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EFFICIENCY OF SOME BIO-INSECTICIDES AGAINST FIELD AND LABORATORY INDIVIDUALS OF *CULEX PIPIENS* (L.) (DIPTERA: CULICIDAE)

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ABSTRACT

Culex pipiens (L.) (Diptera: Culicidae) is the most important medical insect in many parts of the world. Biological and natural chemicals have many advantages over the traditional ones in case of mosquito control. Radiant, Isomectin and Nimbecidine insecticides were evaluated for their efficiency against the wild and laboratory individuals of late 3rd instar larvae of *Culex pipiens* at different concentrations and two periods of exposure under laboratory conditions. Results revealed that the mortality percentage was increased gradually with increasing the insecticide concentrations and the mortality percentage showed significant differences between concentrations and control. Moreover, results showed that mortality percentage increased with increasing the period of insecticide exposure. Tolerance and lab strain of *Culex pipiens* to insecticides showed that wild individuals were more tolerant than lab individuals to Radiant and Isomectin, and *vice versa* with Nimbecidine. Results revealed also that Radiant insecticide was the most effective insecticide against late 3rd instar larvae of *Culex pipiens* followed descendingly by Isomectin and Nimbecidine for both wild and lab strains of mosquitoes. Moreover, the toxicity index of the tested insecticides proved the high toxicity of Radiant than Isomectin and Nimbecidine. Toxicity index of Radiant at LC_{50} showed such superior efficacy (100%) followed by Isomectin and Nimbecidine.

Key words: *Culex pipiens*, bio-insecticides, toxicity, tolerance.

INTRODUCTION

In Egypt, the mosquito *Culex pipiens* is the main vector of filariasis and some arboviruses such as Rift Valley Fever and West Nile Fever viruses **(Southgate, 1979; Hanafi *et al*., 2011).** *Cx. pipiens,* therefore, is the main target in control programs against these diseases. *Culex pipiens* larvae breed in different kinds of water bodies such as wet pit latrines, septic tanks, cesspits, cesspools, drains and canals containing stagnant water polluted with organic waste. They also breed in polluted water associated with home industries, for example coconut husk pits. Other breeding sites are pools and unused wells used for dumping garbage **(Zayed *et al*, 2006).**

For many decades, the scientists have been engaged in searching the effective and efficient of the mosquito control program based on chemicals. The resistance to conventional insecticides is the major problem in mosquito control program. The traditional insecticides are environmentally non-sustainable and harmful the natural enemies, consequently may due to disturbance in the natural balance and most

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mosquito species are becoming physiologically resistant **(Karunamoorthi and Sabesan, 2013).**

The appearance of such problems has been accompanied by growing interest to use new safe bio insecticide with a new mode of action specially when dealing with water **(Salgado, 1997; Salgado, 1998).** Spinosad is a secondary metabolite of the aerobic fermentation of the naturally occurring soil actinomycete *Saccharopolyspora spinose* which produces a mix of compounds known as spinosyns A and D **(Athanassiou *et al*., 2008).**

Neem contains several active ingredients; such as Azadirachtin, Salanin, Meliantriol, Nimbecidine and Nimbin, which are the most known and significant components. They act in different ways under different circumstances **(Saxena, 1983; Ventura and Ito, 2000; Damaria, *et al*., 2004 Mahmoud and shoeib 2008; Shoieb *et al* 2010).** Extracts of neem are effective mosquito larvicides and inhibit metamorphosis **(Saxena, 1983).**

Azadirachtin, a complex tetranortriter penoid limonoid from the neem seeds, is the main component responsible for the toxic effects in insectzs. Neem insecticides are efficient mainly in a variety of different ways: as an antifeedant, insect growth regulator and sterilant.

Isomectin is a semi-synthetic derivative of the compound avermectin, which is a natural fermentation product of the soil bacterium *Streptomyces avermectinius* **(Burg *et al*., 1979; Campbell, 2012).** The Isomectin family of endectocides are 16-membered macrocyclic lactones each of which is comprised of a dissacharide, benzofuran and spiroketal moieties. The family also includes eprinomectin, abamectin, selamectin, doramectin and enamectin, though ivermectin has been shown to have the strongest nematocidal and insecticidal properties **(Pitterna *et al*., 2009; Butters *et al*., 2012; Campbell, 2012).**

The first study on the effects of Avermectin on mosquito disease vectors proved that Avermectin reduced the survivorship of *An. stephensi*, *A. aegypti*, *Cx. pipiens* and *C. quinquefasciatus* **(Pampiglione *et al*., 1985).**

The objective of the present investigation is: to evaluate the efficiency of some natural bio-insecticides against wild and lab strain of *Culex pipiens* larvae.

