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REPELLENT AND TOXIC EFFECT OF VARIOUS INDIGENOUS PLANT EXTRACTS AND PESTICIDES AGAINST *Monacha cantiana* LAND SNAILS.

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ABSTRACT

Repellency effect of 28 plant extracts obtained from different parts of 13 indigenous plants was investigated against *Monacha cantiana* Land snails, using one and two choice feeding methods.

All plant materials either extracted with hexane and/or ethanol showed a considerable snail repellency effect, when their crude extracts were tested using one choice feeding methods.

In contrast results of two choice feeding test method indicated that all the tested plant extracts showed snail repellant effect except Damsisa, Enabeddip, Calotropis and Geranium hexane crude extracts, which failed to achieve 50% or more repellency level. R_{50} values of the pronounced crude plant extracts were evaluated, whereby, Harmala ethanol extract induced the highest repellency effect against *M. cantiana* snails, followed by Khella hexane extract, Khella ethanol extract and Santonica hexane extract.

Crude plant extracts have been preliminary screened for their molluscicidal activity. Results revealed that some extracts exhibited low and/or moderate mortality percentages, while the other failed to induce snail mortality, this trend could be attributed to their repellency effect against snails.

The candidate crude plant extracts, i.e. (Khella and Santonica hexane extracts) and (Khella and Harmala ethanol extracts), were subjected to definitive screening for evaluate their LC_{50} values against snails. Results showed that Khella ethanol extract exhibited the highest toxic effect followed by Santonica hexane, Khella hexane and Harmala ethanol extracts.

Data concerning the repellency effect of the tested pesticides against snails showed that Osbac was the superior one followed by Nabu-s, Topsin-M, while Lebaycide was the least.

The molluscicidal activity of the tested pesticides was also investigated. Topsin-M exhibited the highest toxic action against snails, followed by Osbac, Lebaycide and Nabu-s. The obtained results varied in there activity according to the type of solvent used in extraction processes and plant chemical constituents content of recognized molluscicidal activity.

INTRODUCTION

Land snails are consider as an extremely injurious pest to ornamental flowers and shrubs and a wide variety of vegetables, agronomic, fruits and citrus in most of the areas of their distribution (Miller *et al.*, 1988, El-Okda *et al.* 1990 and Hashem *et al.*, 1992). Those animals attack plants at different growth stages and consequently reduces its yield (El-Okda, 1980).

Pesticide research in the agricultural business generally continueous to emphasize studies on the development and use of synthetic broadly toxic compounds. Although synthetic organic pesticides appear to provide a

solution to the problems of pest control, it has become apparent that repeated application and excessive reliance on synthetic pesticides can be an inadequate method of control. Health and environmental problems and increasing pest resistance to many of these synthetic pesticides, clearly indicate that basic research must be directed to the discover a new, safer types of pest control agents in order to insure high production and preservation of agricultural products.

Thus there is a need for new pesticides with a new or different mode of action and/or improved effective or safety over currently in use. Therefore, they serve as replacements for compounds whose usefulness become limited because of their undesirable persistence or toxicological characteristics. Ideally these new types of pest control agents should be highly selective, biodegradable to nontoxic products, suitable for use in integrated pest management programs, high mammalian and environmental safety, low use rates, and low costs,

It has been speculated for many years that plant resistance to pest is largely due to chemical factors, large numbers of compounds having diverse biological effect on pest (i.e. Killing, attracting, repelling, morphogenetic, feeding deterring, growth inhibiting and reproduction sterilizing effects) have been isolated and identified from plants which are relatively free from insect attack. Natural products affecting pests, therefore, provide continual inspiration to the agricultural chemical in their research for new products to control pests and improve yield. They may serve as leads for chemical synthesis of structurally or topographically related mimics. The mimics might also have more favorable biological and physical properties than the original natural product.

The present study aimed to throw the light on the problems of land mollusca in certain agricultural lands in Egypt. For this purpose, the following two points were taken into consideration.

1- Preliminary screening:

Screening of the repellency and molluscicidal activity of certain Egyptian indigenous plants, of common use in folk-medicine against Moncha Cantiana (Muller) land snails, in addition to some synthetic pesticides was included.

