

The Toxic Effect and some Biochemical Effects of Chlorpyrifos-Methyl and Diflubenzuron on Mosquito, *Culex pipiens* in Sharkia Governorate, Egypt

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ABSTRACT

This work was carried out in the Institute of Medical Insect Research, Dokki-Giza-Egypt to study the toxic and some biochemical effects of chlorpyrifos-methyl and diflubenzuron on the mosquito *Culex pipiens* (L.), larvae and adults. Larvae sampled from ponds of 10th of Ramadan and drainages of both Abo-Kbeer and Dyarb-Negm districts and adults from the adjacent houses of the same three regions, at Sharkia Governorate. Toxic effect on the larvae, the obtained results showed that the mortality percentages for chlorpyrifos-methyl and diflubenzuron were ranged between 32. & 96 and 47 & 86% at tenth of Ramadan; at Abo-Kbeer, 32.5 & 98.75% and 32 & 96% and 38 & 92 and 53 & 94% at Dyarb-Negm; respectively. The LC₅₀ values were ranged between 0.0008 & 0.002 ppm and 0.2153 & 0.4084 ppm, respectively. Chlorpyrifos-methyl insecticide was more efficient than the diflubenzuron inhibitor in control larvae of *Culex pipiens*. Biochemical effects, on the two stages larvae and adult, chlorpyrifos-methyl insecticide affected on activity of β -esterase and α -esterase enzymes values with significant increase in both the two districts 10th Ramadan and Abo-kbeer and ranged between 10.77 except β -esterase activity was decreased in Abo-Kbeer by -1.29 In Dyarb-Negm drainage, the two enzymes cleared insignificant differences compared to control. Total soluble protein cleared significant decrease, whereas, in total lipid and AChE values were insignificant differences between treatments and control. Diflubenzuron insecticide affected on activity of β -esterase values recorded significant increase in Dyarb-Negm for adult stage and insignificant values in the others districts whether for larvae or adult. α -esterase values in Abo-kbeer and Dyarb-Negm recorded significant increase with range between -6.01 and -33.11 for the two stages and insignificant values in 10th of Ramadan. Total soluble protein, lipid and AChE values recorded significant decrease for the two stages, except AChE values recorded significant increase in 10th Ramadan compared to control. Chlorpyrifos-methyl and diflubenzuron play an important role in the toxic effect on the larval and adult stages of *Culex pipiens* as well as the biochemical components, which are positively reflected on their role in the control of the two stages. Chlorpyrifos-methyl insecticide was the best in toxicity, whereas, diflubenzuron was the best in effect on the biochemical components.

Keywords: Chlorpyrifos-methyl and diflubenzuron, *Culex pipiens*, insecticide, biochemical

INTRODUCTION

In Egypt, *Culex pipiens* (L.) is one of the most common mosquito species in urban and rural areas and causes a human health risk (Zahran and Abdelgaleil, 2011). *C. pipiens* (Diptera: Culicidae) is an important vector of several human pathogens such as West Nile virus, Rift Valley Fever virus and Bancroftian filariasis (Claire and Callaghan, 1999). Insecticide resistance in mosquitoes is essentially achieved through two mechanisms: target insensitivity and increased detoxification (Nauen, 2007). There are thus few alternatives to control insects such as *C. pipiens* which are resistant to insecticides, whether organophosphates, carbamates or pyrethroids (Ben Cheikh *et al.*, 1995). The effect of resistance on the chemical control of mosquitoes is very difficult to determine due to a large number of associated factors that may impact on successful control in the field. Understanding the relationship between insecticide resistance and metabolic resistance mechanisms is important in order to address the knowledge gap between control strategies and developing resistance. (Baruah and Das, 1996) tested isopropyl, methoprene and diflubenzuron against mosquito larvae. LC90 values of diflubenzuron against *Cx. quinquefasciatus* was 0.0022 ppm, However, LC50 values of both the IGRs were almost same in case of *Ae Cx. quinquefasciatus*. In case of methoprene, maximum mortality was observed in pupal stage. The diflubenzuron and methoprene were found to eliminate 92-96 % *Culex* and *Anopheles* larvae. Methoprene and diflubenzuron were found equally effective for control of mosquito. Suman *et al.*, (2013) found (IGR,s), (diflubenzuron) and (pyriproxyfen) tested on *Culex pipiens* showed egg hatching was inhibition but diflubenzuron indicated tolerant to eggs of *Cx. pipiens*. Ali *et al.*, (1999)

