Annals of Agric. Sci., Moshtohor **ISSN 1110-0419**
Vol. 49(2) (2011), 191 –199 **http://annagricmoshj.com**

Impact of certain insecticides on enzymes activity of whitefly *Bemisia tabaci* (Genn.) and aphids *Aphis gossypii* (Glover) on cucumber plants

M. M. Azab*; F. A. El- Lakwah *; Horeya Abd-El wahab **; M. M. Khattab* and Maha S. M. El-Ghanam**
Plant Protection Dept., Faculty of Agric., Moshtohor, Benha University, Egypt*.
Plant Protection Research Institute Dokki- Giza, Egypt**.

Abstract

A field trial was conducted at the experimental station of Sindyon, Qalyubia, Egypt during the nili season of 2008. The effect of azadirachtin, cloves oil, damaseia extract, Orizon (acetampride + abamectin), Botany Gard (*Beauveria bassiana*), imidacloprid and profenofos (at a half of the recommended rate) on activity of some enzymes in *Bemisia tabaci* (Genn.) and *Aphis gossypii* (Glover) was studied, on cucumber (*Cucumis sativus*) variety (Hageen eshrak). After five days of the tested compounds application, the results revealed that these compounds had various effects on the activity of acid and alkaline phosphatases, α and β esterases, transaminases (GOT and GPT) and carbohydrates hydrolyzing enzymes (trehalase, invertase and amylase). The enzyme activity reduced or increased significantly for some compounds in both insect species. Activity of acid and alkaline phosphatases, α and β esterases and GPT was more higher in *A. gossypii* than in *B. tabaci*, while the activity of GOT, trehalase, invertase and amylase was more higher in *B. tabaci* than in *A. gossypii*.

Key words azadirachtin, cloves, damaseia, Orizon, imidacloprid, profenofos *Bemisia tabaci*, *Aphis gossypii*, *Cucumis sativus*, enzymes

Introduction

Cucumber, *Cucumis sativus* (Cucurbitaceae) is one of the most important economic cucurbitaceous vegetables cultivated in Egypt, its cultivated area was increased during the last years especially in new reclaimed land for local consumption and exportation to the foreign markets. Cucumber plants are liable to infestation by many phytophagous pests such as the aphids, *Aphis gossypii* (Glover.) and the whitefly, *Bemisia tabaci* (Genn.), which considered the most common and important insect pests of cucumber plants. In case of heavy infestation, these pests are causing serious damage to plants, leading to great reduction in the yield (Hanafy, 2004).

To combat the pests, growers use synthetic organic insecticides, and some biorational insecticides. With the implementation of the Food Quality Protection Act likely to limit the applications of some organic chemical insecticides, scientists and growers are seeking alternative materials that are effective against the pests and safe to humans and the environment (Liu, 1999 and Liu *et al*., 1999). The bio-insecticides which provide control agents equal or better than synthetic insecticides are considered nowadays as mainly of IPM programs (Sannino, 2001 and Raslan, 2002).

The change in response to some biocides in insects could be associated with the decrease in alkaline phosphatases activity and various effect in acid phosphatases activity (El-Mageed *et al*., 2008).

Esterase enzymes play an important role in conferring or contributing to insecticide resistance in insects (Field and Devonshire, 1998, Guillemaud *et al*., 1997, Campbell *et al*., 1998, Claudianos *et al*., 1999; Taskin and Kence, 2004). The reduction in enzyme synthesis is due to the direct effect of toxicants on the synthesis (Kurappasamy *et al*., 2001). The low esterase activity may be used as a marker for resistant individuals in populations of *B. tabaci* (Wool and Greenberg, 1990).

The activities of transaminase enzymes (GOT & GPT) and carbohydrate hydrolyzing enzymes (trehalase, invertase and amylase) affected by some bio-insecticides (Mead, 2000). The invertase enzyme is believed to be important for digestion and utilization of sucrose by insects (Naveed *et al.*, 2009).

In insects' bodies carbohydrates are of vital importance since they can be utilized by the insect body for production of energy or conversion to lipids or proteins. Metabolism of carbohydrates is controlled mainly by trehalase, amylase and invertase enzymes that play a principle role in the digestion and utilization of carbohydrate by insects (Wigglesworth, 1972).

In the present investigation the effect of azadirachtin, imidacloprid, Orizon (acetampride + abamectin), cloves oil, damaseia plant extract, Botany Gard (*Beauveria bassiana*) and profenofos on the enzymes activity of trehalase, invertase, amylase, transaminases (GOT& GPT), alpha- and beta- esterases (α-E & β-E), acid and alkaline phosphatases (AcP & AlKP) of whitefly and aphids on cucumber plants has been studied.

Corresponding author: azabmohamed@hotmail.com

Materials and Methods

Location, experimental design and planting

The field tests were carried out at the experimental station of Sindyon**,** Qalyubia Governorate during the nili season. An area of 1/3 feddan was sown with cucumber seeds (*Cucumis sativus*.) variety (Hageen eshrak) on 5th September. The experiments were designed in the following ways: seeds were sown in rows at the rate of 8 rows/2 poles; the distance between the hills was about 30 cm apart on one side of the ridge. Treatment plots (each plot about 60 m^2) were arranged in a randomized complete block design with three replications. Irrigation and fertilization were done according to the crop schedue.

