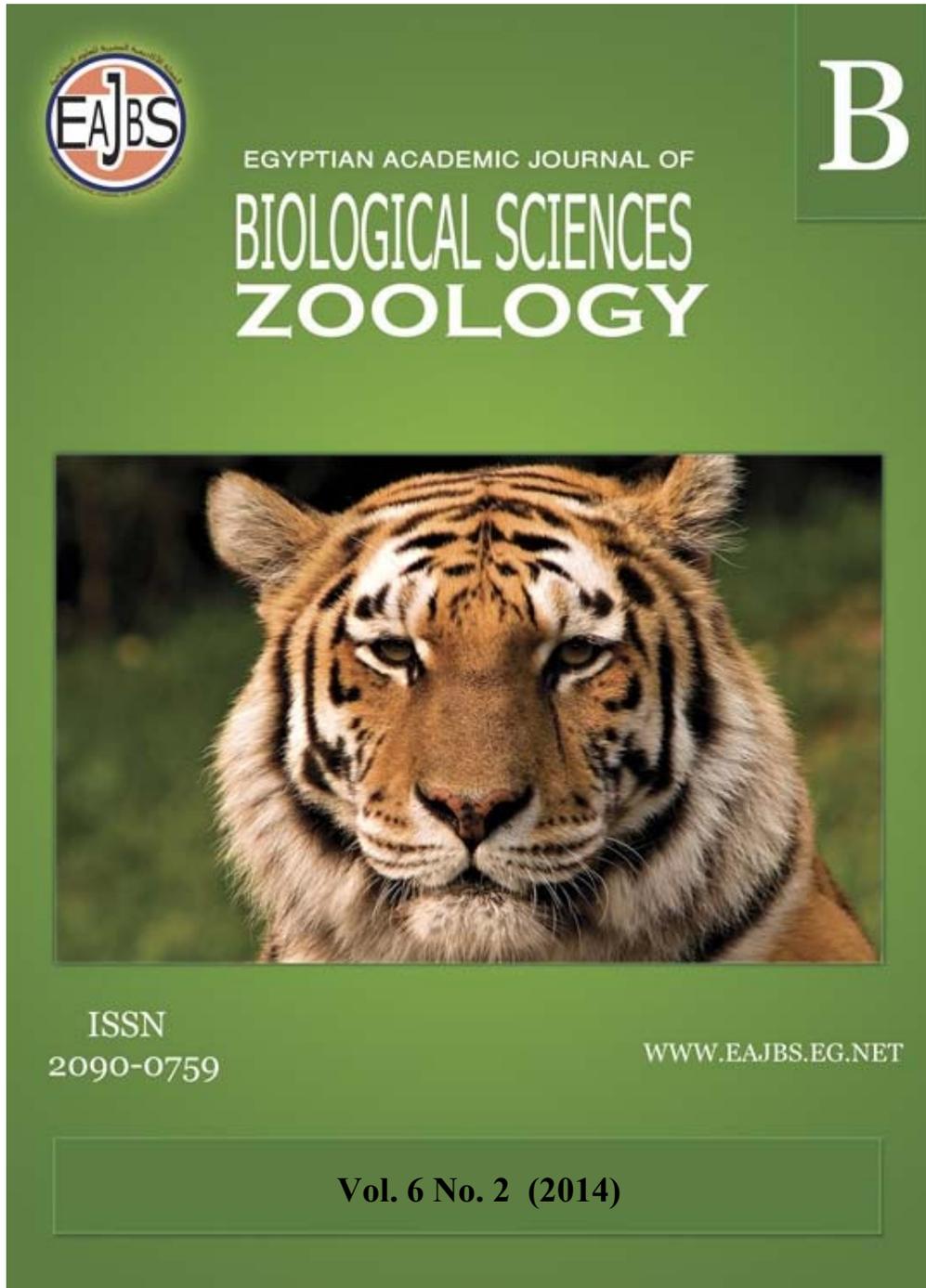


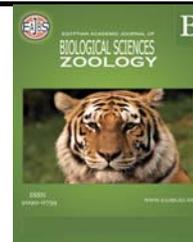
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## Efficiency of different compounds against the principle Calcium precipitation parameters of terrestrial Snails.

