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EFFICACY OF FOUR PESTICIDES APPLIED AGAINST THE LAND SNAIL *Theba cantiana* (Montagn) (Gastropoda: Helicidae) AT THREE EXPOSURE PERIODS.

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ABSTRACT

The efficacy of four pesticides methomyl, fenitrothion, bendiocarb and carbaryl against the land snail, *Theba cantiana* (Montagan) was evaluated under three different exposure periods. Each of the tested pesticides was applied as baits at three concentrations. Data indicated that all pesticides presented the highest snail mortality in the first day of the examination. For the time being, the mortality values showed a gradual decrease to reach the minimum level on the third and fourth day after inspection. The snail mortality percentages were directly associated with the toxicant concentration. It was also clear that methomyl proved to be the most effective material followed by fenitrothion, bendiocarb and carbaryl.

keywords: baits, bendiocarb, carbaryl, fenitrothion, Land snail, methomyl, mortality percentages, *T. cantiana.*

INTRODUCTION

The biological activities of terrestrial snails adversely affect the attacked horticultural and field crops, causing great damage to their growth and yield. This damage attracted the attention of several researchers who did their best to control these snails by different pesticides. Hence trials were done to control some land snails by various Egyptian investigators (El- Okda, 1978and 1979; (Hanafy *et al.*, 1998 and Hussein *et al.*, 1999).

The land snail,*T. cantiana* proved to be a key pest in different agricultural crops of Dakahlia governorate, causing different levels of damage. Therefore, it was felt necessary to evaluate the effect of four pesticides baits as on the land snail, *T. cantiana* under three exposure periods at constant conditions of 20±0.1C and 60%±2 R.H.

MATERIAL AND METHODS

Four pesticides were used as baits to evaluate their efficacy against the land snail, *T. cantiana* under constant temperature 20±0.1C and 60%± 2R.H. For each pesticide,three concentrations were applied.

The experimented pesticides and their concentrations were: -

Bendiocarb

Chemical name: 2,2-dimethyl- 1,3-benzodioxolyl methyl carbamate.

Trade name: Niomil (200% SL)

Used at: 2500, 5000 and 7500 ppm.

Carbaryl

Chemical name: 1- naphthyl methl carbamate

Trade name: Skeb (85% WP)

Used at: 10000, 20000 and 30000 ppm.

Fenitrothion

Chemical name: o,o- dimethyl o-(3-methyl- 4- nithropheny) phosphorathiate (50% SL)

Trade name: Farmathion

Used at: 2500, 5000 and 7500 ppm.

Methomyl

Chemical name: methyl N- (methyl amino carbonyl) ethanimidothiate.

Trade name: Lannate (90% SL).

Used at: 10000, 20000 and 30000 ppm.

Each of the above mentioned concentrations and the control were replicated four times. Pesticide baits were prepared according to the method suggested by Hanafy *et al.* (1998). Accordingly, each concentration of any of these pesticides was dissolved in a mixture containing 10 ml of equal volumes of acetone and ethanol in addition to the methelen blue 0.5% as attractant material. After that, each of the pesticide concentration was carefully mixed with a suitable amount of bran in a plastic jar, spread on a plastic sheet until it became rather dry, then stored in plastic bags.

A stock culture of *T. cantiana* previously collected from Egyptian clover at Agricultural Research Station Farm, Faculty of Agriculture, Mansoura University, was maintained under laboratory conditions. Adult's snails of the same size were divided into 156 groups (replicates), ten individuals for each. The above-mentioned groups (replicates) were distributed in jars with five grams of each pesticide bait.

All treatments (replicates) were exposed to the tested pesticide under three different periods, namely 24,48 and 72 hrs in addition to four replicates were used as untreated control in each exposure period. The experimented snail groups were followed up for fifteen days, where the dead individuals were counted and removed daily.

The obtained data was statistically analyzed using SAS system (1995).

