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GENTIC STUDIES OF SOME CHARACTERS IN SWEET PEPPER (*Capsicum annum* L.)

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ABSTRACT: *These experiments were carried out at Barrage Experimental Station of Hort. Res. Institute, during three successive summer season of 2004, 2005 and 2006. Two sweet pepper, Capsicum annum L. viz., Kyrovck Kapija and Marecony Rosso were used in studying the inheritance of early and total fruit yield per plant, vitamin C content and total soluble solids. In 2004 the two parents were planted in the field during summer season to produced the F_1 seeds. In summer season of 2005 the F_1 plants were selfed and backcrossed to the two parental cultivars to produce the required F_2, BC_1P_1 and BC_1P_2 seeds. In the third season, the six populations, i.e., P_1, P_2, F_1 , F_2 , BC_1P_1 and BC_1P_2 were evaluated. Data obtained indicated that all characters are controlled by 2 – 3 pairs of genes, except the TSS which is controlled by one pairs of genes as simple character. Complete dominance for high parent was found in early yield, fruit weight, vitamin C content and total soluble solids content and over dominance for the high total yield of fruit weight per plant was detected. High broad sense heritability was obtained for all studied attributes, suggesting that considerable improvement through breeding and selection could be detected. Concerning early yield of fruit weight, dominance effect play the main role in the inheritance of this trait since it showed the highest effect value, followed by additive x additive and additive effects, respectively. Regarding total yield of fruit weight the non-allelic interaction (epistatic effects) one type i.e., dominance x dominance; play the main role in the inheritance of this character. As for vitamin C content, both additive and dominance effects play the main role. However total soluble solids, dominance x dominance interaction was the most important.*

Key Words : *Inheritance- Heritability- Gene effects - Heterosis - Potence ratio – Complete dominance.*

INTRODUCTION

Pepper, *Capsicum annum* L., is an important vegetable crop throughout the world including Egypt. According to the statistics of the ministry of Agriculture the acreage of pepper in Egypt in 2007 reached 95126 feddan which produced 651822 tons with an average 6.850 tons per feddan .Pepper is considered as a popular food item in our diet which is consumed either cooked, stuffed, fresh or in salad. Their good flavor, aroma, spice and pungency enhance hundreds of dishes and sauces of many ethnic groups, as they add color and help preserving food. Pepper also has a medicinal value and are excellent sources for vitamin A and C and are low in caloric value.

Yielding ability and fruit characters are important in choosing cultivars for planting in specific regions . The modern cultivars often have higher crop indices than the older outmoded ones (Holiday, 1976). Therefore, attention must be given to the development of new high yielding cultivars or hybrids for the grower and consumer. Increasing yield and improving fruit characters could be achieved through breeding programs.

Before the initiation of any breeding programs in order to improve one or some quantitative characters, it is necessary that, the materials under investigation should be subjected to genetic analysis in order to find out the relative magnitude of various types of the genetic variance. These information would assist the breeders to develop breeding programs for improving many crops.

Maximum progress in improving a trait could be expected with a carefully designed pedigree selection program ,when the additive gene action is the main component of the total genetic variance. Whereas, the presence of high non-additive gene action could suggest the use of a hybrid program. The production of F_1 hybrids should be considered as a result of the direct relationship between the non-additive (dominance and epistasis) gene effects and heterosis.

Therefore the present study was carried out to study the types and relative magnitudes of the genetic variance components, the relative degree of heterosis and the importance which should be given to these parameters in a breeding program hoping to improve the economic characters of pepper.

Several studies had been conducted on the inheritance of early yield, total yield, vitamin C content and total soluble solids content. Kansouh, (1989) found heterosis over mid-parents value for early and total yield per plant. Regarding vitamin C content and total soluble solids, he found that the F_1 plants were intermediate between the two parents. Khalil, *et. al.*, (2004) referred that hybrid vigor was detected for both early and total fruit yield and significant positive average degree of heterosis values were obtained. They added that the best combiner cultivars for total yield as fruit number and weight was Marconi Rosso . Regarding inbreeding depression, all F_2 populations were lower than their corresponding F_1 crosses in early and total yield.