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### ABSTRACT

Effect of different compounds against some principle calcium precipitation parameters in shell was studied on two terrestrial snails, *Eobania vermiculata* and *Monacha obstructa*. The tested compounds were Newmyl (the recommended compound), Lambada, Actra as synthetic compound, Tracer (bioinsecticide) and Tannic acid (natural product). Animals of each species were treated with LC<sub>50</sub> of each compound using contact technique. The calcium precipitation parameters (Alkaline phosphatase (ALP), Acid phosphatase (ACP), Total protein (TP), Total lipid (TL) and cholesterol) were measured after one, three and seven days post treatment.

Results showed that all tested compounds caused vacillated effects for the two snail species. Tannic acid and tracer were the most effective compounds on the all parameters in both species. While the recommended compound (newmyl) came in the last rank in the most of parameters. *E. vermiculata* was more susceptible to tannic acid than *M. obstructa* for ALP, ACP enzymes, total protein and cholesterol, while both species had the same response to total lipid. The fluctuation effects of tested biochemical parameters may be due to damage of cells under the impact of treatment with compounds.

**Keywords:** Terrestrial snails- *E. vermiculata* - *M. obstructa* - pesticides compounds- biochemical parameters.

### INTRODUCTION

The terrestrial molluscs are considered a major pests of a wide range of agricultural crops in temperate and humid habitats world wide (Speiser and Kistler 2002). They attack plants causing great damage to the cultivated plants. Economic damage caused by these molluscs is due to feeding and to contamination with their bodies, feces or slime leading to deterioration of the product quality, in addition the financial loss (Iglesias *et al.*, 2003). In Egypt terrestrial snails attack vegetables, field crops, orchard trees as well as ornamental and medical plants. *E. vermiculata* and *M. obstructa* are the important snail species in the Egyptian governorate attacking various plantations (Eshra 2013). Shell is very important for protecting snail from any risk. The main aim of this work is studying the efficiency of some compounds on the parameters affecting the synthesis of shell for the two snail species. These parameters are: alkaline and acid phosphatase, total protein, total lipid and cholesterol contents.

## MATERIALS AND METHODS

### Tested Compounds

#### Chemical pesticides:

Newmyl 20% SL., (methomyl carbamate compound), supplied by KZ, Co.

Lambada 10% CS., (lambada – cyhalothrin pyrethroid compound) supplied by Syngenta Co.

Actra 25% WG, (thiamethoxam neonicotinoid compound) supplied by Syngenta Co.

#### Bioinsecticide.

Tracer 24% SC., (spinosad) produced by soil microorganisms' actinomycete *Saccharopolyspora spinosa*, it was supplied by Dow Agro Sciences Co. Egypt.

#### Natural compound.

Tannic acid 100% powder. It was supplied from Oxford Co.

#### Experimental Animals

Adult individuals of the two terrestrial snail species, *Eobania vermiculata* and *Monacha obstructa* were collected from the infested ornamental plants at Giza Governorate. Animals were transferred to laboratory, kept in glass boxes and fed on fresh lettuce leaves. For each treatment, 40 healthy animals were allocated and divided into four replicates (each of 10 individuals) and another for control.

#### Contact Application

Animals were treated with LC<sub>50</sub> of each compound using thin layer film technique according to the method of Ascher and Mirian (1981). Two ml of the tested concentration for each compound were spread on inner surface of a Petri-dish using water moving the dish gently in circles. The LC<sub>50</sub> were: 0.08 & 0.05 mg/cm<sup>2</sup> for newmyl, 0.2 & 0.38 for lambada, 0.27 & 0.5 for actra, 1.5 & 0.8 for tracer and 1.05 & 1.2 for tannic acid for *E. vermiculata* and *M. obstructa*, consecutively (Mobarak Soha 2014). Water was evaporated under room conditions in a few minutes leaving a thin layer film of the tested compounds. Animals were exposed to LC<sub>50</sub> of tested compounds for one week. A parallel control test was conducted using plain water.