MATERIALS AND METHODS

Rearing of lab strain of *Culex pipiens*

Culex pipiens larvae were brought from Research Institute of Medical Entomology in Cairo, Egypt, the rearing was conducted in Entomology Lab., Plant Protection Department, Faculty of Agriculture, Suez Canal University. They reared under constant conditions of 27 ± 2ºC and relative humidity 60 ± 10%.

The larvae were kept in a plastic containers (14×20) cm, and sprinkled with bread crumbs twice a day on water surface. Pupae were pipette, placed in groups into plastic container half filled with clean water and transferred to emerging adult cages (25 × 25 × 25cm) with wire screen.

Emerged adults were provided with a piece of cotton that was socked in 10% sugar solution, blood meals were allowed for female adults every 48 hours because it`s necessary for eggs maturity. The mass of eggs was moved in the plastic containers until hatching.

Bio-Insecticides

1. Spinosad (Radiant): (active ingredient: Spinetoram 12%) Spinetoram is a new member of Spinosad, Spinosad consists of spinosyn A and D (Su, 2014), Molecular formula: $C_{42}H_{69}NO_{10}$.

2. Nimbecidine: (active ingredient: Neem oil 75.5%, Azadirachtin (neem butter) 3.5%, Emulsifier 10%, Stabilizers 2% and Diluent 9%), Azadirachtin Molecular formula: $C_{35}H_{44}O_{16}$.
3. Isomectin: (active ingredient: Abamactin 1.8%), Abamectin consists of avermectin B_{1a} and avermectin B_{1b}, Molecular formula: $C_{48}H_{72}O_{14}$.

Bioassays

Batches of 10 of late 3rd instar larvae were put in glass breakers, the glass breakers filled with 100 ml of de-chlorinated water – by lefting tap water for 24 hrs - containing different concentrations of three natural bio-pesticides; Radiant, Nimbecidine and Isomectin. The insecticides concentrations were tested against late 3rd instar. Five replicates were used for each concentrations as well as for the control. Each breaker was inspected 24 and 48 hours post treatment and mortality were recorded.

The experiment was repeated twice in different time for both lab strain and filed strain under lab condition of controlled temp (27±2) ºC and relative humidity (60±10) %, spectic tank water was used in filed strain bioassays, and no food supply for tested larvae during the bioassays.

Statistical Analysis

Mortality rates for each insecticide were analyzed through ANOVA (SAS Institute, 2004). If there were significant differences ($P \leq 0.05$), differences were compared using FLSD test.

A standard probit analysis was used to calculate LC_{20}, LC_{50}, LC_{90} and slope of the tested insecticide using "probit" analysis program of **Schoofs and Willhite (1984)**. Resistance ratio (RR) = LC_{50} of the wild strain/LC_{50} of the lab strain.

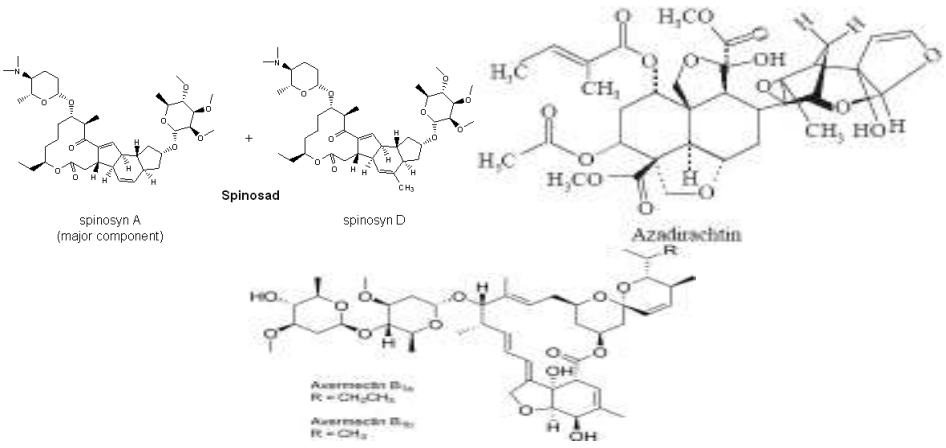

Table (1). Names and concentrations of the tested bio-pesticides.

Bio-pesticide	Concentration (mg/l)				
Radiant (wild and lab strains)	1	0.1	0.01	0.001	0.0001
Nimbecidine (wild and lab strains)	100	10	1	0.1	0.01
Isomectin (wild strain)	100	10	1	0.1	0.01
Isomectin (lab strain)	10	1	0.1	0.01	0.001

RESULTS

Results in Table 2 indicate that the mortality percentage of wild strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Radiant insecticide. The obtained results revealed that the mortality percentage was increased gradually with increasing the Radiant concentrations and the mortality percentage showed significant differences between concentrations and control (F=143.218; P≤ 0.0000 after 24 hr., of treatment and F=97.88; P≤ 0.0000 after 48 hr., of treatment).Moreover, results showed that mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae.