Wang *et. al.*, (1986) found that the content of ascorbic acid in the fruits of F1 plants was very close to those of better parents, indicating dominance for the high content . However Kansouh, (1989) found that partial dominance towards the higher parent was found for vitamin C content (in one cross of 21 crosses).

According to Qunchu, (1995) the broad-sense and narrow-sense heritability were: 58.14% and 42.30%, respectively for "early yield per plant" and 70.78% and 9.10% for the total yield /plant. Showemimo and Olarewaju,

(2002) found that broad sense heritability was estimated as 34.7% in total yield and genotypic coefficient of variance was high for this trait (22.9%). Metwally *et. al.*, (2003) reported that heritability estimates in broad sense were high for vitamin C content and total soluble solids. Geleta and Labuschagne (2006) found that the narrow sense heritability estimate for vitamin C was relatively high (54.8%) indicating that the environment had a less pronounced effect on this trait. On the contrary the heritability for total soluble solids was low (15%).

Chatterjee and Kohli (2004) referred that moderate genotypic coefficient of variation (GCV) and genetic advance (GA), and moderate to high heritability were recorded for fruit yield per plant,. indicating that this trait can be improved through breeding and selection program .

Khalil, *et. al.*, (2004) reported that, additive and non-additive gene effects were involved in the inheritance of both early and total yield. The additive gene effects were more important than the non-additive ones, in the genetic mechanism for total yield, whereas for early yield the non-additive effects play the main role.

MATERIALS AND METHODS

This investigation was carried out at Barrage Experimental Farm of Hort. Res. Station, El-Kanater El-Khyreia Qalubia Governorate. In summer 2004 and 2005 the crosses were made between the parents P_1 (Kyrovck Kapija cv.) and P2 (Marcony Rosso cv.) to produced F_1 seed. F_1 plants were selfed and backcrossed to P_1 and P_2 to produce the required F_2, BC_1P_1 and BC_1P_2 seed, respectively. In the summer 2006 season, parents (P_1 & P_2), F_1, F_2 and the two backcrosses (BC_1P_1 & BC_1P_2) were evaluated in randomized complete block design with three replicates. Each replicate included 14 plants of each P_1 and $P_2$and 19 plants of the F_1 and 40, 30, 30 plants of each F_2, BC_1P_1 and BC_1P_2 respectively. All cultural practices were carried out according to the recommendation followed for pepper crop during the growing seasons.

The plants were transplanted in the field in ridges at 50 cm. apart on March. 15*th*, 2006. The ridge was 5.0 meters long and 70 cm in width. Observations and measurements were recorded on an individual plant basis. Data recorded were as follows: early yield per plant (gm.) in the first three harvests, total yield per plant (Kg.) in all harvests, total soluble solids (TSS %) content; was determined by using by hand refractometers, while ascorbic acid (vitamin C) content; according to A.O.A.C. (1975).

Means, variances, coefficient of variability and standard error were computed for each population. Population means were compared by least significant difference (L.S.D.) according to Snedecor and Cochran (1973).

Various genetic parameters were estimated according to Warner *et. al.*, (1980) as follows:

1- Average degree of heterosis (ADH%):

based on MP =($\overline{F_1} - \overline{MP}$ / $\overline{MP}$) x 100

based on HP =($\overline{F_1} - \overline{HP}$ / $\overline{HP}$) x 100

2- Potence ratio (P.R%) = $\overline{F_1} - \overline{MP} / \frac{1}{2} (P_2 - P_1)$.

3- Inbreeding depression (I.D.%) = $\frac{\overline{F_1} - \overline{F_2}}{\overline{F_1}} \times 100$

4- Environmental variance (E) = $\frac{VP_1 + VP_2 + VF_1}{3}$

5- Gentical variance (G) = $VF_2 - E$

6- Dominance variance (¼ H) = $(VBC_1P_1 + VBC_1P_2) - VF_2 - VE$

7- Additive variance (½ D) = $VF_2 - \frac{1}{4} H + VE$

8- Heritability:

broad sence $h^2_b = (VF_2 - VE)/VF_2 \times 100$

narrow sence $h^2_n = [\,2\,VF_2 - (VBC_1P_1 + VBC_1P_2)]\quad VF_2 \times 100$

9- Gentic advance under selection as percent of F_2 mean (Δ G%) =

$(K.\ 0.05)\ \sqrt{VF_2}\ \times\ h^2_n / F_2 \quad \times 100$

Where h^2_n is the narrow-sense heritability and K is the selection diffetial and equals 2.06 for 5% selection intensity (Johanson *et. al*., 1955).