RESULTS AND DISCUSSTION

Pesticides effect on *T. cantiana* / the exposure period: -

Pesticides efficacy of the tested materials on the land snail *T. cantiana* / 24 hr of exposure:

Examining Table 1, it was clear that on the first day all of fenitrothion concentrations gave the highest snail mortality percentages as compared with longer time after application. A noticeable decrease in these values was observed two days after the application. Mortality percentage decreased from 35.0 %to 20.0 %, from 47.5 % to 27.5% and from 50.0% to30.0% when the snail individuals were exposed to baits containing 2500ppm, 5000 ppm and 7500 ppm, respectively. These values tended to decrease by the fourth and fifth days. It was also noticed that, the mortality percentage was positively correlated with the pesticide concentration increase. Thus, the concentration 7500ppm introduced the highest mortality percentage and completely perished all of the snail individuals on the fourth day.

Similarly, all of the carbaryl concentrations introduced the highest mortality percentages on the first day, showing an obvious decrease by the second and third days, respectively reaching the minimum value on the fifth day (Table 1). Also, high mortality percentage was associated with the raise of carbaryl concentration. Hence the snail gross mortality percentage (GMP) increased from 82.5% to 95% at 10000 and 30000 ppm, after 15 days of treatment, respectively.

Concerning bendiocarb, the highest mortality was also obtained one day after treatment significantly decreased by the second and third days reaching the minimum value on the sixth day (Table 1). The median concentration introduced the same trend, reaching the minimum effect on the fourth day. The highest concentration,(7500ppm) introduced the maximum snail mortality on the first day after treatment, showing a gradual decrease to reach the minimum by the fourth day. A direct relationship was observed between the snail mortality and the concentrations, where the mortality percentage varied from 82.5% to 100% at 2500 and 7500 ppm, respectively.

Similarly all of methomyl concentrations presented the highest snail mortality by the first day after treatment, which gradually decreased to reach the minimum during the fourth and fifth days for the high (30000 ppm) and other two concentrations (10000 and 20000 ppm) , respectively (Table1). It was also noticed that all of methomyl concentrations gave a complete mortality of 100%.

From the above-mentioned results it was evident that methomyl proved to be the most effective material followed by fenitrothion, bendiocarb and carbaryl (Table 1).

Pesticides efficacy of the tested materials on the land snail *T. cantiana* / 48 hr of exposure:

The snail mortality peak which occurred by the first day after fenitrothion application, showed a tendency to be decreased to the minimum on the fifth day for lower concentration, and on the fourth day for the median and higher ones, respectively (Table 2). Also, a direct relationship existed between the concentration and snail mortality, which varied from 97.5% for 2500 ppm to 100% for 5000 ppm and 7500 ppm.

Similarly, carbaryl application induced the highest snail mortality by the first day after its application (Table 2). These mortality values tended to decrease to the minimum level on the fourth day for the highest concentration and the fifth day for the lower one. It was also noticed, that the snail mortality was positively correlated with the carbaryl concentration. Therefore, the gross snail mortality percentage increased from 85% at 10000 ppm to 100% for each of 20000 and 30000 ppm., respectively.

The same trend was obtained with bendiocarb, which presented its highest efficacy on the first day after treatment (Table2).

After that a gradual decrease in snail mortality was noticed, reaching the minimum level by the fifth day for 2500ppm and the fourth day for 5000ppm and 7500ppm. Here again, a direct relationship occurred between the snail mortality and bendiocarb concentration. Hence the snail mortality increased from 95.5% to 100% at 2500 and 7500 ppm, respectively.

Table 1: Effect of four pesticides on the land snail *T. cantiana* adults after 24 hr of exposure at 20 ±0. 1C and 60%±2.0 RH.