2- Definitive screening:

Plant extracts that have shown molluscicidal activity may be considered for definitive screening to determine their R_{50} and LC_{50} values against the tested snails. Synthetic pesticides are also compared on the same basis

MATERIALS AND METHODS

Tested Compounds:

1- Plant materials:

The experimental plants selected for this study are listed in Table (1) which includes; English, Latine, family names and tested plant parts; in addition to region of plant collection.

Table (1): Plant materials used.

English name	Latin name	Family name	Part tested	Source
Damsisa	*Ambrosia mantima*	Compositae	Leaves	Aswan
Halfa barr	*Cymbopagon proximus*	Grammene	Leaves	Aswan
Colocynth	*Citrullus colocynthis*	Cucurbitaceae	Leaves and Fruits	Aswan
Khella	*Ammi majus*	Umbelliferae	Fruits	El-Fayouom
Harmala	*Peganum harmata*	Zygophylaceae	Fruits	Nubaria
Datura	*Datura stramonium*	Solanaceae	Leaves and Fruits	Helwan
Santonica	*Artemesia cinea*	Compositae	Flowers	Aswan
Eucalyptus	*Eucalytus globulus*	Myrthaceae	Leaves and Seeds	Giza
Enab eddhib	*Solanum nigrum*	Solanaceae	Fruits	Giza
Calotropis	*Caltropis procera*	Asclepiadaceae	Leaves	Helwan
Alocasia	*Alocasia cubrea*	Araceae	Fruits	Dakahlia
Halouk	*Heracleum glummiferum*	Umbelliferae	Leaves	Helwan
Geranium	*Pelergonium graviolens*	Geraniaceae	Leaves	Dakahlia

2- Tested pesticides:

1- Lebaycide (Fenthion 50% E.C.) O, O-dimethyl-O-[3-methyl-4-(methylthio) phenryl] phosphorothioate.
2- Osbac (BPMc 50% E.C.) 2-Sec. Butylphenylmethyl carbamate.
3- Nabu-s (12.5% Oil E.C.) 2-[1-(ethoxyimino) butyl]-5-(2-ethylthiopropyl)-3-hydroxy-2-cyclohexene-1-one.
4- Topsin-M (thiophanate-methyl 70% E.C.) 1,2-bis (3-methoxycarbonyl-2-thioureido) benzene.

3- Extraction method:

150 gram dried powder of the tested plant organs were successively extracted with hexane and ethanol according to Freedman *et al.*, 1979) method.

4- Bioassays:

4-1- Tested snails:

Monacha cantiana Land snails were collected from untreated fields at El-Fayoum Governorate. The adults were separated, allowed to feed on fresh lettuce leaves and kept to acclimatize under laboratory conditions for two weeks before testing. The snails were classified according to (Godan, 1983 and Miller *et al.*, 1988).

4-2- Repellency tests:

4-2-1- One choice method:

The one-choice method described by Bullard and Shumake (1979) modified by Shafte *et al.* (1982) was adopted in this work. Ten individually

caged snails, *Monacha cantiana* (Muller) were used for each crude plant extracts and pesticide. Each snail was offered 25 cm^2 green lettuce leaves for four successive days before treatment and consumed diet was daily assessed, then the same pretested snails were offered to 25 cm^2 green lettuce leaves dipped for 3 seconds in tested plant extracts for another four successive days. Consumed diet was daily determined during the post treatment periods. The repellency potential was calculated by using the following equation according to Mason *et al.* (1989).

$$\% \text{ acceptance} = \frac{\text{Average of consumed treated green lettuce leaves}}{\text{av. cons. treated green let. Leaves + av. cons. untr. gr. let. Leaves}} \times 100$$

Snails with food acceptance less than 40% are considered repelled.

4-2-2- Two choice method:

The two-choice method test described by Russell *et al.* (1989) was followed. Ten snails of *Monacha cantiana* (Muller) were individually caged and exposed to each of crude extract and pesticide compound. 25 cm^2 green lettuce leaves from treated and untreated were separately offered to each snail daily in small cage for four successive days. The position of the cage was altered daily to prevent any bias to location, consumed treated and untreated green lettuce leaves area were daily recorded. The repellency potential was calculated according to the previous equation.

