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Population Dynamic of *Aphis gossypii*, and Their Parasitoids, and Effect of Some Insecticides on Aphids, Chlorophyll Content, Non-Enzymatic and Antioxidant Enzymes Activity in Cantaloupe Leaves in Greenhouses

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Abstract: Under green house, the Population density of *Aphis gossypii* on cantaloupe plants recorded two peaks on May 9**th** and 23**th** with 1409 and 1561 individuals/ 10 leaves in season 2022, while one highest peak, on 16th May with 1650 individuals/ 10 leaves in season 2023. Parasitism status of *Aphidius colemani* and *Lysiphlebus fabarum* varied from 1.49% on 25 April to 35.79% on 9th of May with seasonal parasitism 2023 in 2022 and ranged between 0.73% on 25th of April and 30.06% on 16th of May with seasonal parasitism 16.57% in 2023. Acetamiprid, imidacloprid, imidacloprid + abamectin, jojoba oil, orange oil and thiamethoxam + abamectin compounds were tested to control aphids during two seasons. Imidacloprid recorded the highest reduction with all average 97.88 ±1.15 and 97.39 ±1.15 in the first and second season respectively. the highest mean reduction of emergence of the two-parasites caused by thiamethoxam + abamectin by 16.92% followed by Imidacloprid with 16.87%. While the least toxicity to emergence of the parasitoids recorded with jojoba oil 0.0% followed by orange oil 1.93% in season 2022, while in season 2023, the higher parasitoid reduction caused by acetamiprid 18.05% followed by Imidacloprid 17.69% and thiamethoxam + abamectin 17.53%. Chlorophyll content increased with treatment jojoba oil followed by Imidacloprid by 47.91 and 44.73 unit in the first season and Thiamethoxam with abamectin lead to the highest content by 44.05 unit in the leaves followed by jojoba oil with 43.65 unit. The least treatment was Imidacloprid + abamectin with 39.55 unit compared with control treatment 40.43 unit. Treatment Thiamethoxam + abamectin recorded the highest content of carbohydrates (48.43) compared with control (47.71). Treatments of insecticides led to increase of protein, fats and total lipid compared with control. Also, Antioxidant enzymes activity in cantaloupe leaves were found to be increased in the treatment of insecticides compared with control.

Key words: Aphids, parasitoids, cantaloupe, Insecticides, biochemical.

1. Introduction

Cantaloupe is one of the most important cucurbitaceous vegetables grown in Egypt in both open field and under green house for both exporting and local consumption. During the growth season, several insect pests attack cucurbitaceous vegetable plants, including, aphids, thrips and whitefly (**El-Maghraby *et al.*, 1989**). *Aphis gossipyii* Glover (Homoptera: Aphididae) is the most prevalent insect pests on Cantaloupe plants (**El-Maghraby *et al*., 1989**).

The hymenopteran parasitoid, *Aphidius colemani* and *Lysiphlebus fabarum* are a potential bio agent for *Aphis gossypii* on cantaloupe and cucumber (**Hafez *et al*., 1996, Pinto *et al*., 2004, Ali 2014 and Saleh *et al*., 2017).** Traditionally, pests in greenhouses are managed by applying insecticides, even though they might result in issues like the emergence of insect resistance, environmental residue and inhibiting the function of biological control agents (**Ali *et al*., 2006; Nicolas *et al*., 2012 and Eid *et al*., 2018**). The movement toward adopting environmentally friendly pesticides has become a renewed focus and ongoing difficulty for managing cantaloupe insect pests. Among these insecticides, Imidacloprid, abamectin, Thiamethoxam, Acetamiprid, and plant extract such as, Jojoba oil and orange oil against aphids and other sap sucking insects.

