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TOXIC AND BIOLOGICAL EFFECTS OF SOME INSETICIDES ON THE LAND SNAIL *Monacha cantiana* (Montagu)

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ABSTRACT

The toxic effects of some insecticides namely: Biosect, Biocanse, Biofly, Biofar, Actara, Admiral, Admire, Marshal and Kuik under laboratory conditions were studied against the land snail *Monacha cantiana* (Montagu), as well as the effect of LC_{50}'s of Biofar, Admiral, Admire and Kuik on laid eggs and hatchability in snails exposured to those compounds via pouring on the soil surface or feeding on treated bran for one and seven days.

Toxicity results revealed that Biosect was the most effective one against the land snail followed by Biocanse and Biofly, while Biofar was the least one (Entomopathogenic fungi). Whereas, Actara was the most potent compound on the land snail *M. cantiana* followed by Admiral, Admire and Marshal, while Kuik was the lowest effective after one day from treatment.

In all insecticides treatments, the mean numbers of laid eggs per pair were highly reduced as well as, laid eggs that failed to hatch.

INTRODUCTION

Snails are serious pests of plants particularly in moist sites. They tend to feed on the softer parts of plants both above and below ground. Symptoms of injury are regarded holes in leaves, roots, tubers or other plant parts. Seeds and tubers may be largely hollowed out with only a small external hole. Snails are active mostly at night but can usually be found in the vicinity of damage hiding away in the daytime (El-Okda, 1979 & 1980, Miller *et al.*, 1988).

The objective of using any insecticide is to reduce the pest infestation to below the level at which it causes damage, as efficiently, as economically as possible and subsequent benefits from increased crop yield (Goodell, 1984).

Pesticides reach the soil by direct application or as run-off from treated plant. Such pesticides particularly those applied directly to the soil play an important role in soil pollution.

This work aimed mainly to study the toxic effects of some insecticides against the land snail *M. cantiana* for its control and to avoid the caused damage. The effects of LC_{50}'s with Biofar, Admiral, Admire and Kuik on the production of eggs by adult snail of *M. cantiana* and youngsters after exposure for 1, 7 days and on the treated soil was also studied.

MATERIALS AND METHODS

1. Insecticides used:

The tested insecticides and their rates of application are presented in (Table 1).

Table (1):The tested insecticides and their rates of application.

Trade name	Common name	Group	Chemical structure	Field dose
Bio-sect WP	*Beauveria bassiana*	Entomopathogenic fungi	30×10^6 cell/ml.	0.8 kg
Bio-cansa WP	*B. bassiana*		30×10^6 cell/ml.	0.8 kg
Bio-far WP	*B. bassiana*		30×10^6 cell/ml.	0.8 kg
Bio-fly EC	*B. bassiana*		30×10^8 cell/ml.	0.8 L
Marshal 25% WP	Carbosulfan	Carbamate	2,3-dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino) thio] methyl	0.8 kg
Kuik 90% SP	Methomyl	Carbamate	Methyl N-[((methylamino) carbonyl) oxy] ethanimidothioate	0.32 kg
Admiral 10% EC	Pyriproxyfen	Insect growth regulator	2-[1-methyl-2-(4-phenoxyphenoxy) ethoxy] pyridine	0.4 L
Actara 25% WG	Thiamethoxam	Neonicotinoid	3-[(2-chloro-5-thiazolyl) methyl] tetrahydro- 5methyl-N-nitro-4 H-1,3,5-oxadiazin-4-imine	0,08 kg
Admire 20% SC	Imidacloprid	Neonicotinoid	1-[(6-chloro-3-pyridinyl) methyl]-N-nitro-2- imidazolidinimine	0.5 L

The tested plot area was one feddan grown up with sugar beet, (*Beta vulgaris*), while the tested plot area of each of cabbage, (*Brassica oleracea*) and lettuce, (*Lectuca sativa*) was quarter feddan for each crop at Fuwa district, Kafr El-Sheikh Governorate during the spring of 2003. The land snail *M. cantiana* was mostly abundant on leafy soggy vegetable crops.

2. For the Control of the snail:

The selected insecticides were applied at four concentrations as follows:

I. Eighth field dose per 8 kg. bran or 400 L. water.
II. Quarter field dose.
III. Half field dose.
IV. Field dose.

3. Preparation of bait:

The used technique was just the same described by Crowell (1977), Parrella *et al.* (1985) and Miller *et al.* (1988) and it is in brief as follows:

Bait formulation constituted of five (gm.) bran were mixed with two ml. water containing appropriate amount of the tested compound and was broadcasted evenly through each vessel on the damp soil.

The snails that were used in all tests were collected directly before treatment from the chosen fields during spring season and were kept under laboratory conditions 20 + 2°C and R.H. 80 $\pm$ 3%. After that preparation, ten mature snails were placed centrally on the bait. Four replicates were used for each treatment. A control group was maintained in the same design. Controls were provided with a five gm. bran wetted with two ml. tap water.