tested five organophosphates (OPs) (chlorpyrifos, chlorpyrifos-methyl, fenthion, malathion, and temephos), and three IGRs, (diflubenzuron, methoprene, and pyriproxyfen) against *C. quinquefasciatus* larvae. The LC90 values were more effect. Toma *et al.*, (2011) stated that organophosphorus (OP) larvicides tested on *Culex pipiens* caused resistant than temephos and chlorpyrifos, while, AChE was decreased in insect. Alout *et al.*, (2012) found that pyrimidine Trione Furan-substituted (PTF) compounds tested on mosquito and caused killed *Culex pipiens* larvae and AChE was inhibition. Bhinder and Chaudhry (2013) the toxicity of pesticides acephate and chlorpyrifos on *Culex quinquefasciatus* inhibited unhatched eggs. Masarrat *et al.*, (2014) control mosquito *Culex fatigans* using lambda-cyhalothrin, chlorpyrifos were significant efficacy against *Cx. fatigans* larvae. Total protein levels and (AChE) activity were decreased by Lambda-cyhalothrin and chlorpyrifos.

The aim of this work was to study the toxic effect of chlorpyrifos-methyl and diflubenzuron on the mosquitoes, *Culex pipiens* and their effect on some physiological aspects under laboratory condition

MATERIALS AND METHODS

Tested insecticides:

Chlorpyrifos-methyl (Reldan, 40%, EC), Diflubenzuron (Dimilin, 4% WP); insecticides source: Ministry of Health and Population, Arab Republic of Egypt.

The toxic effect

The toxic effect and biochemical studies of chlorpyrifos-methyl and diflubenzuron insecticides on *Culex pipiens* larvae and adults were carried out in the Institute of Medical Insect Research, Dokki-Giza-Egypt.

Preparation of the insecticides concentrations, they were four for each one. Chlorpyrifos-methyl was prepared with dissolve one 1ml of insecticide in 999 ml water as the stock solution; its others concentrations were prepared by dilution until 0.025, 0.005, 0.030 and 0.001ppm. As for diflubenzuron, 12.5 g of the insecticide was dissolved in 987.50 ml water and the others concentrations were prepared by dilution until 1.25, 1.00, 0.50 and 0.250 ppm.

On the larval stage: the larvae were collected by sweep net (that consists of 7-inch circular frame with a bag of hill and a stick with a length of 130 cm) from each district. Twenty-five larvae were transferred to each replicate (Petri dish 10cm² diameter contain 15ml of each concentration), three replicates per concentration and untreated check (the Petri dish contain 15ml of water). Treatments incubated under constant temperature in incubator (27±2°C). Twenty-four hours post treatments with chlorpyrifos and Forty-eight h with diflubenzuron; live and dead larvae were recorded. The lethal concentration of LC50 and LC90 of the larvae was calculated according to the (Finney, 19971) equation and the slope values of the toxic line for both treatments were calculated.

Biochemical studies

On the larval stage: The experiments were carried out at Sharkia, Governorate in three districts, in the 10th of Ramadan (oxide ponds area) and drainages of both Abo-kbeer and Dyarb-Negm districts. The experiments for the two tested insecticides in each district were 250m length x 1m width and untreated check. Chlorpyrifos-methyl was prepared by dissolving one 1ml of insecticide in 10 liters of water. As for diflubenzuron, 12.5 g of the insecticide was dissolved in 10 liters of water. Each experiment was sprayed using a 10 liter of solution of the tested insecticide, chlorpyrifos-methyl and diflubenzuron by dorsal machine gun.

On adult stage: The adult insects were collected from the houses adjacent to the treated areas as mentioned before. The hand sanitizer was used in the collection of insects. It consists of a glass tube length 12 cm in diameter 3 cm and its outer side is a funnel with a small opening into the tube combination. The insects were transferred to plastic cups, covered, lined and transported to the laboratory for biochemical studies.

