Plant length (cm)	-0.8698	2.2695	<u>-1.2011</u>	-3.5149	2.4515	-0.8648
Branches number	0.7913	-2.2219	1.1533	<u>3.6607</u>	-2.5169	0.8665
Maturity duration (days)	-0.8365	2.2386	-1.1648	-3.6447	<u>2.5279</u>	-0.8795

Residual effect = 0.0949

#### 4.1.6. Sensory attributes

Sensory analyses of fresh-cut pieces from melon have great importance to detect the direction of the consumer's palate (Robert and Gene, 2009)

Data in table (4. 13) which shows the mean sensory analysis score values of exterior and interior prosperities in tow lines under studies (line 1<sub>orange flesh</sub> and line 2<sub>Sandafa</sub>). Differences among score values of original population (So), first and second selection generations (S1and S2) and control cultivar (shahd El-doki) were significant in most characters of the tow lines under study. Differences were not significant in the selection generations (So, S1 and S2) of fruit skin color, fruit firmness and flesh texture for line 1<sub>Orange flesh</sub>. While in fruit skin color , general acceptability, flesh color, flesh sweetness, flesh firmness flesh texture, flesh odor for line 2<sub>Sandafa</sub>

Mean performances of sensory score values were in the favorable direction and larger in magnitude in second selection generation than original population, from these results it could be concluded that the two selection cycle applied on the two lines under studies had a great effect on improvement of quality characters which reflected on consumers preferring. Control cultivar scores the highest values in all characters compared with the two lines under studies except that of flesh color in line 1<sub>Orange flesh</sub> these results point to the consumers preferred the orange flesh color compared with other colors.

These results were in cope with those found by Amy *et al.* (2003) who found that the consumer in general, preferred orange fleshed varieties than those of the green fleshed ones. Robert and Gene (2009) stated that the consumers distinctly preferred the overall eating quality of melon pieces from hybrid fruit compared with those from male and female line fruit.

**Table (4. 13) Mean sensory scores values of; exterior and interior prosperities of the two lines under study of melon over two seasons (early and late summer seasons of 2012).**

G	Line 1 <sub>orange flesh</sub>									
	Exterior prosperities					Interior proprieties				
	Fruit skin color	Fruit skin texture	Fruit odor	Fruit firmness	General acceptable	Flesh color	Flesh sweetness	Flesh firmness	Flesh texture	Flesh odor
So	7.7b	8.25b	6.65c	8.2b	7.95c	8.4ab	7.35c	7.4b	6.05b	6.9b
S1	7.95b	8.8ab	7.3bc	7.75b	8.5bc	8.4ab	8.05bc	6.85c	6.5b	6.75bc
S2	8.3b	9.15a	7.85b	7.6b	8.7ab	8.85a	8.4b	7.05bc	6.5b	6.35c
Control	9.15a	9.3a	9a	9a	9.3a	8.05b	9.25a	8.2a	7.7a	8.9a
Line 2 <sub>Sandafa</sub>										
So	7.4b	5.6c	6.65c	8.55ab	7.35b	6.45b	6.55b	7.7a	7.8a	7.6b
S1	7.75b	6.95b	8.2ab	8.2bc	7.6b	6.7b	6.8b	7.9a	7.85a	8.05b
S2	7.65b	7.55b	7.75b	7.75c	8b	5.95b	7b	8.25a	7.95a	7.65b
Control	9.15a	9.3a	9a	9a	9.3a	8.05a	9.25a	8.2a	8.2a	8.9a

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.

Control = Shahd ElDoki (check cultivar).

## **4.2 The second experiment (hybridization)**

### **4.2.1 Analysis of variance**

#### **4.2.1.1 Vegetative measurements and yield components**

Data presented in Table (4. 14) showed that there were significant or highly significant differences among genotypes (5 parent, 10 hybrids, 10 reciprocals, and ananas monanasa as a check variety) in all vegetative measurements and yield components characters.

Mean performances of genotypes under study (5 parents, 10 hybrids, 10 reciprocals and ananas monanasa as a check variety) presented in table (17). Values of plant length and branches number were higher in most of hybrids and reciprocals than parents. The highest values in plant length were in hybrid (L5×L3) followed by (L5×L4). The heist value for branches number were in (L1×L5) followed by (L2×L3). Regarding yield and its components vales of flowering (days) and maturity duration characters were high in parents compared with most of hybrids; these results may be due to the decreases in average fruit weight and increases in fruit number in the hybrids compared with its parents because the small fruit the faster in ripening. These results were in agreement with Ogbonna and Obi (2010) and disagreed with Abd El-Rahman *et al.* (2011). Total yield (kg) values were large in magnitude in hybrids and reciprocals than parents this may be refer to that the total yield controlled by fruit number, similar results were found by Feyzian *et al.* (2009). The highest genotypes in average fruit number of (L5×L3) followed by (L1×L3), (L3×L5) and (L5×L4). But the highest genotypes in average fruit weight were (L1) followed by (L2). Genotypes had the highest total yield were (L2×L5) followed by (L2×L4). Control variety (ananas monanasa) had the highest value in maturity duration (days) 90.17.

#### **4.2.1.2 Fruit characters**

Data in Table (4. 14) showed that there were highly significant differences among genotypes under study (5 parents, 10 hybrids, 10 reciprocals and ananas monanasa as a check variety) in all fruit characters.

Mean performances of genotypes under studies of (5 parents, 10 hybrids, 10 reciprocals and ananas monanasa as a check variety) presented in table (4. 16). Values of net weight, flesh thickness%, placenta hardness and netting were larger in most of hybrids and reciprocals compared with parents. Fruit shape index decreased in most of hybrids and reciprocals, fruits became roundish compared with parent (L1) and (L2) with the exception of the hybrids (L4×L1) and (L5×L4) had oblong shape.

The highest genotypes in net weight were (L2×L4) followed by (L1×L4). Highest genotypes in flesh thickness were (L4×L1) followed by (L2×L4). Highest genotypes in placenta hardness were (L2×L4) followed by (L5×L2) and (L5×L3). Highest genotypes in netting were (L5×L2) followed by (L3×L5). Genotypes which have more oblong shape were (L4) followed by (L1), (L5×L3) and (L4×L1)

#### **4.2.1.3 TSS, moisture content and chemical analysis**

Data in Table (16) showed that there were highly significant differences between genotypes under study (5 parents, 10 hybrids, 10 reciprocals and ananas monanasa as a check variety) in; TSS, moisture content and chemical analysis

Mean performance of the genotypes under study for TSS, moisture content and chemical analysis were presented in Table (4. 17) in general the highest values for TSS,  $\beta$ -carotene, vitamin c and total sugars were in the hybrids compared with parents genotypes. But the moisture content decreased in the hybrids, these results may be due to the increases of placenta hardness and netting which have negative correlation with moisture content the same trend of these results found by Reddy *et al.* (2007) and Mohamed *et al.* (2011). The highest genotypes in TSS were (L3×L2) followed by (L2×L5), (L3×L5) and (L5×L2). The highest genotypes in moisture content were (L1) followed by (L4). The highest genotypes in  $\beta$ -carotene were in (L2) followed by (L1×L2). The highest genotypes in vitamin c were (L2×L3) followed by (L1×L4). The highest genotypes in total sugars were (L5×L2) followed by (L3×L2).

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 (Adel and Atif, 2014) .

#### **4.2.2 Heterosis %**

Heterosis % over the mid-parental value and the better parents and potence ratio were computed for all the characters under the study.

##### **4.2.2.1 Vegetative measurements**

Data in Table (4. 18) showed that the significant positive heterosis over mid-parent and better parents for plant length were in all hybrids with the exception of (L2×L4), (L2×L3) and (L4×L3) the highest heterosis value were in hybrid (L5×L4) 78.22% over mid-parent 67.14 over better parents. The high obtained potence ratio values for most of hybrids were in accordance with the hybrid vigor. These results may be referring to that there were over dominance toward high plant length in most of the hybrids. Hybrids (L1×L5), (L2×L3) and (L2×L4) had significant positive heterosis over mid-parents, and hybrid ((L2×L1) had significant positive heterosis over med-parents and high parent in branches number. Same results found by Shamel (2013) on water melon when found over dominance toward high plant length and branches number.

##### **4.2.2.2 Yield and its components**

Table (4. 19) showed that the most of crosses in flowering character explained negative heterosis and significant in crosses (L2×L3), (L3×L2) and (L4×L2) over med-parents and high parent, and in the crosses (L1×L2), (L2×L5) and (L2×L1) over better parent only. Potence ratio values were in the same direction and negative in most of crosses these results indicate that there were over dominance toward early flowering date. The partial dominance for the late flowering date was detected in crosses (L1×L4), (L4×L1), (L5×L2) and (L5×L4) but it were not significant.

Heterosis values in maturity duration characters were negative in most crosses. The significant negative heterosis values were in (L1×L2), (L1×L3), (L1×L4), (L1×L5), (L2×L3), (L3×L1) and (L3×L2), heterosis value was significant over med-parents only in hybrid ((L4×L3), and over better parent only in hybrid ((L3×L5). These results revealed that the hybrid vigor for the low maturity duration. The high negative obtained potence ratio values is in accordance with the hybrid vigor hypothesis.