Insecticides

- Azadirachtin [Achook 0.15% EC] produced by Bahar Agrochem and Foods Pvt. Ltd., India.
- Cloves-oil, *Syzyguim aromaticu*, (Fam. Myrtaceae) was bought from the local market.
- Damaseia, plant extract of *Ambrosia maritime* (Fam. Compostiae) was obtained from Horticulture Research Institute (HRI) Egypt.
- Acetampride + Abamectin [Orizon 11% EC] produced by Egey kem company.
- Botany Gard, *Beauveria bassiana* (ES2 $x10^6$ conidia/mg) produced by the world Company for Chemicals and pesticides, Egypt.
- Imidacloprid, 1-[(6-chloro-3-pyridinyl) methyl]-*N*-nitro-2-imidazolidinimine: [Nopride 35% SC] produced by Cairo Company for Chemicals.- Profenofos, O O-4-bromo-2-chlorophenylO-ethylS-propyl phosphorothioate: [Selecron 72% EC] produced by Novartis Company, Switzerland.

Insecticide Application

The insecticides were applied on 6th October 2008 using a knapsack sprayer (20 litres). The formulated insecticides were applied at (half of the recommendation concentration for feddan) 93.7, 125, 150, 25, 125, 15 and 93.7 ml/100L water for azadirachtin, cloves-oil, damaseia extract, Orizon, Botany Gard, imidacloprid and profenofos, respectively. Water was used as controls (or untreated plants).

Sampling

Samples of *Bemisia tabaci* and *Aphis gossypii* insects were taken randomly from each replicate 5 days after spray. Samples were frozen for subsequent enzymes activity analysis.

Determination of enzymes activities

Phosphatases enzymes (AcP& AlKP)

Acid phosphatase (AcP) and alkaline phosphatase (AlKP) were determined according to the method described by Powell and Smith (1954).

Non- specific esterases activities

Alpha- and Beta- esterases (α-E, β-E) were determined according to the method of Van Asperen (1962).

Transminase enzymes

Glutamic oxaloacetic Transminase (GOT) and glutamic pyruvic Transminase (GPT) activities were determined colorimetrically according to the method of Reitman and Frankle (1957).

Carbohydrate hydrolyzing enzymes

The methods to determine the digestion of trehalose, starch and sucrose by trehalase, amylase and invertase enzymes respectively were similar to those described by Ishaaya and Swiriski (1976).

Data Analysis

Data were subjected to analysis of variance (ANOVA) followed by least significant difference (CoStat Statistical Software, 1990).

Results and Discussion

The overall results indicated that the activity of tested enzymes varies with different insecticide treatments and insect species.

1- Effect of the tested compounds on alkaline and acid phosphatases activities

Data in Table (1) indicated that, five days after treatment of the tested compounds, the activities of alkaline and acid enzymes in the supernatant of the homogenated insects increased or decreased as affected by the tested compounds compared with control. In damaseia extract treatment, alkaline and acid enzymes activities increased significantly in both tested insects. The percentage of increase of alkaline enzymes activity was 51.6 and 14. 0 % in *B. tabaci* and *A. gossypii*, respectively. These were 19.9 and 37.4 % in acid enzymes activity in *B. tabaci* and *A. gossypii*, respectively. Also, in cloves oil, Orizon, Botany Gard and profenofos treatments, alkaline enzymes activity increased significantly in *B. tabaci*, the percentages of enzyme increase were 45.4, 31.7, 45.7 and 29.7%, respectively. Activity of acid enzymes increased significantly in both tested insects after Orizon and Botany Gard application. In Orizon and Botany Gard treatments, percentages of increase were 14.4 and 21.6 % in *B. tabaci*, they were 17.3 and 22.3 % in *A. gossypii*, respectively. As well, azadirchtin application caused an increase in the activity percentage of acid enzymes by 10.6 % in *A. gossypii* compared with control.

On other hand, in imidacloprid treatment, the activities of alkaline enzymes decreased significantly in both the insects tested, the percentages of reduction were -9.8 and -5.2 % in *B. tabaci* and *A. gossypii*, respectively. Also, azadirchtin caused a

reduction in the activity percentage of alkaline enzymes by -5.5 % in *A. gossypii* compared with control. Activity percentage of acid enzymes decreased significantly in *B. tabaci* after imidacloprid application and in *A. gossypii* after cloves oil treatment, these percentages were -6.3 and -7.6 %, respectively.

Profenofos was the only tested compound that had no significant effect on the activity of acid enzymes in both tested insects in this field trial.

Phosphatases are defined as enzymes hydrolyzing any phosphorus ester or anhydride bond (O' Brien, 1967). Van Asperen (1960) found that resistant strains of houseflies could degrade organophosphorus compounds by increasing phosphate activity.

The inhibition in the activity of both acid and alkaline phosphatases was obtained by Abdel Hafez *et al*., (1993) who stated that treatment with LC_{50} of diflubenzuron and flufenoxuron reduced acid and alkaline phosphatases of 4th instar larvae of *S. littoralis*. Also, Eid (2002) found great reduction in the activities of both enzymes for all tested strains of *S. littoralis* using chlorpyrifos. In continuity, El-Mageed *et al*., (2008) cited that the change in response to biocides (Vertimec, Dipel 2X and Agerin) in *S. littoralis* larvae could be associated with the decrease in alkaline phosphatases activity and multifarious effect in acid phosphatases activity.