Preparation of the samples: Twenty-four and forty-eight hours post treatments with chlorpyrifos and diflubenzuron insecticides, respectively, a sample of 25 larvae and adult stages of *Culex pipiens* were collected (using the sweep net) from each replicate, as well as the untreated once. Each sample was weighed separately for the larvae and adults for each insecticide tested as well as untreated area. The larvae samples were placed in glass tubes (10 cm long) and preserved with 70 % ethyl alcohol and stored in freezer until chemical analysis. But, in case of the adults, the biochemical analysis was done immediately after the collection.

Biochemical analysis

A-Determination of acetylcholine esterase at Plant Protection Institute Research Doki Giza: The activity of acetylcholine esterase (AChE) was measured according to the method described by (Simpson *et al.*, 1964).

B-Determination of total soluble protein: Total protein was determined by the method of (Bradford 1976).

C-Determination of total lipids: Total lipids were estimated by the method of (Knight *et al.*, 1972).

D-Determination of enzyme activities: Alpha- and beta-esterases (α -E, β -E) activities were determined according to the method of Van Asperen (1962).

The percent activity was calculated as follows:

% Increase or decrease than control = $\frac{(\text{treated} - \text{control})}{\text{control}} \times 100$.

Statistical analysis

The obtained data were statistically analyzed. The proper "F" and Standard Error values was calculated as described by Fisher (1950) and Snedecor (1970) using Costat computer program Cohort Software. P.O. Box 1149, Berkeley CA 9471 (Costat program methods, 1990).

RESULTS AND DISCUSSION

Toxic effects:

The toxic effect of chlorpyrifos-methyl and diflubenzuron on *Culex pipiens* larvae treated with different concentrations summarized in Table (1). The mortality percentages were calculated after 24hs for chlorpyrifos-methyl and 48hs for diflubenzuron. The different concentrations of the tested insecticides were 0.001, 0.005, 0.025 and 0.03 ppm & 0.25, 0.50, 1.00 and 1.25ppm, respectively, which recorded percentages mortality 32.00, 52.80, 60.26 and 96.00 & 47.00, 62.00, 67.00 and 86.00% in 10th of Ramadan, respectively. The larval mortality percentages were 32.50, 50.00, 86.25 and 98.75 % & 32.00, 58.00, 73.00 and 96.00 in Abo-kabeer, respectively. The tested insecticides in Dyarb-Negm recorded 38.00, 78.00, 82.00 and 92.00% mortality & 53.00, 77.00, 80.00 and 94.00% mortality, respectively.

Data in Table (1) revealed that LC50 and LC90 values for all insecticides chlorpyrifos and diflubenzuron tested after one and two days post-treatment for mosquito larvae in the three locations. The wide ranges estimated of LC50 values for insecticides tested of the *Culex* larvae were as follows: in the 10th of Ramadan oxidations ponds, 0.0025 and 0.298ppm. At Abo-kbeer drainages were 0.002 and 0.4084 ppm and Dyarb Negm were 0.0008 and 0.2153 ppm. The results showed that the chlorpyrifos-methyl insecticide was more efficient than the diflubenzuron inhibitor in the control of *Culex pipiens* larvae mosquitoes in the ponds of oxides and drainages water.

Biochemical studies: Data in Tables (2 and 3) showed that the effect of Chlorpyrifos-methyl and diflubenzuron on some biochemical contents of the *Culex pipiens* larval and adult stages of β -esterase, α -esterase, total soluble protein, lipid and AChE.

Effect of chlorpyrifos-methyl:

On the larval stage, the results cleared that significant increase in the activity of β -esterase enzyme in the oxidation ponds in 10th Ramadan. The percent of increase was larger than control with 10.77%; whereas, in both Abo-kabeer and Dyarb-Negm drainage was less than control. α -esterase enzyme values showed significant increase in the activity also in 10th of Ramadan with percent of increase 24.42 % and the other districts drainages with 17.11 and 5.34%, respectively. Total protein values cleared significant decrease with declining rates

ranged between -31.52 and -11.86%, whereas, significant increase in the total lipids values that ranged between 6.76 and 17%. As for AChE enzyme values showed insignificant differences between treatments and control.