#### Parameter Determination:

The activities of some enzymes and biochemical parameters were studied to clarify the physiological response of the terrestrial snail to the tested compounds i.e., alkaline and acid phosphatase, total protein, total lipid and cholesterol contents. The parameters were determined at different periods 1, 3 and 7 days post treatment. Samples were prepared according to the method of Bergmeyer (1963).

#### Alkaline and Acid Phosphatase (ALP and ACP):

Both alkaline and acid phosphatase activity was determined according to method of Kind and King (1954).

#### Total Protein:

Soluble protein was determined using the method of Henry (1964).

#### Cholesterol

Cholesterol concentration was determined according to method of Ellefson and Caraway (1976).

## RESULTS AND DISCUSSION

### Response of Alkaline Phosphatase (ALP):

Data in Table (1) show the effect of LC<sub>50</sub> of the tested compounds as contact compared with newmyl (the recommended compound) on alkaline phosphatase (ALP) in both terrestrial snail species after differed periods. Results revealed that after one day of treatment, lambada caused sever decrease in the enzyme level to 35%, and then increased to 64 and 114% after 3 and 7 days, respectively comparing with control for *E. vermiculata*. In case of *M. obstructa*, lambada reduced the enzyme to 99 and 64% after one and three days of administration, respectively but it increased the enzyme to 129% after seven days. Actra compound caused acute reduce in the enzyme activity from 768.3 in control to 277.5 u/l represented 36% after one day of treatment, while it enhanced to 60% and 65% after three and seven days of administration, consecutively but it still under the level of control value for *E. vermiculata*.

Table 1: Response of alkaline phosphatase (u/l) to the different compounds as contact against two terrestrial snail species.

Periods after treatment (day)	Compounds									
	Newmyl		Lambada		Actra		Tracer		Tannic Acid	
	<i>E</i>	<i>M</i>								
0	768.3 ±0.2	437.8 ±0.1								
1	404 ±0.1	110.0 ±0.3	266.6 ±0.5	393.5 ±0.4	277.5 ±0.2	297.2 ±0.6	155.7 ±0.3	426.0 ±0.9	166.9 ±0.5	334.7 ±0.3
3	338.7 ±0.6	320.5 ±0.4	492.9 ±0.1	266.4 ±0.2	460.2 ±0.5	246.3 ±0.4	446.6 ±0.7	243.0 ±0.2	136.0 ±0.1	195.8 ±0.5
7	245.4 ±0.2	105.4 ±0.4	874.7 ±0.1	565.0 ±0.7	496.6 ±0.1	311.8 ±0.2	716.3 ±0.3	455.7 ±0.1	262.0 ±0.1	145.8 ±0.2
LSD	111.0	5.9	96.6	3.8	94.1	4.3	97.8	32.9	98.5	5.3

*E*= *Eobania vermiculata*

*M*= *Monacha obstructa*

The same way was observed in case of *M. obstructa* as the enzyme activity decreased to reach 68 and 56% post one and three days of treatment, respectively while it increased to 71% on the 7<sup>th</sup> day of administration comparing with control. Tracer bioinsecticide reduced ALP enzyme activity to 20% after one day and 58% after three days of treatment for *E. vermiculata* while this value was raised to reach 93% from the control level post seven days of administration. Also, the same compound reduced the enzyme activity with 97 and 56% after one and three days of treatment, and then it increased to reach 104% after seven days in case of *M. obstructa*. Also, tannic acid took the same trend with *E. vermiculata* whereas it caused sever decrease in the enzyme level to 22% and 18% after one and three days of treatment respectively, while the level of enzyme raised to 34% after seven days of treatment but it still under the level of control value. Concerning *M. obstructa*, alkaline phosphatase was gradually reduce with prolongation the period after treatment with tannic acid as it decreased to 76, 45 and 33% after one, three and seven days of administration, consecutively. Newmyl (the recommended compound) caused inhibition in the ALP enzyme activity whereas the enzyme reduced to 53%, 44% and 33% after one, three and seven days of treatment, consecutively for *E. vermiculata*. Regarding *M. obstructa* newmyl caused fluctuated in the ALP activity whereas it reduced to reach 25% after one day of treatment, then it increased to 73% post three days of administration and reduced again to 24% after seven days comparing with control value.