2- Effect of the tested compounds on alpha- and beta- esterases activities:

Table (2) shows the changes in the activity of alpha- and beta- esterases, Orizon and cloves oil revealed significant decrease in the both enzyme activity and in both tested insects, this effect was higher in *A. gossypii* than *B. tabaci*. In Orizon treatment, percentages of alpha- esterases reduction were -19.5 and -29. **7** % in *B. tabaci* and *A. gossypii*, respectively. While the reduction percentages of beta- esterases activity were -35.3 and -51.1 % in *B. tabaci* and *A. gossypii*, respectively. In cloves oil treatment, percentages of alpha-esterases reduction were -14 and -20.5 % in *B. tabaci* and *A. gossypii*, respectively. The reduction percentages of beta- esterases were -18 and -42.6 % in *B. tabaci* and *A. gossypii*, respectively.

Although, in azadirchtin treatment, alpha-esterases activity decreased significantly, beta-esterases increased significantly in *B. tabaci* and *A. gossypii*, the percentages of enzyme decrease were -14.6 and -11.8 %, respectively, and the increase percentages were 22.2 and 16.1 %, respectively. The activity of beta- esterases decreased significantly (by -1.8 %) only in *B. tabaci* after Botany Gard treatment, while alpha- esterases activity increased significantly in both tested insects, the percentage of enzyme increase reached 54.5 % in *B. tabaci* and 24.7 % in *A. gossypii*.On other hand, in imidacloprid and profenofos treatments, beta- esterases increased significantly in both tested insects, while alpha-esterases activity increased significantly only in *B. tabaci*. This effect was more higher in case of profenofos than imidacloprid, in profenofos treatment, the percentages of activity increase of beta- esterases were 36.1 and 18.8 % in *B. tabaci* and *A. gossypii*, respectively, in imidacloprid treatment, these percentages were 13.8 and 10.1% in *B. tabaci* and *A. gossypii*, respectively. In *B. tabaci*, the percentages of activity increase of alpha-esterases were 25.4 and 22.7 % in profenofos and imidacloprid treatments, respectively. In damaseia extract treatment, only alpha- esterases activities were increased significantly, the percentages of enzyme increase were 26.7 and 18.0% in *B. tabaci* and *A. gossypii*, respectively. In addition to, damaseia extract was the only tested compound that had no significant effect on the activity of acid enzymes in both tested insects in this field experiment. Esterases activity may be used as a marker for resistance of *B. tabaci* (Wool and Greenberg, 1990). The direct effect of the insecticides is on the enzyme synthesis (Kurappasamy *et al*., 2001).

3- Effect of the tested compounds on GOT and GPT activities:

The results in Table (3) revealed that, five days after application of azadirchtin, cloves oil, damaseia extract, Botany Gard and profenofos, the activity of glutamic oxaloacetic transminase (GOT) increased significantly in *B. tabaci* by 67.6, 73.8, 51, 30.7 and 65.1 %, respectively. While GOT activity increased significantly in *A. gossypii* by 21.3, 33.1, 54.0 and 35.8 % when azadirchtin, damaseia extract, Botany Gard and profenofos were applied. Also glutamic pyruvic transminase (GPT) activity increased significantly in *B. tabaci* by 136, 55.11, 22.7 and 119.8 % after treatment of azadirchtin, cloves oil, damaseia extract and imidacloprid, respectively. In case of *A. gossypii*, azadirchtin, cloves oil and imidacloprid treatments caused significant increase in GPT activity, the percentages of increase were 39.4, 24.5 and 92.7 %, respectively.

It was clear that, except for Botany Gard, GOT and GPT activities were more sensitive to increase in *B. tabaci* than *A. gossypii* after treated with the other effective tested compounds. The activity of GOT and GPT reduced significantly only after Orizon treatments, the reduction percentages of GPT activity were -60.1 and -45.1 % in *A. gossypii* and *B. tabaci*, respectively, the significant decrease of GOT activity was only in *B. tabaci* by -17.2 %. As well as GOT activity decrease significantly only in *A. gossypii* after treated with imidacloprid by -15.0 %. Profenofos was the only tested compound that had no significant effect on the activity of GOT in both tested insects in this field experiment. An increase in

the activities of transaminase enzymes (GOT & GPT) in adults of *A. craccivora* after treatment with the aqueous extracts of garlic bulbs (Mead, 2000). There was irregular effect of fenvalerate on GOT and GPT activity of the 4th instars larvae of *S. littoralis* at the different time intervals where it fluctuated between increase and decrease throughout the 72 hrs period of the experiment (Mohamady, 2000).

Heba (2005) investigated the efficacy of *Bacillus thuringiensis* on GOT activity of *S. littoralis* did not affected through the first three days then activities decreased to -44.44 % after 8 days. While, GPT activity increased through the 2nd day to 30 %, then decreased to -20 % after 9 days.