5- Assessment of repellency and molluscicidal activity:

5-1- Repellency effect:

A laboratory trials had been conducted to determine R_{50} values of plant extracts and pesticides that showed a snail repellent effect in the previous experiments i.e. Khella, Santonica and Harmala plant extracts and Lebaycide, Osbac, Topsin-M and Nabu-s pesticides. Ten individually caged *M. cantiana* snails were used for each tested plant extract and/or pesticide concentration. The healthy snails were fed on fresh lettuce leaves for four successive days for acclimatization before testing and consumed area of lettuce leaves was daily calculated for all animals, the fresh lettuce leaves were dipped for 3 seconds in the candidate concentration of each extract or chemical compound and offered to the individual caged snails for 24 hours exposuer period, the consumed diet was measured, snails that consumed from the treated diet less than half on the untreated ones were considered repelled (Engeman *et al.*, 1989).

5-2- Molluscicidal activity:

The molluscicidal activity of the promising plant extracts, i.e.: Khella and Santonica hexane extracts and Khella and Harmala ethanol extracts in addition to Lebaycide, Osbac, Nabu-s and Topsin-M were evaluated against *Monacha cantiana* snails according to Grosslund *et al.* (1965).

Ten healthy snails were offered fresh lettuce leaves discs treated with serial concentrations of the tested crude plant extracts and/or pesticides for 24 hrs, then untreated fresh leaves were replenished daily for four successive days. Each treatment was replicated five times in addition to control.

Mortality was corrected according to Abbott's formula (1925) and data were statistically analysed according to Litchfield and Wilcoxon (1949).

RESULTS AND DISCUSSION

Molluscicidal effect of some natural and chemical compounds:

1- Molluscicidal effect of crude plant extracts:

1-1- Repellency effect:

Data in Table (2) revealed that all plant extracts, either extracted by hexane or ethanol, exhibited highly repellency effect against *Monacha cantiana* (Muller) Snails when their crude extractes were tested using one choice method. The repellency percentages of Damsisa, Halfa barr, Colocynth, Khella, Harmala, Datura, Santonica, Eucalyptus (Leaves and Seeds), Enabeddhib, Calotropis, Alocasia, Halouk and Geranium from hexane and ethanol solvent were [91.7, 100.0, 99.2, 100.0, 94.9, 99.5, 99.4, 98.7, 92.0, 98.4, 89.0, 92.0, 98.1 and 88.6] and [100.0, 98.0, 98.0, 100.0, 100.0, 99.7, 99.5, 100.0, 100.0, 100.0, 96.9, 98.6, 100.0 and 98.1] respectively.

Regarding the effectiveness of those wild plant extracts against *M. cantiana* using two choice feeding method, it is cleared from data shown in the same table, that the repellency potential considerably differed according to the solvent used.

Damsissa, Enebeddhib, Calotropis and Geranium hexane extracts did not exhibited the required percentage of repellency (50% or more) i.e. 41.1, 21.4, 37.5 and 27.0% repellency were achieved with these extracts, respectively. Repellency percentages of the other hexane extracts ranged between 50% for Eucalyptus (seeds) extract to 100% for Halfa barr and Khella extracts. On the other hand, when these extracts obtained by ethanol solvent, all showed highly repellency potential against the snail and its repellency percentage ranged between 56.5% for Datura to 100% for Damsissa, Khella, Harmala, Eucalyptus leaves and seeds, Enabeddhib, Calotropis, Alocasia and Halouk extracts.

It could be concluded that in case of one choice method application, the obtained results were in paralled line with those obtained from two choice method where Khella, Santonic hexane extracts and Khella, Harmala ethanolic extracts showed the highly repellent effect against *Monacha cantiana* (Muller) in both methods.

1-2- R_{50}-Determination:

Results in Table (3) showed the repellency percentages and R_{50} values of the selected promising crude plant extracts against *M. cantiana* Land snails. Data indicated that Khella, Santonica hexane and Khella ethanol extracts, when tested against snails at concentrations of 50, 100, 200, 400, 800 and 1000 ppm exhibited (41, 61.9, 84.1, 84.4, 86.9 and 90.9%) repellency effect with R_{50} value of 64.59 ppm, (32.5, 45.9, 54.1, 65.0, 74.4 and 77.9%) repellency effect with R_{50} value of 162.99 ppm., and (46.9, 52.6, 57.8, 62.5, 73.3 and 79.3%) repellency effect with R_{50} value of 106.88 ppm. Respectively, while Harmala ethanol extract, when tested at concentrations of 10, 20, 40, 80, 160 and 240 ppm. exhibited (33.8, 60.1, 66.7, 71.7, 79.2 and 85.8%) repellency effect respectively with R_{50} value of 17.31 ppm.