Also, the toxicity lines in Fig. 1 revealed that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure (y= -23. 2 x=128.5; R^2= 0.939 after 24 hr., of treatment and y=-23.62x=141.8; R^2= 0.872 after 24 & 48 hr., of treatment. results revealed that the elevation mortality rates were concentration-dependent and time of exposure.

Results obtained from Table (3) show that the mortality percentage of the late 3rd instar of lab strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Radiant as bio-insecticide.

Results revealed that the mortality percentage was increased gradually with increasing the Radiant concentrations and the mortality percentage showed significant differences between concentrations and control (F=295.646; P≤ 0.0000 after 24 hr., of treatment and F=176.110; P≤ 0.0000 after 48 hr., of treatment).

In addition to, results showed that mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae. Also, the toxicity lines in Fig. 2) revealed that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure (y= -24. 2x=134.6; R^2= 0.917 after 24 hr., of treatment and y=-21.02x=137.6; R^2= 0.909. results revealed that the elevation mortality rates were concentration-dependent and time of exposure.

Results in Table 4 show a great decrease in the LC_{20}, LC_{50} and LC_{90} values by increasing times of exposure, *i.e*: the LC_{90} value after 48 hours had nearly (1/6) the value after 24 hours of exposure in the wild strain. The LC_{50} value after 48 hours is 11.5 time decrease than the value of LC_{50} after 24 hours of exposure in the lab strain. Also the value of LC_{50} after 48 hours is about 12 times decrease than the value of LC_{50} after 24 hours of exposure in the wild strain. In addition, the value of LC_{90} after 48 hours had nearly (1/3) the value of LC_{90} after 24 hours of exposure in the lab strain.

The slope values either in wild or in lab strain proved that the homogeneity between wild and lab individuals. The resistance ratio of the response of the late 3rd instar larvae of *Culex pipiens* to the bio-insecticidal pressure of Radiant was 1.71 and 1.66 after 24 and 48 hr., of exposure in the wild strain.

Results obtained from Table (5) show that the mortality percentage of the late 3rd instar of wild strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Nimbecidine insecticide.

Results revealed that the mortality percentage was increased gradually with increasing concentrations of Nimbecidine and the mortality percentage showed significant differences between concentrations and control (F=92.608; P≤ 0.0000 after 24 hr., of treatment and F=55.059; P≤ 0.0000 after 48 hr., of treatment).

Table (2). Effect of different concentrations of Radiant on larvae of wild strain of *Culex pipiens* after 24 and 48 hours exposure.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
1	100 a	100 a
0.1	98 a	100 a
0.01	52 b	94 b
0.001	34 c	58 b
0.0001	0 d	3 c
cotrol	0 d	0 c

Means followed wit the same letter (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

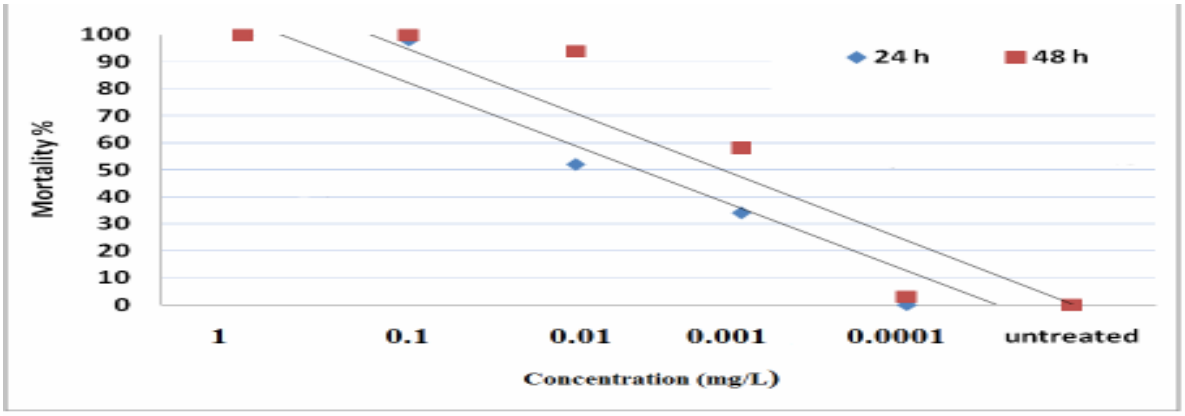

Fig. 1. Toxicity lines of Radiant against the late 3rd instar of wild strain of *Culex pipiens* larvae.