Worldwide, pesticides are used to protect plants from pests. Plants are toxicized by pesticides, which negatively affects to growth and development of plants. Protein and chlorophyll content are reduced as a result of pesticide damage **(Sharma *et al.* (2017).** Also, pesticides application causes reactive oxygen species in plants, which stresses them out. This ultimately leads to retarded growth and photosynthetic efficiency of plants. plants try to ameliorate Pesticide toxicity by activation of their internal antioxidative defense system which includes antioxidative enzymes and non- enzymatic antioxidants**.** Treated the cucumber plants with the entomopathogen *Beauveria bassiana* for the control of *Aphis craccivora* and this treatment increased the concentration of alkaloids, flavonoids, phenols, hydrogen peroxidase and total chlorophyll as compared with non – treated cucumber plants 28 days post treatment (**Homayoonzadeh *et al*., 2022).** There was an increase in the antioxidant enzymes SOD and CAT in the cucumber cultivar (Melouky) which had a high content of plant secondary metabolites. Also, increasing levels of plant secondary metabolites tend to increase *Bemisia tabaci* CAT and SOD levels **(Mona *et al.*, 2023)**.

The current study was conducted to investigate the Population fluctuation of *Aphis gossypii*, Parasitism status of *Aphidius Colemani and Lysiphlebus Fabarum* on *Aphis gossypii*, Potency of tested compounds in reducing *A. gossypii* populations**,** and role of some pesticides in lowering emergence of the parasitoids from *A. gossypii* on cantaloupe plants and the effect of some pesticides on chlorophyll content, non-enzymatic compounds and antioxidant enzymes activity in cantaloupe leaves.

2. Material and methods

Field experimental

The current study was carried out on the experimental farm (green house) of the Kafr El-Sheikh Governorate Sakha Agricultural Research Station during the 2022 and 2023 seasons.

2.1. Population density of *Aphis gossypii* in cantaloupe plants

Cantaloupe seedlings were transplanted in the two seasons 2022 and 2023which planted during the 2nd week of March in both seasons. Under greenhouse conditions, a half feddan area split into four plots with four replicates. The design employed was a complete randomized block. Cantaloupe plants were weekly examined after one month of transplanting until the end of season. Ten leaves were removed from ten plants, and the number of aphids (including nymphs and adults) on each leaf was counted.

2.2. Survey of the common parasitoid species associated with *A. gossypii* on cantaloupe plants

To evaluate the parasitoids aphids, collected samples randomly of the aphid *A. gossypii*. It was gathered from cantaloupe plants that were grown at the experimental farm in 2022 and 2023 seasons. The host plant was cantaloupe variety (Hybrid Galea), which kept free from any pesticide application. Each week, samples of strongly afflicted plant portions were selected, and the prior aphid infestation was recorded. Parts of infested plants were moved to the laboratory and sealed in paper bags. Five cantaloupe leaves made up the size of the samples. All individuals from each aphid species found on the host plant samples were counted. Aphids were fed on their natural host and kept. Every 50 aphids in a petri dish until formation of mummies. Aphid mummies were kept apart and separated in tiny glass tubes until adult parasitoids appeared. The emerged parasitoids were primarily classified, counted and preserved in 70% ethyl alcohol. Parasitoid specimens were identified by the aid of Biological Control Unit, Rice Research and Training Centre (R.R.T.C.), Sakha, Kafr El-Sheikh, Egypt.The rates of parasitism resulting from several parasitoids were calculated. Aphids were separated into three groups in the lab: a) aphid mummies, b) live aphids carrying parasitoid larvae (which were maintained until the mummies formed), and c) counted parasitized aphids. The parasitism % was determined using **(Farrell and Stufkens 1990).**

2.3. Potency tested compounds in reducing *Aphis gossypii* populations on cantaloupe plants

This experiment carried out on the green house of the Sakha Agricultural Research Station during the seasons 2022 and 2023. The cantaloupe variety (Hybrid Galea) was planted in the 2^{nd} week of March in both seasons in a total area of 4000 square meters and divided into ten parts with an area of 400 m/treatment. All agricultural operations were applied on the green house, including irrigation and fertilization without any insecticide treatments, A Knapsack sprayer was used to apply the tested compounds.

2.4. The tested compounds

The experiment was conducted to evaluate six compounds were applied in green house in the corresponding commercial formulations that are obtainable from the market (Table 1). The Egyptian Ministry of Agriculture recommendations for each pesticide concentrations were the basis for the concentrations to control sucking insect pests under greenhouse conditions.