Table (2): Repellency effect of certain crude plant extracts against *Monach cantiana* (Muller) snails using one and two choice feeding methods, under laboratory conditions.

Plant extracts	One-choice feeding method						Two-choice feeding method					
	Hexane extracts			Ethanol extracts			Hexane extracts			Ethanol extracts		
	Average consumption			Average consumption			Average consumption			Average consumption		
	Untreated	Treated	Repellents %	Untreated	Treated	Repellents %	Untreated	Treated	Repellents %	Untreated	Treated	Repellents %
Damsisa	35.90	3.23	91.7	47.53	0.00	100.0	2.30	3.30	41.1	1.67	0.66	100.0
Halfa barr	31.50	0.00	100.0	46.61	0.92	98.0	0.30	0.00	100.0	7.60	1.33	85.1
Colocynth	42.40	0.33	99.2	52.18	0.65	98.0	8.30	0.66	92.6	2.30	1.30	63.9
Khella	37.32	0.00	100.0	26.68	0.00	100.0	0.67	0.00	100.0	0.33	0.00	100.0
Harmala	43.40	2.31	94.9	37.18	0.00	100.0	2.00	0.67	75.0	3.30	0.00	100.0
Datura	33.33	0.16	99.5	51.68	0.17	99.7	1.67	1.00	62.6	1.30	1.00	56.5
Santonica	45.60	0.25	99.4	47.72	0.23	99.5	2.00	0.30	87.0	0.67	0.38	67.0
Eucalyptus (Leaves)	32.71	0.42	98.7	50.68	0.00	100.0	6.30	5.00	55.7	0.00	0.00	100.0
Eucalyptus (seeds)	36.12	3.12	92.0	49.80	0.00	100.0	0.66	0.66	50.0	0.33	0.00	100.0
Enabed-dhib	41.20	0.65	98.4	41.20	0.00	100.0	2.00	3.67	35.27	2.70	0.00	100.0
Calotropis	38.90	4.80	89.0	46.68	1.50	96.9	3.00	5.00	37.5	4.30	0.00	100.0
Alocasia	41.90	3.62	92.0	34.68	0.50	98.6	4.00	2.70	59.7	0.67	0.00	100.0
Halouk	37.80	0.72	98.1	52.33	0.00	100.0	11.00	6.70	62.1	12.00	0.00	100.0
Geranium	40.61	5.22	88.6	45.20	0.88	98.1	4.70	12.70	27.0	4.67	0.67	87.5

Table (3): Percent Repellency of *Monacha cantiana* snails, treated with different crude plant extracts concentrations and the corresponding R_{50} valus under laboratory conditions.

Conc. ppm	Plants extracted with Hexane									Plants extracted with Ethanol								
	Khella				Santonica					Khella				Harmala				
	Conc. ppm	Average consumption		Repellency %	R_{50} ppm	Conc. ppm	Average consumption		Repellency %	R_{50} ppm	Conc. ppm	Average consumption		Repellency %	R_{50} ppm	Conc. ppm	Average consumption		Repellency %	R_{50} ppm
		Untreated %	Treated %				Untreated %	Treated %				Untreated %	Treated %				Untreated %	Treated %		
50	4.3	6.2	41.0		50	1.3	2.7	32.5		50	10.0	11.3	46.9		10	2.2	4.30	33.8	
100	6.0	3.7	61.9		100	1.7	2.0	45.9		100	10.0	9.0	52.6		20	2.0	1.33	60.1	
200	5.3	1.0	84.1	64.59	200	2.0	1.7	54.1	162.99	200	10.0	7.3	57.8	106.88	40	2.0	1.00	66.7	17.31
400	3.8	0.7	84.4		400	3.7	2.0	65.0		400	5.0	3.0	62.5		80	1.7	0.67	71.7	
800	4.0	0.6	86.9		800	4.3	1.7	74.7		800	6.3	2.3	73.3		160	1.3	0.33	79.2	
1000	5.0	0.5	90.9		1000	5.3	1.5	77.9		1000	4.7	1.2	79.7		240	2.0	0.33	85.8	

$$\text{Repellency \%} = 100 - \frac{\text{Treated \% of average consumption}}{\text{(\% treated + undtreated \%) of average consumption}}$$

It is clear that the tested crude plant extracts could be arranged according their repellant potency in descending order as follow: Harmala ethanol extract, (Khella Hexane and ethanol extracts) and Santonica hexane extract. R_{50} values were 17.31, (64.59 and 106.88) and 162.99 ppm. respectively.