On the adult stage, the effect of the insecticide on the enzymes β and α -esterases in the adult stage showed significant increase in 10th Ramadan and Abo-kbeer

drainage with range between 30.01 and 19.68%, while, insignificant differences between treatments and control in Dyarb-Negm drainage. Total protein values cleared significant decrease in the three districts. But the effect on the total lipid and acetylcholine esterase were insignificant differences between treatments and control in the three districts Table (2).

Table 1. Toxicity effect of Chlorpyrifos and Diflubenzuron on Mosquito *Culex pipiens* larvae.

| Country treatment | Compounds | Concentrations ppm | Mortality percentages | LC50 ppm | LC90 ppm | Slope |
|--------------------------|----------------------|--------------------|-----------------------|----------|----------|---------------|
| 10 th Ramadan | Chlorpyrifos-methyl | 0.025 | 96 | 0.0025 | 0.0187 | 1.4734±0.1608 |
| | | 0.005 | 60.26 | | | |
| | | 0.003 | 52.8 | | | |
| | | 0.001 | 32 | | | |
| | Diflubenzuron | 1.25 | 86 | 0.298 | 2.8674 | 1.3034±0.2407 |
| | | 1 | 67 | | | |
| 0.5 | | 62 | | | | |
| 0.25 | | 47 | | | | |
| Abu-Kabir | Chlorpyrifos-methyle | 0.025 | 98.75 | 0.002 | 0.009 | 1.9633±0.2063 |
| | | 0.005 | 86.25 | | | |
| | | 0.003 | 50 | | | |
| | | 0.001 | 32.5 | | | |
| | Diflubenzuron | 1.25 | 96 | 0.4084 | 1.3854 | 2.4157±0.2604 |
| | | 1 | 73 | | | |
| 0.5 | | 58 | | | | |
| 0.25 | | 32 | | | | |
| Diyarb-Negm | Chlorpyrifos-methyle | 0.025 | 92 | 0.0008 | 0.0494 | 0.7260±0.1644 |
| | | 0.005 | 82 | | | |
| | | 0.003 | 78 | | | |
| | | 0.001 | 38 | | | |
| | Diflubenzuron | 1.25 | 94 | 0.2153 | 1.2593 | 1.6707±0.2618 |
| | | 1 | 80 | | | |
| 0.5 | | 77 | | | | |
| 0.25 | | 53 | | | | |

Table 2. Effect of Chlorpyrifos on β -esterase, α -esterase, total soluble protein, lipid and AChE contents of the Mosquito *Culex pipiens*.

| Treatments | Larval stage | | | | | | | | | |
|---------------------------|--|-------------------------------------|---|-------------------------------------|----------------------------|-------------------------------------|---------------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| | β -esterase (μ g/aphthol/min/g.b.wt.) | % Increase or decrease than control | α -esterase (μ g/aphthol/min/g.b.wt.) | % Increase or decrease than control | Total Protein (Mg/g.b.wt.) | % Increase or decrease than control | Total lipids (Mg/g.b.wt.) | % Increase or decrease than control | AChE (μ g AchB/min/g .b.wt.) | % Increase or decrease than control |
| 10 th - Ramdan | 370.00±13.00a | 10.77 | 698.00±39.00a | 24.42 | 82.00±2.60ab | -11.86 | 6.40±0.20a | 17.00 | 1123.00±82.00 | 0.89 |
| Abo-kbeer | 219.00±12.00b | -34.43 | 657.00±20.00ab | 17.11 | 73.60±bc | -20.00 | 6.13±0.25ab | 12.06 | 997.00±23.00 | -10.42 |
| Dyarb Negm | 333.00±8.00ab | -1.29 | 591.00±18.00bc | 5.34 | 63.60±c | -31.52 | 5.84±0.19ab | 6.76 | 1063.00±57.00 | -4.49 |
| Control | 334.00±26.00ab | 0.00 | 561.00±29.00c | 0.00 | 92.30±a | 0.00 | 5.47±0.48b | | 1113.00±120.00 | 0.00 |
| F. Test | ** | | ** | | ** | | ** | | N.S | |
| Treatments | Adults stage | | | | | | | | | |
| | β -esterase (μ g/aphthol/min/g.b.wt.) | % Increase or decrease than control | α -esterase (μ g/aphthol/min/g.b.wt.) | % Increase or decrease than control | Total Protein (Mg/g.b.wt.) | % Increase or decrease than control | Total lipids (Mg/g.b.wt.) | % Increase or decrease than control | AChE (μ g AchB/min/g .b.wt.) | % Increase or decrease than control |
| 10 th - Ramdan | 645.00±12.00a | 30.01 | 999.00±16.00a | 33.2 | 108.00±4.70ab | -8.47 | 7.29±0.27 | 11.63 | 1596.00±26.00 | -4.14 |
| Abo-kbeer | 602.00±11.00b | 19.68 | 1103.00±91.00a | 47.06 | 98.60±2.00bc | -16.44 | 6.47±0.38 | -0.91 | 1707.00±88.00 | 2.52 |
| Dyarb Negm | 522.00±11.00c | 3.77 | 731.00±31.00b | -2.53 | 91.30±3.20c | -22.88 | 6.74±0.22 | 3.21 | 1545.00±59.00 | -7.20 |
| Control | 503.00±13.00c | 0.00 | 750.00±43.00b | 0.00 | 118.00±6.20a | | 6.53±0.58 | 0.00 | 1665.00±142.00 | 0.00 |
| F. Test | * | | ** | | ** | | N.S | | N.S | |