Table (1). Common and trade names of tested compounds, their chemical classes and application

Common name	Trade name	Company	Application rate/100L
Acetamiprid	Mosiplan 20%SP	Parijat New Delhi Co.Modern Arab Company	25g
Imidacloprid	Keribs 35% SC	National Agricultural Chemicals Co.	75 ml
Imidacloprid 12% + abamectin 2%	Congest-Extra 14% SC	Starchem Industrial Chemicals Egpyt	50 ml
Jojoba oil	Top healthy 60% EC	Top Chemical Factory for the manufacture of pesticides and specialized Chemicals	400 ml
Orange oil	Pref –am 66% sl	Top Chemical Factory for the manufacture of pesticides and specialized Chemicals	400
Thiamecthioxam 15.24% + abamectin 3.32%	Regular-zol 18.56% SC	Mirs Agricultural Development Co.	60 l

A. gossypii (nymphs and adults) counts They were recorded prior to the application of spray 40 cantaloupe leaves (10 leaves / replicate) for each treatment in the greenhouse, counts were also taken to assess the infestation levels of insect two, five, seven and ten days after application. To determine the percentage of infestation reductions, equation of (**Fleming and Ratnataran, 1985**) was used.

2.5. Determination of malondialdehyde content (MDA)

Fresh cantaloupe leaf samples (1 gm) were mixed with 1 ml of 10% trichloroacetic acid (TCA) and 1 ml of 0.67% thiobarbituric (TBA) and heated in a boiling water bath for 15 min. MDA was measured spectrophotometric ally by absorbance at 535 nm and expressed as n mol of MDA per gram fresh leaf samples (**Madhava Rao and Sresty, 2000**).

2.6. Antioxidant enzymes, total carbohydrates and protein content assays

cantaloupe the freshly collected leaves (1 gm) were mixed together in a liquid N2 with 0.05 M. EDTA and 1 PVP at 4 °C, the extracts were centrifuged at 4 °C 5000 mg (**Lowry *et al.,* 1951**). The resulting supernatant was employed in order to identify antioxidant enzymes (Catalase, peroxidase and superoxidase) and nonenzymatic components (total carbohydrates and protein content). Catalase Activity was calculated using (**Aebi 1984**), method of (**Polle *et al*., 1994**) was used for determination of peroxidase activity. Superoxide activity was determined as described by (**Zhou *et al.,* 2007)**, The amount of protein was measured. based on (**A.O.A.C. 1990**), and total carbohydrates was determined using the technique of phenol-sulphuric acid given by (**Dubois *et al.,* 1956**) and calculated as percentage. Determination of photosynthetic pigments, enzymes activity, protein content and total carbohydrates were assessed in the laboratory of Pesticides Chemistry and Toxicology Department, Faculty of Agriculture, Damanhur University.

2.7. Statistical analysis

Analysis of variance (ANOVA) was calculated, and significant differences between the means of these treatments by Duncan's Multiple Rang Test **(Duncan 1955)** using the SPSS statistical software package 16.0 (**SPSS Inc., Chicago, IL, USA, 2016).**

3. Results and discussion

3.1. Population density of *Aphis gossypii* on cantaloupe plants

Population density of aphids on cantaloupe plants in green house of the Sakha Agricultural Research Station were recorded for the 2022 and 2023 seasons. Information shown in Table (2) and Fig (1) demonstrated that during the first season 2022, the insect was observed during the third week of April with 23 individuals of aphids, then the population densities gradually increased forming two peaks on May 9th and 23th with 1409 and 1561 individuals/ 10 leaves respectively. While in the second season 2023 *Aphis gossypii* on cantaloupe plants started to appear by second week of April, with low numbers 5 individuals/ 10 leaves then increased gradually forming the highest peak 1650 individuals/ 10 leaves on 16th May and decreased in numbers of insect. **Saleh *et al.,* (2017**) recorded those four peaks for *A. gossypii* on cucumber plants, during the first season of 2015. The third and last week of April regard these peaks. and second week of May. While recorded three peaks for *A. gossypii* on cucumber plants during the second season 2016. The first week of April, May, and June, respectively, incidence these peaks.

3.2. Parasitism status of some parasitoids on *Aphis gossypii* infesting cantaloupe plants

Data presented in Table (2) noticed that during the first season 2022, The ratio of parasitism caused by *A. colemani* and *L. fabarum* on Aphids infesting cantaloupe plants varied from 1.49% on 25 April to 35.79% on 9 May (first week of May) 2023 with average rate of parasitism 11.47% with seasonal parasitism 20.23%. As shown in Table (2) the percentage of parasitism in the second season 2023 on *A. gossypii* ranged between 0.73% on 25 April 2023 and 30.06% on 16 may 2023. The average rate of parasitism on *A. gossypii* reached 12.93% with seasonal parasitism 16.57%.