1-3- Toxicity effect:

Data in Table (4) revealed that most of wild plant extracts when applied as crude extract on lettuce leaves make snails avoid it. Thus, their toxic potential was absent or low. Damsissa, Halfa barr, Colocynth, Khella, Harmala, Datura, Leaves and seeds of Eucalyptus and Calotropis extracts obtained from hexane solvent failed to cause any mortality percentages.

Table (4): Toxicity effect of crude extracts for some wild plants against *Monacha cantiana* (Muller) under laboratory conditions.

Wild plant extracts	Hexane extracts	Ethanol extracts
	Mortality %	Mortality %
Damsisa	0.0	0.0
Halfa barr	0.0	0.0
Colocynth	0.0	0.0
Khella	0.0	47.0
Harmala	0.0	40.0
Datura	0.0	13.3
Santonica	40.0	13.3
Sucalyptus (L)	0.0	6.7
Eucalyptus (S)	0.0	20.0
Enab eddhib	6.7	33.0
Calotropis	0.0	40.0
Alocasia	6.7	46.7
Halouk	6.7	13.0
Geranium	6.7	26.7

L = Leaves S = Seeds

While, Santonica, Enabeddhib, Alocasia, Halouk and Geranium hexane extracts caused 40.0, 6.7, 6.7 and 6.7% snail mortality.

Regarding, the toxic effect of ethanol crude plant extracts, it is clear that Damsissa, Halfa barr, and Colocynth did not induce any snails mortality, while 47.0, 40.0, 13.3, 6.7, 20.0, 33.0, 40.0, 46.7, 13.0 and 26.7% moralities were obtained when snails fed on lettuce leaves treated with the crude extracts of Khella, Harmala, Datura, Santonica, Eucalyptus (Leaves and Seeds), Enabeddhib, Calotropis, Alocasia, Halouk and Geranium , respectively.

1-4- LC_{50}-Determination:

Data tabulated in Table (5) revealed that, snails when fed on lettuce leaves treated with Khella and Santonica hexane extracts, Khella exhibited 6.7, 13.3, 26.7, 40.4, 46.7, 53.3 and 66.7% snails mortality at concentrations of 50, 100, 200, 400, 600, 800 and 1000 ppm, respectively, while Santonica exhibited 6.7, 20.0, 40.0, 46.7, 53.3, 73.3 and 86.7% snails mortality at concentration of 50, 100, 200, 800, 1000, 1500 and 2000 ppm, respectively.

On the other hand, when *M. cantiana* snails fed on lettuce leaves treated with Khella and Harmala ethanol extracts, 6.7, 13.3, 53.3, 60.0, 66.7, 80.0 and 93.3% snails mortality were obtained in case of Khella extract at concentrations of 100, 200, 300, 400, 800 and 1000 ppm, respectively, while 6.7, 13.3, 20.0, 33.3, 40.0, 46.7 and 53.3% snails mortality were recorded with Harmala extract at concentration of 50, 100, 200, 400, 800, 1000 and 1600 ppm, respectively. The obtained results showed that Khella ethanol extract was the most potent one followed by Santonica hexane extract, Khella hexane extract and Harmala ethanol, extract whereas its LC_{50} values were 332.08, 545.13, 607.57 and 666.98 ppm, consequently.

Several plants with promising pesticidal activity have been tested to evaluate its toxicity against land snails. In this respect, Ghamry (1994) found that cabbage cauliflower seeds powder only gave pronounced effects, so they were extracted by ethanol, acetone and cold or boiled water. Also, he found that powders and crude extracts of cabbage and cauliflower seeds were the most effective for killing snails after 3-10 days. Hamdy *et al.* (1994) tested Uscharin (*Catotropis procera*) which grows wild in the Egyptian desert. The plant was discovered to be highly toxic to the land snails *Theba pisana*.