NS=Non-significant * =Significant ** = Highly significant Data are the means ±SE of the three replicates of immature or adult stages. Within the same column and source data followed by the same letter are not significantly different (P>0.05)
 % Increase or decrease than control = (treated – control) ÷ (control) ×100.

On the two stages larvae and adult, Chlorpyrifos-methyl insecticides affected on activity of β -esterase and

α -esterase enzymes values with significant increase in 10th Ramadan and Abo-kbeer by range between 10.77 and

30.01%, except β -esterase activity was in Abo-Kbeer by decrease -34.43%. In Dyarb-Negm drainage, the two enzymes cleared insignificant differences compared to control. Total soluble protein cleared significant decrease, whereas, in total lipid and AChE values were insignificant differences between treatments and control.

Effect of diflubenzuron inhibitor:

On the larval stage, the results showed in the three districts a significant increase in the activity of α -esterase enzyme and insignificant differences in β -esterase values compared to control. Total protein, lipid and AChE values cleared significant decrease in the three districts, except AChE value in 10th of Ramadan cleared significant increase.

On the adult stage, the effect of insecticide tested on adult stage showed highly increase in α -esterase enzyme values at Dyarb-Negm and Abo-kbeer districts, with 334.40 and 64.13%, respectively, however, insignificant differences between the treatment in 10th Ramadan and control. β -esterase enzyme value was significant increase in Dyarb-Negm and insignificant differences between treatments in 10th of Ramadan and Abo-kbeer compared to control. Total protein, lipid and AChE values decreased in the three districts with decline rate ranged between -26.08, 17.0 and 44.62%, except AChE value in 10th Ramadan was decreased with rate 0.0 compared to control treatment Table (3).

Table 3. Effect of diflubenzuron on β -esterase, α -esterase, total soluble protein, lipid and AChE contents of the Mosquito *Culex pipiens*.