10- Genetic coefficient of variance (G.C.V) = $\frac{\sqrt{VF_2 - VE}}{\overline{XF_2}}$

11- The minimum number of genes differentiating the parents was determined from the formula after Castle-Wright (1921) .

12- Nature of gene effects were estimated, according to Gamble's method (1962) as follows:

$a = \overline{BC_1P_1} - \overline{BC_1P_2}$

$d = \overline{F_1} - 4\overline{F_2} - \frac{1}{2}\overline{P_1} - \frac{1}{2}\overline{P_2} + 2\overline{BC_1P_1} + 2\overline{BC_1P_2}$

$aa = 2\overline{BC_1P_1} + 2\overline{BC_1P_2} - 4\overline{F_2}$

$ad = \overline{BC_1P_1} - \frac{1}{2}\overline{P_1} - \overline{BC_1P_2} + \frac{1}{2}\overline{P_2}$

$dd = \overline{P_1} + \overline{P_2} + 2\overline{F_1} + 4\overline{F_2} - 4\overline{BC_1P_1} - 4\overline{BC_1P_2}$

Where the parameters m, a, d, aa, ad and dd refer to mean effects, additive, dominance, "additive x additive", "additive x dominance" and "dominance x dominance", respectively.

The significance of gene effects were tested by the t-tests:

$$t = \frac{\text{effect}}{\sqrt{\text{variance of effect}}}$$

Where the variance of an effect is a liner of the variance of its mean.

RESULTS AND DISCUSSION

Data of the studied characters for P_1, P_2, F_1,F_2, BC_1P_1 and BC_1P_2 populations of the cross "Kyroveke Kapija x Marcony Rosso" are given in Table (1, 2,3 & 4). The analysis of variance indicated that there were significant differences among the studied generations in all characters under study.

1- Early yield of fruit weight per plant:

The two parental cultivars (P_1) Kyroveke Kapija and (P_2) Marcony Rosso showed significant difference in early yield. Their means were 172.976 and 149.524 gm/plant, respectively. The F_1 mean (170.526 was close to that of the higher parent, indicating dominance for the high early yield. The estimated ADH% (-1.416%) and potence ratio (0.791) support the postulated suggestion. Slight additive effects was found by Kansouh (1989) and Geleta and Labuschagne (2004).

Variances of the non-segregating populations i.e., P_1, P_2 and F_1 were different, indicating that the environmental variance varies considerable among different genotypes (Table 1). However their variances were less than those of F_2 and backcrosses, this indicates that their homogeneity was higher than that of F_2 populations which had greater variance.

The obtained F_2 mean did not differ significantly from its theoretical mean, which was estimated based on the dominance hypothes , which were (165.642) and (167.113), respectively. This correspondence between the actual and theoretical mean of the F_2 populations support the dominance gene effects postulated.

The distribution of F_2 plants were stretched over a wide range of early yield fruit weight per plant without distinct classes, with a mean ranged from 154 -176 gram per plant.

Table (1): Statistics obtained on early yield fruit weight (gram/plant) for parents, F_1, F_2, BC_1P_1 and BC_1P_2 of the pepper cross "Kyrovcke Kapija x Marcony Rosso".

Population	Number of plant	Range	Actual mean ± SE	Expected mean	S^2
P_1	42	160-177	172.976 ± 0.382	....	6.121
P_2	42	144-156	149.524 ± 0.661	....	18.353
F_1	57	165-180	170.526 ± 0.470	161.250	12.575
F_2	120	154-176	165.642 ± 0.564	167.113	38.131
BC_1P_1	90	163-180	173.133 ± 0.469	171.751	19.827
BC_1P_2	90	150-173	163.267 ± 0.647	160.025	37.729

L.S.D. at 5% = 1.687 at 1% = 2.791

Minimum number of genes was calculated as 2.690 pairs as shown in Table (5). These results suggested that this trait is controlled by 2 – 3 genes.

