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BIOCHEMICAL AND TOXICOLOGICAL STUDIES ON THE EFFICACY OF CERTAIN MINERAL OILS, NEEM EXTRACT AND PIRIMICARB AGAINST *Aphis craccivora* KOCH. AND THEIR SIDE EFFECTS ON THE NATURAL ENEMY *Chrysoperla carnea* STEPH.

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ABSTRACT

The present investigation was carried out to study the efficacy of certain mineral oils, neem extract (*Azadirachta indica A. Juss*) and pirimicarb insecticide against nymphs and adults of a susceptible strain of *Aphis craccivora* Koch. Toxicity lines of the three mineral oils (Super-misrona^R, Shokrona^R and Kz^R oils) as well as neem extract and pirimicarb were determined by using thin layer technique in petri dishes for 24 hour exposure periods.

The mineral oils, neem extract and pirimicarb were evaluated using the LC_{25} and LC_{50} for each compound. The obtained data show that the high concentrations of neem extract, mineral oils and pirimicarb caused decrease in the activities of cholinesterase (ChE), acid phosphates (Acp) and total proteins in the nymphs and adults of *A. craccivora*. The biological effects of the five materials under investigation were tested on eggs and second instar larvae of the predator *Chrysoperla carnea* Steph. Eggs treated with Super-misrona and pirimicarb showed a high percentage of hatching. The highest larval mortality occurred in the case of the second instar larvae treated

with pirimicarb and the lowest was in those treated with Shokrona oils and neem extract.

Key words: acp, *Aphis craccivora*, *Azadirachta indica*, che, *Chrysoperla carnea*, mineral oils, pirimicarb, total proteins, and toxicity.

1. INTRODUCTION

Legumes are considered among the important crops in Egypt. The importance of legumes as food lies in their high protein content. In the field, legumenous plants are infested with many insect pests, the most serious one is the cowpea aphid, *Aphis craccivora* Koch. Infestation with *A. craccivora* starts to appear on winter legumes by the second half of February then increases with the increase of temperature to reach its peak on bean plants during March causing serious direct and indirect damage to the plants and loss in the yield (Ahmed ,1955). Synthetic insecticides have side effects and may cause problems to general human health and are a source of environmental pollution. For these reasons research has been promoted to find new means of pest control. Rresearch on insect control agents which are selective in their action and may prompt physiological disorder during insect development resulting in its mortality or steriliy is needed. Terpenoids specially sesquiterpene lactones are a well known class of compounds with biological active action. During the past 20 years over 500 sesquiterpene lactones have been isolated and identified from many species of higher and lower plants. Sesquiterpene lactones have also been reported from most plant parts including roots, wood, flowers and root barks (Fischer *et al*., 1979 and Seaman, 1985).

Application of mineral oils is an efficient way of controlling insect pests, (Belal *et al*., 1998). Many plant products have been tried as insecticides, insect repellents and attractants (Mc-Indoo,1945). A general procedure for extraction and detection of sesquiterpene lactones " STL" in plants has been described by Harborne (1984) and Giordano *et al*., (1990). The crude sesquiterpene lactones extract of neem showed a high insecticidal activity against *Aphis craccivora* (Kaethner, 1991).

In integrated pest control (IPC) programs, certain chemical insecticides, mineral oils and plant extracts used, may prove to be harmful to the natural enemies found on the same crops. Experiments have been carried out to test their safety. Kaethner (1991) and Jakob (1996) proved that neem extracts were safe for *Chrysoperla carnea.* Toda and Kashio (1997) found the carbamate insecticide Pirimicarb to be relatively safe to the formentioned Chrysopid.

The objective of this study was to test the effect of certain mineral oils, neem extract and the insecticide Pirimicarb on the aphid species, *A. craccivora* and its natural enemy *C. carnea.*

2. MATERIALS AND METHODS

2.1. Materials

2.1.1. Test insect

In this experiment colonies of *Aphis craccivora* were reared under laboratory conditions at 20-25°C, 70± 5 % R.H. and under a photoperiod of 16: 8 hours according to El-Arnaouty (1991).

2.1.2. Insect predator

Eggs and 2nd instar larvae of *Chrysoperla carnea* used in this study, were isolated from the stock culture of the mass rearing unit, of the predator mass production laboratory, Faculty of Agriculture, Cairo University.