Table (2). Parasitism status of *Aphidius colemani* and *Lysiphlebus fabarum* on *Aphis gossypii* infesting cantaloupe plants at Sakha Agricultural Research Station

Month/year	Aphid (No.)	Mummy (No.)	Parasitism%
2022			
4 Apr.	0	0	0
11	0	0	0
18	23	0	0
25	606	9	1.49
2 May	998	89	8.92
9	1409	500	35.79
16	1395	399	28.60
23	1561	311	19.92
30	820	70	8.54
Average	756.89	153.11	11.47
Seasonal parasitism %	-	-	20.23
2023			
4 Apr.	0	0	0
11	5	0	0
18	35	0	0
25	275	2	0.73
2 May	1005	102	10.15
9	1572	354	22.92
16	1650	496	30.06
23	902	108	11.97
30	606	41	6.77
Average	739.56	122.56	12.93
Seasonal parasitism %	-	-	16.57

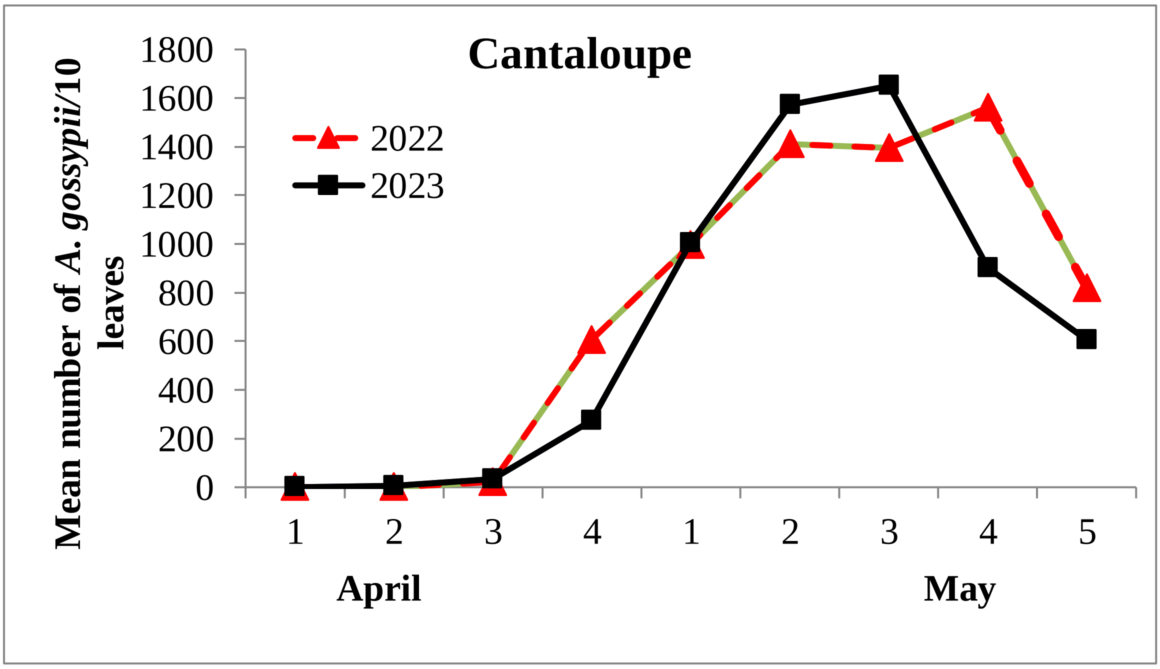

Fig. (1). Population density of *Aphis gossypii* on cantaloupe plants under greenhouse at Sakha Research Station during 2022 and 2023 seasons