From the previous results, it is cleared that tannic acid was the most effective on ALP in both snail species. For *E. vermiculata* tracer came in the second rank

followed by actra, lambada and newmyl. While for *M. obstructa* newmyl came in the second rank followed by lambada, actra and tracer. The decrease or increase of ALP activity may be due to damage of cells under the impact of pesticide compound.

The obtained results are in accordance with those obtained by Kandil, *et al.*, (2010) who found that ALP activity decreased with increasing the exposure period to newmyl compound. (Godan, 1983) recorded that regeneration of damaged shell takes places more rapidly than increase in size at the edge of the shell. The epithelium of the mantel plays an important role during the process of repair whereas an increase in the activation of alkaline phosphatase. The alkaline phosphatase associated with process and also in the newly repaired outer shell membrane in active of the forming of periostracum proteins.

#### Response of acid phosphatase (ACP):

The data which tabulated in Table (2) showed the effect of LC<sub>50</sub> of various compounds on acid phosphatase in both snail species. Results pointed out that lambada increased the enzyme level gradually to (197 & 112%), (303 & 160%) and (393 & 250%) after one, three and seven days of administration for *E. vermiculata* and *M. obstructa*, consecutively. Concerning actra compound, it decreased the enzyme activity to 69% after one day of treatment while it caused sever elevation in the enzyme activity after three and seven days of treatment (201, 373%) consecutively for *E. vermiculata*. In case of *M. obstructa* actra compound increased the enzyme level gradually to 124, 143 and 236% post one, three and seven days of administration, respectively.

Table 2: Response of acid phosphatase (u/l) to the different compounds as contact against two terrestrial snail species.

Periods after treatment (day)	Compounds									
	Newmyl		Lambada		Actra		Tracer		Tannic Acid	
	E	M	E	M	E	M	E	M	E	M
0	3.37 ±0.1	3.29 ±0.1	3.37 ±0.1	3.29 ±0.1	3.37 ±0.1	3.29 ±0.1	3.37 ±0.1	3.29 ±0.1	3.37 ±0.1	3.29 ±0.1
1	0.07 ±0.0	0.41 ±0.0	6.66 ±0.0	3.69 ±0.0	2.32 ±0.1	4.08 ±0.1	1.92 ±0.1	4.54 ±0.1	2.66 ±0.0	6.38 ±0.1
3	0.41 ±0.0	0.40 ±0.0	10.24 ±0.0	5.29 ±0.0	6.76 ±0.0	4.69 ±0.1	3.43 ±0.0	6.86 ±0.0	5.96 ±0.1	5.05 ±0.1
7	1.05 ±0.0	0.54 ±0.7	13.27 ±0.1	8.22 ±0.0	12.57 ±0.0	7.77 ±0.1	4.89 ±0.0	14.00 ±0.0	4.63 ±0.1	4.63 ±0.1
LSD	0.06	0.06	0.45	0.37	0.66	0.32	0.69	0.53	0.19	0.21

E= *Eobania vermiculata*.

M= *Monacha obstructa*.

Concerning tracer, it reduced the enzyme activity to 57% after one day of treatment but it caused high elevation in the enzyme level to 102 and 145% post three and seven of administration for *E. vermiculata*. While it caused emphasize increase in the enzyme activity from 3.29 u/l in control to 4.29, 6.86 and 14.0 u/l after one, three and seven days of treatment represented 138, 209 and 466%, respectively for *M. obstructa*. Tannic acid caused fluctuation effect between decrease and increase for the two snail species. Tannic acid reduced the ACP activity to 97% after one day and increased it to 177% after three days, then caused slight reduce again to 165% after seven days of administration for *E. vermiculata*. In case of *M. obstructa* the enzyme activity increased to 194% after one day of treatment, then it reduced to 153 and 141% after three and seven day of treatment but it still up to control level. Concerning the recommended compound it is obvious that newmyl caused acute reduce in enzyme level from 3.37 u/l in control to 0.07 u/l represented 2% after one day of treatment and