4- Effect of the tested compounds on carbohydrates hydrolyzing enzymes activities:

The changes in the activity of carbohydrate hydrolyzing enzymes (trehalase, invertase and amylase) of *B. tabaci* than *A. gossypii* after treated with tested insecticides (Table 4).

Trehalase activity reduced significantly after application of cloves oil, Botany Gard and imidacloprid in both tested insects, the percentages of enzyme reduction were -17.6, 25 and -20.6 % in *B. tabaci*, respectively, and they were -11.1, -29.0 and -16.4 % in *A. gossypii*, respectively. In damaseia extract and Orizon treatments, trehalase activity increased significantly only in *A. gossypii*, the percentages of activity increase were 6.3 and 7.3 %, respectively. Azadirchtin and profenofos were the only tested compounds that had no significant effect on the activity of trehalase in both tested insects in this field experiment.

Invertase activity had a different affect (a significant decrease or increase) according to the insect species in azadirchtin, cloves oil and profenofos treatments, In these the invertase activity decreased significantly in *A. gossypii* by -7.1, -22.6 and -13.9 %, respectively, and it inecreased significantly in *B. tabaci* by 12.2, 46.3 and 46.3 %, respectively. Invertase activity decreased significantly after application of Botany Gard in both tested insects, the percentages of enzyme reduction were -21.8 and -17.5 % in *B. tabaci* and *A. gossypii*, respectively. Also invertase activity decrease significantly only in *A. gossypii* after treated with imidacloprid by -10.8 %. In damaseia extract and Orizon treatments, invertase activity increased significantly only in *B. tabaci*, the percentages of activity increase were 10.6 and 30.9 %, respectively.

Amylase activity was reduced significantly in both tested insects after the application of cloves oil, Orizon, Botany Gard, imidacloprid and profenofos, the percentages of enzyme reduction were -30.6, -6.9, -42.7, -45.7 and -18.6 9 % in *B. tabaci*, respectively, and they were -33.9, -26.3, -42.6, -37.5 and -13.1 in *A. gossypii*, respectively. In azadirchtin treatment, amylase activity increased significantly only in *B. tabaci*, the percentage of activity increase was 7.1 %. Damaseia extract was the only tested compound that had no significant effect on the activity of amylase in both tested insects in this field application.

The results indicated also, that amylase appeared as the most affected enzyme activity with high level of significant reduction more than both trehalase and invertase enzymes. Carbohydrates are of vital importance since they can be utilized by the insect body for production of energy or conversion to lipids or proteins. Metabolism of carbohydrates is controlled mainly by trehalase, amylase and invertase enzymes that play a principle role in the digestion and utilization of carbohydrate by insects (Wigglesworth, 1972). Trehalase has the important function for liberating glucose for energy and activated during molting to generate glucose for chitin build up. Invertase and amylase are two important digestive enzymes, however, few data is known about their physiological and biochemical contribution to insecticide toxicity. The general disturbance in carbohydrate metabolism as expressed by reduction of trehalase, invertase and amylase activities could be result from a chain effect originating primarily from inhibition of chitin synthesis (Meisner *et al*., 1978).

These results are in harmony with El-Ghar *et al*., (1995) who observed pronounced decrease in the carbohydrate hydrolyzing enzymes especially amylase and invertase after treated 5th instar larvae with sub lethal concentrations of thuringeinsin (beta-exotoxin of *B. thuringiensis*). Also, Eid, (2002) found Consult and Mimic decreased the invertase activity after 5 days of treatment, whereas Consult, Atabron and Cascade exhibited reduction in trehalase and invertase activities.

The activities of trehalase, invertase and amylase enzymes in larvae treated with spinosad and triflumuron were generally decreased than untreated larvae during different tested times (Mead *et al*., 2008). On the other hand, Khedr *et al*., (2005) reported that, when 4th instar larvae were treated with Consult, Atabron, Match, Mimic and Cascade noticed increase in the carbohydrate hydrolyzing enzymes was recorded. Furthermore, the irregular effects of IGRs which ranged between decrease or increase during the tested time intervals was observed by Mohamady, (2000). This contradiction in results may be due to difference in treatments, larval instar, concentrations used and tested times. The activities of trehalase and amylase were increased at the initial time intervals (after 24 hr.) than the last one (after 72 hr.). The reverse was true in the case of invertase enzyme. Abdel-Fattah *et al*., (1986) showed that the activities of the three enzymes were much higher at the initial time interval (Zero-time) than at the last one (96 hr.) at the three

concentrations used of diflubenzuron and triflumuron (LC_{15}, LC_{30} and LC_{50}).

Great reduction was also showed in amylase activity of the 4th instars larvae of *S. littoralis* after fenvalerate treatment. As for invertase and trehalase enzymes activity was decreased after 48 hrs from treatment but after 72 hrs from treatment, the enzymes activity were increased (Mohamady, 2000).

Trehalase, amylase and invertase activities increased in *S. littoralis* to highest activities after 7 days of *Bacillus thuringiensis* treatment. Then this enzymes activities begin to decrease (Heba, 2005).

Generally, in case of white fly *B. tabaci* treatments, the results of azadirachtin indicated high increase (more than 10% in comparison to control) in activity of beta- esterases, GOT , GPT and invertase enzymes but high decrease (more than 10%) in alpha- esterases activity only.