The results above agree with those attained by **Saleh *et al*. (2017**) indicated that the percentage of parasitism by *Lysiphlebus Fabarum*, *Diaeretiella rapae* and *Binodoxys angelica* on *Aphis gossypii* ranged from 3.14% to 21% in 2015 season. while it is ranged from 2.66% to reach its maximum 42.66% in the second season 2016. They recorded primary parasitoid *Lysiphlebus fabarum* was the highly dominant species with high relative densities during the two successive seasons. **Gissella, *et al*., (2006**) indicated that the efficacy of *Aphidius colemani* Viereck (Hymenoptera: Braconidae) for suppression of *A. gossypii* in greenhouse-grown chrysanthemums, *Dendranthema grandiflora* (Tzvelev), was compared with a pesticide standard, imidacloprid (Marathon 1% G) and an untreated check. No significant differences were found between aphid populations in the two treatments. *A. colemani* and imidacloprid kept aphid numbers very low, with the correspondent aphid populations exhibiting very low intrinsic rates of increase (r (m) = -0.0369 and r (m) = 0.0151, respectively)

3.3. Potency tested compounds in reducing *Aphis gossypii* populations on cantaloupe plants

Reduction percentage of *A. gossypi*i caused by Imidacloprid, Imidacloprid + abamectin**,** Acetamiprid, jojoba oil, and orange oil after 2 days and 5,7 and 10 days of treatment were evaluated in 2022 and 2023 cantaloupe seasons (Table 3). All insecticides were applied alone at their recommended field rates and mixed. Results in table (3) showed that the highest mean reduction percentages of A. *gossypii* were recorded by Imidacloprid 97.88 and 97.39% followed by Acetamiprid 96.82 and 96.10% in season 2022 and 2023 respectively. While the lowest mean of reduction percentages was 78.25% and 73.745 in season 2022 and 76.79% and 72.89% in season 2023 after application of orange oil and jojoba oil respectively. **Aneesa *et al.* (2024**) showed that all tested compound recorded a high reduction against *B. tabaci* and *L. sativa* on initial effects. **El-Fakharany *et al*. (2024)** found that, almost, reduction was found highly significant differences among treatments of *T. urticae* eggs (p≤0.01) and all treatments proved to be the most potent on *T. Tabaci* reduction, with highly significant differences (p≤0.01).

Table (3). Potency of tested compounds in reducing *Aphis gossypii* populations on cantaloupe plants at Sakha Agricultural Research Station in greenhouse

Compound	Used* conc. [mg a.i.l^{-1}]	Aver. No. pre- treat. /10 leaves	% Reduction ±SE		
			Initial effect % (2 days)	Residual effect average (5,7 and10 days)	Grand Average
2022					
Imidacloprid	262	939	98.41a ± 0.58	97.35a ± 1.15	97.88a ± 1.15
Imidacloprid + abamectin	70	998	97.42a ± 1.6	93.97a ± 2.31	95.70a ± 2.31
Thiamecthioxam + abamectin	111	817	91.22b ± 1.73	98.28a ± 0.58	94.75a ± 2.31
Acetamiprid	50	841.5	94.49ab ± 1.15	99.15a ± 0.29	96.82a ± 1.73
Jojoba oil	2395	606.75	72.03c ± 1.15	75.45c ± 2.89	73.74b ± 2.31
Orange oil	120	1032	70.73c ± 1.15	85.76b ± 3.46	78.25b ± 4.04
Untreated (No.)	-	295.50	395.25	1329.00	-
2023					
Imidacloprid	262	909	98.13a ± 0.58	96.65a ± 1.73	97.39a ± 1.15
Imidacloprid + abamectin	70	989	97.03a ± 1.16	92.02a ± 2.31	94.53a ± 2.31
Thiamecthioxam + abamectin	111	875	90.66b ± 1.15	97.94a ± 1.15	94.3a ± 2.89
Acetamiprid	50	798.25	93.39ab ± 1.73	98.80a ± 0.58	96.10a ± 1.73
Jojoba oil	2395	701.5	72.44c ± 1.73	73.33c ± 2.31	72.89b ± 1.73
Orange oil	120	1000	71.05c ± 2.31	82.52b ± 3.46	76.79b ± 2.89
Untreated (No.)	-	909	411.00	1274	-

In a column, means followed by different letters show significant differences according to Duncan's test (1955) at $P < 0.05$

3.4. Effect of tested compounds in reducing emergence of the parasitoid, *Aphidius colemani* and *Lysiphlebus fabarum* from *Aphis gossypii* on cantaloupe plants in greenhouse

Results in table (4) clarify the side effects of some compound on reducing emergence of the two parasitoids, *Aphidius colemani* and *Lysiphlebus fabarum* from *A. gossypii* after 2, 5, 7 and 10 days of treatments at 2022 and 2023 cantaloupe seasons were investigated and presented in Table (4). In season 2022, the highest average reduction of emergence of the two-parasitoid caused by Thiamecthioxam + abamectin 16.92% followed by Imidacloprid by 16.87% and Acetamiprid 16.09%. While the least toxicity to emergence of the parasitoids from *A. gossypii* was jojoba oil 0.0% followed by orange oil 1.93%.