| Treatments | Larva stage | | | | | | | | | | | |
|--------------------------|--|---|---|---|----------------------------------|---|-----------------------------|---|-------------------------------------|---|--|--|
| | β -esterase (μ g/naphthol /min/g.b.wt.) | % Increase or decrease than control | α - esterase(μ g/n aphthol /min/g.b.wt.) | % Increase or decrease than control | Total Protein (Mg/g.b.wt.) | % Increase or decrease than control | Total lipid (Mg/g.b.wt.) | % Increase or decrease than control | AChE μ AChB/min/g. b.wt.) | % Increase or decrease than control | | |
| 10 th Ramadan | 28.0±2.6 ^a | 5.26 | 34.3±2.51 ^c | 0 | 68±3.05 ^b | -26.08 | 5±0.26a | 17 | 175±4.5 ^a | 44.62 | | |
| Abo-kbeer | 29±2.08 ^a | 9.02 | 56.3±5.1 ^b | 64.13 | 80±4.5 ^a | -13.84 | 3.9±0.36b | 12.06 | 120±4.58 ^b | -0.86 | | |
| Diyarb-Negm | 25±1.00 ^a | -6.01 | 149±12.4 ^a | 334.4 | 83±3.21 ^a | 1.08 | 4.8±0.26ab | 6.27 | 103. ±3.80 ^c | -14.87 | | |
| Control | 26.6±4.16 ^a | 0 | 34.3±2.08 ^c | 0 | 92±3.20c | 0 | 5.46±0.49a | 0 | 121. ±7. ^b | 0 | | |
| F. Test | N.S. | | * | | * | | * | | * | | | |
| Adult stage | | | | | | | | | | | | |
| 10 th Ramadan | 40.3±2.08 ^b | -11.03 | 74. ±2.64 ^b | -4.26 | 91±3.2c | -8.47 | 3.6±3.20c | 11.63 | 223. ±7.6 ^a | 38.5 | | |
| Abo-kbeer | 42. ±3b | -7.28 | 196±6.42 ^a | 153.55 | 104. ±3.6b | -16.44 | 5.03±0.25b | -0.91 | 135±6.4 ^c | -16.14 | | |
| Diyarb Negm | 60.3±5.5 ^a | -33.11 | 220 ±19.6 ^a | 184.6 | 101±2.08bc | -22.62 | 3.93±0.15c | 3.21 | 103. ±6.08 ^d | -36.02 | | |
| Control | 45.3±4.72 ^b | 0 | 77.3±6.42 ^b | 0 | 118±6.24 ^a | 0 | 6.53±0.58a | 0 | 161. ±10. ^b | 0 | | |
| F. Test | * | | * | | ** | | N.S. | | * | | | |

NS=Non-significant * =Significant ** = Highly significant Data are the means ±SE of the four replicates of immature stages. Within the same column and source data followed by the same letter are not significantly different (P>0.05) % Increase or decrease than control = treated - control ÷ control ×100. Data are the means ±SE of the four replicates of biochemical parameters

On the two stages larvae and adult, diflubenzuron insecticides affected on activity of β -esterase values recorded significant increase in Dyarb-Negm for adult stage and insignificant values in the others districts whether for larvae or adult. α -esterase values in Abo-kbeer and Dyarb-Negm recorded significant increase with range between 64.13 and 334.4% for the two stages and insignificant values in 10th of Ramadan. Total soluble protein, lipid and AChE values recoded significant decrease for the two stages, except AChE values recorded significant increase in 10th of Ramadan compared to control. Chlorpyrifos-methyl and diflubenzuron play an important role in the toxic effect on the larval and adult stages of *C. pipiens* larvae as well as the biochemical components, which are positively reflected on their role in the control of the two stages. And the chlorpyrifos-methyl insecticide was the best in toxicity, whereas, diflubenzuron was the best in effect on the biochemical components. These results are in agree with those others, (Suman *et al.*, 2013) found (IGR,s), (diflubenzuron) and (pyriproxyfen) tested on *Culex pipiens* showed egg hatching was inhibition but diflubenzuron indicated tolerant to eggs of *Cx. pipiens*. (Ali *et al.*, 1999) tested five organophosphates (OPs) (chlorpyrifos, chlorpyrifos-methyl, fenthion, malathion, and temephos), and three IGRs, (diflubenzuron, methoprene, and pyriproxyfen) against *C. quinquefasciatus*

larvae. The LC90 values were more effect. (Toma *et al.*, 2011) stated that organophosphorus (OP) larvicides tested on *Culex pipiens* caused resistant than temephos and chlorpyrifos, while, AChE was decreased in insect. (Alout *et al.*, 2012) found that pyrimidine Trione Furan-substituted (PTF) compounds tested on mosquito. And caused killed *Culex pipiens* larvae and AChE was inhibition. (Bhinder_and Chaudhry 2013) the toxicity of pesticides acephate and chlorpyrifos on *Culex quinquefasciatus*. Inhibited un-hatched eggs. (Masarrat *et al.*, 2014) control mosquito *Culex fatigans* using Lambda-cyhalothrin, chlorpyrifos were significant efficacy against *Cx. fatigans* larvae. Total protein levels and (AChE) activity were decreased by Lambda-cyhalothrin and chlorpyrifos.