Table (3). Effect of different concentrations of Radiant on the late 3rd instar of laboratory strain of *Culex pipiens* larvae.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
1	100 a	100 a
0.1	100 a	100 a
0.01	74 b	92 b
0.001	24 c	64 c
0.0001	0 d	32 d
control	0 d	0 e

Means followed with the same letters (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

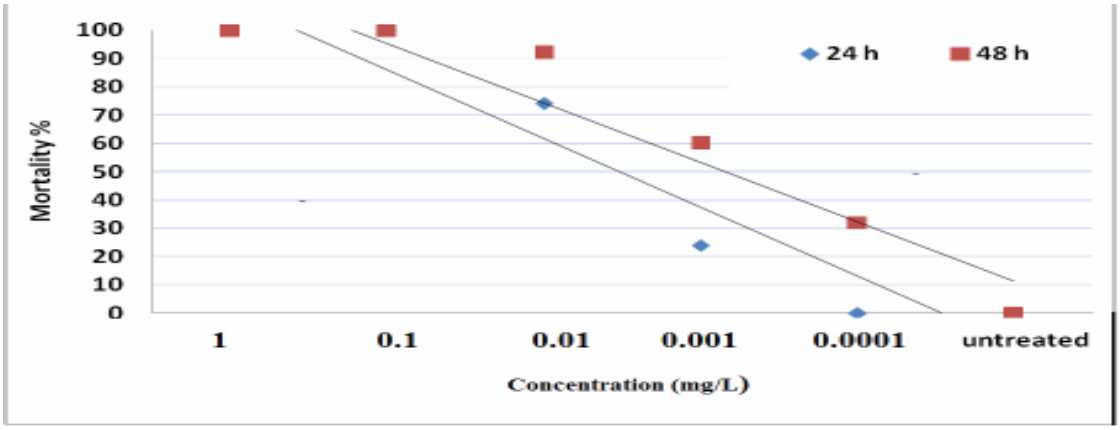

Fig. 2. Toxicity lines of Radiant against the late 3rd instar of lab strain of *Culex pipiens* larvae.

Table (4). Toxicity data of Radiant against the late 3rd instar of wild and laboratory strain of *Culex pipiens* larvae.

Mosquito strain	Time of exposure (Hours)	LC_{20} (mg/l) [95%CI]	LC_{50} (mg/l) [95%CI]	LC_{90} (mg/l) [95%CI]	Slope	Slope function (S)	Resistance ratio (RR) LC_{50}
Wild	24	0.001 (0.001-0.001)	0.006 (0.002-0.008)	0.097 (0.075-0.155)	1.0617	8.630	1.71
	48	0 (0.000-0.001)	0.0005 (0.0003-0.0007)	0.0154 (0.009-0.030)	0.8409	15.189	
Lab.	24	0.0008 (0.0005-0.0012)	0.0035 (0.0024-0.0044)	0.0309 (0.014-0.0436)	1.3471	5.459	1.66
	48	0 (0.000-0001)	0.0003 (0.0002-0.0005)	0.0107 (0.0063-0.0216)	0.8449	14.760	

(Resistance ratio (RR) = LC_{50} of wild strain/ LC_{50} of lab. Strain.

Table 5. Effect of different concentrations of Nimbecidine against the late 3rd instar of wild strain of *Culex pipiens* larvae.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
100	80 a	93 a
10	34 b	71 b
1	14 c	32 c
0.1	13 cd	31 c
0.01	8 cd	21 cd
Control	1 d	7 d

Means followed with the same letters (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

Moreover, results showed that mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae. The toxicity lines in (Fig. 3) revealed that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure (y= -13.5x+72.4; R^2= 0.757 after 24 hr., of treatment and y=-16.6x+100.6; R^2= 0.905 after 48 hr., of exposure. results revealed that mortality percentage was concentration-dependent and time of exposure.

Results obtained from (Table 6) showed that the mortality percentage of the late 3rd instar of lab. strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Nimbecidine insecticide. Likewise the wild strain, the mortality percentage was increased gradually with increasing concentrations of Nimbecidine and the mortality percentage showed significant differences between concentrations and control (F=15.697; P≤ 0.0000 after 24 hr., of treatment and F=21.543; P≤ 0.0000 after 48 of treatment). Moreover, results showed that, mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae.

The toxicity lines in Fig. 4 reveale that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure (y= -16.17x+104.6; R^2= 0.964 after 24 hr., of treatment and y=-16.82x+117.7; R^2= 0.891 after 48 hr., of exposure. results revealed that mortality percentage was concentration-dependent and time of exposure.

The value of LC_{20}, LC_{50} and LC_{90} were tabulated in Table 7 with the corresponding slope, slope function and resistance ratio for Nimbecidine insecticide against the wild and lab strain of *Culex pipiens* larvae after 24 and 48 hours of exposure.