In season 2023, the highest average reduction of emergence of the two-parasitoid caused by acetamiprid 18.05% followed by Imidacloprid 17.69% and Thiamecthioxam + abamectin 17.53% while the lowest reduction of emergence of the two parasitoids recorded from *A. gossypii* was jojoba oil 0.00 and orange oil 2.09%. The previous results showed that all insecticides treatments were classified as slightly harmful on emergence of the parasitoids, *Aphidius colemani* and *Lysiphlebus fabarum* from *Aphis gossypii* on cantaloupe plants green house. while jojoba oil and orange oil were least effect on emergence of two parasitoids from *A. gossypii*.

Table (4). Effect of tested compounds in reducing emergence of the parasitoid, *Aphidius colemani* and *Lysiphlebus fabarum* from *Aphis gossypii* on cantaloupe a plant at Sakha Agricultural Research Station

Compound	% Emergence pre- treat	% Reduction emergence ±SE		
		Initial effect %/2 days	Residual effect average (5,7 and10 days)	Grand Average
2022				
Imidacloprid	66.67	24.37b ± 1.73	9.37a ± 1.15	16.87a ± 1.73
Imidacloprid+ abamectin	70.0	12.61c ± 1.15	10.55a ± 1.73	11.58b ± 1.15
Thiamethoxam + abamectin	66.67	33.83a ± 1.73	0.00c ±0.0	16.92b ± 1.15
Acetamiprid	87.5	23.17b ± 1.15	9.00a ± 1.44	16.09a ± 1.73
Jojoba oil	60.0	0.0d ± 0.0	0.00c ± 0.0	0.00d ± 0.00
Orange oil	100	0.0d ± 0.0	3.85b ± 0.58	1.93c ± 0.25
Untreated (No.)	100	85.00	47.60	-
2023				
Imidacloprid	70.13	25.54b ± 2.31	9.83a ± 1.15	17.69ab ± 2.31
Imidacloprid+ abamectin	74.00	14.41c ± 1.15	11.11a ± 1.73	12.76b ± 1.73
Thiamethoxam + abamectin	70.15	35.06a ± 1.73	0.00c ± 0.00	17.53ab ± 1.15
Acetamiprid	90.00	25.93b ± 2.31	10.17a ± 1.15	18.05a ± 2.31
Jojoba oil	73.00	0.00d ± 0.00	0.00c ± 0.00	0.00c ± 0.0
Orange oil	95.00	0.00d ± 0.00	4.17b ± 0.58	2.09c ±0 .29
Untreated (No.)	100.00	90.00	60.92	-

In a column, means followed by different letters show significant differences according to Duncan's test (1955) at $P< 0.05$

Eid *et al.* (2018) reported that in cantaloupe summer plantation, releasing rates of more than 4 individual/ m^2 of the parasitoid *A. colemani* and more than 10 individual/ m^2 of predator C. *septempunctata* is suggested for the biological management of cucumber greenhouse aphid infestations. Even though the expense was comparatively greater and the aphid population did not decline as much as it did with the chemical control and the cost was relatively higher and despite the comparatively greater cost, the output in terms of both quantity and quality was substantially higher.

3.5. Effect of tested compounds on chlorophyll content in cantaloupe leaves

Data in Table (5) indicated that some compound caused increasing of chlorophyll content compared with control treatment. In the first season 2022 the highest grand average of chlorophyll content was recorded 47.91 unit in treatment jojoba oil followed by Imidacloprid 44.73 unit while the least chlorophyll content was found in treatment Imidacloprid +abamectin with average 41.25 unit.