2.1.3. Chemicals used

The compounds used in the bioassays can be sorted out in the following three categories:

a- Mineral oils : Super-misrona^R, Shokrona^R and KZ^R.

b- Plant extracts of neem seeds: *Azadirachta indica* A. Juss. The collected plant sample was cleaned, air dried in shade, and then ground to fine powder before extraction.

The air dried material (300g) was soaked in chloroform at room temperature, the combined chloroform extract was evaporated under vaccum and dissolved in 95% ethanol, then an equal volume of 5% aqueous lead acetate solution was added. The aqueous cloudy solution was filtered through a celite pad, and filtrate was concentrated under vacuum. The residue was extracted three times with equal volume of chloroform and the extract was dried over

anhydrous sodium sulphate and evaporated. The residue was mainly sesquiterpene lactone. The crude sesquiterpene lactone content in the dry plant material was calculated. The "STL" residue was completed to a defined volume with distilled chloroform and stored in a deep freezer at –20°C for subsequent work.

c- Carbamates : pirimicarb (pirimor^{R} Aphox ^{R} 50% EC).

2.2. Methods

2.2.1. Bioassays

Colonies of *A. craccivora* were tested for resistance and compared to a susceptible laboratory strain, using the "thin layer technique" in Petri dishes (10 cm diameter). Dead individuals were counted after 24 hours and mortality was assessed and corrected using Abbott's formula (1925). The slope of log concentration probit regression lines and both the LC_{25} and LC_{50} values for the tested compounds were calculated by probit analysis according to Finney (1952).

2.2.2. Toxicological studies

The LC_{25}, LC_{50} and slope values of the tested compounds are summarized in Table (1).

Table (1): Toxicity for the tested compounds of mineral oils, neem extract and pirimicarb to a susceptible (S) laboratory strain of *Aphis craccivora* after 24 hrs of exposure periods.

Tested compound	LC_{25} (ml per litre)	LC_{50} (ml per litre)	Slope
Super-misrona	1.45	2.9	2.2
Shokrona	1.05	2.1	2.1
KZ oil	0.8	1.6	1.9
Neem extract	0.05	0.1	2.0
Pirimicarb	0.6	1.2	2.0

The data obtained in Table (1) show that pirimicarb and neem extract are much more potent than the different tested mineral oils. These results are in agreement with those reported by Belal *et al.*, (1998).

2.2.3. Biochemical analysis on *A. craccivora*

The soluble protein rate in *A. craccivora* was determined according to the method of Captain *et al.*, (1946). Soluble proteins were determined using Biuret reagent, the liberated as amino acid nitrogen to produce the blue color. Moreover, acid phosphatase and cholinesterase activities were measured according to Kind & King (1954). Acid phosphatase activity was determined using sodium phenyl phosphate as a substrate by the same method. The developing of color was done according to the following reaction.

$$\text{Phenyl phosphate} \xrightarrow[\text{pH 4.9}]{\text{acid phosphate}} \text{phenol} + \text{phosphate}$$

The liberated phenol was measured in the presence of amino – 4–antipyrine and potassium ferricyanide, (Ellman *et al.*, 1961). The principle of this method is the measurement of thiocholine produced from the hydlrolysis of acetylthiocholine. This is accomplished by the continuous reaction of thiocholine with 5:5 –dithio – bis nitrobenzoate ion to produce the yellow amino of 5- thio – 2 – nitrobenzoic acid.

2.2.4.Bioassays on *C. carnea* and evaluation of impact on biological development

Survival rate of *C. carnea* to the above mentioned chemicals was evaluated using the thin layer technique. LC_{25} and LC_{50} values were also determined.

The eggs and 2^{nd} instar larvae were isolated individually and then tested in small plexiglass boxes (2.5 cm in diameter, 1 cm high). The cover of each box cover was provided with a small grid of muslin (1cm in diameter) during the experiment.

The hatching rate of the treated eggs group was accounted for and the resulting larvae were reared on *Ephestia kuchniella* and monitored until adulthood.

For the 2^{nd} instar larvae, treated groups were monitored until adulthood, and the developmental features (*e. g.*, instar mortality, instar duration, pupation rate, adult emergence rate) were recorded, while feeding as well on *E. kuchniell.* From both groups after emergence, 10 couples were formed and placed in small boxes of 7 cm in diameter, 6 cm high displaying a black fabric as egg laying support. These adults were also fed on a semi-artificial diet (4 g of yeast hydrolysate, 8 g of honey and 4 ml of distilled water) and

monitored up to the hatching of their laid eggs.