El-Hwashy *et al.* (1996) reported that, Hexane and ethanolic plant crude extracts were tested as leaf-dip and residue film technique. Results revealed that crude ethanolic leave extracts of cauliflower, Oshar and Pergularia were the most effective when tested as residue film with mortality percentage of 88.8, 88.8 and 77.7 LC_{50} values were 72.9, 39.97 and 36.47 ppm, respectively.

2- Molluscicidal effect of some pesticides:

2-1- Repellency effect:

The repellency potential of Lebaycide, Osbac, Tobsin-M and Nabu-s compounds to *M. cantiana* snails is shown in Table (6).

Results obtained revealed that when Lebaycide applied on lettuce leaves with 0.0004, 0.0005, 0.0006, 0.0008, 0.0010 and 0.0012 ppm levels exhibited 36.9, 44.4, 55.4, 65.5, 72.2 and 77.1% snails repellency, respectively. Average percentage of consumed diet decreased with the increase of Osbac concentration where 0.00020, 0.00025, 0.00040, 0.00050, 0.00100 and 0.00120 ppm, levels decreased the diet consumption with 47.9, 58.3, 67.4, 70.4, 76.9 and 82.5%, consequentively. Lettuce leaves treated with 0.0001, 0.0002, 0.0003, 0.0004, 0.0007 and 0.0009 ppm of Topsin-M repelled the snails with 21.5, 32.8, 41.3, 55.8, 60.7 and 85.6% respectively. The corresponding relative percentages of consumed treated diet with Nabu-s decreased gradually with increasing the concentration, whereas, 26.3, 29.8, 44.3, 56.0, 67.4 and 74.4% consumption decreased of lettuce leaves were

Table (5): Percent mortality of *Monacha cantiana* snails, treated with different concentrations and the corresponding LC_{50} value of tested crude plant extracts.

Plants extracted with Hexane						Plants extracted with Ethanol					
Khella			Santonica			Khella			Harmala		
Conc. (ppm)	% Mortality	LC_{50} (ppm)	Conc. (ppm)	% Mortality	LC_{50} (ppm)	Conc. (ppm)	% Mortality	LC_{50} (ppm)	Conc. (ppm)	% Mortality	LC_{50} (ppm)
50	6.7		50	6.7		100	6.7		50	6.7	
100	13.3		100	20.0		200	13.3		100	13.3	
200	26.7	607.57	200	40.0	545.13	300	53.3	332.08	200	20.0	666.98
400	40.0		800	46.7		350	60.0		400	33.3	
600	46.7		1000	53.3		400	66.7		800	40.0	
800	53.3		1500	73.3		800	80.0		1000	46.7	
1000	66.7		2000	86.7		1000	93.3		1600	53.3	

Table (6): Percent repellency of *M. cantiana* snails treated with different concentrations and the corresponding R_{50} value of the tested pesticides.

Tested compounds Concentration ppm	Lebaycide Average consumption		Lebaycide % Repellency	Osbac Conc. (ppm)	Osbac Average consumption		Osbac % Repellency	Topsin-M Conc. (ppm)	Topsin-M Average consumption		Topsin-M % Repellency	Nabu-S Conc. (ppm)	Nabu-S Average consumption		Nabu-S % Repellency
	Untreated %	Treated %			Untreated %	Treated %			Untreated %	Treated %			Untreated %	Treated %	
0.0004	3.1	5.3	36.9	0.00020	9.0	9.8	47.9	0.0001	1.4	5.1	21.5	0.0008	1.5	4.2	26.3
0.0005	4.0	5.0	44.4	0.00025	11.7	8.3	58.3	0.0002	1.9	3.9	32.8	0.0010	1.7	4.0	29.8
0.0006	5.6	4.5	55.4	0.00040	15.3	7.4	67.4	0.0003	6.4	9.1	41.3	0.0012	5.4	8.6	44.3
0.0008	6.4	3.9	55.5	0.00050	15.0	6.3	70.4	0.0004	5.3	4.2	55.8	0.0014	6.5	5.1	56.0
0.0010	6.5	2.5	72.2	0.0010	13.3	4.0	76.9	0.0007	9.6	6.2	60.7	0.0016	9.5	6.4	67.4
0.0012	4.7	2.2	77.1	0.0012	19.8	4.2	82.5	0.0009	6.8	2.2	75.6	0.020	6.7	2.3	74.4
R_{50} values = 0.0006 (ppm)				R_{50} values = 0.00020 (ppm)				R_{50} values = 0.00037 (ppm)				R_{50} values = 0.00240 (ppm)			

induced when treated with 0.0008, 0.0010, 0.0012, 0.0014, 0.0016 and 0.0020 ppm Nabu-s levels; respectively.