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التأثير السام وبعض التأثيرات البيوكيميائية للكوربيريفوس ميثيل والديفلوبنزورون على البعوض كيوليكس بيبباز في محافظة الشرقية، مصر

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قد تم تنفيذ هذا العمل في معهد بحوث الحشرات الطبية و معهد بحوث وقاية النباتات ، قسم بحوث فسيولوجيا الافات الدقي- الجيزة- مصر لدراسة التأثير السام وبعض التأثيرات البيوكيميائية لمبيد الكوربيريفوس ميثيل وديفلوبنزورون على يرقات بعوض كيوليكس بيبباز. تم جمع عينات اليرقات من أحواض المعالجة بمدينة العاشر من رمضان ومصارف كل من مركزى أبو كبير وديرب نجم وتم جمع الحشرات الكاملة من المنازل المجاورة لنفس المناطق الثلاث في محافظة الشرقية بدراسة تأثير السمية على اليرقات، أظهرت النتائج التي تم الحصول عليها أن نسبة الموت لمبيد كوربيريفوس ميثيل و ديفلوبنزورون في العاشر من رمضان تراوحت بين 32 و 96 و 47 و 86%؛ في أبو كبير، 32 و 96 و 18 و 84% وفي ديرب نجم، 55 و 92 و 77 و 94%. على التوالي، وكانت قيم التركيز القاتل 50% من التعداد هو 0.0038 و 28.4582 جزء في المليون، على التوالي. وكان المبيد الحشري كوربيريفوس ميثيل أكثر كفاءة من مثبط النمو ديفلوبنزورون في مكافحة يرقات البعوض كيوليكس بيبباز. وبينت التأثيرات البيوكيميائية على الطورين اليرقى والحشرة الكاملة، أن المبيد الحشري كوربيريفوس ميثيل أثر على نشاط الانزيمات بيتاإستريز و ألفاإستريز بزيادة معنوية في مركزى العاشر من رمضان وأبو كبير بنسبة تراوحت بين 19.68 و 47.06% باستثناء بيتاإستريز حيث كان نشاطه في أبو كبير بنسبة انخفاض 34.43%. في حين أظهر الإنزيمين فروق معنوية في مصرف ديرب نجم بالمقارنة مع الكنترول. أظهر البروتين الكلى القابل للذوبان إنخفاض معنوى، في حين أن قيم الدهون الكلية وإنزيم أستيل كولين إستريز أظهرت فروق ضئيلة غير معنوية بين المعاملات والمقارنة. وقد أثر مبيد الحشرات ديفلوبنزورون على نشاط قيم بيتاإستريز من خلال زيادة كبيرة معنوية في مركز ديرب نجم للطور الكامل من الحشرة وقيم ضئيلة غير معنوية في المراكز الأخرى سواء لليرقات أو للطور الكامل. وسجلت قيم ألفا إستريز في مركزى أبو كبير وديرب نجم ارتفاعا ملحوظا الذى تراوح بين 64.13 و 334.4% للطورين اليرقى والحشرة الكاملة، وقيم غير معنوية في العاشر من رمضان. وقد سجلت قيم البروتين الكلى الذاتى، الدهون الكلية وإنزيم أستيل كولين إستريز انخفاضا ملحوظا في الطورين اليرقى والحشرة الكاملة، باستثناء قيم إنزيم أستيل كولين إستريز التى سجلت زيادة كبيرة في العاشر من رمضان مقارنة مع الكنترول. وأظهرت النتائج أن مبيد كوربيريفوس ميثيل و ديفلوبنزورون يلعبا دورا هاما في التأثير السام على الطورين اليرقى والحشرة الكاملة لبعوض الكيوليكس بيبباز وكذلك التأثير على المكونات البيوكيميائية، والذي ينعكس بالإيجاب على دورهم في مكافحة الطورين وكان مبيد كوربيريفوس ميثيل الأكثر سمية بينما ديفلوبنزورون كان الأفضل في التأثير على المكونات البيوكيميائية.