The results of larvae showed that Nimbecidine was less toxic to both of wild and lab strain of larvae. The respective values of LC_{20}, LC_{50} and LC_{90} were 0.569, 17.078 and 3000.33(mg/l) after 24 hours of wild strain exposure, 0.027, 0.993 and 224.01(mg/l) after 48 hours of wild strain exposure, respectively. Also, the respective values of $LC_{20,}$ LC_{50} and LC_{90} were 0.002, 0.250 and 475.94 (mg/l) after 24 hours of wild strain exposure, 0.0001, 0.017 and 71.78(mg/l) after 48 hours of wild strain exposure, respectively.

The resistance ratio of the response of the late 3rd instar of *Culex pipiens* larvae to the bio-insecticidal pressure of Nimbecidine was 68.28 and 48.41 after 24 and 48 hr., of exposure in the wild strain; results showed relatively low level of resistance. The slope values proved that the homogeneity between lab and wild individuals.

Results in Table 8 showed that the mortality percentage of the late 3rd instar of wild strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Isomectin insecticide. The mortality percentage showed significant differences between concentrations and control (F=213.271; P≤ 0.0000 after 24 hr., of treatment and F=120.092; P≤ 0.0000 after 48 hr., of treatment). Moreover, results showed that mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae.

The toxicity lines in Fig. 5 reveale that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure (y= -21.94x+123.4; R^2= 0.956 after 24 hr., of treatment and y=-19.97x+136.7; R^2= 0.875 after 48 hr., of treatment. results revealed that mortality percentage was concentration-dependent and time of exposure.

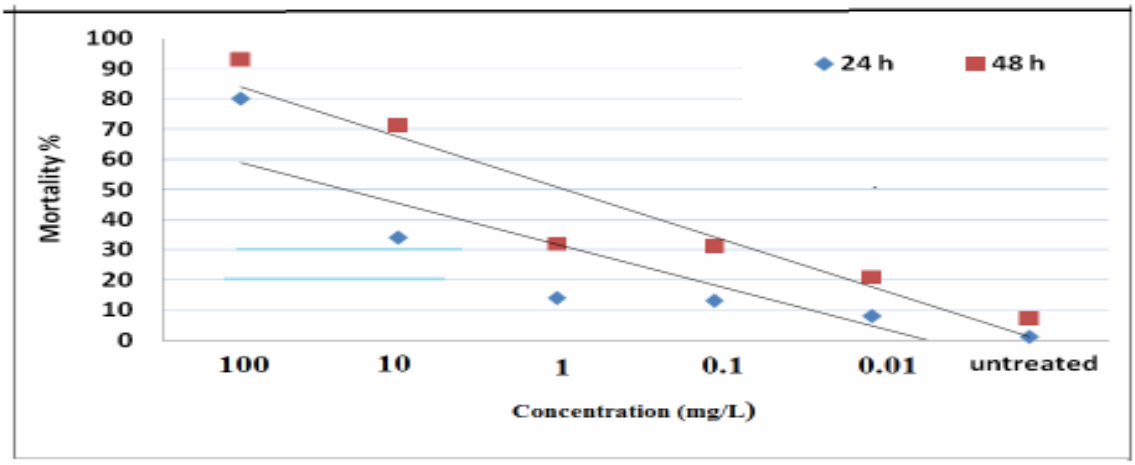

Fig. 3. Toxicity lines of Nimbecidine against the late 3rd instar of wild strain of *Culex pipiens* larvae.

Table (6). Effect of different concentrations of Nimbecidine on the late 3rd instar of lab. strain of *Culex pipiens* larvae.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
100	86 a	96 a
10	71 ab	80 ab
1	60 abc	71 abc
0.1	38 bc	58 bc
0.01	33 cd	48 c
Control	0 d	0 D

Means followed with the same letters (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