Heterosis values in average fruit number / plant were positive in most of crosses over mid-parent and better parent, and significant in (L1×L2), (L5×L3) and (L5×L4) over med-parents and better parent, and in (L1×L3), (L3×L4), (L3×L5) and (L4×L2) over mid-parent only. In average fruit weight the heterosis values were negative and significant in most of the crosses. These indicate the hybrid vigor for high fruit number and low average fruit weight. The same trend was found in heterosis values for total yield / plant which presented high positive significant values for heterosis in most of the crosses over mid-parents and better parent. Potence ratio were in accordance with the hybrid vigor hypothesis. These results indicated that the total yield controlled by average fruit number. Similar results were found by El- Shimi *et al.* (2003), Iria *et al.* (2008) and with disagreement with found by Abd-El-Rahman *et al.* (2011) Rasoul *et al.* (2014) who found that the average fruit weight have a great positive effect on total yield and there were over dominance toward low flowering and maturity duration in most crosses.

#### 4.2.2.3 Fruit characters

Data in Table (4. 20) showed the heterosis values for fruit characters. Heterosis values were positive in all crosses over med parents and in most crosses over better parent, significant values were in (L1×L2), (L2×L4), (L3×L5), (L4×L1), (L4×L2), (L5×L2) and (L5×L3) over med-parent and in hybrid (L1×L4) over med-parent and better parent. These results may revealed that the hybrid vigor may go towards the direction of high net weight. Potence ratio values were in the favorable direction and accordance with the hybrid vigor. Partial dominance for high net weight appeared in crosses (L2×L5), (L3×L4), (L4×L5) and (L2×L1). Heterosis values in flesh thickness were positive in most crosses over med-parents and high parent and significant in hybrids (L1×L4), (L1×L5) and (L2×L4) over med-parents and in (L4×L1) over med-parents and high parent. Same trend were observed in potence ratio values but the partial dominance toward high flesh thickness appeared in crosses (L2×L5), (L2×L1), (L3×L2) and (L4×L3). Same trend of these results were observed by Hatem *et al.* (1997) and Rasoul *et al.* (2014) in flesh thickness of melon. Significant positive heterosis values in placenta hardness characters were found in crosses (L5×L1) and (L5×L4) over med-parents only with high positive potence ratio 4.55 and 6.45 this may indicate that the hybrid vigor for the high placenta hardness in these tow crosses. In netting degree the significant heterosis value was negative in hybrid (L4×L3), but the remain values were positive in most crosses and not significant. Partial dominance toward high netting appeared in crosses (L2×L4), (L3×L4) and (L5×L1), potence ratio values were in agreement with hybrid vigor in most crosses. Fruit shape index characters explained negative and significant heterosis values in crosses (L1×L4), (L3×L4) and (L4×L5) over med-parents and better parent, and in crosses (L1×L3), (L2×L4), (L4×L1), (L5×L1), (L4×L2), (L4×L3) and (L5×L4) over better parent. Potence ratio was negative in all crosses with exception of three crosses, these results indicated that this trait controlled by over dominant gene action for roundness shape. Meanwhile partial dominance for roundness shape were observed in crosses (L1×L3), (L1×L5), (L2×L4), (L3×L4), (L4×L5), (L2×L1), (L5×L1), (L4×L2), (L5×L2) and (L5×L4). These results disagreement with those found by Iria *et al.*, (2008) who found over dominance toward the oblong shape.

#### 4.2.2.4 TSS, moisture content and chemical analysis

Heterosis values for TSS, moisture content and chemical analysis were presented in table (23). Heterosis values for TSS were significant and positive for hybrid (L1×L2) over

med-parents and better parent, while crosses (L1×L5), (L2×L5), (L3×L5), (L2×L1), (L3×L1), (L4×L1), (L3×L2) and (L5×L2) over med-parents. Potence ratio were positive in most of crosses this may point to the hybrid vigor toward high TSS value in most of hybrids. Partial dominance for high TSS values appeared in crosses (L1×L3), (L1×L4), (L2×L4), (L5×L1) and (L4×L2). Complete dominance for low TSS value appeared in hybrid (L4×L5). Moisture content expressed negative significant heterosis values for most crosses these results may be due to the increases in netting degree and placenta hardness which have negative effects on moisture content. Potence ratio were in same direction and partial dominance for low moisture content were detected in crosses (L1×L4), (L2×L3), (L2×L5), (L3×L5) and (L5×L3).

$\beta$ -carotene content gave high significant positive heterosis for most of crosses over med-parents but the heterosis values were negative over better parent. Same direction was detected in potence ratio which showed partial dominance for high  $\beta$ -carotene content for most crosses. Heterosis values in vitamin c content were positive and significant in crosses (L1×L2), (L2×L3), (L2×L4), (L3×L5), (L3×L2), (L4×L2) and (L5×L2) over med-parents and in crosses (L2×L3), (L3×L2) and (L5×L2) over better parent, these results indicated that the hybrid vigor goes towards high vitamin C content in previous crosses, partial dominance for high vitamin c content appeared in crosses (L1×L3), (L4×L2) and (L5×L3) same results were observed by Hatem *et al.* (2009), but the partial dominance for low vitamin c content were found in crosses (L1×L5), (L2×L1), (L5×L1) and (L5×L4). Heterosis values were positive and significant for total sugars content in crosses (L1×L2), (L1×L5), (L2×L4), (L2×L5), (L4×L1), (L3×L2), (L5×L2) and (L5×L3) over med-parents and in crosses (L1×L2), (L4×L1), (L5×L2) over better parent these results refer to hybrid vigor for high total sugars in these crosses. Potence ratio in accordance with the hybrid vigor hypothesis. Partial dominance for high total sugars appeared in crosses (L3×L1), (L5×L1), (L4×L2).

**Table (4. 14) Mean squares and degrees of freedom for the 5 parents, 10 hybrids and 10 reciprocals and ananas monanasa (Check variety), in all characters under study 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					Chemical analysis				
		Net weight %	Flesh thickness %	Placenta hardness (1-10)	Netting (1-10)	Fruit shape index	TSS %	Moisture content %	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.

