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COMPARATIVE PERFORMANCE OF SIX COMPOUNDS AGAINST LARVAE AND PUPAE OF *Culex pipiens* UNDER LABORATORY CONDITION IN ASSIUT AREA

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Abstract: Toxicity of six compounds representing, carbamate (methomyl), tow organophosphates (chlorpyrifos and temephos), pyrethroid (α--cypermethrin), chitin synthesis inhibitor (chlorfluazuron) and bio-insecticide (abamectin) was evaluated against 2nd and 4th instar larvae, and pupal stage of *Culex pipiens* under laboratory conditions.

The pyrethroid, α-cypermethrin showed the highest toxic effect against 2nd and 4th instar larvae, and pupal stage too. Temephos was the least toxic compound against the 2nd instar larvae and pupal stage, while abamectin was the least toxic one against the 4th instar larvae.

Results of the present study revealed that *C.pipiens* in Assiut area became more tolerant to organophosphate insecticides compared with the results of previous studies in the same area.

Key words: larvae, pupae, *culex pipiens,* laboratory, compounds.

Introduction

Mosquitoes are problematic pest allover the world as nuisance insects Besides, in tropical and subtropical countries, certain species of mosquitoes are vectors of serious diseases (i.e. malaria, yellow fever, dengue, filariasis and encephalitides.

In Egypt, several culicine mosquitoes are vectors of human diseases (Darwish and Hoogstraal, 1981 and Harb *et al.*, 1993).

Among the culicine species recorded in Egypt, *Culex pipiens* (L.) have been found to be the most prevailing species of mosquitoes and considered the main vector of filariasis in endemic areas of Egypt (Khalil *et al.*, 1932).

Susceptibility tests of *C.pipiens* to various groups of insecticides have been conducted in different parts of the world by many authors, Ali *et al.* (1999), David *et al.* (2002), Cheng *et al.* (2003), and Ujihara *et al.* (2004).

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The present work was planned to throw the light on the susceptibility status of larvae, and pupae of *C.pipiens* to six compounds representing, organophosphorus, carbamate, pyrethroid, chitin inhibitor and biocides under laboratory conditions.

Materials and Methods

Laboratory experiments were conducted at department of Plant Protection, Faculty of Agriculture, Al-Azhar University, Assiut Governorate.

The compounds under study were provided by Central Laboratory of Pesticides, Dokii, Cairo. The compounds are: α-cypermethrin, abamectin, chlorfluazuron, chlorpyrifos, temephos and methomyl.

Bioassay Experiments:-

Six concentrations were prepared from each compound in water. The concentrations of the tested chemical were prepared and adjusted to give mortality percent between 20 and 90% in mosquito larvae or pupae.

Ten larvae or pupae were added in test beaker containing 100 ml of tap water within 15-30 minutes of preparation of the test concentration. In control experiment, water only was used.

A nylon strainer was used to transfer the larvae and pupae from the container to specified test beaker to avoid dilution or over concentration of the compounds under test.

Mortality count were calculated after 24h for chlorpyrifos, α-cypermethrin, methomyl and temephos, while abamectin and chlorfluazuron were calculated after 48h.

The mortality percentages were corrected by Abott's formula when the mortality in control units exceeded 5%, according to Abbott (1925).

The corrected mortalities at different concentrations were subjected to probit analysis using computer program (Propan) and the variance in LC_{50} between compounds were determined by comparing the 90% fudicial Limits, **Finney (1971).**

Results and Discussion

Toxicity effect of six compounds tested against *C.pipiens* mosquitoes:

1- Second instar Larvae:

Data in Table (1) showed the toxicity effect of six compounds tested against the 2nd instar larvae of *C. pipiens*. The six compounds showed variable toxicity degrees. In general, the toxicity increased with increasing of the concentration. Comparing the LC_{50} and LC_{90} values, α-cypermethrin showed the highest toxic effect against 2nd instar larvae. The LC_{50} and LC_{90} values were 0.0011 and 0.0049 ppm, respectively. The toxicity index was 100.