induced slightly increase to 12%, 31% after three and seven days of treatment for *E. vermiculata* respectively. For *M. obstructa* newmyl reduced the enzyme activity to 12% after one day and still stable in the 3<sup>rd</sup> day of treatment, then it increased to 16% after seven days of treatment but still under the control level. Reviewing the above data it is cleared that lambada was the most effective compound in ACP followed by actra, tannic acid, tracer while newmyl was the lowest effective one for *E. vermiculata*. Tracer came in the first rank in case of *M. obstructa* followed by lambada > actra > Tannic acid while newmyl came in the last rank.

From the aforementioned results in Tables (1& 2) we can observed that newmyl (the recommended compound) came in the last rank against both terrestrial snails on the two tested enzymes ALP and ACP. But the effect of the rest compounds on both enzymes differed between the two snail species. The elevation of the activities of ALP and ACP treated with pesticides may be attribute to leakage from the organs into extra cellular fluids due to change in endothelial permeability while the decreases of enzymes level may be due to disease or damage in the major organ of enzymes synthesis. Marxen *et al.*, (2003) indicated that Alkaline and acid phosphatase involved participate in mollusc shell formation, also, they are expressed in a constant pattern and help to identify the different zones of the adult shell forming tissue

#### **Response of total protein:**

Data in Table (3) showed the effect of LC<sub>50</sub> of the tested compounds on total protein against both terrestrial snail species. Results indicated that after one day lambada caused high increase in the total protein level to 256% , then it decreased to 206 and 159% after three and seven days of treatment, respectively for *E. vermiculata*. While, the same compound caused fluctuation effect between decrease and increase for *M. obstructa* in the total protein level. Lambada achieved acute elevation in total protein from 100% of control to 843% after one day of treatment then, it reduced this level to 238% post three days while it enhanced again to reach 850% after seven days of administration.

The response of total protein to actra treatment in *E. vermiculata* was great raise to 259% after one day and reached to 500% after three days of treatment, respectively comparing with control. After seven days total protein reduced again to 111% near the control level. Regarding *M. obstructa* it took the same manner whereas actra compound raised total protein to reach 688% and 1275% in the first and third days of administration comparatively with control while it gave sever decrease to 431% post 7 days of treatment. Tracer compound caused high enhance on total protein level reached to 118, 600 and 659% after one, three and seven days of administration, respectively for *E. vermiculata*. Also, it achieved high increase in the level of total protein 725 and 1043% from the control level post one and three days of treatment while, it decreased again to 350% after seven days of treatment for *M. obstructa* but still up to the level of control. Tannic acid caused sever increase in total protein level whereas it enhanced from the level of control to reach 1317% after one day of treatment then, gradually reduce occurred to 1305 and 912% for *E. vermiculata*. Concerning *M. obstructa*, tannic acid elevated the total protein level to 1250% after one day of treatment, then it decreased to 275% after three days while induced increase 575% after seven days of treatment. Newmyl compound caused sever raised for total protein level 1564% after one day, then it reduced to 947% after three days while it increased with 1394% after seven day of treatment for *E. vermiculata*. Regarding *M. obstructa* the compound increased total protein level to 431 and 581%

after one and three days of administration, but it decreased to 429% after seven days of treatment but still more than normal level of control.

Table 3: Response of Total protein (g/dl) to the different compounds as contact against two terrestrial snail species.

Periods after treatment (day)	Compounds									
	Newmyl		Lambada		Actra		Tracer		Tannic Acid	
	<i>E</i>	<i>M</i>								
0	0.17 ±0.1	0.16 ±0.1								
1	2.66 ±0.2	0.69 ±0.1	0.45 ±0.1	1.35 ±0.3	0.44 ±0.1	1.10 ±0.1	0.20 ±0.1	1.16 ±0.1	2.24 ±0.2	2.01 ±0.1
3	1.61 ±0.1	0.93 ±0.1	0.35 ±0.1	0.38 ±0.1	0.85 ±0.1	2.04 ±0.1	1.02 ±0.0	1.67 ±0.0	2.22 ±0.2	0.44 ±0.1
7	2.37 ±0.1	0.73 ±0.0	0.27 ±0.1	1.36 ±0.1	0.19 ±0.1	0.69 ±0.1	1.12 ±0.0	0.56 ±0.0	1.55 ±0.2	0.92 ±0.0
LSD	0.32	0.17	0.39	0.15	0.13	0.19	0.06	0.15	0.19	0.13

*E*= *Eobania vermiculata*.