**Table (4. 15) Mean performances of the 5 parents, 10 hybrids and 10 reciprocals and ananas monanasa (Check variety) in vegetative measurements and yield components of melon, over 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	164.56 <sub>j</sub>	2.94 <sub>cde</sub>	35.83 <sub>abcd</sub>	82.33 <sub>abcd</sub>	2.67 <sub>e</sub>	1.565 <sub>a</sub>	2.770 <sub>ghijkl</sub>
L2	171 <sub>ij</sub>	3.11 <sub>bcde</sub>	41.72 <sub>a</sub>	87.06 <sub>abc</sub>	2.83 <sub>de</sub>	1.306 <sub>b</sub>	2.784 <sub>ghijkl</sub>
L3	215.83 <sub>fghi</sub>	2.89 <sub>de</sub>	39.72 <sub>ab</sub>	88.11 <sub>ab</sub>	3.33 <sub>abcde</sub>	0.941 <sub>fghi</sub>	2.864 <sub>ghijk</sub>
L4	183.28 <sub>hij</sub>	3.17 <sub>bcde</sub>	41.44 <sub>a</sub>	86.94 <sub>abc</sub>	3 <sub>cde</sub>	1.080 <sub>cdef</sub>	2.242 <sub>mn</sub>
L5	160.5 <sub>j</sub>	3.39 <sub>abcde</sub>	34.94 <sub>abcd</sub>	79.83 <sub>abcde</sub>	3.03 <sub>cde</sub>	0.861 <sub>ghij</sub>	2.550 <sub>klm</sub>
L1×L2	252.39 <sub>cdef</sub>	3.28 <sub>abcde</sub>	33.28 <sub>bcd</sub>	75.39 <sub>def</sub>	3.5 <sub>abcd</sub>	0.826 <sub>hijk</sub>	2.776 <sub>ghijkl</sub>
L1×L3	289.94 <sub>abc</sub>	3.28 <sub>abcde</sub>	38.17 <sub>abc</sub>	67.44 <sub>f</sub>	3.83 <sub>ab</sub>	0.704 <sub>k</sub>	2.687 <sub>hijkl</sub>
L1×L4	249.17 <sub>cdef</sub>	3.61 <sub>abcd</sub>	37.22 <sub>abcd</sub>	74.83 <sub>def</sub>	3.17 <sub>bcde</sub>	1.133 <sub>cde</sub>	3.195 <sub>defg</sub>
L1×L5	223.39 <sub>efgh</sub>	4 <sub>a</sub>	36.44 <sub>abcd</sub>	70.67 <sub>ef</sub>	3.17 <sub>bcde</sub>	1070 <sub>def</sub>	3.033 <sub>efghi</sub>
L2×L3	267.39 <sub>bcde</sub>	3.72 <sub>ab</sub>	33.56 <sub>bcd</sub>	77.17 <sub>bcdef</sub>	3.17 <sub>bcde</sub>	0.896 <sub>ghij</sub>	2.673 <sub>hijkl</sub>
L2×L4	194.33 <sub>ghij</sub>	3.78 <sub>ab</sub>	36.39 <sub>abcd</sub>	85.22 <sub>abcd</sub>	3.33 <sub>abcde</sub>	1.217 <sub>bc</sub>	3.786 <sub>ab</sub>
L2×L5	248.44 <sub>cdef</sub>	3.5 <sub>abcde</sub>	33.11 <sub>bcd</sub>	79.67 <sub>abcde</sub>	3.33 <sub>abcde</sub>	0.993 <sub>efg</sub>	3.800 <sub>ab</sub>
L3×L4	274.17 <sub>abcd</sub>	3.28 <sub>abcde</sub>	37.39 <sub>abcd</sub>	85.17 <sub>abcd</sub>	3.67 <sub>abc</sub>	1.278 <sub>b</sub>	3.981 <sub>a</sub>
L3×L5	239.94 <sub>defg</sub>	3.61 <sub>abcd</sub>	35.44 <sub>abcd</sub>	77.72 <sub>bcdef</sub>	3.83 <sub>ab</sub>	0.813 <sub>ijk</sub>	3.008 <sub>fghij</sub>
L4×L5	247.83 <sub>cdef</sub>	3.5 <sub>abcde</sub>	33.78 <sub>bcd</sub>	83.56 <sub>abcd</sub>	3.33 <sub>abcde</sub>	1.119 <sub>cde</sub>	3.451 <sub>bcde</sub>
L2×L1	257.22 <sub>cdef</sub>	3.78 <sub>ab</sub>	33.44 <sub>bcd</sub>	82.89 <sub>abcd</sub>	3.17 <sub>bcde</sub>	1012 <sub>efg</sub>	3.177 <sub>defg</sub>
L3×L1	238.44 <sub>defg</sub>	3.28 <sub>abcde</sub>	35.56 <sub>abcd</sub>	75.11 <sub>def</sub>	3.5 <sub>abcd</sub>	0.966 <sub>fgh</sub>	3.481 <sub>bcd</sub>
L4×L1	311.89 <sub>ab</sub>	3.39 <sub>abcde</sub>	39.28 <sub>ab</sub>	83.06 <sub>abcd</sub>	3.67 <sub>abc</sub>	1.003 <sub>efg</sub>	3.627 <sub>abc</sub>
L5×L1	270.67 <sub>abcde</sub>	3.67 <sub>abc</sub>	34.33 <sub>bcd</sub>	72.61 <sub>abcd</sub>	3.5 <sub>abcd</sub>	0.879 <sub>ghij</sub>	3.103 <sub>defgh</sub>
L3×L2	201.33 <sub>ghij</sub>	3.56 <sub>abcde</sub>	30.67 <sub>d</sub>	76.61 <sub>cdef</sub>	3.17 <sub>bcde</sub>	0.750 <sub>jk</sub>	2.367 <sub>lmn</sub>
L4×L2	233.28 <sub>defg</sub>	3.67 <sub>abc</sub>	32 <sub>cd</sub>	80.28 <sub>abcde</sub>	3.33 <sub>abcde</sub>	0.819 <sub>hijk</sub>	2.585 <sub>jklm</sub>
L5×L2	271.94 <sub>abcd</sub>	3.61 <sub>abcd</sub>	39.22 <sub>ab</sub>	83.22 <sub>abcd</sub>	3.17 <sub>bcde</sub>	0.797 <sub>ijk</sub>	2.090 <sub>n</sub>
L4×L3	195.83 <sub>hij</sub>	3.61 <sub>abcd</sub>	34.89 <sub>abcd</sub>	79.39 <sub>abcde</sub>	2.83 <sub>de</sub>	0.948 <sub>fghi</sub>	2.648 <sub>ijkl</sub>
L5×L3	316.33 <sub>a</sub>	2.83 <sub>e</sub>	39.88 <sub>ab</sub>	83.17 <sub>abcd</sub>	4 <sub>a</sub>	0.709 <sub>k</sub>	3.290 <sub>cdef</sub>
L5×L4	306.33 <sub>ab</sub>	3.67 <sub>abc</sub>	38.44 <sub>abc</sub>	80.94 <sub>abcde</sub>	3.83 <sub>ab</sub>	0.888 <sub>ghij</sub>	3.499 <sub>bcd</sub>
Control	304 <sub>ab</sub>	2.83 <sub>e</sub>	39.5 <sub>ab</sub>	90.17 <sub>a</sub>	3.17 <sub>bcde</sub>	1.191 <sub>bcd</sub>	3.406 <sub>bcdef</sub>

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<sub>Koz-EL\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub> and Control = Ananas monanasa (check cultivar)

**Table (4. 16) Mean performances of the 5 parents, 10 hybrids and 10 reciprocals and ananas monanasa (Check variety) in Fruit characters of melon over 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	89.84 <sub>bcdef</sub>	53.48 <sub>cd</sub>	8.44 <sub>abcd</sub>	8.83 <sub>bcde</sub>	1.48 <sub>ab</sub>
L2	90.71 <sub>abcde</sub>	58.23 <sub>abc</sub>	9.22 <sub>abc</sub>	9.47 <sub>abc</sub>	1.03 <sub>ghij</sub>
L3	87.37 <sub>f</sub>	50.97 <sub>d</sub>	9.33 <sub>abc</sub>	9.25 <sub>abcd</sub>	1.08 <sub>efghi</sub>
L4	89.26 <sub>cdef</sub>	57.47 <sub>abcd</sub>	8.28 <sub>bcd</sub>	8.78 <sub>bcde</sub>	1.59 <sub>a</sub>
L5	88.26 <sub>ef</sub>	54.95 <sub>cd</sub>	7.83 <sub>d</sub>	9.33 <sub>abc</sub>	1.02 <sub>ghij</sub>
L1×L2	92.64 <sub>ab</sub>	58.6 <sub>abc</sub>	9.06 <sub>abcd</sub>	9.56 <sub>abc</sub>	1.32 <sub>bcd</sub>
L1×L3	89.79 <sub>bcdef</sub>	55.97 <sub>cd</sub>	8.56 <sub>abcd</sub>	9.33 <sub>abc</sub>	1.23 <sub>de</sub>
L1×L4	92.66 <sub>ab</sub>	60.14 <sub>abc</sub>	9.39 <sub>ab</sub>	8.22 <sub>de</sub>	1.33 <sub>bcd</sub>
L1×L5	91.1 <sub>abcde</sub>	59.12 <sub>abc</sub>	8.78 <sub>abcd</sub>	9.42 <sub>abc</sub>	1.33 <sub>bcd</sub>
L2×L3	90.86 <sub>abcde</sub>	56.7 <sub>bcd</sub>	9.39 <sub>ab</sub>	9.83 <sub>ab</sub>	1.01 <sub>ghij</sub>
L2×L4	93.03 <sub>a</sub>	63.05 <sub>ab</sub>	9.72 <sub>a</sub>	9.44 <sub>abc</sub>	1.24 <sub>cde</sub>
L2×L5	89.71 <sub>bcdef</sub>	57.49 <sub>abcd</sub>	9.39 <sub>ab</sub>	9.67 <sub>abc</sub>	0.98 <sub>ghij</sub>
L3×L4	89.02 <sub>def</sub>	54.05 <sub>cd</sub>	8.11 <sub>bcd</sub>	9.06 <sub>abcd</sub>	1.12 <sub>efgh</sub>
L3×L5	89.92 <sub>bcdef</sub>	56.81 <sub>bcd</sub>	9.5 <sub>ab</sub>	9.87 <sub>ab</sub>	0.969 <sub>hij</sub>
L4×L5	88.89 <sub>def</sub>	56.09 <sub>cd</sub>	8.22 <sub>bcd</sub>	8.72 <sub>cde</sub>	1.12 <sub>efgh</sub>
L2×L1	90.56 <sub>abcde</sub>	56.24 <sub>cd</sub>	7.78 <sub>d</sub>	9.61 <sub>abc</sub>	1.33 <sub>bcd</sub>
L3×L1	89.97 <sub>bcdef</sub>	53.95 <sub>cd</sub>	8.28 <sub>bcd</sub>	9.83 <sub>ab</sub>	1.33 <sub>bcd</sub>
L4×L1	92.04 <sub>abc</sub>	63.93 <sub>a</sub>	9.28 <sub>abc</sub>	9.28 <sub>abcd</sub>	1.41 <sub>bc</sub>
L5×L1	90.88 <sub>abcde</sub>	57.8 <sub>abc</sub>	9.5 <sub>ab</sub>	9.17 <sub>abcd</sub>	1.17 <sub>def</sub>
L3×L2	89.5 <sub>cdef</sub>	58.02 <sub>abc</sub>	8.33 <sub>abcd</sub>	9.67 <sub>abc</sub>	1.08 <sub>efghi</sub>
L4×L2	92.18 <sub>abc</sub>	58.86 <sub>abc</sub>	8.83 <sub>abcd</sub>	8.67 <sub>cde</sub>	1.25 <sub>cde</sub>
L5×L2	91.82 <sub>abcd</sub>	56.06 <sub>cd</sub>	9.5 <sub>ab</sub>	9.94 <sub>a</sub>	1.03 <sub>ghij</sub>
L4×L3	89.67 <sub>bcdef</sub>	55.25 <sub>cd</sub>	8.56 <sub>abcd</sub>	7.87 <sub>e</sub>	0.896 <sub>j</sub>
L5×L3	90.67 <sub>abcde</sub>	57.3 <sub>bcd</sub>	9.5 <sub>ab</sub>	9.83 <sub>ab</sub>	0.937 <sub>ij</sub>
L5×L4	90.7 <sub>abcde</sub>	59.87 <sub>abc</sub>	9.44 <sub>ab</sub>	8.67 <sub>cde</sub>	1.45 <sub>efg</sub>
Control	92.13 <sub>abc</sub>	57.43 <sub>abcd</sub>	8 <sub>cd</sub>	8.83 <sub>bcde</sub>	1.1 <sub>efghi</sub>

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<sub>Koz-EL\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub> and Control = Ananas monanasa (check cultivar).