For cloves oil treatment, high increase in activity of alkaline phosphatase, GOT, GPT and invertase enzymes and high decrease in acid phosphatase, alpha- and beta- esterases, trehalase and amylase enzymes activities were obtained. After damaseia extract treatment, high increase in alkaline and acid phosphatases, alpha- esterases, GOT, GPT and invertase enzymes activities was shown. For Orizon treatment, high increase in alkaline and acid phosphatases and invertase enzyme activities, but high decrease in activity of alpha- and beta- esterases, GOT and GPT enzymes were obtained. In case of Botany Gard treatment, high increase in alkaline and acid phosphatases, alpha- esterases, GOT and GPT, but high decline in trehalase, invertase and amylase enzyme activities were observed. With imidacloprid treatment, high increase in alpha- and beta- esterases, and GPT but high decrease in trehalase enzyme activities were recorded. After treatment of *B. tabaci* with profenofos, high increase in activity of alkaline phosphatases, alpha- and beta- esterases and GOT enzymes but high reduction in amylase activity were observed. For aphids *A. gossypii*, after azadirachtin treatment, the results showed high increase in activity of acid phosphatases, beta- esterases, GOT and GPT enzymes, but high decrease in activity of alpha- esterases only. After cloves oil treatment, the results indicated high increase activity of GPT only, but high decrease in alpha- and beta- esterases, trehalase, invertase and amylase activities. For damaseia extract treatment, high increase in activity of alkaline and acid phosphatases, alpha- esterases, GOT and GPT was recorded.

After Orizon treatment, high increase in activity of acid phosphatases only and high decrease in activity of alpha- and beta- esterases, GPT and amylase were shown. With Botany Gard treatment, high increase in acid phosphatases, alpha- esterases, GOT and GPT activities and high decrease in activity of trehalase, invertase and amylase were obtained. For imidacloprid treatment, high increase in activity of beta- esterases, GOT and GPT and high inhibition in trehalase, invertase and amylase activities were recorded. After treatment of *A. gossypii* with profenofos, the results revealed high increase in activity of beta- esterases and GOT and high decrease in invertase and amylase activities.

References

Abdel-Fattah, M. S.; Shaaban, M. N.; Omar, A. E.; Gomaa, E. A. and Abdel-Hafez, M. M. (1986): Effect of diflubenzuron and triflumuron on trehalase, invertase and amylase enzymes activity in susceptible and profenofos-resistant strains of *Spodoptera littoralis* (Boisd.). Bull. Entomol. Soc. Egypt, Econ. Ser., 15: 207-220.

Abdel Hafez, M. M.; Mohanna, A.; El-Sheakh, A. and Farag, M. (1993): Effect of IGR / insecticide mixtures on transaminase and phosphates activities of *Spodoptera littoralis* (Boisd.) larvae. J. Product. & Dev., 1 (2): 178-193.

Campbell, P. M. ; Yen J. L. and Masoumi A. (1998): Cross-resistance patterns among *Lucilia cuprina* (Diptera: Calliphoridae) resistant to organophosphorus insecticides. J. Economic Entomol. 91(2): 367-375.

Claudianos, C.; Russell R. J. and Oakeshott J. G. (1999): The same amino acid substitution in orthologous esterases confers organophosphate resistance on the house fly and a blowfly. Insect Biochemistry and Molecular Biology 29(8): 675-686.

CoStat Statistical Software, (1990): Microcomputer program analysis Version 4.20, CoHort Software, Berkeley, CA.

Eid, A. M. (2002): Esterases and phosphatases in relation to chlorpyrifos-resistance in *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae). Egypt. J. Appl. Sci., 17 (2): 275-284.

El-Ghar, G. E.; Radwan, H. S. ; El-Bermawy, Z. A. and Zidan, L. T. (1995): Inhibitory effect of thuringiensin and abamectin on digestive enzymes and non-specific esterases of *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae) larvae. J. Appl. Entomol., 119 (5): 355-359.

El-Mageed, A. E.; Anwar E. M. and Elgohary, L. R. (2008): Biochemical side effects of some commercial biocides on cotton leafworm.Archives of Phtopathology and Plant Protection, 41 (3): 227-232.

Field, L. M. and Devonshire A. L. (1998): Evidence that the E4 and FE4 esterase genes responsible for insecticide resistance in the aphid *Myzus persicae* (Sulzer) are part of a gene family. *Biochemical Journal.* 330: 169-173.

Guillemaud, T.; Makate N.; Raymond M.; Hirst B. and Callaghan A. (1997): Esterase gene amplification in *Culex pipiens*. *Insect Molecular Biology.* 6(4): 319-327.

Table 1. Alkaline and Acid phosphatases activities (ug phenol released /g.b.wt./minute) in the supernatant of the homogenated aphids *A. gossypii* and whitefly *B. tabaci* after five days of the tested compounds application.