Data in the same table revealed that Osbac exhibited the highest repellent effect followed by Topsin-M and Lebaycide, while Nabu-s was the lowest repellent one against the snails. R_{50} values were 0.00020, 0.00037, 0.00060 and 0.00240 ppm, respectively.

2-2- Toxicity effect:

A preliminary laboratory experiment was designed to compare the toxic effect of the same pesticides, mentioned before, against *M. cantiana*. Data presented in Table (7) revealed that Lebaycide at 0.005, 0.010, 0.024, 0.030, 0.040 and 0.050 ppm tested concentrations induced 6.7, 40.0, 73.3, 80.0, 86.7 and 93.3% mortality percentages of the tested snails respectively, Osbac at 0.0070, 0.0100, 0.0144, 0.0200, 0.0300 and 0.0360 ppm induced 13.3, 20.0, 33.3, 46.7, 66.7, 93.3 and 100% snails mortality, consequentively. Also, tabulated data showed that 6.7, 20.0, 33.3, 46.7, 73.3, 86.7 and 93.3% of snails were Killed when leaves treated with 0.0027, 0.0038, 0.0050, 0.0074, 0.0100, 0.0150 and 0.0180 ppm, Topsin-M. Mortality percentage of snails increased gradually with the increasing Nabu-s concentration, where 6.7, 20.0, 46.7, 66.7, 86.7 and 93.3% of snails were killed when this compound applied with 0.003, 0.010, 0.030, 0.036, 0.040 and 0.050 ppm, consequentively. When LC_{50} values were calculated for these chemical compounds against *M. cantiana*, it is cleared that Topsin-M compound was the most toxic one (0.0073 ppm) followed by Osbac (0.0124 ppm), Lebaycide (0.0150 ppm) and Nabu-s (0.0179 ppm), respectively.

2-3- LC_{50} Determination:

The potency of the tested compounds were expressed as the percent mortality after exposure to different concentrations range, and the concentrations that Killed 50% of the tested snails (LC_{50}) were calculated.

Data illustrated in (Table 7) reveled that Lebaycide, Osbac, Topsin-M and Nabu-S, when tested at rang of (0.005 – 0.050 ppm), (0.0058 – 0.036 ppm), (0.0027 – 0.180 ppm) and (0.003 – 0.050 ppm) exhibited mortality percentages ranged between (6.7 – 93.3%), (13.3 – 100%), (6.7 – 93.3%) and (6.7 – 93.3%) at the lowest and the highest concentrations, respectively.

Table (7): Percent mortality of *M. cantiana* snails treated with different pesticides concentrations and their corresponding LC_{50} values.

Lebaycide		Osbac		Topsin-M		Nabu-S	
Concen-tration (ppm)	Mortality %	Concen-tration (ppm)	Mortality %	Concen-tration (ppm)	Mortality %	Concen-tration (ppm)	Mortality %
0.005	6.7	0.0058	13.3	0.0027	6.7	0.003	6.7
0.010	40.0	0.0070	20.0	0.0038	20.0	0.010	20.0
0.024	73.3	0.0100	33.3	0.0050	33.3	0.030	46.7
0.030	80.0	0.0144	46.7	0.0074	46.7	0.036	66.7
0.040	86.7	0.0200	66.7	0.0100	73.3	0.040	86.7
0.050	93.3	0.0300	93.3	0.0150	86.7	0.050	93.3
-	-	0.0360	100.0	0.180	93.3	-	-
LC_{50}= 0.150 ppm		= 0.0124 ppm		= 0.0073 ppm		= 0.0179 ppm	

It is also seen that Topsin-M was the most toxic one followed by Osbac, Lebaycide and Nabu-S. LC_{50} values were 0.0073, 0.0124, 0.0150 and 0.0179 ppm, respectively.