*M*= *Monacha obstructa*.

Discussing the previously results, it is obvious that *E. vermiculata* more susceptible to tannic acid than *M. obstructa* followed by newmyl, tracer, actra and lambada while it was more tolerant than *M. obstructa* to actra compound followed by tracer, lambada, tannic acid and newmyl. The fluctuation in total protein level might be resulted from imbalance between the rate of synthesis and degradation process. Khidr Fatma *et al.*, (2011) found that Thyophyline decreased total protein after 4 days of treatment for *Monacha obstructa*. Hedegaard and wenk (1998) mentioned that mollusca shell is polycrystalline composites of calcium carbonate, Protein and glycoprotein. Also Karl and Saleuddin (1983) mentioned that the formation of shell can be described in terms of two major phases: (1) cellular processes of ion transport, protein synthesis, and secretion and (2) a series of physicochemical processes in which crystals of CaCO<sub>3</sub> are nucleated, oriented, and grow in intimate association with a secreted organic matrix.

#### Response of Total Lipid:

Data tabulated in Table (4) showed the effect of the different tested compounds on the total lipid content in both tested snail species. Results obtained that lambada decreased total lipid to 38% and 37% post one and three days of administration while it increased to 59% after seven days of treatment but it still under the level of control. Fluctuated response occurred with *M. obstructa* to lambada whereas it reduced the level of total lipid from the normal level of control to 22% post one day of treatment while it increased to 83% after three days and decreased to 46% after seven days of administration. Actra had the same effect on the total lipid in *E. vermiculata*. It caused notice reduced (26%) after one day, while it increased to 48% after three days and then it reduced again to 29% post seven days of treatment comparing with control level. The same compound achieved gradually decrease in total lipid from 100% of control to 57% and 35% after one and three days post administration, then it increased to 58% after seven days of treatment for *M. obstructa*. Regarding tracer compound, sever decline occurred in total lipid from 100% to 21%, 17% and 15% post one, three and seven days of administration, respectively for *E. vermiculata*. Also, it decreased total lipid level to 14% after one day, but it induced increase 38 and 40% after three and seven days of treatment for *M. obstructa*. Concerning tannic acid, the level of total lipid fluctuated between decrease and increase for the two snail species.

Table 4: Response of Total lipid (g/l) to the different compounds as contact against two terrestrial snail species.

Periods after treatment (day)	Compounds									
	Newmyl		Lambada		Actra		Tracer		Tannic Acid	
	<i>E</i>	<i>M</i>								
0	7.03 ±0.3	4.81 ±0.3								
1	2.56 ±0.1	1.44 ±0.2	2.69 ±0.1	1.07 ±0.5	1.83 ±0.2	2.73 ±0.2	1.47 ±0.1	0.68 ±0.1	2.77 ±0.1	5.12 ±0.1
3	1.28 ±0.1	2.04 ±0.1	2.61 ±0.1	3.99 ±0.1	3.40 ±0.2	1.69 ±0.2	1.21 ±0.0	1.58 ±0.1	5.22 ±0.1	4.99 ±0.1
7	1.57 ±0.1	1.52 ±0.1	4.15 ±0.1	2.22 ±0.1	2.01 ±0.1	2.79 ±0.2	1.08 ±0.0	1.93 ±0.1	4.03 ±0.1	6.07 ±0.3
LSD	0.39	0.33	0.57	0.44	0.53	0.47	0.42	0.35	0.57	0.79