**Table (4. 17) Mean performances of the 5 parents, 10 hybrids, 10 reciprocals and ananas monanasa (Check variety) in TSS , Moisture content and chemical analysis of melon over tow summer seasons of 2012 and 2013.**

G	TSS%	Moisture content %	Chemical analysis		
			$\beta$ -carotene	Vitamin C	Total sugars
L1	11.27 <sub>jk</sub>	94.26 <sub>a</sub>	2.25 <sub>fghi</sub>	30.91 <sub>abc</sub>	6.52 <sub>ij</sub>
L2	12.57 <sub>cdefgh</sub>	90.54 <sub>fghi</sub>	3.57 <sub>a</sub>	26.95 <sub>gh</sub>	6.98 <sub>cdefg</sub>
L3	13.37 <sub>abcde</sub>	89.84 <sub>hij</sub>	0.45 <sub>l</sub>	29.59 <sub>bcde</sub>	7.29 <sub>abc</sub>
L4	11.03 <sub>k</sub>	93.91 <sub>ab</sub>	2.6 <sub>cdef</sub>	30.92 <sub>abc</sub>	6.47 <sub>j</sub>
L5	12.37 <sub>efghi</sub>	90.05 <sub>ghij</sub>	0.31 <sub>l</sub>	27.55 <sub>fgh</sub>	6.89 <sub>defgh</sub>
L1×L2	13.47 <sub>abcd</sub>	89.86 <sub>hij</sub>	3.05 <sub>b</sub>	31.22 <sub>abc</sub>	7.33 <sub>abc</sub>
L1×L3	13.13 <sub>abcdef</sub>	91.16 <sub>efgh</sub>	2.24 <sub>fghi</sub>	30.41 <sub>abcd</sub>	6.86 <sub>defghi</sub>
L1×L4	11.17 <sub>k</sub>	93.36 <sub>abc</sub>	2.48 <sub>defg</sub>	31.26 <sub>ab</sub>	6.53 <sub>hij</sub>
L1×L5	12.83 <sub>abcdefg</sub>	90.84 <sub>fghi</sub>	1.82 <sub>j</sub>	27.8 <sub>fgh</sub>	7.02 <sub>cde</sub>
L2×L3	13.55 <sub>abc</sub>	90.99 <sub>fgh</sub>	2.88 <sub>b</sub>	31.83 <sub>a</sub>	6.91 <sub>defg</sub>
L2×L4	12.47 <sub>cdefghi</sub>	91.28 <sub>efgh</sub>	2.77 <sub>bcd</sub>	31.18 <sub>abc</sub>	7.03 <sub>cde</sub>
L2×L5	13.73 <sub>ab</sub>	90.33 <sub>fghij</sub>	2.91 <sub>bc</sub>	27.75 <sub>fgh</sub>	7.21 <sub>bcd</sub>
L3×L4	11.43 <sub>ijk</sub>	92.49 <sub>cde</sub>	2.61 <sub>cdef</sub>	29.38 <sub>cdef</sub>	6.67 <sub>efghij</sub>
L3×L5	13.73 <sub>ab</sub>	90.77 <sub>fghi</sub>	0.42 <sub>l</sub>	29.69 <sub>bcde</sub>	7.00 <sub>cdef</sub>
L4×L5	11.03 <sub>k</sub>	92.75 <sub>bcd</sub>	2.46 <sub>defg</sub>	26.7 <sub>h</sub>	6.61 <sub>ghij</sub>
L2×L1	12.67 <sub>bcdefgh</sub>	91.77 <sub>def</sub>	2.69 <sub>bcde</sub>	27.76 <sub>fgh</sub>	7.02 <sub>cde</sub>
L3×L1	13.4 <sub>abcde</sub>	91.04 <sub>fgh</sub>	2.48 <sub>defg</sub>	31.02 <sub>abc</sub>	7.02 <sub>cde</sub>
L4×L1	12.33 <sub>efghi</sub>	91.31 <sub>efgh</sub>	2.16 <sub>ghij</sub>	31.1 <sub>abc</sub>	6.89 <sub>defghi</sub>
L5×L1	12.33 <sub>fghij</sub>	91.49 <sub>defg</sub>	2.47 <sub>defg</sub>	28.18 <sub>efgh</sub>	6.85 <sub>defghi</sub>
L3×L2	13.93 <sub>a</sub>	89.52 <sub>ij</sub>	2.05 <sub>hij</sub>	31.03 <sub>abc</sub>	7.58 <sub>a</sub>
L4×L2	12 <sub>ghijk</sub>	91.34 <sub>efg</sub>	2.35 <sub>efgh</sub>	30.13 <sub>abcd</sub>	6.78 <sub>efghij</sub>
L5×L2	13.73 <sub>ab</sub>	89.06 <sub>j</sub>	2.79 <sub>bcd</sub>	28.73 <sub>defg</sub>	7.59 <sub>a</sub>
L4×L3	11.23 <sub>jk</sub>	92.58 <sub>bcd</sub>	2.66 <sub>cde</sub>	28.98 <sub>def</sub>	6.64 <sub>fghij</sub>
L5×L3	13.55 <sub>abc</sub>	90.33 <sub>fghij</sub>	0.37 <sub>l</sub>	28.96 <sub>def</sub>	7.42 <sub>ab</sub>
L5×L4	11.6 <sub>hijk</sub>	92.59 <sub>bcd</sub>	1.97 <sub>ij</sub>	27.93 <sub>efgh</sub>	6.61 <sub>fghij</sub>
Control	12.4 <sub>defghi</sub>	91.18 <sub>efgh</sub>	1.45 <sub>k</sub>	31.01 <sub>abc</sub>	6.86 <sub>defghi</sub>

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<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>, and Control = Ananas monanasa (check cultivar).

$\beta$ -carotene measured by mg / 100 gm fresh weight, Vitamin C measured by mg / 100 ml juice and Total sugars measured by mg / 100 ml juice.

**Table (4. 18) Heterosis (ADH%) over mid and better parents (MP and BP) and potence ratio (PR) for 10 hybrids and their reciprocals in vegetative measurements of melon, over tow summer seasons of 2012 and 2013.**

G	Vegetative measurements					
	Plant length(cm)			Branches number		
	MP	BP	PR	MP	BP	PR
L1×L2	50.43**	47.59**	26.26	8.26	5.36	3
L1×L3	52.45**	34.34**	3.89	12.38	11.32	13
L1×L4	43.27**	35.95**	8.04	18.18	14.04	5
L1×L5	37.45**	35.75**	30.01	26.32**	18.03	3.75
L2×L3	38.45**	23.89*	3.29	24.07*	19.64	6.5
L2×L4	9.71	6.03	2.8	20.35*	19.29	23
L2×L5	49.89**	45.29**	15.75	7.69	3.28	1.8
L3×L4	37.39**	27.03**	4.58	8.26	3.51	1.8
L3×L5	27.52**	11.17	1.87	15.04	6.56	1.89
L4×L5	44.18**	35.22**	6.67	6.78	3.28	2
L2×L1	53.31**	50.42**	27.76	24.77*	21.42*	9
L3×L1	25.37*	10.48	1.88	12.38	11.32	13
L4×L1	79.33**	70.17**	14.74	10.91	7.02	3
L5×L1	66.54**	64.48**	53.33	15.79	8.19	2.25
L3×L2	4.09	-6.72	0.35	18.52	14.29	5
L4×L2	31.69**	27.28*	9.14	16.81	15.79	19
L5×L2	64.07**	59.03**	20.23	11.11	6.56	2.6
L4×L3	-1.87	-9.27	-0.23	19.27	14.04	4.2
L5×L3	68.11**	46.56**	4.63	-9.73	-16.39	-1.22
L5×L4	78.22**	67.14**	11.8	11.86	8.19	3.5

\*, \*\* Significant and highly significant at the 0.05 and 0.01 level of probability, respectively.

G = genotypes, L1 = Line 1<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub> and L5 = Line 5<sub>Primal</sub>.