3. RESULTS AND DISCUSSION

3.1. Biochemical studies

Data in Table (2) clearly show that the total proteins determined in nymphs of the susceptible strain *A. craccivora* reached the highest level after 6 hours for most of the treatments of *A. craccivora* nymph. Such a high level was reached after 18 hours in the case of adults when treated with the same compounds. In the present investigation the reduction in the total proteins was more evident in nymphs than in adults in comparison to the control. Similar results were obtained by Mohamed (1998) who found that the adult aphids treated with different concentrations of Pirimicarb, mineral oils and neem extract, exhibited inhibition in the total protein.

Data in Table (3) indicate that the maximum cholinesterase activity in both nymphs and adults of *A. craccivora* susceptible strain was reached 24 hours after treatment with pirimicarb, neem extract, Super-misrona, KZ and Shokrona, respectively. These results are in agreement with those obtained by Belal *et al.*, (1998) who showed that the inhibition of cholinesterase activity in adults of *A. craccivora* treated with a mixture of insecticides and mineral oils occurred after 24 hours. Obrein *et al.*, (1992) obtained a significant high carboxylesterase activity in the resistant colony of *Aphis gossypii* Glover compared with a susceptible one. They estimated LC_{50} of the resistant colony and found it 4 times higher than that of the susceptible one. El-Ghareeb (1993) indicated higher esterase and oxidase activities in resistant than in susceptible populations of cotton aphids to carbamate insecticides.

Pirimiphos ethyl was the most effective chemical tested and star oil was superior over all the organophosphorus insecticides recommended for apricot aphid *Hyalopterus pruni* Falori control (El-Deeb *et al.*, 1989).

The results suggested that esterase and mixed function oxidase play a major role in different tested compounds. Owusu *et al.*, (1996) and Losch *et al.*,(1999) found that aphids can be controlled effectively on apple with neem extract which are more safe to the environment

Table (2): Total proteins of a susceptible strain of *Aphis craccivora* after different intervals of time (in hours) following treatments with mineral oils, neem extract and pirimicarb insecticides .

Exposure periods	Total proteins at different intervals after treatment																			
	N		A		N		A		N		A		N		A		N		A	
	3				6				12				18				24			
Tested compounds	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}
Control	3.2	4.8	4.1	6.5	3.2	4.8	4.1	6.5	3.2	4.8	4.1	6.5	3.2	4.8	4.1	6.5	3.2	4.8	4.1	6.5
KZ	2.5	4.1	3.3	5.6	2.7	4.7	3.5	5.5	2.9	4.3	3.6	5.5	2.7	4.3	3.8	6.1	2.9	4.5	3.3	5.2
Super-misrona	2.1	3.3	3.0	4.7	2.4	3.9	2.1	4.3	2.6	3.5	2.5	4.9	2.2	3.6	3.3	5.9	2.1	3.5	2.0	4.1
Shokrona	2.3	3.7	2.7	5.0	2.2	4.1	2.4	4.5	2.2	3.8	2.6	4.7	2.5	3.6	3.1	5.3	2.4	3.9	2.7	4.7
Neem extract	2.6	4.2	3.5	6.1	2.7	4.9	3.2	5.7	2.5	4.5	3.4	5.3	2.7	4.7	3.7	6.5	3.1	4.5	3.4	5.2
Pirimicarb	1.9	3.0	2.3	3.9	1.9	3.2	2.5	4.2	2.0	3.4	2.2	4.4	2.1	3.4	2.2	4.9	2.0	3.4	2.0	3.9

N = Nymph, A = Adult

Table (3): Cholinesterase activity in *Aphis craccivora* after different intervals of time (in hours) following treatments with mineral oils, neem extract and pirimicarb insecticide.

Exposure periods	Cholinesterase activity at different intervals after treatment																			
	N		A		N		A		N		A		N		A		N		A	
	3				6				12				18				24			
Tested compounds	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}
Control	98.1	95.0	116	110	99.1	97.2	119	113	98.1	97.0	128	119	101.3	99.3	129	121	105	101	134	126
KZ	98.1	95.0	116	110	99.1	97.2	119	113	98.1	97.0	128	119	101.3	99.3	129	121	105	101	134	126
Super-misrona	98.8	97.6	108	103	99.6	98.4	123	119	101.1	99.5	125	121	103.0	99.8	137	126	103.1	99.8	139	131
Shokrona	99.5	98.1	112	105	101	99.3	117	111	103	99.7	129	115	106	101	128	119	106	101	132	118
Neem extract	94.3	90.1	113	105	96.0	93.0	113	108	97.1	96.0	126	115	99.4	97.8	129	117	104.1	99.5	128	119
Pirimicarb	81.3	81.5	85	82	80.0	77.1	81.6	78.3	74.3	78.5	76.1	74.0	72.5	69.7	71.5	72.3	75.1	72.3	74.3	76.1

Activities are expressed as percentage activity of untreated aphid

*VS: control

N= Nymph, A= Adult

Table (4): Acid phosphatase activity in *Aphis craccivora* after different intervals of time (in hours) following the treatment with mineral oils, neem extract and pirimicarb.