Days after Treatment	% Mortality percentage due to the application of											
	Fenitrothion			Bendiocarb			Carbaryl			Methomyl		
	2500 ppm	5000 ppm	7500 ppm	2500 ppm	5000 ppm	7500 ppm	10000 ppm	20000 ppm	30000 ppm	10000 ppm	20000 ppm	30000 ppm
1	35.0± 0.5	47.5± 0.48	50.0± 0.58	25.0± 0.5	30.0± 0.158	40.5± 0.82	25.0± 0.5	30.0± 0.82	35.0± 1.3	47.5± 0.48	50.0± 0.48	57.5± 0.25
2	20.0± 0.6	27.5± 0.75	30.0± 0.25	15.0± 0.75	20.0± 0.58	29.0± 0.82	22.5± 0.5	25.0± 1.0	30.0± 1.3	20.0± 0.29	22.5± 0.29	30.0± 0.41
3	10.0± 0.8	12.5± 0.48	17.5± 0.58	15.0± 0.5	18.0± 0.52	20.5± 0.63	15.0± 0.86	25.0± 0.65	25.0± 0.65	15.0± 0.71	22.5± 0.25	10.0± 0.58
4	7.5± 0.48	7.5± 0.48	2.5± 0.25	15.0± 0.5	17.5± 0.48	10.0± 0.25	15.0± 0.29	2.5± 0.48	5.0± 0.41	12.5± 0.25	5.0± 0.29	2.5±
5	7.5± 0.48	5.0± 0.58	--	7.5± 0.75	0.0± 0.0	--	5.0± 0.25	2.5± 0.25	0.0± 0.0	5.0± 0.5	--	--
6	0.0± 0.0	--	--	5.0± 0.5	0.0± 0.0	--	0.0± 0.0	0.0± 0.0	0.0± 0.0	--	--	--
7---15	0.0± 0.0	--	--	0.0± 0.0	0.0± 0.0	--	0.0± 0.0	0.0± 0.0	0.0± 0.0	--	--	--
G.M.P.	80.0	100.0	100.0	82.5	85.5	100.0	82.5	85.0	95.0	100.0	100.0	100.0

G.M.P.= Gross mortality percentage of dead snails.

Table 2: Effect of four pesticides on the land snail *T. cantiana* adults after 48hr of exposure at 20±. 1C and 60% ±2.0RH.

Days after Treatment	% Mortality percentage due to the application of											
	Fenitrothion			Bendiocarb			Carbaryl			Methomyl		
	2500 ppm	5000 ppm	7500 ppm	2500 ppm	5000 ppm	7500 ppm	10000 ppm	20000 ppm	30000 ppm	10000 ppm	20000 ppm	30000 ppm
1	42.5± 0.25	47.5± 0.48	55.0± 0.29	32.5± 0.48	35.0± 0.29	40.0± 0.41	40.0± 0.15	47.0± 0.15	50.0± 0.65	47.5± 0.25	52.5± 0.48	57.5± 0.2
2	25.0± 0.62	27.5± 0.48	30.0± 0.41	25.0± 0.29	27.5± 0.25	30.0± 0.41	17.5± 0.63	22.5± 0.48	25.0± 0.41	22.5± 0.48	30.0± 0.41	30.0± 0.4
3	17.5± 0.23	20.0± 0.71	12.5± 0.25	20.0± 0.41	20.0± 0.71	27.5± 0.25	17.5± 0.63	20.5± 0.25	22.5± 0.25	17.5± 0.48	17.5± 0.25	12.5± 0.0
4	10.0± 0.41	5.0± 0.5	2.5± 0.25	12.5± 0.63	15.0± 0.29	25.0± 0.25	5.0± 0.29	0.5± 0.29	2.5± 0.25	12.5± 0.25	--	--
5	2.5± 0.25	--	--	5.0± 0.32	0.0± 0.0	--	5.0± 0.5	2.5± 0.25	--	--	--	--
6	0.0± 0.0	--	--	0.0± 0.0	0.0± 0.0	--	0.0± 0.0	2.5± 0.25	--	--	--	--
7---15	0.0± 0.0	--	--	0.0± 0.0	0.0± 0.0	--	0.0± 0.0	--	--	--	--	--
G.M.P.	97.5	100.0	100.0	95.5	97.5	100.0	85.0	100.0	100.0	100.0	100.0	100.0

G.M.P. =Gross mortality percentage of dead snails.