*E*= *Eobania vermiculata*

*M*= *Monacha obstructa*

Tannic acid reduced the level of total lipid from control level to 39% after one day for *E. vermiculata*, while it enhanced to 74% post three days and reduced again to 57% after seven days of administration. Also, the level of total lipid increased from the normal level of control to 106% after one day in case of *M. obstructa* while it decreased to 104% post three days of administration then, it increased to 126% after seven days of treatment. The recommended compound newmyl reduced the level of total lipid to 36% and 18% after one and three days of treatment but it caused slightly increase to 22% comparing with control level post seven days of treatment for *E. vermiculata*. The same compound caused fluctuated effect on the level of total lipid for *M. obstructa* whereas it reduced it from the normal level of control to 30% after one day of treatment, while it increased to 42% after three days, then it reduced again to 32% after seven day of administration. Reviewing the above data, it is noticed that all tested compounds caused fluctuated effect for the two terrestrial snail species. In case of *E. vermiculata* the tested compounds could be arranged according to their effect as follows: tracer > actra > newmyl > lambada > tannic acid. Also, for *M. obstructa* tracer came in the first rank and tannic acid in the last while the rest compounds were lambada > newmyl > actra. The depression in total lipid may be due to decline in lipid synthesis capacity and attribute to an increase in hydrolysis of hepatic lipid to compact the stress conditions. Kandil *et al.*, (2014) reported that acetylsalicylic acid exhibited the highest effect on total protein and total lipid which important for synthesis of shell and mucus. Watabe (1983) mentioned that molluscs are capable of repairing damage inflicted to the shell. These processes of shell repair depended on chemical and structural characteristics of insoluble and soluble protein and carbohydrate fractions, and lipid components.

#### Response of Cholesterol:

Data in Table (5) showed the response of cholesterol to the different treatments against the two tested snail species. Results noticed that lambada compound decreased the level of cholesterol from the control level to 81% and 80% after one and three days of administration while increase it to 82% after seven days of treatment for *E. vermiculata*. The same trend occurred in case of *M. obstructa* whereas the cholesterol level reduced to 43 and 42% after one and three days post treatment, then it increased to 43% after seven days of administration. Actra compound take the same pattern in case of *E. vermiculata* whereas it decreased cholesterol content to 81 and 78% after

one and three days of treatment, while it enhanced to 80% post seven day of treatment comparing to control.

Table 5: Response of Cholesterol (mg/dl) to the different compounds as contact against two terrestrial snail species.

Periods after treatment (day)	Compounds									
	Newmyl		Lambada		Actra		Tracer		Tannic Acid	
	E	M	E	M	E	M	E	M	E	M
0	251.7 ±0.2	477.9 ±0.2								
1	211.5 ±0.3	201.5 ±0.1	203.4 ±0.2	204.1 ±0.3	203.1 ±0.7	189.9 ±0.3	201.5 ±0.7	195.5 ±0.1	513.7 ±0.6	463.6 ±0.5
3	204.4 ±0.2	199.5 ±0.4	200.9 ±0.8	202.4 ±0.5	195.5 ±0.3	199.4 ±0.4	203.5 ±0.3	203.3 ±0.7	513.7 ±0.4	425.5 ±0.2
7	207.1 ±0.1	192.7 ±0.2	207.1 ±0.2	206.0 ±0.9	201.7 ±0.1	196.3 ±0.1	197.0 ±0.1	203.7 ±0.5	385.7 ±0.1	460.1 ±0.7
LSD	2.9	13.1	2.0	12.4	2.2	12.7	1.9	12.7	9.3	38.1