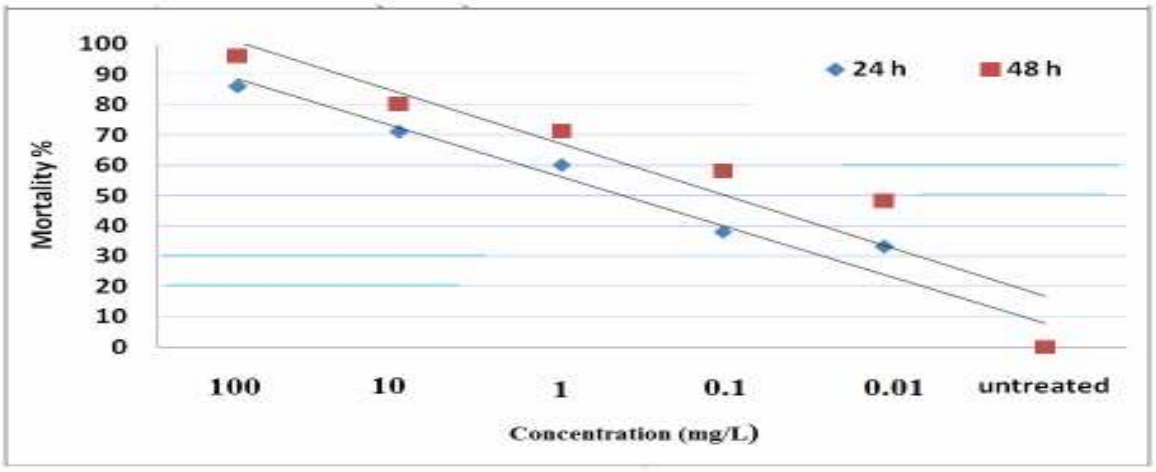

Fig. 4. Toxicity lines of Nimbecidine against the late 3rd instar of lab. strain of *Culex pipiens* larvae.

Table (7). Toxicity data of Nimbecidine against the late 3rd instar of wild and laboratory strain of *Culex pipiens* larvae.

Mosquito strain	Time of exposure (hour)	LC_{20} ((mg/l)) [95%CI]	LC_{50} (mg/l) [95%CI]	LC_{90} (mg/l) [95%CI]	Slope	Slope function (S)	Resistance Ratio (RR) LC_{50}
Wild	24	0.569 (0.312-1.036)	17.078 (9.186-31.752)	3000.335 (765.98-11752.22)	0.5699	55.169	68.28
	48	0.027 (0.012-0.059)	0.993 (0.590-1.673)	244.019 (80.883-736.186)	0.5356	71.574	
Lab.	24	0.002 (0.001-0.008)	0.250 (0.098-0.640)	475.947 (61.119-3706.280)	0.3859	350.695	84.41
	48	0.0001 (0.0001-0.0002)	0.017 (0.004-0.076)	71.789 (9.826-524.508)	0.3476	661.608	

(Resistance ratio (RR) = LC_{50} of wild strain/ LC_{50} of lab. Strain.

Table (8). Effect of different concentrations of Isomectin on the late 3rd instar of wild strain of *Culex pipiens* larvae.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
100	100 a	100 a
10	91 a	100 a
1	54 b	92 a
0.1	24 c	74 b
0.01	10 d	28 c
Control	1 d	7 D

Means followed with the same letters (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

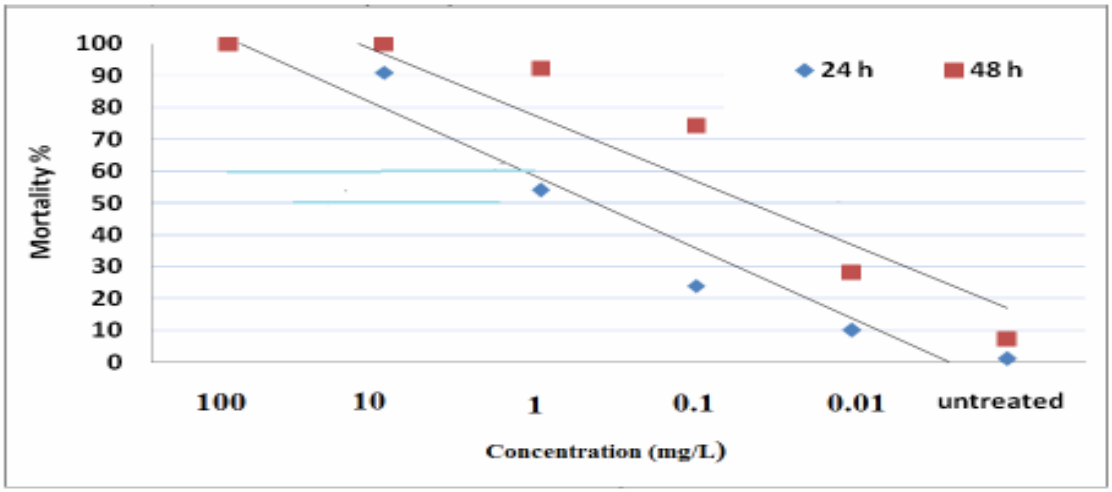

Fig. 5. Toxicity lines of Isomectin against the late 3rd instar of wild strain of *Culex pipiens* larvae.

Results obtained from Table (9) show the mortality percentage of the late 3rd instar of lab. strain of *Culex pipiens* larvae after 24 and 48 hours of exposure to different concentrations of Isomectin insecticide.