Methomyl, introduced the highest snail mortality on the first day of examination, which gradually decreased reaching the minimum values by the fourth day (Table2). The snail mortality was positively associated with the toxicant concentration. All of the tested concentrations presented a commulative snail mortality of 100%. Methomyl, generally proved to be the most effective material in killing the snails, followed by fentrothion, bendiocarb and carbaryl.

Pesticides efficacy of the tested materials on the land snail *T. cantiana* l 72 hr of exposure:

Here again, seventy-two hours of snail exposure to the tested pesticides introduced the highest mortality on the first day of inspection (table 3). These mortality values showed a gradual decrease reaching the minimum on the third day for the high concentrations of fenitrothion, bendiocarb, carbaryl and methomyl and the fifth day for the lower ones of bendicarb (Table 3). The snail mortality was directly correlated with the toxicant concentrations except for fenitrothion and methomyl that caused 100% snail death. The snail mortality percentages varied from 90% to 100% when carbaryl used at 10000 ppm and 30000 ppm, respectively. For bendiocarb, the snail mortality increased from 95% to 100% at 2500 ppm and 7500-ppm , respectively. Also methomyl, proved to be the most effective pesticide, followed by fenitrothion, bendiocarb and carbaryl.

From the previous results, it can be noticed that all of the tested pesticides were significantly different in their effect on the snail mortality. At all exposure times, methomyl seemed to be the most effective compound on *T. cantiana* followed by fenitrothion, bendiocarb and carbaryl. Accordingly, the snail mortality averages decrease from 3.025 to 1.148 due to the application of methomyl and carbaryl, respectively (Table 4).

These results agreed with the previous authors data who noticed that methomyl baits proved to be the most effective material against *T. pisana* and *Limax maximus* (El- Okda, 1980; Radwan *et al.*1992), and *Monacha obstructa* (Hussein *et al.* 1999). While Abd El- Karim (2000) stated that, fenitrothion was more toxic than skkiper on *Eobania vermiculata*, *M. obstructa* and *T. pisana* under laboratory conditions.

The pesticide persistence was negatively associated with the inspection periods, where the highest effect was obtained on the first day of inspection and gradually decreased to reach the minimum level on the sixth day (Table 4). Moreover, the average toxicant efficacy values decreased from 3.448 to 0.089 at the first and sixth day of inspection, reaching zero value 0.000 by the seventh day. This could be attributed to, the susceptibility differences among the snail individual tissues for the toxicant transportation and spread rate, in addition to the amount of ingested bait. Obviously, snail individuals ingested more bait and having body tissues with more ability for toxicant transportation, quickly died within 24hr. In contrast, those individuals fed on rather low amount of the bait and having body tissues with less ability for toxicant transportation and release died gradually, through the following days.

Table 3: Effect of four pesticides on the land snail *T. cantiana* adults after 72hr of exposure at 20±0.1C and 60±2.0 RH.

Days after Treatment	Mortality percentage due to the application of											
	Fenitrothizn			Bendiocarb			Carbaryl			Methomyl		
	2500 ppm	5000 ppm	7500 ppm	2500 ppm	5000 ppm	7500 ppm	10000 ppm	20000 ppm	30000 ppm	10000 ppm	20000 ppm	30000 ppm
1	45.0± 0.65	47.5± 0.48	55.0± 0.29	37.5± 0.63	42.5± 0.48	45.0± 0.29	37.5± 0.63	43.75± 0.41	50.0± 0.41	47.5± 0.48	50.0± 0.41	60.0± 0.40
2	27.5± 0.25	30.0± 0.71	32.5± 0.25	22.5± 0.25	32.5± 0.25	35.0± 0.5	30.0± 0.48	36.25± 0.29	40.0± 0.41	35.0± 0.29	35± 0.29	3205± 0.48
3	17.5± 0.48	20.0±0.4 1	12.5± 0.48	20.0± 0.0	20.0± 0.41	20± 0.41	22.5± 0.41	15.0± 0.63	10.0± 0.0	17.5± 0.48	15± 0.29	7.5± 0.48
4	10.0± 0.41	2.5± 0.25	--	10.0± 0.41	205± 0.25	--	0.0± 0.0	0.0± 0.0	--	--	--	--
5	--	--	--	5.0± 0.5	0.0± 0.0	--	0.0± 0.0	0.0± 0.0	--	--	--	--
6	--	--	--	0.0± 0.0	0.0± 0.0	--	0.0± 0.0	0.0± 0.0	--	--	--	--
7---15	--	--	--	0.0± 0.0	0.0± 0.0	--	0.0± 0.0	0.0± 0.0	--	--	--	--
G.M.P.	100.0	100.0	100.0	95.0	97.5	100.0	90.0	95.0	100.0	100.0	100.0	100.0