E= *Eobania vermiculata*

M- *Monacha obstructa*

Also, it reduced cholesterol content to 40% after one day of administration while it was raised to 42% after three days, then it reduced again to 41% after seven days of treatment comparing with control for *M. obstructa*. Tracer caused fluctuated effect for *E. vermiculata* whereas it decline cholesterol level from 100% in control to 80% after one day of treatment, then it caused slightly increase with 81% after three days of administration while it decreased to 78% post seven day of treatment. Concerning *M. obstructa* tracer compound reduced cholesterol content to 41% post one day of administration, but it increased to 48% after three days and still at the level even seven days of treatment comparing with control content. Vice versa occurred in case of tannic acid whereas it achieved sever elevation reached to 204% after one day. Also, it still confined this level even three days of administration, while it reduced to 153% but still up to control level for *E. vermiculata*. Regarding *M. obstructa* tannic acid decreased cholesterol level 97 and 89% after one and three days of treatment, then it increased to 96% but it still under the level of control. Regarding the recommended compound newmyl, it reduced cholesterol level to 84 and 81% after one and three days of treatment while it increased to 82% after seven days of treatment but still under the control level for *E. vermiculata*. Also, it decreased cholesterol level to 42, 42% and 40% after one, three and seven days of administration for *M. obstructa*.

Reviewing the aforementioned results, it is cleared that tannic acid is the most effective compound on cholesterol content against *E. vermiculata*. The rest tested compounds, it could be arranged in descending order as follows: tracer > actra > lambada > newmyl. In case of *M. obstructa* actra came in the first rank followed by newmyl > tracer > lambada > tannic acid. The decrease in cholesterol level may be due to inhibition of shell regeneration in snails because the cholesterol accelerates shell regeneration in snails deprived plant food (Whited and Saleuddin, 2002). Chaudhari and Kulkarni (1994) found that cholesterol increased after 1, 7 and 14 days of treatment with sub lethal dose of monocrotophose against land snail *Zooteceus insularis*. Also, Gleason *et al.*, (1991) reported that the increase in cholesterol content increase calcium levels in smooth muscle cells.

From the previous results in Table (1- 5) we can concluded that *E. vermiculata* was more susceptible to tannic acid effect on the some of biochemical parameters than

*M. obstructa*. Mobarak Soha (2014) recorded that tannic acid bait had strong effect on ACP, ALP and Cholesterol which are responsible to the production of shell that is very important for snail life.

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### ARABIC SUMMARY

كفاءة المركبات المختلفة ضد العوامل المسؤولة عن ترسيب الكالسيوم في نوعين من القواقع الارضية

سها عبدالله مبارك – راندا عبدالسميع قنديل  
معهد بحوث وقاية النباتات – مركز البحوث الزراعية

تم دراسة تأثير المركبات المختلفة (نيوميل كمركب موصى به ولمبادا، اكثرا كمركبات مخلقة، وتريسر كمبيد حيوى وحمض التانيك كمنتج طبيعي) ضد بعض العوامل المسؤولة عن ترسيب الكالسيوم في الصدفة ضد نوعين من القواقع الارضية ( قوقع الخطوط الشيكولاتى وقوقع البرسيم الزجاجى) . عولمت الحيوانات بالتركيز النصفى المميت LC<sub>50</sub> لكل مركب بطريقة الملامسة وتم قياس العوامل البيوكيميائية المؤثرة على ترسيب الكالسيوم (انزيم الكالين فوسفاتيز، والاسيد فوسفاتيز، والبروتين الكلى، والليبيدات الكلية، والكوليستيرول) وذلك على فترات مختلفة (يوم وثلاثة وسبعة ايام).

اظهرت النتائج حدوث تدبذب واضح ما بين الارتفاع والانخفاض في مستوى كل منهم على مدار الفترات المختلفة في كلا النوعين من القواقع. كما اوضحت النتائج ان حمض التانيك والمبيد الحيوى تريسر هما الاعلى تأثيرا على جميع العوامل البيوكيميائية المختبرة في كلا النوعين بينما احتل المركب الموصى به (نيوميل) المرتبة الاخيرة في التأثير على معظم العوامل. واطهرت النتائج ان قوقع الخطوط الشيكولاتى كان الاعلى حساسية لحمض التانيك من قوقع البرسيم الزجاجى في حالة انزيم الالكالين والاسيد فوسفاتيز وكذلك البروتين الكلى ومحتوى الكوليستيرول ، بينما تشابه كلا النوعين في الاستجابة لتأثير حمض التانيك بالنسبة لليبيدات الكلية. التأثير المتذبذب على العوامل البيوكيميائية المختبرة ربما يعزى الى حدوث خلل في الخلايا تحت ضغط المعاملة بالمركبات المختلفة .