**Table (4. 19) Heterosis (ADH%) over mid and better parents (MP and BP) and potence ratio (PR) for 10 hybrids and their reciprocals in yield and its components of melon, over tow summer seasons of 2012 and 2013.**

G	Yield and its components														
	Flowering (days)			Maturity duration (days)			Average fruit number / plant			Average fruit weight(kg)			Total yield / plant (kg)		
	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR
L1×L2	-14.18	-20.24*	-1.87	-10.99*	-13.4*	-3.94	27.27**	23.53*	9	-42.42**	-47.18**	-4.71	-0.03	-0.29	-0.13
L1×L3	1.03	-3.92	0.2	-20.86**	-23.46**	-6.15	27.78**	15	2.5	-43.81**	-55.00**	-1.76	-4.6	-6.17	-2.76
L1×L4	-3.67	-10.19	-0.5	-11.59*	-13.93*	-4.25	11.26	5.56	2	-14.32**	-27.59**	-0.78	27.48**	15.32*	2.61
L1×L5	2.99	1.71	2.38	-12.85*	-14.17*	-8.33	11.11	4.39	1.73	11.74**	-31.58**	-0.4	14.01**	9.49*	3.39
L2×L3	-17.59*	-19.57*	-7.17	-11.89*	-12.42*	-19.74	2.7	-5	0.33	-20.27	-31.41	-1.25	-5.36	-6.68	-3.79
L2×L4	-12.49	-12.78	-37.4	-2.04	-2.11	-32	14.29	11.11	5	2	-6.32	0.21	50.65**	35.98**	4.69
L2×L5	-13.62	-20.64*	-1.54	-4.53	-8.49	-1.05	13.64	9.89	4	-8.39	-24**	-0.41	42.45**	36.46**	9.67
L3×L4	-7.87	-9.79	-3.71	-2.69	-3.34	-4.05	15.79*	10	3	26.47**	18.35	3.86	55.91**	38.98**	4.59
L3×L5	-5.06	-10.77	-0.79	-7.44	-11.79*	-1.51	20**	15	4.33	-9.76	-13.61	-2.19	11.12	5.03	1.92
L4×L5	-11.56	-18.49	-1.36	0.19	-3.89	0.05	10.49	9.89	19	15.27**	3.58	1.35	44.02	35.31**	6.84
L2×L1	-13.75	-19.84*	-1.81	-2.13	-4.79	-0.76	15.15	11.76	5	-29.47**	-35.29**	-3.27	14.39**	14.10*	56.44
L3×L1	-5.88	-10.49	-1.14	-11.86*	-14.75**	-3.5	16.67*	5	1.5	-22.89**	-38.25**	-0.92	23.55**	21.52**	14.12
L4×L1	1.65	-5.23	0.22	-1.87	-4.47	-0.69	29.41**	22.22	5	-24.15**	-35.89**	-1.32	44.74**	30.84**	4.24
L5×L1	-2.98	-4.19	-2.38	1.88	0.34	1.22	22.81**	15.38	3.55	-27.55*	-43.84**	-0.95	16.64**	12*	4.02
L3×L2	-24.69**	-26.49**	-10.06	-12.53**	-13.05*	-20.79	2.7	-5	0.33	-33.22**	-42.54**	-2.05	-16.17*	-17.37*	-11.44
L4×L2	-23.05**	-23.30**	-6.9	-7.73	-7.79	-1.21	14.29*	11.11	5	-31.37**	-37.31*	-3.31	2.87	-7.15	0.27
L5×L2	2.32	-5.99	0.26	-0.27	-4.4	-0.06	7.95	4.39	2.33	-26.43**	-38.97**	-1.29	-21.63	-24.93**	-4.93
L4×L3	-14.03	-15.82	-6.61	-9.29*	-9.89	-13.95	-10.53	-15	-2	-6.18	-12.2	-0.89	3.74	-7.53	0.31
L5×L3	6.81	0.38	1.06	-0.95	-5.6	-0.19	25.65**	20*	5.44	-21.35	-24.7**	-4.79	21.55**	14.88*	3.72
L5×L4	0.65	-7.24	0.08	-2.93	-6.9	-0.69	27.07**	26.37**	49	-8.49	-17.77**	-0.75	46.03**	37.20	7.15

\*, \*\* Significant and highly significant at the 0.05 and 0.01 level of probability, respectively.

G = genotypes, L1 = Line 1<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, and L5 = Line 5<sub>Primal</sub>. G= genotypes

**Table (4. 20) Heterosis (ADH%) over mid and better parents (MP and BP) and potence ratio (PR) for 10 hybrids and their reciprocals in fruit characters of melon, over tow summer seasons of 2012 and 2013.**

G	Fruit characters														
	Net weight%			Flesh thickness %			Placenta hardness (1-10)			Netting (1-10)			Fruit shape index		
	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR
L1×L2	2.62*	2.13	5.45	4.19	0.63	1.16	2.52	-1.81	0.57	4.4	0.88	1.26	5.00	-10.76	0.28
L1×L3	1.35	-0.05	0.96	7.17	4.64	2.97	-3.84	-8.49	-0.75	3.23	0.9	1.4	-3.07	-16.74**	-0.23
L1×L4	3.48*	3.15*	10.81	8.41*	4.65	2.34	12.29	11.18	12.33	-6.62	-6.33	21	-13.07**	-16.2**	-3.47
L1×L5	2.3	1.4	2.59	9.04*	7.58	6.69	7.74	3.95	2.12	3.67	0.89	1.33	6.82**	-9.86	0.37
L2×L3	2.19	0.31	1.17	3.85	-2.63	0.58	1.17	0.42	1.61	5.04	3.81	4.25	-3.77	-5.63	-1.91
L2×L4	3.39*	2.56	4.22	8.99*	8.27	13.59	11.11	5.42	2.06	3.5	-0.29	0.92	-5.5	-22.09**	-0.26
L2×L5	0.28	-1.07	0.20	1.58	-1.28	0.55	9.99	1.81	1.24	2.81	2.05	3.8	-4.61	-5.43	-5.31
L3×L4	0.8	-0.27	0.75	-0.03	-5.94	-0.05	-7.97	-13.25*	-1.31	0.46	-2.1	0.18	-15.68**	-29.38**	-0.81
L3×L5	2.41*	1.89	4.74	7.27	3.38	1.93	10.66	1.78	1.22	6.19	5.71	13.8	-7.25	-9.82	-2.55
L4×L5	0.15	-0.42	0.26	-0.21	-2.39	-0.09	1.96	-0.67	0.74	-3.68	-6.55	-1.2	-14.36*	-29.87**	-0.65
L2×L1	0.32	-0.16	0.66	0.69	-3.42	0.16	-11.95*	-15.66*	-2.71	5.01	1.47	1.43	5.98	-9.93	-0.34
L3×L1	1.55	0.15	1.11	3.29	0.86	1.37	-6.96	-11.47	-1.37	8.76	6.31	3.8	4.2	-9.97	0.27
L4×L1	2.78*	2.45	8.65	15.24*	11.24*	4.24	10.96	9.87	11	5.36	5.69	-17	-8.39	-11.72*	-2.23
L5×L1	2.06	1.16	2.32	6.6	5.18	4.88	16.6*	12.5	4.55	0.92	-1.79	0.33	-5.88	-20.57**	-0.32
L3×L2	0.53	-1.32	0.28	6.27	-0.37	0.94	-10.26	-10.87	-14.91	3.26	2.05	2.75	2.24	0.26	1.13
L4×L2	2.45*	1.63	3.05	1.74	1.07	2.63	0.95	-4.22	0.18	-5.02	-8.5	-1.32	-5.16	-21.81**	-0.24
L5×L2	2.61*	1.23	1.91	-0.94	-3.74	-0.33	11.29	3.01	1.4	5.76	4.99	7.8	0.33	-0.54	0.38
L4×L3	1.53	0.46	1.43	1.9	-3.86	0.32	-2.93	-8.49	-0.48	-12.48**	-14.71**	-4.76	-32.81	-43.72**	-1.69
L5×L3	3.25**	2.73	6.40	8.19	4.28	2.18	10.47	1.6	1.2	5.83	5.36	13	-10.34	-12.82	-3.64
L5×L4	2.19	1.61	3.87	6.5	8.95	-2.9	17.12*	14.09	6.45	-4.29	-7.14	-1.4	-12.19	-28.09**	-0.55

\*, \*\* Significant and highly significant at the 0.05 and 0.01 level of probability, respectively.

G = genotypes, L1 = Line 1<sub>Koz-EI\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