Compounds	Application Rate (ml/100 L Water)	Alkaline phosphatase				Acid phosphatase			
		Activity (mean ± S.E.)		Increase or decrease (%)		Activity (mean ± S.E.)		Increase or decrease (%)	
		A	B	A	B	A	B	A	B
Azadirchtin	93.7	1413±40^{d}	679±4^{d}	- 5. 5	-2.16	775±13^{c}	474±5^{c}	+ 10.6	-3.5
Cloves oil	125	1526±16^{bc}	1009±20^{a}	+ 2.0	+45.4	648±17^{e}	371±7^{c}	-7.6	-19
Damaseia extract	150	1706±20^{a}	1052±29^{a}	+14. 0	+51.6	963±32^{a}	549±10^{a}	+37.4	+19.9
Orizon (Acetampride + Abamectin)	25	1476±21^{c}	914±6^{a}	- 1. 3	+31.7	822±11.3^{b}	524±6^{b}	+17.3	+14.4
Botany Gard	125	1573±25^{b}	1011±10^{a}	+ 5.1	+45.7	857±20^{b}	557±11^{a}	+22.3	+21.6
Imidacloprid	15	1418±25^{d}	626±5^{e}	- 5.2	-9.8	690±10de	429±3^{d}	-1.6	-6.3
Profenofos	93.7	1536±23^{bc}	900±8^{c}	+2.7	+29.7	658±17de	456±5.5^{c}	-6.1	-0.4
Control	-	1496±25^{c}	694±4^{d}	-	-	701±7.6^{d}	458±7.6^{c}	-	-

Values within the same column having the same letters are not statistically different, $p<0.05$.

A= aphids *(A. gossypii*) B= whitefly (*B. tabaci)*

Table 2. Alpha- and Beta- esterases activities (ug naphthol released /g. b. wt. /minute) in the supernatant of the homogenated aphids *A. gossypii* and whitefly *B. tabaci* after five days of the tested compounds application**.**

Compounds	Application Rate (ml/100 L Water)	α-esterase				β- esterase			
		Activity (mean ± S.E.)		Increase or decrease (%)		Activity (mean ± S.E.)		Increase or decrease (%)	
		A	B	A	B	A	B	A	B
Azadirchtin	93.7	54.66±1.16^{e}	15.6±0.6^{d}	-11.8	-14.6	22.22±0.69^{a}	20.4±1.25^{b}	+16.1	+22.2
Cloves oil	125	49.26±1.28^{f}	15.7±0.64^{d}	-20.5	-14	10.98±0.43^{d}	13.7±0.5^{d}	-42.6	-18
Damaseia extract	150	73.17±2.26^{b}	29.7±0.83^{a}	+18.0	+26.7	18.74±0.95^{c}	17.4±0.53^{c}	-2.1	+4..2
Orizon (Acetampride + Abamectin)	25	43.6±2.3^{f}	14.7±0.64^{d}	- 29. 7	-19.5	9.36±0.8^{e}	10.8±0.46^{e}	-51.1	-35.3
Botany Gard	125	77.33±1.53^{a}	28.21±1.33^{a}	+24.7	+54.5	19.97±0.55^{bc}	16..4±0.53^{e}	+4.3	-1.8
Imidacloprid	15	64.07±0.89^{c}	22.4±0.5^{b}	+3.3	+22.7	21.08±1.01^{ab}	19±0.32^{b}	+10.1	+13.8
Profenofos	93.7	58.6±1.22^{d}	22.9±0.9^{b}	-5.5	+25.4	22.73±0.31^{a}	25±1^{a}	+18.8	+36.1
Control	-	62±1^{cd}	18.26±0.29^{c}	-	-	19.14±0.19^{c}	16.7±0.26^{c}	-	-

Values within the same column having the same letters are not statistically different, $p<0.05$.

A= aphids *(A. gossypii*) B= whitefly (*B. tabaci)*

Table 3. GOT and GPT activities (uM pyruvate released /g. b. wt. /minute) in the supernatant of the homogenated aphids *A. gossypii* and whitefly *B. tabaci* after five days of the tested compounds application**.**

Compounds	Application Rate (ml/100 L Water)	Glutamic Oxaloacetic Transminase (GOT)				Glutamic Pyruvic Transminase (GPT)			
		Activity (mean ± S.E.)		Increase or decrease (%)		Activity(mean ± S.E.)		Increase or decrease (%)	
		A	B	A	B	A	B	A	B
Azadirchtin	93.7	12±0.4^{c}	32.2±1.2^{a}	+21.3	+67.6	14.23±0.69^{b}	14.56±0.92^{a}	+39. 4	+136
Cloves oil	125	10.45±0.25^{de}	33.39±1.6^{a}	+5.7	+73.8	12.8±0.72^{b}	9.57±0.16^{b}	+24. 5	+55.11
Damaseia extract	150	13.16±0.62^{b}	29±0.15^{b}	+33.1	+51	12.11±0.29^{bc}	7.57±0.18^{c}	+17. 8	+22.7
Orizon (Acetampride + Abamectin)	25	9.16±0.39^{e}	15.9±0.46^{e}	-7.4	-17.2	4.1±6.88^{e}	3.39±0.28^{e}	- 60. 1	-45.1
Botany Gard	125	15.23±0.68^{a}	25.1±0.5^{c}	+54.0	+30.7	12.11±0.54^{bc}	6.81±0.32$^{c\,d}$	+17.8	+10.4
Imidacloprid	15	11.37±0.32^{cd}	19.13±0.11^{d}	+15.0	-1.1	19.81±1.58^{a}	13.56±0.75^{a}	+92. 7	+119.8
Profenofos	93.7	13.43±0.25^{b}	31.71±2^{a}	+35.8	+65.1	9.6±0.44^{d}	6.25±0.17^{d}	- 6. 6	+1..3
Control	-	9.89±0.38^{e}	19.21±0.2^{d}	-	-	10.28±0.73^{cd}	6.17±0.11^{d}	-	-

Values within the same column having the same letters are not statistically different, $p<0.05$.