G.M.P. =Gross mortality percentage of dead snails.

Regarding the effect of the exposure time on the toxicant efficacy, it was clear that the elongation of snail exposure period gave a high mortality percentage. In other word the toxicants efficacy was positively associated with the exposure time. Accordingly, the efficacy of pesticides increased from 0.793 to1.165 at the exposure time of 24 hr and 72 hr, respectively (Table 4). This phenomenon could be attributed to the exposure time element, which gave chance to some snail individuals to obtain more baited food, together with feasibility of the pesticides release and penetration through the animal tissues.

Table 4: Effect of pesticide durability of efficacy and exposure time on the land snail *T. cantiana*, at 20±0.1C and 60%±2.0RH.

Durability		Pesticides efficacy		Exposure time effect	
Days after treatment	Mortality average	Pesticide	Mortality average	Period of exposure	Mortality average
1	3.448 a	Methomyl	3.025 a	24 hr	0.793 a
2	2.022b	Fenitrothion	1.971 b	48 hr	1.141 b
3	1.594 c	Bendiocarb	1.369 c	72 hr	1.165 c
4	0.817d	Carbaryl	1.148 d		
5	0.321 e				
6	0.089f				
7—15	0.00 0f				

Means in each column followed by the same letter didn't differ at P<0.05 according to SAS system analysis.

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فاعلية أربعة مبيدات ضد القوقع الأرضي *Theba. cantiana* عند التعرض لثلاث فترات زمنية.

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استهدفت الدراسة تقييم فاعلية أربعة مبيدات هي الميثوميل، الفنتروثيون، البنديوكارب والكاربارايل ضد القوقع الأرضي *T. cantiana* وذلك تحت ظروف ثابتة من الحرارة والرطوبة.

استخدمت طعوم سامة تحتوى على ثلاث تركيزات من كل مبيد، حيث تم تجهيز تركيزات ٢٥٠٠، ٥٠٠٠و ٧٥٠٠ جزء في المليون لكلا من مبيد الفنتروثيون والبنديوكارب بينما استخدمت التركيزات ١٠٠٠٠، ٢٠٠٠٠و ٣٠٠٠٠ جزء في المليون لكلا من مبيد الميثوميل والكاربارايل. حيث تم تعريض الأطوار الكاملة للقوقع وذلك باستخدام أربعة مكررات من كل تركيز وكل مكررة تحتوى على ١٠ أفراد. عرضت أفراد كاملة من القواقع للطعوم السامه لفترات زمنية ٢٤،٤٨و ٧٢ ساعه كاملة للتغذية عليها ثم حساب أعداد الأفراد الميتة والحية يوميا ولمدة ١٥ .

أوضحت النتائج ما يلي :-

١- جميع المبيدات تعطى أعلى نسبة موت في اليوم الأول ثم يحدث انخفاض تدريجي في الموت حتى يصل إلى اقل نسبة موت في اليوم الخامس السادس من المعاملة.

٢- لم نلاحظ أي معدلات موت في أفراد القواقع بداية من اليوم السابع

٣- مبيد الميثوميل اكثر المبيدات فاعليه وذلك في مختلف التركيزات يليه مبيد الفنتروثيون ثم البنديوكارب بينما احتل مبيد الكاربارايل المرتبة الأخيرة من حيث التأثير.

٤- هناك فروق معنوية بين التركيزات الثلاثة على نسبة الموت وأيضا طول فترة التعريض للطعم السام.