**Table (4. 21) Heterosis (ADH%) over mid and better parents (MP and BP) and potence ratio (PR) for 10 hybrids and their reciprocals in TSS, moisture content and chemical analysis of melon, over 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 mg / 100 ml juice		
	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR	MP	BP	PR
L1×L2	13.01**	7.16*	2.38	-2.74*	-4.66**	-1.36	4.82	-14.61**	0.21	7.92**	1.02	1.15	8.53**	4.98*	2.53
L1×L3	6.63*	-1.75	0.78	-0.97	-3.29**	-0.4	66.29**	-0.37	0.99	0.54	-1.59	0.25	-0.7	-5.92**	-0.13
L1×L4	0.15	-0.89	0.14	-0.76	-0.95	-4.09	2.34	-4.65	0.32	1.09	1.05	25.25	0.45	0.05	1.13
L1×L5	8.6**	3.77	1.85	-1.42*	-3.62**	-0.62	42.82**	-18.88**	0.56	-4.88**	-10.04**	-0.85	4.58*	1.76	1.65
L2×L3	4.49	1.37	1.46	0.89	0.5	2.29	43.6**	-19.24**	0.56	12.56**	7.54**	2.69	-3.2	-5.27*	-1.47
L2×L4	5.65	-0.79	0.87	-1.02	-2.79**	-0.56	-10.41*	-22.55**	-0.66	7.73**	0.79	1.12	4.55*	0.75	1.21
L2×L5	10.16*	9.28	12.67	0.05	-0.22	0.17	50.34**	-18.4**	0.59	1.84	0.73	1.67	3.96*	3.34	6.64
L3×L4	-6.28*	-14.46**	-0.66	0.67	-1.51*	0.3	70.95**	0.11	1.01	-2.92	-5.02**	-1.32	-3.13	-8.56**	-0.53
L3×L5	6.74*	2.74	1.73	0.92	0.8	7.83	11.39	-6.11	0.611	3.9*	0.32	1.09	-1.28	-3.94	-0.46
L4×L5	-5.69*	-10.78**	-1	0.84	-1.24	0.39	69.02**	-5.57	0.87	-8.69**	-13.68**	-1.5	-1.11	-4.16	-0.35
L2×L1	6.29*	0.79	1.15	-0.68	-2.64**	-0.34	-7.44	-24.59**	-0.33	-4.03*	-10.17**	-0.59	3.97*	0.58	1.18
L3×L1	8.79**	0.25	1.03	-1.09	-3.41**	-0.46	84.28**	10.41	1.26	2.54	0.37	1.17	1.65	-3.69	0.29
L4×L1	10.61*	9.47	10.14	-2.95**	-3.13**	-15.78	-10.97*	-17.05**	-1.49	0.59	0.55	13.88	6.04**	5.62*	15.19
L5×L1	3.53	-1.08	0.76	-0.72	-2.94**	-0.31	93.39**	9.84	1.23	-3.6*	-8.84**	-0.63	2.06	-0.7	0.74
L3×L2	7.46*	4.24	2.42	-0.74	-1.12	-1.91	2.28	-42.48**	0.03	9.74**	4.84*	2.09	6.2**	3.94	2.85
L4×L2	1.69	-4.51	0.26	-0.96	-2.74**	-0.53	-24.03**	-34.33**	-1.53	4.09*	-2.61	0.59	0.83	-2.83	0.22
L5×L2	10.16**	9.28	12.67	-1.37	-1.63*	-5.07	43.83**	-21.93**	0.52	5.42**	4.27*	4.93	9.53**	8.88**	15.96
L4×L3	-7.92*	-15.96**	-0.83	0.77	-1.41*	0.35	74.31**	2.07	1.05	-4.24**	-6.3**	-1.92	-3.42	-8.84**	-0.58
L5×L3	5.31	1.37	1.37	0.43	0.31	3.68	-0.59	-16.21	-0.03	1.34	-2.16	0.38	4.55*	1.73	1.64
L5×L4	-0.85	-6.19*	-0.15	0.67	-1.39*	0.32	35.1**	-24.52**	0.44	-4.5*	-9.72**	-0.78	-0.62	-3.67	-0.19

\*, \*\* Significant and highly significant at the 0.05 and 0.01 level of probability, respectively.

G = genotypes, L1 = Line 1<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

### 4.2.3. Combining ability

Mean squares of general and specific combining abilities and reciprocals for all studied traits are given in table (24). The results showed that mean squares of general combining ability (GCA) were significant or 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 significant or highly significant in plant length, maturity duration, average fruit number / plant, average fruit weight (kg), total yield / plant, moisture content,  $\beta$ -carotene, vitamin C and total sugars. These results indicate that the GCA, SCA and reciprocals were important in the inheritance of these traits. 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 the remain characters, the GCA higher in magnitudes, these results pointed to predominant role for additive variance of these traits. These results disagreement with those found by Abd El-Hady *et al.* (2005) and in agreement with Obiadalla-Ali (2006) in *cucurbita pepo*, L. who reported that mean squares of GCA were more important than these of SCA for earliness and average fruit weight.

Values of general combining ability effects ( $g_i$ ) of each parent for all studied characters presented in Table (4. 23). Significant or highly significant positive general combining ability (GCA) effects were observed in the parents, L1 for; average fruit weight, fruit shape index, moisture content, vitamin C and  $\beta$ -carotene, L2 for; net weight, netting, TSS, vitamin C and total sugars, L3 for; average fruit number / plant, TSS,  $\beta$ -carotene and total sugars, L4 for; maturity duration, average fruit weight, total yield / plant, flesh thickness %, fruit shape index, moisture content, vitamin C and  $\beta$ -carotene and L5 for; TSS and total sugars content. These results suggested that these 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, indicated that, these parents seem better suited for a breeding program concerned with commercial production in musk melon.

Significant or 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  $\beta$ -carotene. These results suggested that these parents were the worst combiner for these traits.

**Table (4. 22) 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<sub>1</sub>s and 10 reciprocals F<sub>1</sub>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 mg / 100 ml juice.

**Table (4. 23) 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
(G <sub>i</sub> -G <sub>j</sub> ) 0.05	13.12	0.22	2.14	2.88	0.17	0.03	0.12
(G <sub>i</sub> -G <sub>j</sub> ) 0.01	17.49	0.29	2.85	3.84	0.23	0.05	0.15

Genotypes	Fruit characters					Chemical analysis				
	Net weight %	Flesh Thickness %	Placenta hardness (1-10)	Netting (1-10)	Fruit shape index	TSS %	Moisture content%	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*
(G <sub>i</sub> -G <sub>j</sub> ) 0.05	0.77	1.65	0.38	0.28	0.05	0.27	0.37	0.09	0.36	0.09
(G <sub>i</sub> -G <sub>j</sub> ) 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.

(G<sub>i</sub>) = critical differences of (GCA) values. (G<sub>i</sub> - G<sub>j</sub>) = 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 mg / 100 ml juice. L1 = Line 1<sub>Koz-El\_Asal</sub>,

L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

Values of specific combining ability effects (SCA) for the 10F<sub>1</sub> hybrids and their reciprocals regarding vegetative characters and yield components presented in Table (4. 24). 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 height, these results suggested that these hybrids were good in combinations for this character. The results recorded in Table (17) mean performances of these characters (Table 17) confirmed these results. 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 suggesting that these crosses were poor for this character. The data of mean values for these crosses showed that these crosses gave the shortest plant. The values of specific combining ability effects (SCA) for the tested F<sub>1</sub> hybrids for number of branches per plant revealed that the crosses L1 x L2, L1 x L4, L1 x L5, L2 x L3, L2 x L4, L3 x L4 and reciprocals cross L5 x L3 gave high significant positive SCA effect value. This result suggested that this cross was good combination 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.

The data of SCA effects for maturity duration character appeared that both crosses L1 x L3, and L1 x L2 had high significant negative SCA effect values. This result means that, these two F<sub>1</sub> hybrids were good in combinations for reducing maturity duration. The mean performances recorded in Table (4. 15) for maturity date character confirmed this result, where the hybrids L1 x L3 and L5 x L1 were earlier mature compared with the remains hybrids which gave late maturing fruits. The Crosse L3 x L5 gave high significant positive SCA effect values with regard to fruit number character. This result suggested that this hybrid was the best hybrids for producing high fruit number. From data of 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 L1 x L4, L3 x 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 gave highly significant positive SCA effect values. On the other hand, crosses L2 x L3 and reciprocals L2 x L1, L3 x 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.

Values of specific combining ability effects for each of 10 F<sub>1</sub> hybrids and their reciprocal for fruit characters are shown in Table (4. 25). The cross L1 x L4 gave significant positive SCA effect value for flesh thickness character. These results suggested 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 these 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 effect so, 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.

Values of specific combining ability effects for each of 10 F<sub>1</sub> hybrids with reciprocal for; TSS, flesh thickness and chemical analysis are shown in Table (4. 26). T.S.S. %, only one hybrid of the reciprocal crosses L4 x L1 gave high significant negative SCA effect value. These results suggested that this cross had bad combination for produce sweet fruits. Calculated SCA values for the moisture content showed that the crosses L1 x L4 and reciprocals L2 x L1 were the best combinations, where these two crosses gave highly significant negative SCA effect values. These results suggested that these two hybrids gave fruits with lower moisture percentages compared with the other studied crosses. On the other hand, the reciprocal crosses L4 x L1 and L5 x L2 were the worst in this respect, where they gave highly significant positive SCA values. The results respecting to  $\beta$ - carotene indicated that five crosses, L1 x L3, L1 x L5, L2 x L5, L3 x L4 and L4 x L5, and five reciprocals, L2 x L1, L4 x L1, L3 x L2, L4 x L2 and L5 x L4 exhibited highly significant positive SCA effect values, suggesting that these ten hybrids were good combinations for high concentration of  $\beta$ - carotene. On the other hand, five hybrids L1 x L2, L1 x L4, L2 x L4, L3 x L5 and reciprocal L5 x L1 reflected significant or high significant negative SCA effect values. These results suggested that these hybrids the worst combination for high  $\beta$ - carotene concentration. The four crosses L1 x L4, L2 x L3, L2 x L4, L2 x L5 and L3 x L5 and one reciprocals L2 x 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 L1 x L5, L3 x L4, L4 x L5 and reciprocal L5 x L4 reflected significant or high significant negative SCA affect values. These results suggested 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 L4 x L1, L3 x L2, L5 x L2 and L5 x L3 reflected significant or highly significant negative SCA affect values. These results suggested that these hybrids were the worst combination for high total sugars concentration.

These 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.* 2006). In our study no definite genetic mechanism could be ascribed for such reciprocals differences. It is evident from the foregoing results that the crosses showing 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, indicating that selection program could be executed in order to select and develop superior varieties in the advanced segregating generations from promising F<sub>1</sub> hybrids (Obiadalla 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 parental lines of the crosses. Similar results and conclusion were reported by Ann *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.