A= aphids *(A. gossypii*) B= whitefly (*B. tabaci)*

Table 4. Carbohydrates hydrolyzing enzymes activities (ug.glucose released /g. b. wt. /g. b. wt. /minute) in the supernatant of the homogenated aphids *A. gossypii* and whitefly *B. tabaci* after five days of the tested compounds application.

Compounds	Application Rat (ml/100 L Water)	Trehalase				Invertase				Amylase			
		Activity (mean ± S.E.)		Increase or decrease (%)		Activity (mean ± S.E.)		Increase or decrease (%)		Activity (mean ± S.E.)		Increase or decrease (%)	
		A	B	A	B	A	B	A	B	A	B	A	B
Azadirchtin	93.7	83.57±2.23^{b}	131±3.6^{b}	-1.4	-3.7	31.37±1.18^{b}	211±3.2^{c}	-7.1	+12.2	16.87±0.32^{a}	71±2.1^{a}	+1.0	+7.1
Cloves oil	125	75.33±1.15^{c}	112±2.5^{c}	-11.1	-17.6	26.12±0.82^{d}	275±4.4^{a}	-22.6	+46.3	11.03±0.25^{c}	46±1.5^{e}	-33.9	-30.6
Damaseia extract	150	90.17±2.75^{a}	138±2^{a}	+6.3	+1.5	35.78±0.37^{a}	208±2.6^{c}	+5.9	+10.6	16.1±0.26^{a}	64.7±1.5^{bc}	-3.5	-2.4
Orizon (Acetampride + Abamectin)	25	91.00±2.1^{a}	139±2.1^{a}	+7.3	+2. 2	36.1±1.6^{a}	246±4.2^{b}	+6.8	+30.9	12.3±0.4^{c}	61.7±1.5^{c}	-26.3	-6.9
Botany Gard	125	60.17±0.76^{d}	102±5.3^{d}	-29.0	-25	27.85±0.54^{cd}	147±3.1^{e}	-17.5	-21.8	9.57±0.51^{d}	38±2.1^{f}	-42.6	-42.7
Imidacloprid	15	70.83±1.26^{c}	108±1.5^{cd}	-16.4	-20.6	30.11±0.85^{bc}	194±2.4^{d}	-10.8	+3.2	10.43±0.4^{cd}	36±2.1^{f}	-37.5	-45.7
Profenofos	93.7	86.93±2.53^{ab}	135±2^{a}	+2.5	0	29.07±0.81^{bc}	274±6.4^{a}	-13.9	+45.7	14.5±0.5^{b}	54±1^{d}	-13.1	-18.6
Control	-	84.77±1.37^{b}	135±1.5^{ab}	-	-	33.78±1.44^{a}	188±2.1^{d}	-	-	16.7±0.36^{a}	66.3±1.5^{b}	-	-

Values within the same column having the same letters are not statistically different, $p<0.05$.

A= aphids *(A. gossypii*) B= whitefly (*B. tabaci)*

Hanafy, A. R. I. (2004): Studies on the most important cucumber pests in the open field and suitable control programs. Ph. D. thesis, Fac. of. Agric. Moshtohor, Benha Branch- Zagazig Univ., Egypt.

Heba, A.N. (2005): Histological and physiological studies of the effect of some microbial pathogens of the cotton leafworm. M. Sc. Thesis, Fac. Agric. Mansoura Univ., pp. 197.

Ishaaya, I. and Swiriski, E. (1976): Trehalase, invertase and amylase activities in the black scale, *Saissetia oleae* and their relation to host adablebility. J. Insect Physiol., 16:1025-1029.

Khedr, M. M.; Desuky, W. M.; El-Shakaa, S. M. and Yousif-Khalil, S. I. (2005): Toxicological and biochemical studies on the effect of some insect growth regulators on *Spodoptera littoralis* (Boisd.) larvae. Egypt. J. Agric. Res. 83 (2): 539-561.

Kurappasamy, R. C.; Ecanthezhiyan and K. Parasarthi (2001): Inhibitory effects of *Annona squamota*(Annonaceae) on the digestive enzymes of *Pheropsophus hilaris* (fabr.) (Coleoptera: Carabidae). Environment and Ecology 19: 584-587.

Liu, T. X. (1999): Effects of some new formulations of *Bacillus thuringiensis* for management of cabbage looper and diamondback moth on cabbage in south Texas. Southwest Entomol., 24.

Liu, T. X.; Sparks, A. J.; Hendrix, W.; Yue, B.; Lui, T. and Yue, B. (1999): Effects of SpinTor (spinosad) on cabbage looper (Lepidoptera: Noctuidae): toxicity and persistence of leaf residue on cabbage under field and laboratory condition. J. of Economic Entomology, 92: 6, 1266-1273.