A heritability in broad since h^2_b and narrow sense h^2_n were calculated as 67.612 and 49.058, respectively. In this respect, broad sense heritability was higher than that of narrow sense in this trait, indicating that superior genotypes for this character in the respective cross could be identified from its genotypic expression, and illustrate the importance of strain. Similar results were found by Qunchu (1995) who found that, broad-sense and narrow-sense heritability of this character were 58.14% and 42.30%, respectively, (Table, 5).

The expected genetic advance (ΔG) % under 5% selection intensity depends mainly on the value of narrow sense heritability. Estimated genetic advance was 376.748%, indicating that improvement of this trait could be achieved by selection. Considerable progress of early yield fruit weight by breeding and selection was also verified by the calculated ΔG, (Table, 5).

Calculated additive variance (43.406%), dominance variance (7.075%), and inbreeding depression (2.949%) were not in accordance with dominance hypothesis, (Table, 5).

The F_1 and F_2 means were very close, being 170.526 and 165.642 gram per plant, respectively. This value is expected and logically, since the absence of heterosis in F_1 will not followed by reduction in F_2 performance.

2- Total yield of fruit weight per plant (kg./plant):

Data presented in Table (2) showed significant difference between the two parental lines in total fruit weight per plant. The Kyrovcke Kapija cv. Significantly exceeded Marcony Rosso by about 0.349 kg./plant .

The F_1 mean was exceeded the mid-parents and the higher parent for total fruit yield per plant, indicating over-dominance for the high yield and the importance of the non-additive gene effects (Table, 2&5). These results are obtained by Kansouh, (1989) and Khalil, *et. al.*, (2004). The average degree of heterosis for high parent and potence ratio were 9.170% and 1.682, respectively.

The actual F_2 mean, BC_1P_1 mean and BC_1P_2 mean differ significantly from its theoretical mean, (Table, 2). The actual means were higher than those theoretical means. This figure may be due to the over dominance of the high yield observed.

Table (2): Statistics obtained on total yield fruit weight (Kg./plant) for parents, F_1, F_2, BC_1P_1 and BC_1P_2 of the pepper cross "Kyrovcke Kapija x Marcony Rosso".

Population	Number of plant	Range	Actual mean ± SE	Expected mean	S^2
P_1	42	1.115-1.650	1.300 ± 0.017	....	0.013
P_2	42	0.730-1.146	0.951 ± 0.015	....	0.009
F_1	57	1.200-1.600	1.419 ± 0.014	1.126	0.011
F_2	120	0.975-1.500	1.381 ± 0.012	1.223	0.017
BC_1P_1	90	1.200-1.650	1.373 ± 0.017	1.360	0.012
BC_1P_2	90	0.975-1.400	1.160 ± 0.014	1.185	0.017

L.S.D. at 5% = 0.039 at 1% = 0.065

Minimum number of genes were calculated as 2.545 pairs by Castle-Wright formula. Heritability in the broad sense h^2_b and narrow sense h^2_n were calculated as 35.541 and 21.615%, respectively, indicating that total yield per plant is affected by the environmental conditions and quantitavely inherited (Table,5). Similar results were found by Qunchu, (1995); and Showemimo and Olarewaju (2002).

Calculated additive variance, dominance variance, "heritability in broad sense h^2_b and narrow sense h^2_n", genetic advance under selection (ΔG)%, minimum number of gene and inbreeding depression were in accordance with the polygenic inheritance. These values were 0.025, 0.001, "35.541 and 21.615", 417.959%, 2.545 pairs and 2.816%, respectively, (Table, 5).

3- Vitamin C content:

Data presented in Table (3) revealed significant difference between the two parents in vitamin C content. The Keyrovck Kapija significantly exceeded Marcony Rosso by about 10.111 mg. /100 g.

The F_1 mean was approximately similar to that of P_1 (the higher parent) in vitamin C content, indicating the complete dominance for the high content. Estimated values of ADH% based on high parent and the potence ratio were -0.494 % and 0.897, respectively, (Table 5), supported the complete dominance of the high content.

Table (3): Statistics obtained on vitamin C content of fruits for the parents, F_1, F_2, BC_1P_1 and BC_1P_2 of the pepper cross "Kyrovcke Kapija x Marcony Rosso".