**Table (4. 24) Values of specific combining ability (SCA) effects and reciprocal effects on the vegetative measurements and yield components traits, of the 10 F<sub>1</sub>s and their reciprocals F<sub>1</sub>, 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
(S <sub>ij</sub> -S <sub>ik</sub> ) 0.05	26.23	0.45	4.27	5.77	0.34	0.07	0.23
(S <sub>ij</sub> -S <sub>ik</sub> ) 0.01	34.99	0.59	5.69	7.69	0.46	0.09	0.31
(r <sub>ij</sub> -r <sub>ik</sub> ) 0.05	29.33	0.5	4.78	6.45	0.38	0.08	0.26
(r <sub>ij</sub> -r <sub>ik</sub> ) 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.

(S<sub>ij</sub>) = critical differences of (SCA) values. (S<sub>ij</sub> - S<sub>ik</sub>) = Critical differences between two (SCA) values of two parental cultivars. C.D.(r<sub>ij</sub> - r<sub>ik</sub>) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line 1<sub>Koz-EL\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

**Table (4. 25) Values of specific combining ability (SCA) effects and reciprocal effects on the fruit characters, of the 10 F<sub>1</sub>s and their reciprocals F<sub>1</sub>, 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
(S <sub>ij</sub> ,S <sub>ik</sub> ) 0.05	1.54	3.29	0.76	0.57	0.09
(S <sub>ij</sub> ,S <sub>ik</sub> ) 0.01	2.05	4.39	1.01	0.76	0.13
(r <sub>ij</sub> ,r <sub>ik</sub> ) 0.05	1.72	3.69	0.85	0.64	0.11
(r <sub>ij</sub> ,r <sub>ik</sub> ) 0.01	2.29	4.92	1.13	0.85	0.15

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

(S<sub>ij</sub>) = critical differences of (SCA) values. (S<sub>ij</sub> - S<sub>ik</sub>) = Critical differences between two (SCA) values of two parental cultivars. C.D.(r<sub>ij</sub> - r<sub>ik</sub>) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line 1<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

**Table (4. 26) Values of specific combining ability (SCA) effects and reciprocal effects on TSS, moisture content and chemical analysis of the 10 F<sub>1</sub>s and their reciprocals F<sub>1</sub> of five melon cultivars, over the tow summer seasons of 2012 and 2013.**

G	TSS %	Moisture content %	Chemical analysis		
			$\beta$ -carotene mg / 100 gm fresh weight	Vitamin C mg / 100 ml juice	Total sugars mg / 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
(S <sub>ij</sub> .S <sub>ik</sub> ) 0.05	0.54	0.74	0.19	0.72	0.19
(S <sub>ij</sub> .S <sub>ik</sub> ) 0.01	0.72	0.99	0.25	0.96	0.25
(r <sub>ij</sub> .r <sub>ik</sub> ) 0.05	0.60	0.83	0.21	0.80	0.21
(r <sub>ij</sub> .r <sub>ik</sub> ) 0.01	0.80	1.10	0.28	1.07	0.28

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

(S<sub>ij</sub>) = critical differences of (SCA) values. (S<sub>ij</sub> - S<sub>ik</sub>) = Critical differences between two (SCA) values of two parental cultivars. C.D.(r<sub>ij</sub> - r<sub>ik</sub>) = Critical differences between two (RCA) values of two parental cultivars. G = Genotypes, L1 = Line 1<sub>Koz-EL\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub>.

Components of genetic variance, ratio between additive and dominance variance (A / D ratio), and ratio between general and specific combining ability variance ( $\delta^2_{gca} / \delta^2_{sca}$ ) of all melon characters under studied presented in Table (4. 27). The additive genetic variance values ( $\delta^2_A$ ) were larger in magnitude than the dominance variance ( $\delta^2_D$ ) for netting, fruit shape index, TSS, moisture content,  $\beta$ -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. Same results were found by Chandrashekhar (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  $\delta^2_{gca} / \delta^2_{sca}$  were in netting followed by fruit shape index and moisture content

**Table (4. 27) Components of genetic variance, ratio between additive and dominance variance (A / D ratio), and ratio between general and specific combining ability variance ( $\delta^2_{gca} / \delta^2_{sca}$ ) of all melon characters under study, over the tow summer seasons of 2012 and 2013.**

Traits	$\delta^2$ additive	$\delta^2$ dominant	A / D ratio	$\delta^2_{gca} / \delta^2_{sca}$
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
$\beta$ -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

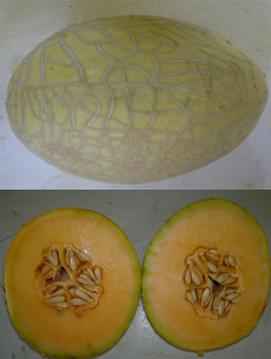
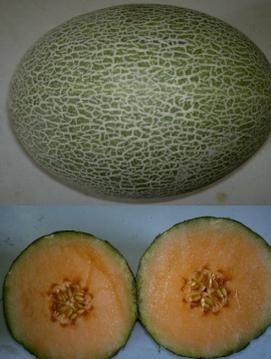
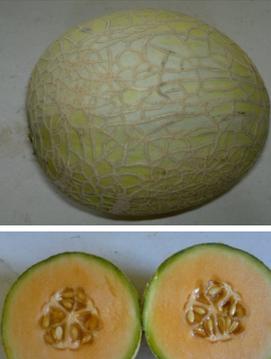
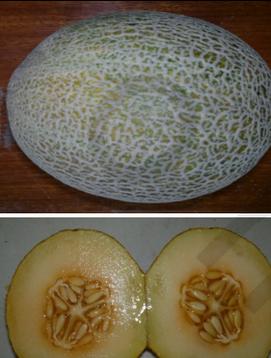
#### 4.2.4 Sensory attributes

Sensory attributes are considered of a great importance in determining the fruit quality of melon (Abd-El-Sayyed *et al.* 2003). Sweetness, aroma volatiles and carotenoids were important sensory parameters in melon (Bernadac *et al.*, 2003)

Table (4. 28) showed Mean sensory scores values of; exterior properties for 5 parents, 10 hybrids and 10 reciprocals. From data it can be observed that the differences were significant between all crosses, and most of crosses scored the highest value compared with their parents. The best genotypes in consumers preferring for exterior

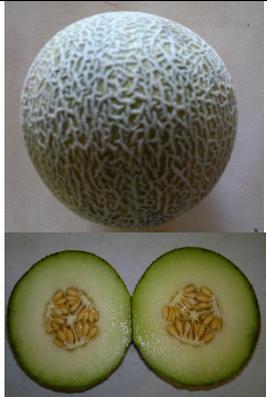
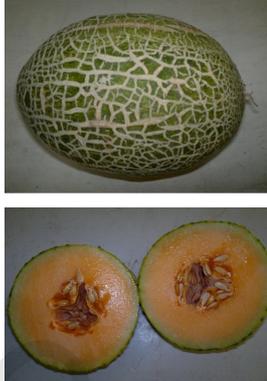
properties were L2×L3, L1×L2, L2×L1, L1 and L1×L5 and L3×L5 for fruit skin color, fruit skin texture, fruit odor, fruit firmness and general acceptability, respectively. The mean sensory analysis for interior properties presented in Table (4. 29) from values it can be observed that the hybrid scored 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. From these results it can be observed that the consumers prefer the hybrids than their parents. The mean performance for most quality characters confirmed these results. These results could be refer to the effect of the hybridization on improving the quality characters, the results are in agreement with the obtained by Robert and Gene (2009) 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 and L2×L5. But the best genotypes according to mean performance tables (17), (18) and (19) L2×L4 followed by L4×L1, L1×L2, L1×L4 and L2×L3. seven hybrids were chosen from this work as a result of some factors such consumers preferring, sweetness, flavor, taste, texture, resistance to certain pests, such as powdery and downy mildew. These factors along with high yield make these hybrids the best ones among the tested hybrids as shown from Table (4. 28).

**Table (4. 28) Special features of the best crosses in hybridization experiment**

Genotypes	Characterization	Pictures
L1×L2	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and moderate yield production 2.77 kg / plant.</li> <li>- Fruit skin has yellow white color with high netted, and the fruit shape was oblong.</li> <li>- Days to maturity; 75.39 days with average fruit weight and number were 0.826 kg and 3.5 fruit / plant respectively.</li> <li>- The flesh color was dark orange and the placenta hardness was very hard, sweetness was very good 13.47 TSS %, with good soft flavor.</li> </ul>	
L2×L4	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and high yield production was 3.786 kg / plant.</li> <li>- Fruit skin has green yellow color with high netted, and the fruit shape was oblong.</li> <li>- Days to maturity: 85 days, average fruit weight and number were 1.217 kg and 3.33 fruit / plant respectively.</li> <li>- 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.</li> </ul>	
L2×L3	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and yield production was 2.673 kg / plant.</li> <li>- Fruit skin has yellow white color with high netted, and the fruit shape was roundish.</li> <li>- Days to maturity: 77.17 days (very early yielding). Average fruit weight and number were 0.896 kg and 3.17 fruit / plant respectively.</li> <li>- The flesh color was orange and the placenta hardness was very hard, and small placenta diameter, sweetness was very good 13.55 TSS % with good flavor.</li> </ul>	
L1×L5	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and high yield production, was 3.033 kg / plant.</li> <li>- Fruit skin has green copperish color with high netted, and the fruit shape was oval.</li> <li>- Days to maturity: 70.67 days (very early yielding). Average fruit weight and number were 1.070 kg and 3.033 fruits / plant respectively.</li> <li>- 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</li> </ul>	

To be conts....