Discussing the aforementioned results, it could be concluded that repellent and toxic effect varied according to the type of tested pesticide. A similar study had been conducted by Crowell (1967) who reported that the organophosphorous insecticide and metaldehyde showed little toxicity against land mollusca, while El-Sebae *et al.* (1982) reported that LC_{50} values of aldicarb with and without blue dye against *Helicella* sp. were 0.06 and 0.22%, respectively, and all tested carbamates had shown molluscicidal activity against the land snail. El-Okda (1985) mentioned that both Mesurol and Methomyl indicated the same poisoning signs as subsequent irritation, paralysis and lastly death.

Ghamry *et al.* (1993) revealed that metaldhyd compound was the most effective one against *Monacha cantiana* and *Eobania vermiculata* followed by monocrotofos. The mortality percentages after 14 days wee 93, 85 and 87, 82 and 70, 63, respectively. On the other hand, monocrotophos exhibited the lowest activity against the two other tested species whereas the mortality percentages were 36 and 28, respectively.

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التأثير الطارد والسام لبعض مستخلصات النباتات المحلية والمبيدات ضد قوقع البرسيم موناكا كانتيانا.

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تم إجراء حصر لثمانية وعشرون مستخلصا نباتيا ناتجة من استخلاص أجزاء مختلفة لثلاثة عشر نباتا باستخدام مذيب الهكسان والأيثانول لمعرفة تأثيرها الطارد والسام ضد قوقع البرسيم (موناكا كانتيانا) وهذه النباتات هى: دمسيسة - حلفاء - زربيح - خلة شيطانى - حرمل - داتورة - شيح - كافور - عنب الديب - عشار - الوكاسيا - هالوك - عتر بالإضافة إلى اختبار كفاءة مجموعة من المبيدات الكيميائية من حيث تأثيرها الطارد والسام أيضا ضد نفس القوقع وهذه المبيدات هى: ليباسيد- أوسباك- توبسن - نابو- سى. وقد أوضحت النتائج أن المستخلصات الأيثانولية للحرمل والخلة الشيطانى والهكسانية للشيح والخلة الشيطانى قد أعطت أعلى تأثير طارد للقوقع عن باقى المستخلصات المختبرة حيث كانت قيم التركيز النصف طارد (R_{50}) للمستخلصات: الأيثانولى للحرمل، الهكسانى للخلة الشيطانى، الأيثانولى للخلة الشيطانى، الهكسانى للشيح هى: ٣١ر١٧، ٥٩ر٦٤، ٨٨ر١٠٦، ٩٩ر١٦٢ جزء فى المليون على التوالى.

كما أوضحت النتائج أن القواقع المختبرة تجنبت التغذية على أوراق الخس المعاملة بالمستخلصات الخام، ولذلك فإن غالبية المستخلصات لم تعطى التأثير المطلوب فى الاختبارات الأولية ولكنها أعطت تأثيرات عالية عند استخدام تخفيضات مختلفة من المستخلص الخام.

تم اختيار المستخلصات التى أعطت أعلى تأثير سام فى الاختبارات الأولية ضد قوقع البرسيم وتم حساب قيم التركيز النصف قاتل (LC_{50}) لهذه المستخلصات حيث كانت ٠٨ر٣٣٢، ١٣ر٥٤٥، ٥٧ر٦٠٧، ٩٨ر٦٦٦ جزء فى المليون لمستخلصات الخلة الأيثانولى، الشيح الهكسانى، الخلة الهكسانى وأخيرا الحرمل الأيثانولى على التوالى.

أظهرت نتائج اختبارات المبيدات ضد القواقع أن مبيد الأوسباك أعطى أعلى تأثير طارد يليه مبيد توبسين ثم الليباسيد وأخيرا نابو- (س) حيث كانت قيم التركيز النصف طارد (R_{50}) ٠٠٠٢ر٠، ٠٠٠٣٧ر٠، ٠٠٠٦ر٠، ٠٠٢٤ر٠ جزء فى المليون على التوالى.

أظهرت نتائج اختبارات التأثير السام للمبيدات ضد القواقع أن مبيد التوبسن هو الأعلى تأثيرا يليه الأوسباك ثم الليباسيد وأخيرا مبيد النابو- س وكانت قيم التركيز النصف قاتل LC_{50} لهذه المركبات هى ٠٠٧٣ر٠، ٠١٢٤ر٠، ٠١٥ر٠، ٠١٧٩ر٠ جزء فى المليون على التوالى.