Population	Number of plant	Range	Actual mean ± SE	Expected mean	S^2
P_1	42	104.18-107.00	105.293 ± 0.163	....	1.111
P_2	42	92.42-97.46	95.182 ± 0.205	....	1.766
F_1	57	102.74-106.64	104.772 ± 0.114	100.238	0.746
F_2	120	96.2-109.84	100.064 ± 0.238	102.770	6.801
BC_1P_1	90	100.20-107.68	104.501 ± 0.201	99.978	3.631
BC_1P_2	90	95.12-102.12	98.867 ± 0.224	105.033	4.499

L.S.D. at 5% = 0.330 at 1% = 0.545

Minimum number of genes were calculated as 2.1 pairs by Castle-Wright formula. Heritability in the broad-sense h^2_b and narrow-sense h^2_n were estimated as 82.240 and 80.438%, respectively, indicating that vitamin C content moderately affected by the environmental condition and considerable improvement can made through breeding and selection (Table, 5). Results obtained, concerning vitamin C content agree with Chatterjee and Kohli (2004), who concluded that vitamin C content in pepper was highly heritable, quantitatively inherited.

Calculated additive variance (7.886), dominance variance (0.123), genetic advance under selection (431.824%) and inbreeding depression (4.705%) were in accordance with the complete dominance for this trait. On the other hand, the heritability in broad and narrow sense was estimated as 82.240 and

80.43%, respectively, (Table, 5). Similar results were found by Geleta and Labuschagne (2006).

4- Total soluble solids (TSS):

Data presented in Table (4&5) showed highly significant difference between the two parental lines in total soluble solids. The Keyrovck Kapija cv. significantly exceeded Marcony Rosso cv. By about 0.676%.

Table (4): Statistics obtained on total soluble solids content of fruits for the parents, F_1, F_2, BC_1P_1 and BC_1P_2 of the pepper cross "Kyrovcke Kapija x Marcony Rosso".

Population	Number of plant	Range	Actual mean ± SE	Expected mean	S^2
P_1	42	4.6-6.2	5.350 ± 0.056	....	0.132
P_2	42	5.4-6.8	6.026 ± 0.057	....	0.134
F_1	57	5.0-6.6	6.030 ± 0.043	5.858	0.134
F_2	120	5.0-6.6	5.903 ± 0.054	5.858	0.143
BC_1P_1	90	4.7-6.0	·5.299 ± 0.049	5.692	0.139
BC_1P_2	90	5.3-6.7	5.890 ± 0.056	6.030	0.138

L.S.D. at 5% = 0.094 at 1% = 0.155

Significant differences were observed between both obtained (6.033) and expected (5.688), arithmetic means of F_1 population. The average degree of heterosis (ADH %) was estimated as 6.07% and 0.119% based on mid-parents and high parental, respectively, suggesting dominance for the high content. The estimated potence value (1.020) was in accordance with the suggested dominance hypothesis (Table, 4). Significant difference was observed between the actual mean of the F_1 and F_2 population with an estimated inbreeding depression value of 2.15 (Table, 4).

The actual F_2 mean, BC_1P_1 mean and BC_1P_2 mean differences significantly from its theoretical mean, (Table, 4). The differences between actual and theoretical mean also suggest dominance effect. Kansouh (1989), found that complete dominance and over-dominance for the high TSS content were observed in some crosses.

Minimum number of genes were calculated as 0.234 pair of gene by Castle-Wright formula, suggesting that TSS is controlled by one pair of genes. Heritability in broad sense h^2_b and narrow sense h^2_n were calculated as 61.908% and 59.847%, respectively. These values is relatively low based on monogenic inheritance (Table, 5). Similar results were found by Ben Chaim and Paran, (2000) and Geleta *et. al.*, (2006) they reported that total soluble solids had low narrow sense heritability.

Genetic coefficient to variance (G.C.V)% and genetic advance under selection (ΔG)% were estimated as 7.892 and 1236.570%, respectively, indicating that considerable progress by selection cannot be made. It is expected when most of the genetic variability is due to dominant gene effect, (Table. 5).

It appears from the examination of data presented that the total soluble solid is controlled by one pair of gene with complete dominance for the high over the low content.

Table (5): Estimates of genetic parameters for early yield fruit weight, total yield fruit weight, vitamin C content and total soluble solids content in pepper.