Mortality percentages were recorded (Anonymous, 1965) after one day from start of treatment and LC_{50} values were calculated according to Litchfield & Wilcoxon (1949).

4. Effects of the applied insecticides on laid eggs:

Monacha cantiana land snails were collected from the previous mentioned fields during last spring 2003 and kept under laboratory conditionS for evaluating LC_{50}'s of four insecticides on the snail laid eggs in laboratory from December 2003 to March 2004.

Three glass jars (one liter capacity each) were used for each insecticidal treatment. Fifty adult snails were transferred to each experimental jar containing bran bait which contains the tested insecticide at the concentration of the LC_{50} value for one and seven days. Control treatment was done using snails fed on bran bait free insecticides. Soil treatment was carried out as follows: The snails were paired with individuals of a similar size and placed in plastic boxes (13.5 cm diameter and 7.5 cm. height), which contained moist soil (three cm deep). Four replicates were used for each treatment. The boxes were tightly covered with cloth netting and secured with a rubber band to prevent snails from escaping. Food, fresh leaves of cabbage was added to the boxes.

Each week, for fourteen weeks, the soil within each box was searched for clutches of eggs. A fine pair of forceps was used to sort through the soil and find the eggs. Clutches were removed and the numbers of eggs

in each clutch were counted. Repeated sorting of soil on several occasions failed to find additional eggs and it was assumed that the searching method was highly efficient. The soil was remoistened weekly as required and the food replaced. Dead snails were removed from boxes when seen (Baker, 1991).

RESULTS AND DISCUSSION

1. Toxicity of the tested insecticides:

The toxic action of insecticides from different active groups was tested against the adult of the land snail *Monacha cantiana* under laboratory conditions and the results were summarized in Tables (2 & 3). Biosect seemed to be the most active tested compound based on the LC_{50} level, while Biofar had the least toxic effect, Biocansa and Biofly had LC_{50} values between those of Biosect and Biofar. Thus, the tested Entomopathogenic fungi could be arranged ascendingly according to LC_{50} by million cells per milliliter as follows: Biosect (9.9), Biocansa (11.4), Biofly (12.0) and Biofar (15.6) after one day from treatment.

Table (2): Toxicity of some insecticides on the land snail *Monacha cantiana* (Montagu) under laboratory conditions.

Compounds	LC_{50} (10^6 cells/ml)	Confidence limits	Slope
Biosect	9.9	7.8: 12.6	3.09
Biocansa	11.4	8.7: 14.7	2.26
Biofly	12.0	9.0: 15.9	2.01
Biofar	15.6	12.6: 19.2	2.84

Actara baits mostly gave higher molluscicidal activity after one day exposure than other chemical insecticides. Due to higher percent mortality of the high toxic, LC_{50} was considered as a comparable level of toxicity. Regarding LC_{50} of Actara, Admiral, Admire, Marshal and Kuik for *Monacha cantina* they were 8.25, 15.0, 80.0, 82.5 and 108 ppm respectively (Table 3).

Table (3): Molluscicidal activity of insecticides on the land snail *Monacha cantiana* under laboratory conditions.

Tested compounds	LC_{50} (ppm)	Confidence limits	Slope
Actara 25% WG	8.25	6.5: 10.5	2.96
Admiral 10% EC	15.00	12.0: 19.0	2.31
Admire 20% SC	80.00	62.0: 104.0	2.23
Marshal 25% WP	82.50	62.5: 105.0	2.93
Kuik 90% SP	108.00	81.0: 144.0	1.88

The slopes of the concentration mortality lines for all of the tested entomopathogenic fungi and insecticides almost have the same rate (Tables 2 & 3).

Our results showed that all the tested compounds were highly effective against the land snail *Monacha cantiana* after one day from treatment (Tables 2 & 3). Those different insecticides were applied to control the main insect pests of vegetable crops, however, the use of chemical insecticides in agriculture still constitutes the most available tool that gives satisfactory control of the pest insects, though, these chemicals are injurious to the environment, man and soil (Ahmed *et al.*, 1999 and Badawy *et al.*, 1999a & b).

Those results are in agreement with the finding of (Okka *et al.*, 1996), who indicated that poisonous baits of Cymbush, Dimethoate and Karate with field dose gave a mortality of 100, 97.5 and 87.5% a one day from application on the same snail, whereas, the methiocarb was the lowest effective compound on the snail, the mortality percentage was 90.0 after six days of treatment at a rate of field dose.

Gastrotox (Metaldehyde 5%) bait gave higher mortality rate of 93% against the land snail *M. cartusiana* after 12 days of treatment (Lokma, 1999).