Exposure periods	Acid phosphatse activity at different intervals after treatment																			
	N		A		N		A		N		A		N		A		N		A	
	3				6				12				18				24			
Tested compounds	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}
Control	2.4± 0.22	5.9± 0.29	6.4+ 0.31	7.3± 0.36	4.5± 0.22	5.9± 0.29	6.4± 0.31	7.3± 0.36	4.5± 0.22	5.9± 0.29	6.4± 0.31	7.3± 0.36	4.5± 0.22	5.9± 0.29	6.4± 0.31	7.3± 0.36	4.5± 0.22	5.9± 0.29	6.4± 0.36	7.3± 0.36
KZ	3.1± 0.15	4.3± 0.21	5.8± 0.28	6.8± 0.33	3.6± 0.18	4.8± 0.23	5.9± 0.29	6.9± 0.34	3.7± 0.18	4.9± 0.24	5.7± 0.28	6.7± 0.33	3.8± 0.19	4.6± 0.22	5.5± 0.27	6.6± 0.32	4.1± 0.20	5.3± 0.26	5.1+ 0.25	6.3+ 0.31
Super-misrona	3.4± 0.17	4.6± 0.22	5.8± 0.28	6.8± 0.33	3.7± 0.18	4.6± 0.22	5.7± 0.28	6.9± 0.34	3.8± 0.19	4.9± 0.24	5.8± 0.28	6.7± 0.33	3.6± 0.18	4.7± 0.23	5.7± 0.28	6.6± 0.32	4.2± 0.21	5.2± 0.25	5.3± 0.26	6.2± 0.30
Shokrona	3.7± 0.18	4.6± 0.22	6.1± 0.30	6.9± 0.34	3.6± 0.18	4.6± 0.22	5.9± 0.29	6.7± 0.33	3.9± 0.19	4.7± 0.23	5.6± 0.27	6.6± 0.32	3.7± 0.18	4.7± 0.23	5.8± 0.28	6.7± 0.33	4.2± 0.21	5.3± 0.26	5.6± 0.27	6.6± 0.32
Neem extract	3.2± 0.16	4.2± 0.21	5.7+ 0.28	6.6± 0.32	3.5± 0.17	4.5± 0.22	5.5± 0.27	6.8± 0.33	3.6± 0.18	4.6± 0.22	5.4± 0.26	6.5± 0.32	3.5± 0.17	4.5± 0.22	5.3± 0.26	6.4± 0.31	4.0± 0.2	5.1± 0.25	5.2± 0.26	6.2± 0.30
Pirimicarb	2.5± 0.13	3.7± 0.19	5.0+ 0.25	5.8± 0.28	2.7± 0.13	3.5± 0.17	4.8+ 0.23	5.7± 0.28	2.8± 0.14	3.9± 0.19	5.0± 0.25	5.9± 0.29	2.9± 0.14	3.9± 0.19	5.0± 0.25	5.9+ 0.29	3.1± 0.15	4.3± 0.21	5.0± 0.25	5.9± 0.29

N= Nymph, A= Adult

Acid phosphatase activity is expressed as kind and King unit activity of untreated aphid

n values ± SE

Table (5): Biological aspects of *Chrysoperla carnea* eggs resulting from treatment with mineral oils, neem extract and pirimicarb insecticide.