In the second season 2023 results presented in Table (5) indicated that, treatment Thiamecthioxam + abamectin lead to the highest chlorophyll content 44.05 unit in the leaves of cantaloupe followed by jojoba oil with 43.65 unit. while the least treatment was Imidacloprid + abamectin with 39.55 unit compared with control treatment 40.43 unit. **Aneesa *et al*. (2024)** clarify that All compounds significantly increased chlorophyll content at initial, five and seven days. While when using imidacloprid that reduced chlorophyll content. **El-Fakharany *et al*. (2024)** clarify the application of different compounds resulted in significant differences in chlorophyll content.

Table (5). Effect of tested compounds on chlorophyll content in cantaloupe leaves

Compound	Chlorophyll content (SPAD) unit effect after indicated days				
	2	5	7	10	Grand average
2022					
Imidacloprid	36.3c ± 1.15	45.8ab ± 1.45	44.6b ± 1.73	52.2a ± 1.15	44.73ab ± 1.73
Imidacloprid+ abamectin	35.23c ± 2.31	49.74a ± 1.73	35.43d ± 1.73	44.6bc ± 1.73	41.25b ± 0.33
Thiamecthioxam + abamectin	38.33c ± 1.73	43.32bc ± 1.73	39.6bc ± 2.31	53.8a ± 1.73	43.76ab ± 1.73
Acetamiprid	38.2c ± 0.58	43.84bc ± 1.73	39.6bc ± 1.73	46.55b ± 1.73	42.05b ± 1.73
Jojoba oil	49.88a ± 1.15	39.07cd ± 1.15	50.3a ± 1.73	52.4a ± 1.15	47.91a ± 2.31
Orange oil	43.58b ± 1.73	42.0bcd ± 1.15	42.3b ± 1.15	40.2c ± 1.15	42.02b ± 1.15
Control	39.6bc ± 1.15	38.92d ± 1.15	41.0b ± 1.15	46.9b ± 1.73	41.61b ± 1.15
2023					
Imidacloprid	33.5b ± 2.31	39.5bc ± 2.89	43.8a±1.73	54.7a±3.46	42.88a ± 1.15
Imidacloprid+ abamectin	35.2ab ± 1.73	46.9a ± 2.31	33.5c±1.73	42.6c±2.31	39.55a ± 2.89
Thiamecthioxam + abamectin	36.2ab ± 2.89	46.8a ± 1.73	42ab ± 2.89	51.2ab±2.31	44.05a ± 2.31
Acetamiprid	38.0ab ± 2.31	43.2ab ± 1.73	36.1bc ± 1.15	45.7bc±1.15	40.75a ± 1.73
Jojoba oil	42.1a ± 1.73	35.2c±2.31	43.1a ± 1.73	54.2a±2.31	43.65a ± 1.73
Orange oil	36.9ab ± 1.73	40bc±1.15	38.4abc ± 2.89	45.7a±2.89	40.25a ± 1.88
Control	39.2ab ± 2.6	39.0bc±1.15	38.1abc ± 1.73	45.4bc ± 2.31	40.43a ± 2.89

In a column, means followed by different letters show significant differences according to Duncan's test (1955) at $P < 0.05$

3.6. Effect of insecticides compounds on nonenzymatic components in cantaloupe leaves

Data presented in Table (6) showed that, effect of some insecticide compounds on nonenzymatic components in cantaloupe leaves after treatment on *Aphis gossypii* for 10 days. Treatment Thiamecthioxam + abamectin causes the highest content of carbohydrates (48.43) followed by control

(47.71) while the other treatments of tested compound of insecticides were lower compared to control treatment. The lowest Carbohydrates content was recorded in treatments were Acetamiprid (38.93) and orang oil (34.91). Whereas protein content and fat content in treatments of insecticides were higher compared to control (3.77 and 0.62) respectively. Data in table (6) showed that, Total lipid% in treatments of insecticides were higher than control treatment except Acetamiprid was lower compared with control. **El-Fakharany *et al.* (2024)** showed that the application of different insecticides compounds resulted non -enzymatic components significantly decreased in cucumber plants due to some compounds in comparison with the control. The increase of carbohydrates, fats and total phenols% were observed in leaves with abamectin + bifenthrin treatment. Also, jojoba oil increasing the protein content and total lipid in the leaves.