Table (1) : LC_{50}, LC_{90}, their Confidence limitis and slope values of LCP lines of six tested insecticides against 2nd larval instar of *C.pipiens* :

Compounds	LC_{50} ppm	Confidence limits		Toxicity index	LC_{90} ppm	Confidence limits		slope
		lower	upper			lower	upper	
α-cypermethrin	0.0011	0.0003	0.0039	100.00	0.0049	0.0022	0.0244	1.9850
Chlorpyrifos	0.0496	0.0482	0.051	0.124	0.0875	0.831	0.0929	1.9000
Methomyl	0.0449	0.0304	0.0570	0.123	0.0979	0.0716	0.280	0.9477
Temephos	0.3579	0.3144	0.4125	1.41	1.07	0.829	1.550	5.202
Abamectin	0.0054	0.0024	0.0096	1.13	0.0254	0.0128	0.0413	2.710
Chlorfluazuron	0.2827	0.1870	0.4500	1.13	1.6900	0.8680	2.460	1.648

*ppm (mg a.i / Litter)

The least effective compound was tempephos exhibiting LC_{50} and LC_{90} values of 0.03579 and 1.07 ppm, respectively, with toxicity index of 1.41. The LC_{50} values of chlorpyrifos and methomyl were 0.0496 and 0.0449 ppm, respectively. Comparing the slope values, the second instar larvae of *C.pipiens* showed homogeneity response to temephos (5.202) followed by abamectin (2.71). Whereas, 2nd instar showed heterogeneity response to methomyl (0.9477).

2- Fourth instar larvae:

As shown in Table (2), the six tested compounds showed variable activity against the fourth instar larvae of *C. pipiens*. The mortality percentages increased with the increase of concentration.

According to LC_{50} value, the pyrethroid insecticide, α-cypermethrin showed the highest toxicity (0.0013 ppm) followed by chlorpyrifos (0.0405 ppm). The least active compounds were, abamectin (0.621 ppm) and temephos (0.246 ppm). Methomyl and chlorfluazuron were of intermediate toxicity (0.145 and 0.1264 ppm, respectively).

Comparing the slope values, 4th instar larvae of *C.pipiens* showed high homogeneity response to temephos and α-cypermethrin (3.48 and 3.222, respectively), whereas it exhibited heterogenity response to methomyl and chlorpyrifos (0.948 and 1.496, respectively). The fourth instar larvae showed much tolerance to the compounds tested than the second instar.

3- Pupal stage:

Data in Table (3), show that pupae of *C. pipiens*. was more susceptible than larvae to the compounds tested except for temephos and chlorfluazuron.

According to the LC_{50}, LC_{90} and toxicity index, α-cypermethrin showed the highest toxic effect (LC_{50} value = 0.0009 ppm), followed by abamectin (0.0064 ppm). Temephos was the least effective compound (LC_{50} = 0.6268 ppm) followed by chlorfluazuron (0.22 ppm). However, methomyl and chlorpyrifos were of moderate toxicity (0.0211 and 0.0374 ppm).

Comparing the slope values, pupae showed homogenity response to α-cypermethrin (4.327), chlorpyrifos (4.084), chlorfluazuron (3.280) and methomyl (2.738). Whereas it exhibited heterogeneity response to abamectin (1.985) and temephos (0.962).

Generally, the pyrethroid insecticide, α-cypermethrin exhibited the highest effect against both 2nd and 4th instar larvae and pupae of *C.pipiens*. However, temephos was the least effective compound against larvae and pupae. The biocide, abamectin showed great toxicity against 2nd instar larvae and pupae, but against 4th instar larvae, it was the least effective compound. The chitin synthesis inhibitor, chlorfluazuron

Table (2): LC_{50}, LC_{90}, their Confidence limitis and slope values of LCP lines of six tested insecticides against 4th larval instar of *C.pipiens* :

Compounds	LC_{50} ppm	Confidence limits		Toxicity index	LC_{90} ppm	Confidence limits		slope
		lower	upper			lower	upper	
α-cypermethrin	0.0013	0.0010	0.0016	100.00	0.0031	0.0023	0.0062	3.222
Chlorpyrifos	0.0405	0.0320	0.0506	0.034	0.2916	0.1948	0.5416	1.496
Methomyl	0.145	0.0186	0.336	8.48	3.279	0.94	9.566	0.948
Temephos	0.246	0.220	0.273	2.86	0.573	0.476	0.750	3.48
Abamectin	0.621	0.483	0.787	3.27	1.755	1.256	3.412	2.843
Chlorfluazuron	0.1264	0.0958	0.162	3.12	0.4826	0.33	0.93	2.12