Biological criteria		Shokrona oil		Super-misrona		KZ		*Azadirachta indica*		Pirimicarb		Control
		LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	
Hatching (%)		85	73	93	93	87	89	91	85	92	82	91
Sterility (%)		3	2	0	0	1	4	1	0	0	3	2
Duration (days)	1st larval instar	2.6±0.5	2.8±0.6	2.9±0.7	2.7±0.4	2.5±0.5	2.5±0.5	2.6±0.4	2.6±0.5	2.5±0.5	2.4±0.5	2.4±0.5
	2nd larval instar	2.9±0.3	3.04±0.6	3.3±0.5	3.04±0.6	2.8±0.4	2.9±0.6	2.8±0.6	3.1±0.6	2.9±0.7	2.8±0.5	2.8±0.4
	3rd larval instar	3.4±0.5	3.6±0.6	3.5±0.5	3.7±0.6	3.3±0.5	3.4±0.5	3.4±0.6	3.5±0.5	3.4±0.5	3.3±0.9	3.0±0.4
	Pupal stage	8.5±0.7	8.5±0.8	8.4±0.7	8.4±0.7	8.7±0.8	8.6±0.7	8.6±0.8	8.4±0.9	8.6±0.7	8.1±0.6	8.04±0.6
Mortality (%)	1st larval instar	2	6	1	0	5	2	1	0	1	3	0
	2nd larval instar	0	1.4	0	1.07	2.3	1.1	0	1.2	2.2	0	1
	3rd larval instar	0	1.3	0	0	0	0	0	1.2	1.1	0	0
	Pupal stage	2	2	2.08	6.7	0	2	2	4	2	0	0
Adult emergence (%)		97.9	97.9	96	91.2	97.9	95.9	95.8	89	93.5	97.8	97.9
Adult malformation(%)		0	0	2	2	2.1	2.1	2.2	7	4.5	2.2	2
*Eggs hatching (%)		64.5±5.6	68.8±6.3	77.0±5.2	70.7±4.9	65.9±3.1	65.3±7.7	64.3±0.1	57.7±3.9	64.1±5.5	71.1±3.6	90.4±2.2
*Eggs sterility (%)		0.9±0.2	2.1±0.2	0.4±0.1	5.9±1.1	0	0.2±0.1	2.6±1.07	8.05±3.3	1.4±0.2	3.5±0.3	0.4±0.1

*Viability of eggs laid by adults resulting from treated eggs

and beneficial arthropods than the products containing pyrethrum commonly used in biological control programs in fruit crops.

The results in Table (4) show that the maximum inhibition in Acid phosphatase (AcP) in aphid nymphs of a susceptible strain when treated with pirimicarb, neem extract and three mineral oils was 3.0 hours after treatment. While it was 24 hours after treatment in the case of adults. Other investigations estimated the effect of different materials on the total protein and acid phosphatase (AcP) on other important pests. Zidan *et al.*, (1996) studied the effect of KZ oil on *Spodoptera littoralis* and found that the total protein and acid phosphatase (AcP) were reduced in all treated larvae.

3.1.1. Biological studies

The carbamate Pirimicarb, Shokrona, Super-misrona and KZ oils, as well as *Azadirachta indica* extract were tested on both eggs and second instar larvae of the predator *Chrysoperla carnea*.

3.1.1.1. Results of treated eggs

Table (5) shows that the highest percentages of hatchability occurred in the case of eggs treated with Super-misrona were 93% followed by neem 91% and 85%. Treatment with Pirimicarb also showed a high percentage of hatchability (92% and 82%).

As for pupal mortality, the highest (6.7%) was in pupae resulting from eggs treated with super- misrona and the least was from those treated with KZ and pirimicarb. Percentage of adult emergence was relatively high under all the five treatments (Table 5).

3.1.1.2. Results of treated larvae

Results shown in Table (6) indicate that the highest rate of larval mortality was in the second instar larvae treated with Pirimicarb (8 and 12%) and the lowest was in those treated with Shokrona oil and neem extract (0 and 4%),for LC_{25} and LC_{50}, respectively. The highest pupal mortality was in pupae resulting from larvae treated with pirimicarb (4.5%).

The obtained results concerning the effect of neem extract on the predator *C. carnea* are in agreement with those of Kaethner (1991); Jakob (1996); Schultz *et al.*, (1997); and Sarode and Sonalkar (1999) who stated that neem extract can be used safely with little or no significant effect on the formentioned predator.

Table (6): Biological aspects resulting from treatment of *Chrysoperla carnea* second instar larvae with mineral oils, neem extracts and pirimicarb insecticide.