**Table (4. 28) Contd....**

Genotypes	Characterization	Pictures
L3×L5	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and high yield production 3.008 kg / plant.</li> <li>- Fruit skin has yellow green color with high netted, and the fruit shape was roundish.</li> <li>- Days to maturity; 77.72 days (very early yielding) with average fruit weight and number were 0.813 kg and 3.83 fruit / plant respectively.</li> <li>- The flesh color was green and the placenta hardness was very hard, sweetness was very good 13.73 TSS %, with good soft flavor.</li> </ul>	
L4×L1	<ul style="list-style-type: none"> <li>- Have strong vegetative growth and high yield production was 3.627 kg / plant.</li> <li>- Fruit skin has canary yellow color with high netted, and the fruit shape was oblong.</li> <li>- Days to maturity: 83.06 days, average fruit weight and number were 1.003 kg and 3.67 fruit / plant respectively.</li> <li>- The flesh color was orange and the placenta hardness was very hard, and moderate placenta diameter, sweetness was very good 12.33 TSS, with good flavor.</li> </ul>	
L1×L4	<ul style="list-style-type: none"> <li>- Have moderate vegetative growth and yield production was 3.195 kg / plant.</li> <li>- Fruit skin has green yellow white color with high netted, and the fruit shape was oblong.</li> <li>- Days to maturity: 74.83 days (very early yielding). Average fruit weight and number were 1.133 kg and 3.17 fruit / plant respectively.</li> <li>- The flesh color was orange and the placenta hardness was very hard, and moderate placenta diameter, sweetness was very good 11.55 TSS % with good flavor.</li> </ul>	

**Table (4. 29) Mean sensory scores values of; exterior prosperities of 5 parents, 10 hybrids and 10 reciprocals under study of melon over two seasons (early and late summer seasons 2012 and 2013).**

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

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<sub>Koz-El\_Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub> and Control = Shahd El-Doki (check cultivar).

**Table (4. 30) Mean sensory scores values of; interior prosperities of 5 parents, 10 hybrids and 10 reciprocals under study 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 <sub>gh</sub>	8 <sub>ij</sub>	9.25 <sub>abc</sub>	8.75 <sub>abcde</sub>	9.3 <sub>ab</sub>
L2	7.55 <sub>i</sub>	9.15 <sub>bcdef</sub>	9.35 <sub>abc</sub>	9.3 <sub>abc</sub>	9.45 <sub>a</sub>
L3	9 <sub>abcdef</sub>	9.1 <sub>bcdef</sub>	7.95 <sub>fgh</sub>	9 <sub>abcd</sub>	8 <sub>fg</sub>
L4	9.55 <sub>ab</sub>	8.05 <sub>ij</sub>	9.4 <sub>abc</sub>	9 <sub>abcd</sub>	9.3 <sub>ab</sub>
L5	8.65 <sub>efg</sub>	8.8 <sub>efgh</sub>	7.55 <sub>ghi</sub>	7.5 <sub>g</sub>	7.25 <sub>hi</sub>
L1×L2	9.4 <sub>abcd</sub>	9.7 <sub>ab</sub>	8.8 <sub>bcde</sub>	8.45 <sub>def</sub>	8.9 <sub>abcde</sub>
L1×L3	9.25 <sub>abcde</sub>	8.55 <sub>fghi</sub>	7.65 <sub>ghi</sub>	9 <sub>abcd</sub>	7.85 <sub>fgh</sub>
L1×L4	9.4 <sub>abcd</sub>	8.4 <sub>ghij</sub>	9.65 <sub>a</sub>	9.35 <sub>ab</sub>	9.15 <sub>abcd</sub>
L1×L5	9.5 <sub>abc</sub>	9.85 <sub>a</sub>	9.55 <sub>a</sub>	9 <sub>abcd</sub>	8.55 <sub>bcdef</sub>
L2×L3	9.65 <sub>a</sub>	9.15 <sub>bcdef</sub>	9.05 <sub>abcd</sub>	8.9 <sub>abcd</sub>	8.85 <sub>abcde</sub>
L2×L4	9.1 <sub>abcdef</sub>	9.15 <sub>bcdef</sub>	9.45 <sub>ab</sub>	9.3 <sub>abc</sub>	9.25 <sub>abc</sub>
L2×L5	9.45 <sub>abcd</sub>	9.3 <sub>abcde</sub>	8.8 <sub>bcde</sub>	8.6 <sub>cdef</sub>	9.4 <sub>a</sub>
L3×L4	9.4 <sub>abcd</sub>	8.9 <sub>defgh</sub>	9 <sub>abcd</sub>	8 <sub>fg</sub>	8.05 <sub>fg</sub>
L3×L5	9.4 <sub>abcd</sub>	9.25 <sub>abcde</sub>	8.95 <sub>abcd</sub>	8.85 <sub>abcd</sub>	9.3 <sub>ab</sub>
L4×L5	9.85 <sub>bcdef</sub>	7.8 <sub>j</sub>	7.25 <sub>i</sub>	8.65 <sub>bcdef</sub>	8.1 <sub>fg</sub>
L2×L1	7.2 <sub>i</sub>	8.45 <sub>ghij</sub>	8.45 <sub>def</sub>	9.45 <sub>a</sub>	9 <sub>abcd</sub>
L3×L1	8.55 <sub>fg</sub>	8.25 <sub>hij</sub>	7.5 <sub>hi</sub>	7.6 <sub>g</sub>	8.5 <sub>cdef</sub>
L4×L1	8.45 <sub>fg</sub>	8.05 <sub>ij</sub>	8.2 <sub>efg</sub>	7.6 <sub>g</sub>	8.9 <sub>abcde</sub>
L5×L1	8.8 <sub>def</sub>	8.35 <sub>ghij</sub>	7.9 <sub>fghi</sub>	8.8 <sub>abcde</sub>	7.55 <sub>ghi</sub>
L3×L2	7.25 <sub>i</sub>	9.5 <sub>abcd</sub>	8.4 <sub>def</sub>	8.1 <sub>efg</sub>	8.95 <sub>abcd</sub>
L4×L2	9.1 <sub>abcdef</sub>	8.1 <sub>ij</sub>	9.3 <sub>abc</sub>	8.85 <sub>abcd</sub>	8.9 <sub>abcde</sub>
L5×L2	7.7 <sub>hi</sub>	9.55 <sub>abc</sub>	7.75 <sub>bcde</sub>	8.7 <sub>bcdef</sub>	8.2 <sub>efg</sub>
L4×L3	7.15 <sub>i</sub>	8.8 <sub>efgh</sub>	9.05 <sub>abcd</sub>	8.5 <sub>def</sub>	8.45 <sub>def</sub>
L5×L3	8.85 <sub>cdef</sub>	9.55 <sub>abc</sub>	8.8 <sub>bcde</sub>	8.6 <sub>def</sub>	7.15 <sub>i</sub>
L5×L4	8.7 <sub>efg</sub>	9 <sub>cdefg</sub>	8.4 <sub>def</sub>	8.1 <sub>efg</sub>	7.95 <sub>fg</sub>
Control	8.55 <sub>fg</sub>	8.85 <sub>defgh</sub>	8.7 <sub>cde</sub>	8.9 <sub>abcd</sub>	9.25 <sub>abc</sub>

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<sub>Koz-El-Asal</sub>, L2 = Line 2<sub>Charantais</sub>, L3 = Line 3<sub>Green flesh</sub>, L4 = Line 4<sub>Matroh</sub>, L5 = Line 5<sub>Primal</sub> and Control = Shahd El-Doki (check cultivar).

**Table (4. 31) plates of the remain hybrids (4 hybrids and 9 reciprocals)**

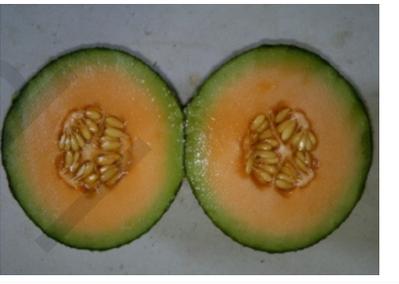
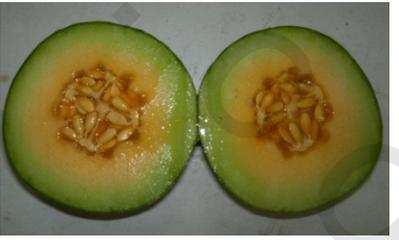
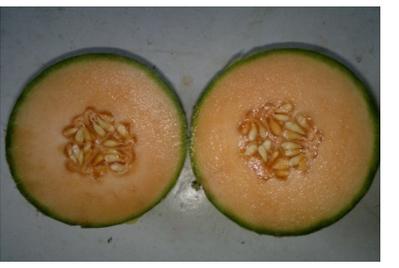
Hybrids name	Complete fruit	Cross section
L2×L1		
L1×L3		
L2×L5		
L3×L4		
L4×L5		
L3×L1		

Table (4. 31) Contd....

Hybrids name	Complete fruit	Cross section
L5×L1		
L3×L2		
L4×L2		
L5×L2		
L4×L3		
L5×L3		
L5×L4	