Mead-Hala, M. I. M. (2000): New approaches in the control of legumes aphids, *Aphis craccivora* Koch (Homoptera: Aphididae). M. Sc. Thesis, Department of Biological and Natural Sciences Institute of Environmental Studies & Research Ain Shams Univ..

Mead- Hala, M. I.; El-Sheakh, A. A.; Soliman, B. A.; Desuky, W. M. and Abo-Ghalia, A. H. (2008): Biochemical effect of some compounds on carbohydrate hydrolyzing enzymes of cotton leafworm, *Spodoptera littoralis* (Boisd.). Egypt. J. Agric. Res., 86 (6): 2169-2192.

Meisner, J.; Ishaaya, I.; Ascher, K. R. and Zur Aro, M. (1978): Gossypol inhibits protease and amylase activity of *Spodoptera littoralis* (Boisd.). Ann. Entomol. Soc. Amer., 71 (1): 5-8.

Mohamady - Aziza, H. (2000): Biochemical and toxicological studies on the effect of some insecticides on the cotton leafworm *Spodoptera littoralis* (Poisd.). M. Sc. Thesis, Fac. of Agric. Zagazig Univ.

Naveed, A.; Dayananda G.Y. and Hosetti B. B. (2009): Effect of some selected insecticides on the activity of invertase at different stages of pentatomid bug *Cyclopelta siccifolia* W. Our Nature 7: 222-225.

O' Brien, R. D. (1967): Insecticides - action and metabolism. Academic Press New York & London.

Powell, M. E. A. and Smith M. J. H. (1954): The determination of serum acid and alkaline phosphate activity with 4-amino antipyrine. Amer. J. Clin. Pathol., 7: 245-248.

Raslan, S. A. (2002): Preliminary report on initial kill and residual mortality of the natural product spinosad for controlling cotton leafworm egg masses in 2002 cotton season at Skarkia Governorate, Egypt. 2nd International Conference, Plant Protection Research Institute, Cairo, Egypt, 635-638.

Reitman, S. and Frankel S. (1957): Colourimetic method for aspartate and alanine transaminases. Amer. J. Clin. Pathol., 28:56.

Sannino, L. (2001): Efficacy of a new formulation against Spodoptera littoralis Informatore Agrario, 57 (5): 74-76.Taskin, V. and Kence M. (2004): The genetic basis of malathion resistance in housefly (Musca domestica L) strains from Turkey. Russian Journal of Genetics 40: 1475-1482.

Van Asperen, K. (1960). Toxic action of organophosphorus compounds and esterase inhibition in houseflies. Biochem. Pharma., 3: 136-146.

Van Asperen K. (1962): A study of house fly esterase by means of a sensitive colorimetric method. J. of Insect Physiology 8: 401-416.

Wigglesworth, V. B. (1972): The Principles of Insect Physiology. 7th ed. Chapman and Hall Ltd.

Wool, D. and S. Greenberg (1990): Esterase activity in whiteflies (*Bemisia tabaci*) in Israel in relation to insecticide resistance. Entomo. Experimentalis-et- Applicata. 57(3): 251-258.

تأثير بعض المبيدات على نشاط إنزيمات حشرتى الذبابة البيضاء ومن القطن على نباتات الخيار

محمد محمد عزب* ، فارس أمين اللقوة*، حورية على عبد الوهاب، متولى مصطفى خطاب***
مها صبرى الغنام

قسم وقاية النبات – كلية الزراعة – جامعة بنها – مصر
معهد بحوث وقاية النبات – مركز البحوث الزراعية – وزارة الزراعة – مصر

أجريت تجربة حقلية بمحطة سنديون البحثية بمحافظة القليوبية – مصر خلال الموسم النيلى سنة 2008 لدراسة تأثير كل من الأندراختين والإيميدكلوبريد والأوريزيون وزيت القرنفل والبوتانى جارد والبروفينوفوس وذلك بنصف التركيز الحقلى الموصى به على نشاط بعض الإنزيمات فى حشرتى الذبابة البيضاء ومن القطن على نباتات الخيار من صنف هجين إشراق.

وقد أظهرت النتائج أنه بعد خمس أيام من تطبيق هذه المركبات كان لهذه المركبات تأثيرات معنوية متباينة على نشاط إنزيمات الفسفاتيز الحامضى والقاعدى و الألفا وبيتا إستيريز والترانس أمينيز (جوت وجبت) بالأضافة إلى التيريهاليز والأنفرتيز والأميليز حيث كان التأثير إما بالنقص أو الزيادة فى نشاط هذه الإنزيمات مع بعض المركبات فى كل من الحشرتين تحت الدراسة.

كما بينت النتائج أيضاً أن نشاط إنزيمات الفسفاتيز الحامضى والقاعدى و الألفا وبيتا إستيريز والترانس أمينيز (جبت) كان أعلى فى من القطن عن الذبابة البيضاء بينما كان نشاط إنزيمات الترانس أمينيز (جوت) و التيريهاليز والأنفرتيز والأميليز كان أعلى فى الذبابة البيضاء عن من القطن.