Biological criteria		Shokrona oil		Super-misrona		KZ		*Azadirachta indica*		Pirimicarb		Control
		LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	LC_{25}	LC_{50}	
Duration (days)	2^{nd} larval instar	3.4 ± 0.6	3.4 ± 0.6	3.5 + 0.5	3.4 ± 0.5	3.5 ± 0.5	3.4 ± 0.6	3.4 ± 0.5	3.3 ± 0.6	3.5 ± 0.5	3.6 ± 0.5	2.9 ± 0.5
	3^{rd} larval instar	3.8 ± 0.4	3.9 ± 0.5	3.6 ± 0.5	4.4 ± 0.5	3.7 ± 0.5	3.6 ± 0.5	3.6 ±0.6	3.7 ± 0.6	3.7 ± 0.5	4.9 ± 0.6	3.5 ± 0.5
	Pupal stage	8.3 ± 0.5	8.2 ± 0.6	8.2 ± 0.5	8.0 ± 0.5	8.4 ± 0.5	8.3 ± 0.4	8.4 ± 0.8	8.0 ± 0.8	8.4 ± 0.4	8.3 ± 0.6	7.9 ± 0.6
Mortality(%)	2^{nd} larval instar	0	4	4	4	8	8	0	4	8	12	2
	3^{rd} larval instar	0	0	0	0	0	0	0	0	4.3	0	0
	Pupal stage	0	0	0	0	0	0	0	0	0	4.5	0
Adult emergence (%)		96	95.8	100	95.8	100	100	100	100	100	95.5	100
Adult malformation		4	4.2	0	4.2	0	0	0	0	0	0	0
*Egg hatching(%)		76.7 ±3.9	79.4±2.8	80.1±1.5	81.9± 5.7	85.3±2.1	83.5±4.9	69.4± 6.4	82.4±2.2	70.2± 6.2	78.4±1.9	89.5±1.7
*Egg sterility (%)		18.6±4.2	12.2±2.4	16.8±2.3	11.4± 3.1	10.8±1.5	13.6± 4.3	22.3±5.4	14.9±2.1	16.4± 3.5	16.4±1.8	6.7±1.2

* Viability of eggs laid by adults resulting from treated second instar larvae

The results of this work are similar to those found by Dimetry and Marei (1992); Badawy and El- Arnaouty (1999) who considered pirimicarb to be a relatively safe insecticide on *C.carnea*. The data observed different influences of three insecticides (malathion, pirimicarb and M-pede) on *C. carnea* from eggs hatchability and larval stages. It was so confirmed that the use of Pirimicarb to control aphids is safe to *C. carnea*. On the other hand, Toda and Kashio (1997) stated that Pirimicarb showed no toxicity at all towards *C. carnea*.

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دراسات بيوكيماوية وسمية لتحديد كفاءة بعض الزيوت المعدنية ومستخلص نبات النيم ومبيد البريمكارب ضد حشرة منّ اللوبيا *Aphis craccivora* Koch. ومدى أمان هذه المركبات على العدو الطبيعي أسد المن *Chrysoperla carnea* Steph.

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ملخص

يستهدف هذا البحث تحديد كفاءة بعض الزيوت المعدنية ومستخلص نبات النيم ومبيد البريمكارب على الحوريات والحشرات الكاملة للسلالة الحساسة لمن الفول . تم عمل خطوط السمية للزيوت المعدنية (سوبر مصرونا وشيكورونا و KZ) ومستخلص نبات النيم ومبيد البريمكارب وحساب التركيز السام النصفي ونصف التركيز السام النصفي LC_{25} and LC_{50} وتمت معاملة الحوريات والحشرات الكاملة للمن على فترات مختلفة ٣ ، ٦ ، ١٢ ، ١٨ ، ٢٤ ساعة من المعاملة عن طريق الطبقة الرقيقة للمركب فى أطباق بترى (قطرها ١٠سم).

أظهرت النتائج أن التركيزات المرتفعة LC_{50} للمركبات المختبرة قد أحدثت إنخفاضاً فى نشاط أنزيمات الكولين أستريز والفوسفاتيز الحامضى والبروتين الكلى فى كل من الحوريات والحشرات الكاملة لمن الفول .

كما أظهرت النتائج مدى الأمان للمركبات المختبرة على المفترس أسد المن العدو الطبيعي لمن الفول من خلال معاملة البيض والعمر اليرقى الثاني لمفترس أسد المن حيث سجلت أعلى نسبة فقس لمفترس أسد المن خلال المعاملة بمبيد البريمكارب وزيت الشيكورونا. وكانت أعلى نسبة موت للأعمار اليرقية للمفترس خلال المعاملة بمبيد البريمكارب وأقل نسبة موت خلال المعاملة بالزيت المعدنى شيكورونا ومستخلص النيم.

يتضح مدى أمان مستخلص نبات النيم والزيوت المعدنية ومبيد البريمكارب على الترتيب لمفترس أسد المن.

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