Likewise the wild strain, the mortality percentage was increased gradually with increasing the Isomectin concentrations and the mortality percentage showed significant differences between concentrations and control ($F=115.782$; $P\leq 0.0000$ after 24 hr., of treatment and $F=45.347$; $P\leq 0.0000$ after 48 hr., of treatment). Moreover, results showed that mortality percentage increased with increasing the time of insecticide exposure for *Culex pipiens* larvae.

The toxicity lines in Fig. (6) reveale that the regression equation and regression of the mortality percentage after 24 and 48 hours of exposure ($y= -19.25x+103.0$; $R^2= 0.893$ after 24 hr., of treatment and $y=-18.22x+132.8$; $R^2= 0.859$ after 48 hr., of treatment. Results revealed that mortality percentage was concentration-dependent and time of exposure.

The value of LC_{20}, LC_{50} and LC_{90} were tabulated in Table (10) with the corresponding slope, slope function and resistance ratio for Isomectin insecticide against the wild and lab strain of *Culex pipiens* larvae after 24 and 48 hours of exposure.

The results of larvae showed that Isomectin was moderate toxic to both of wild and lab strain of larvae than the high toxic Radiant and the low toxic Nimbecidine. The resistance ratio of the response of the late 3rd instar of *Culex pipiens* larvae to the bio-insecticidal pressure of Isomectin was 2.06 and 16.

Results showed relatively low level of resistance. The slope values proved that the homogeneity between lab and wild individuals. Results obtained from Tables (11 and 12) revealed that Radiant insecticide was more toxic among the tested insecticides followed by Isomectin and Nimbecidine for both the wild and lab strain of mosquitoes. Moreover, the toxicity index of the tested insecticides proved the high toxicity of Radiant than Isomectin and Nimbecidine.

DISCUSSION

The current study provides such information on the toxicity of these natural bio-insecticides against the late 3rd instar larvae of *Culex pipiens*.

This study, carried out in the laboratory revealed that Radiant, Isomectin and Nimbecidine insecticides had good impact and powerful toxicity on *Culex pipiens* larvae particularly Radiant and Isomectin. In this study, Radiant and Isomectin had high impact and toxic effect than Nimbecidine after 24 and 48 hours of insecticide exposure.

These findings are in conformity with those reported by **El-Kady *et al.* (2008)** who mentioned that Spinosad and Isomectin had significant effects on the percentage of larval mortality of *Culex pipiens.* **Walaa *et al.* (2015)** reported that the highest larvicidal effect was recorded for Spinosad treatment followed by Temephos, Fenitrothion then Malathion.

Ali and Nayer (1985) mentioned that the highest larvicidal effect was recorded for Abamectin against *Aedes aegypti* and *Culex quinquefasciatu*s. **Alouani *et al.* (2009)** proved that Azadirachtin had high larvicidal effect against *Culex pipiens*, similar results were obtained by **Alkofahi *et al.* (1989).**

In its Twenty five years of use, resistance to Spinosad has been limited in part because of its unique mode of action. Thus, no cross-resistance to Spinosad has been measured in mosquitoes that are resistant to pyrethroids or OPs **(Darriet *et al.*, 2005).**

Table (9). Effect of different concentrations of Isomectin on the late instar of lab. strain of *Culex pipiens* larvae.

Concentration (mg/L)	Mortality (%)	
	After 24 hr.,	After 48 hr.,
10	100 a	100 a
1	56 b	100 a
0.1	40 c	96 a
0.01	12 d	56 b
0.001	4 e	54 b
Control	2 e	8 C

Means followed with the same letters (column wise) are not significantly different (Tukeys HSD, P≤ 0.05).

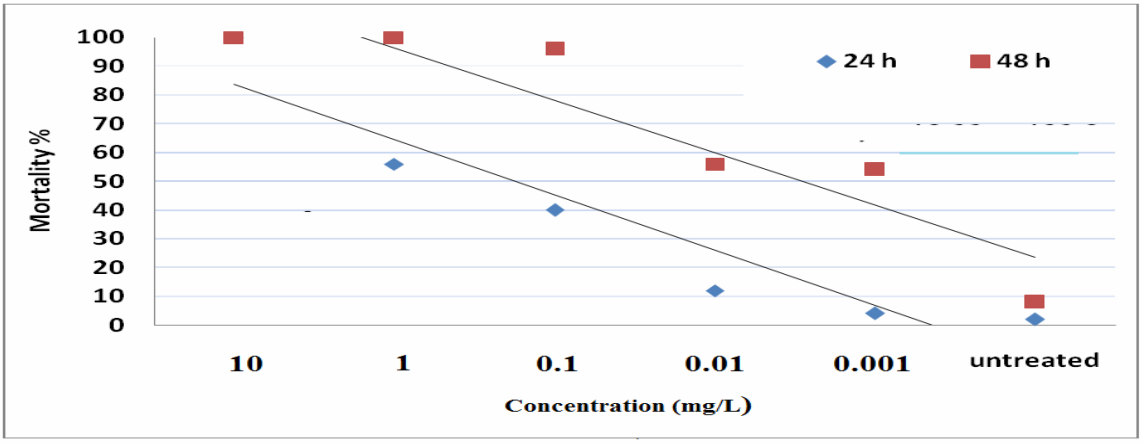

Fig. 6. Toxicity lines of Isomectin against the late 3rd instar of lab strain of *Culex pipiens* larvae.