*ppm (mg a.i / Litter)

Table (3) : LC_{50}, LC_{90}, their confidence Limitis and Slope values of LCP Lines of six tested insecticides Against Pupal Stage of *C.pipiens* :

Compounds	LC_{50} ppm	Confidence limits		Toxicity index	LC_{90} ppm	Confidence limits		Slope
		lower	upper			lower	upper	
α-cypermethrin	0.0009	0.0008	0.0011	100.00	0.0018	0.0014	0.0033	4.327
Chlorpyrifos	0.0374	0.0062	0.2106	0.0054	0.8017	0.1659	0.8073	4.084
Methomyl	0.0211	0.0164	0.0256	0.124	0.0620	0.0481	0.0937	2.738
Temephos	0.6268	0.5199	0.7503	0.00016	1.54	1.180	2.490	0.962
Abamectin	0.0064	0.0057	0.0073	1.92	0.0132	0.0093	0.0426	1.985
Chlorfluazuron	0.22	0.146	0.337	0.00073	1.006	0.590	3.310	3.280

*ppm (mg a.i / Litter)

exhibited low toxic activity against both larval instars and pupae because it acts during molting process and needs long time to exhibit its toxicity.

The LC_{50} value of chlorpyrifos recorded in the present study is much higher than that obtained by Farghal, (1974) for *C.pipiens* in Assiut area (0.00034 ppm). Also, Scirocchi and D'Erme (1977), stated that chlorpyrifos at 0.002 ppm gave complete kill to *Culex* larvae in the laboratory.

On the other hand, Scirocchi and D'Erme (1977) found that temephos at concentration of 0.0011 ppm gave complete mortality to *Culex* larvae, in addition Zhang *et al.*, (2002) reported that temephos exhibited good larvicidal activity and remains active for long time even at low concentration. On contrary, temephos in the present study gave 50% mortality to the 4th instar larvae at concentration of 0.246 ppm.

According to the results of chlorpyrifos and temephos in the present study, it might be concluded that *C.pipiens* in Assiut area became more tolerance to the organophosphate insecticides. This may be due to the wide use of these insecticides in pest control programm for the last several years.

Increased tolerance of *C.pipiens* to organophosphorus compounds was reported by many authors, Micks and Rougeau (1977) found that larvae of *C.pipiens fatigans* wied. were 2-13 times more tolerant to chlorpyrifos than the susceptible strain. Also, Thompson (1987) found that *C.tarsalis* larvae were resistant to chlorpyrifos.

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مقارنة الأداء لستة مركبات ضد يرقات وعذارى بعوض كيولكس ببينز تحت ظروف المعمل بمنطقة أسيوط

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تم دراسة تقييم سمية ستة مركبات تمثل مجموعات الكرباميت (ميثوميل) والفوسفورية (كلوروبيروفوس والتيمفوس) والبيروثرويد (ألفا – سيبرمثرين) ومضادات تخليق الكيتين (كلورفلوذيورن) والمبيدات الحيوية (أبامكتين) على يرقات العمر الثانى والرابع وكذلك عذارى بعوض كيولكس ببينز تحت ظروف المعمل – بالنسبة للعمر اليرقى الثانى أظهر مركب ألفا سيبرمثرين أعلى سمية يليه مركب الأبامكتين بينما كانت مركبات التيمفوس والكلورفلوذيرون أقل المبيدات سمية. وفى حالة العمر اليرقى الرابع كان مركب الألفا سيبرمثرين أعلى كفاءة بينما كان مركب الأبامكتين أقل المركبات سمية – أما طور العذراء كان مركب الالفا سيبرمثرين أعلى سمية ومركب التيمفوس هو أقل المركبات فعالية وعموما فإن مركب البيروثرويد (ألفا سيبرمثرين) كان أعلى المركبات سمية على طور اليرقة والعذراء بينما كان مركب التيمفوس أقل المركبات كفاءة . وقد أظهرت النتائج أن بعوض الكيولكس فى منطقة أسيوط أصبح اكثر تحملاً للمبيدات الفوسفورية بالمقارنة بنتائج الدراسات السابقة فى نفس المنطقة.