Genetic parameters	Early yield fruit weight	Total yield fruit weight	Vitamin C content	Total sluble solids content
1- Average degree of heterosis (ADH)%				
based on MP.	5.753%	26.120%	4.520%	6.070%
based on HP.	-1.416%	9.170%	-0.494%	0.119%
2- Potence ratio (PR)	0.791	1.682	0.897	1.020
3- Inbreeding depression (ID)%	2.949	2.816	4.705	2.157
4- Environmental variance (VE)	12.350	0.011	1.208	0.124
5- Genetical variance (VG)	25.781	0.006	5.593	0.226
6- Additive variance (½ D)	43.406	0.025	7.886	6.915
7- Dominance variance (¼ H)	7.075	0.001	0.123	0.017
8- Heritability:				
broad sense%	67.612%	35.541%	82.240	64.535%
narrow sense%	49.058%	21.615%	80.434	59.847%
9- Genetic advance under selection as percent of F2 mean (ΔG)%	376.748 %	417.959 %	431.824 %	1236.570%
10- Genetic coefficient of variation (G.C.V)	3.065%	4.178%	2.263%	8.058%
11- Minimum number of gene:				
by Castle-Wright formula	2.690 pairs	2.545 pairs	2.110 pairs	0.264 pairs

Nature of gene action:

Nature of gene action in this work was investigated according to the relationship illustrated by Gamble (1962). Varietal differences in response to their genetic background were found to be significant in all characters under investigation. The genetic variance of F_2 population was found to be significant for all traits, (Table, 6). Therefore, the various genetic parameters needed in this concern were calculated. Means of the studied traits are shown in table (6).

Estimates of the various types of gene effects contributing to the genetic variability; i.e., mean (m), additive (a), dominance (d), "additive x additive" (aa), "additive x dominance" (ad) and "dominance x dominance" (dd) are presented in (Table 6). The obtained mean effects parameter (m), which reflects the contribution due to the over-all mean (additive) plus the locus effects (dominance) and interaction of the fixed loci (digenic epistasis) found, to be highly significant in all traits studied.

1- Early yield of fruit weight:

As mention before, the estimated value of the mean effects (m) was highly significant for this trait. Three effects, i.e., additive, dominance and additive x additive showed significant positive values. The comparison between obtained additive (d) and additive x additive (aa) values showed that, both additive and (additive x additive) effects were nearly equal. Meanwhile, the dominance effect had the main role in the inheritance of this trait, since it showed the highest effect value. While (dominance x dominance) (dd) was found to be significantly negative, while the other one kind of (additive x dominance) (a x d) showed insignificant value. These results were in accordance with findings of Thakur *et. al.*, (1980) and Kansouh, (1989) who found that this character was controlled by additive and non-additive effects.

2- Total yield fruit weight:

Both additive and epistatic gene effects gave significant positive values, while the dominance effects showed significant negative value. For the non-allelic interaction (epistatic effects) one types, i.e., dominance x dominance (dd); play the main role in the inheritance of this character, since the additive interaction (aa) showed significant negative value (Table, 6). This result suggest that the non-allelic interaction (dd) had an important role in the inheritance of total yield fruit weight. A similar result was obtained by Kansouh, (1989) and Khalil *et. al.*, (2004), who mentioned that the epistatic effects are important in the inheritance of total fruit yield.

3- Vitamin C content:

The vitamin C content was influenced by additive (a), dominance (d) and additive x additive interaction gene effect, since they showed significant positive values. The comparison between obtained dominance and additive values showed that, both additive effect (a) and (additive x additive) interaction (aa) were nearly equal. Among the three digenic types, only the dominance (d) showed high significant effects, while the other one kinds of epistasis (ad) showed insignificant values. Khalil, (1974) and Khalil and Omran (1982) reported that the inheritance of vitamin C content in the pepper fruit was controlled by additive gene effects.

4- Total soluble solids:

Estimates of various types of gene effects involved in the inheritance of total soluble solids are shown in Table (6). The total soluble solids content was influenced by additive and non-additive gene effects. Among the epistatic effects, "dominance x dominance" interaction was the most important. However, the dominance interaction (dd) exhibited the highest effects. Similar results were obtained by Kansouh (1989), when found that the types of digenic epistatic effects, the dominance interaction was highly significant and more important than the other two kinds of epistasis.

Table (6): Estimates of the various types of gene effects and standard error for the studied traits.