The Methiocarb and Metaldehyde are used as recommended molluscicides against of the land snails (Godan, 1983 and Miller *et al.*, 1988).

2. Effects of applied insecticides with LC_{50}'s on eggs laid and hatchability by pairs of the land snail *M. cantiana* under laboratory conditions:

Results in Table (4) showed that, the mean period for clutches laid were short for snails treated with Kuik and Admire. This period was 2 weeks, while, this period was 5 and 6 weeks of snails treated with Admiral and Biofar after one day treatment exposure compared to 7 weeks in the Control.

After 7 days from to begining of the treatment, the mean period for clutches laid were 5 weeks of snails treated with Admire and 6 weeks of snails treated with the compounds perviously mentioned, compared to 7 weeks in the Control (Table 4).

The land snail *M. cantiana* was placed on the treated soil with Kuik and Admiral failed to eggs laid, while the mean period for clutches laid were 3 and 6 weeks of the land snail on the treated soil with Biofar and Admire, compared with 7 weeks in the untreated Control (Table 4).

For land snail *M. cantiana* treated with the tested insecticides, the eggs laid were very reduced, the mean numbers of eggs ranged between 21 to 35.75 eggs per pairs in all treatments, compared with 187.25 eggs per pairs in the control (Table 4).

The treated land snail laid eggs failed to hatch, the unhatched percentages were 100% for the treated land snail *M. cantiana*, compared with 19.2% in the Control (Table 4).

Table (4): Effect of the applied insecticides with LC_{50}'s on eggs laid and hatchability by pairs of the land snail *M. cantiana* under laboratory conditions after exposure period 1, 7 days and on the treated soil.

Insecticide used	Mean weeks for clutch laid	Mean No. eggs per pair	% unhatched
	One day treatment exposure		
Biofar	6	35.75	100
Kuik	2	35.0	100
Admire	2	29.0	100
Admiral	5	28.75	100
	7 days treatment exposure		
Biofar	6	33.75	100
Kuik	6	34.0	100
Admire	5	25.5	100
Admiral	6	21.0	100
	On the soil		
Biofar	3	33.0	100
Kuik	0.0	0.0	100
Admire	6	25.25	100
Admiral	0.0	0.0	100
Untreated (check)	7	187.25	19.2

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التأثير السام والبيولوجى لبعض المبيدات الحشرية على القوقع الارضى موناكا كانتيانا

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مركز البحوث الزراعية ــ معهد بحوث وقاية النبات ــ سخا ــ كفرالشيخ

أجرى هذا البحث فى ربيع ٢٠٠٣م وشتاء وربيع ٢٠٠٤ لمكافحة القوقع الأرضى موناكا كانتيانا باستخدام تسعة مبيدات حشرية تنتمى إلى مجاميع مختلفة من المبيدات الحشرية على هيئه طعوم بالاضافة الى تأثير التركيز المميت لـ ٥٠% لأربعة مبيدات حشرية على وضع البيض والفقس لنفس القوقع.

وكانت المبيدات الحشرية المستخدمة والجرعة الحقلية للفدان هى: بيوفلاى ٨٠٠مل ، بيوفار ٨٠٠جم ، بيوسكت ٨٠٠جم ، بيوكانزا ٨٠٠جم ، مارشال ٨٠٠جم ، كويك ٣٠٠جم ، اكتارا ٨٠جم ، أدمير ٤٨٠ مل ، ادميرال ٤٠٠مل ولقياس مدى سمية المبيدات المختبرة فقد تم تحضير طعوم هذه المواد.

وقد أظهرت النتائج أن:

- المبيدات المختبرة كانت عالية الفعالية حيث وصلت نسبة القتل ما بين ٨٥-٩٧,٥% للقوقع الأرضى موناكا كانتيانا بعد يوم واحد من المعاملة.
- جميع القواقع المعاملة بالمبيدات كان متوسط عدد البيض لكل زوج من القواقع منخفض جدا حيث يتراوح عدد البيض ما بين ٢١ إلى ٣٥,٨ بيضة/زوج مقارنة مع الغير معامل ١٨٧,٢٥ بيضة/زوج.
- فشلت بعض القواقع فى وضع البيض مع مركب الكويك وادميرال عند معاملة التربة بالمركبين.
- جميع القواقع المعاملة بالمبيدات فشلت فى عملية فقس البيض وكانت نسبة عدم الفقس ١٠٠% بينما كانت هذه النسبة فى الغير معامل ١٩,٢%.

من نتائج هذه الدراسة فانه يمكن استخدام هذه المركبات فى مكافحة القوقع الأرضى حيث أن تعرض القواقع لهذه المركبات بالطريقة المباشرة أو الغير مباشرة بتلوث التربة بها يخفض إنتاج البيض ويسبب عدم فقسه وهذا فعال فى خفض تعداد القوقع وتفادى أضراره.