Table (6). Effect of insecticides compounds on non-enzymatic components in cantaloupe leaves after treatment on *Aphis gossypii* for 10 days

Treatment	Non-enzymatic components ±SE				
	Carbohydr-ates	Protein	Fats	Total lipid%	Total phenols%
Imidacloprid	39.23cd ± 1.73	5.48a ± 0.58	0.79abc ± 0.06	0.56a ± 0.06	1.73bc ± 0.12
Imidacloprid+ abamectin	43.20bc ± 1.73	5.10ab ± 0.10	0.73bc ± 0.12	0.52a ± 0.06	1.67c ± 0.12
Thiamecthioxam + abamectin	48.43a ± 1.73	4.66ab ± 0.17	0.96a ± 0.02	0.42ab ± 0.06	2.07a ± 0.04
Acetamiprid	38.93cd ± 1.15	5.10ab ± 0.23	0.85ab ± 0.06	0.30b ± 0.03	1.93ab ± 0.02
Jojoba oil	41.85c ± 1.15	5.03ab ± 0.58	0.83ab ± 0.02	0.46ab ± 0.02	1.85abc ± 0.03
Orange oil	34.91d ± 1.73	4.87ab ± 0.58	0.70bc ± 0.06	0.50a ± 0.06	1.47c ± 0.02
Control	47.71ab ± 1.15	3.77b ± 0.58	0.62c ± 0.01	0.34b ± 0.02	2.00a ± 0.06

In a column, means followed by different letters show significant differences according to Duncan's test (1955) at $P < 0.05$

3.7. Effect of insecticides compounds on antioxidant enzymes activity in cantaloupe leaves after treatment on *Aphis gossypii* for 10 days

Data presented in Table (7) showed that, antioxidant enzymes Catalase, Peroxidase and Superoxides of *A. gossypii* collected from cantaloupe leaves for 10 days were found to be increased for Catalase activity in the treatment by insecticides compounds such as; Imidacloprid (5.36u/ mg Protein) following by Thiamecthioxam + abamectin (5.12u/ mg Protein) and other insecticides compounds were higher content than control treatment (3.52 u/ mg Protein). Also, data revealed that insecticides compounds Acetamiprid and Imidacloprid raised the activity of Peroxidase (8.64 and 8.49 u/ mg Protein) respectively, compared by control (5.78u/ mg Protein), while other compounds were higher than control. Data in Table (7) showed that Superoxides activity was recorded higher in treatments of insecticides compounds than control. Analytical statistics shows that there were significant variations in Antioxidant (CAT, Peroxidase and Superoxides) of *A. gossypii* treated by insecticides compounds in cantaloupe leaves as agree with **Mona *et al*. (2023**).

Aneesa *et al*. (2024) clarify that the application of different insecticides compounds treatments reduced significantly the antioxidant enzymes and non-enzymatic components in cucumber plants. **El-Fakharany *et al*. (2024)** showed that the application of different compounds resulted in Jojoba oil treatment increased the enzymatic activity (catalase, peroxidase and polyphenol oxidase) specially at 10 days after application to an extent of 29.91, 19.68 and 21% respectively.

Table (7). Effect on antioxidant enzymes activity in cantaloupe leaves after treatment on *Aphis gossypii* for 10 days

Treatment	Antioxidant enzymes±SE		
	Catalase (nmol H2O2 mg protein-1 min-1)0) (CAT)	Peroxidase (nmol ascorbate oxidized mg protein-1 min-1)	Superoxides (nmol NO2 mg protein-1 min-1)
Imidacloprid	5.36a ± 0.23	8.49a ± 0.23	9.34a ± 0.12
Imidacloprid + abamectin	3.95bc ± 0.58	7.40ab ± 0.58	8.95a ± 0.58
Thiamecthioxam + abamectin	5.12a ± 0.58	6.61bc ± 0.58	8.35a ± 0.58
Acetamiprid	4.57abc ± 0.12	8.64a ± 0.12	9.36a ± 0.58
Jojoba oil	4.69ab ± 0.17	7.70ab ± 0.17	8.90a ± 0.29
Orange oil	4.77ab ± 0.17	7.56ab ± 0.29	8.31a ± 0.58
Control	3.52c ± 0.29	5.78c ± 0.58	6.67b ± 0.04

In a column, means followed by different letters show significant differences according to Duncan's test (1955) at $P< 0.05$

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