Traits	Gene effects					
	m	a	d	aa	ad	dd
Early fruit weight	165.642** ± 0.487	9.867** ± 0.799	19.629** ± 2.600	10.233** ± 2.520	-1.741 ± 0.899	-19.719** ± 3.947
Total fruit weight	1.381** ± 0.017	0.213** ± 0.018	-0.163* ± 0.081	-0.457** ± 0.079	0.038** ± 0.021	0.482** ± 0.107
Vitamin C	100.064** ± 0.163	5.634** ± 0.301	11.013** ± 0.903	6.479** ± 0.886	0.579 ± 0.328	-3.193* ± 1.411
Total soluble solids	5.903** ± 0.056	-0.591** ± 0.074	-0.890** ± 0.275	-1.232** ± 0.269	-0.253** ± 0.084	2.290** ± 0.389

* , ** significant at 0.05 and 0.01 levels of probability, respectively.

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دراسات وراثية علي بعض الصفات في الفلفل الحلو

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الملخص العربي

أُجريت التجارب الخاصة بهذه الدراسة بمزرعة محطة بحوث البساتين بالقناطر الخيرية خلال الموسم الصيفي لأعوام ٢٠٠٤، ٢٠٠٥، ٢٠٠٦ وذلك بهدف الحصول على مزيد من المعلومات الخاصة بوراثة بعض الصفات في الفلفل الحلو- حيث تُساعد هذه المعلومات المربي عند وضع وتنفيذ برامج التربية والتحسين لمحصول الفلفل الحلو- واستخدم في هذه الدراسة صنفين من الفلفل الحلو هما كيروفك كابيجما، وماركونى روزو- وأجري التهجين بينهما في الموسم الأول ٢٠٠٤ لإنتاج بذور الجيل الأول وفي موسم ٢٠٠٥ ثم زراعة نباتات الجيل الأول مع الآباء وأجري التلقيح الذاتي لنباتات الجيل الأول لإنتاج بذور الجيل الثاني وفي نفس الوقت أجري التلقيح الرَجعي لكلا الأبوين للحصول على الجيل الرَجعي الأول وفي موسم ٢٠٠٦ تم زراعة الآباء والجيل الأول والجيل الثاني الجيل الرَجعي الأول لكلا الأبوين في تجربة مصممة بطريقة القطاعات الكاملة العشوائية في ثلاث مكررات وذلك لدراسة وراثة المحصول المبكر والكلي ومحتوى الثمار من فيتامين ج ومحتوى الثمار من المواد الصلبة الذائبة الكلية.

وكانت أهم النتائج ما يلي:

١- صفة المواد الصلبة الكلية سلَكت سلوك الصفات البَسيطة وقد تحكم في وراثتها زوج واحد من العوامل الوراثية أما باقي الصفات تحت الدراسة فسلَكت سُلوك الصفات الكمية وقد تحكم في وراثتها أكثر من زوجين من العوامل الوراثية .

٢- ظَهَرَت سيادة تامة للأب العالي لكل من صفات المحصول المبكر ومحتوى الثمار من فيتامين ج ومحتوي الثمار من المواد الصلبة الذائبة الكُلية.

٣- ظَهَرَت سيادة فائقة للأب العالي في المحصول الكلي للنبات .

٤- كانت الكفاءة الوراثية بالمعنى الواسع عالية في جميع الصِفات المدروسة مما يُؤكد تـأثير هذه الصِفات بالعوامل الوراثية بنسبة كبيرة و يُشجع من تحسين هذه الصِفات عن طريـق برامج التربية .

٥- أوضحت النتائج أن السيادة تلعب دور هام في صِفةِ المحصول المبكر بالإضافة إلى الفعـل الجيني المضيف في وراثة هذه الصِفة. بينما أظهرت النتائج وجود أهميـة للسيادة فـي وراثة صفة المحصول الكلي في الفلفل الحلو .

٦- أظهرت النتائج أن صِفة محتوى الثمار من فيتامين ج يتحكم فيها كلا من الجينات السائدة والفِعل المضيف- وأيضاً صفة محتوى الثمار من المواد الصلبة الذائبة الكلية مما يؤكـد أهمية برامج التربية في تحسين هذه الصفات في الفِلفِل الحلو .