Table (10). Toxicity data of Isomectin on the late 3rd instar of wild and laboratory strain of *Culex pipiens* larvae.

Mosquit(strain	Time of exposure (Hours)	LC_{20} (mg/l) [95%CI]	LC_{50} (mg/l) [95%CI]	LC_{90} (mg/l) [95%CI]	Slope	Slope function (S)	Resistance ratio (RR)c LC_5
Wild	**24**	0.058 (0.036-0.093)	0.478 (0.335-0.683)	11.724 (6.595-20.840)	0.8964	11.966	2.06
	48	0.005 (0.003-0.009)	0.032 (0.022-0.047)	0.514 (0.303-0.870)	0.9973	8.622	
Lab.	**24**	0.024 (0.015-0.038)	0.232 (0.159-0.338)	7.362 (3.782-14.329)	0.8392	14.612	16
	48	0.0001 (0.0001-0.0002)	0.002 (0.001-0.003)	0.069 (0.036-0.133)	0.7321	18.487	

(Resistance ratio (RR) = LC_{50} of wild strain/ LC_{50} of lab. Strain.

Table (11). Toxicity index of the tested insecticides against wild and lab strains after 24 hours of exposure.

Insecticide	LC_{50}		Toxicity index	
	Wild strain	Lab strain	Wild strain	Lab strain
Radiant	0.006	0.0035	100	100
Nimbecidine	17.07	0.250	0.035	1.2
Isomectin	0.478	0.232	1.25	1.29

Table (12). Toxicity index of the tested insecticides against wild and lab strain after 48 hours of exposure.

Insecticide	LC_{50}		Toxicity index	
	Wild strain	Lab strain	Wild strain	Lab strain
Radiant	0.0005	0.0003	100	100
Nimbecidine	0.993	0.017	0.05	1.76
Isomectin	0.032	0.002	1.56	15

Conclusion

The present work demonstrated that Spinosad, Isomectin and Nimbecidine proved to be effective and viable alternative to broad spectrum of insecticides for controlling mosquito larvae.

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الملخص العربى

تأثير بعض المبيدات البيولوجية علي أفراد برية ومعملية من بعوض الكيوليكس ببينز

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تعتبر البعوضة المنزلية (الكيوليكس ببينز) هي الحشرة الطبية الأكثر أهمية في أنحاء كثيرة في العالم، المبيدات البيولوجية والطبيعية لها مزايا كثيرة عن تلك المبيدات التقليدية في حالة السيطرة علي البعوض، تم تقييم بعض المبيدات البيولوجية والطبيعية (الراديانت، الايزوميكتين النيمبيسيدين) ومعرفة تأثيرها ضد يرقات العمر الثالث ليرقات بعوض الكيوليكس ببينز بعدة تركيزات مختلفة ووقتين من التعرض تحت ظروف المعمل، أظهرت النتائج أن نسبة موت اليرقات قد زادت تدريجيا مع زيادة تركيزات المبيدات السابقة ونسبة الموت أظهرت فروقا معنوية بين التركيزات والمعاملة القياسية، كما أظهرت البيانات أن نسبة الموت زادت مع زيادة وقت تعرض يرقات البعوض للمبيدات، وأظهرت النتائج أن نسبة مقاومة يرقات بعوض السلالة البرية كان أكثر مقاومة من يرقات بعوض السلالة المعملية، وكشفت البيانات أن مبيد الراديانت هو الأكثر تأثيرا ضد يرقات البعوض يليه الايزوميكتين ثم النيمبيسيدين لكل من السلالة المعملية والبرية، وعلاوة علي ذلك، اثبت خط السمية للمبيدات الحشرية اختبار سمية عالية للراديانت اكبر من الايزوميكتين والنيمبيسيدين. وأظهر خط السمية للراديانت للجرعة المميتة للنصف فعالية متفوقة (١٠٠%) تليها الايزوميكتين ثم النيمبيسيدين.

الكلمات الإسترشادية: الكيوليكس ببينز، المبيدات الحشرية، تأثير، مقاومة.