

LABORATORY STUDIES ON THE MOLLUSCICIDAL EFFECT OF SUMITHION, BINDIOCARB AND MACHET PESTICIDES AGAINST THREE LAND SNAIL SPECIES

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ABSTRACT

Molluscicidal effects of the tested pesticides namely ; bindiocarb, sumithion and machet against adult stage of three land snail species ; *Monacha obstructa* , *Theba pisana* and *Eobania vermiculata* were studied under laboratory conditions .Two techniques, (i.e.contact and bait) were used for exposure the snails to pesticides . Bindiocarb proved to be the most toxic one for the three tested snails . The LC_{50} 's were 1.12 & 2.26 ; 1.77 & 2.53 and 1.87 & 3.17 % ; while machet gave the lowest efficacy (LC_{50} 's 3.19 & 3.48 ; 3.69 & 3.64 and 4.08 & 4.18 %) for the three tested snail species as contact and bait technique , respectively.The difference in toxicity of tested pesticides against snails could be explained on the basis of their chemical structure . The relationship between the chemical structure and the toxicity . *M. obstructa* was comparatively sensitive for the three tested compounds than *T. pisana* ; while *E. vermiculata* exhibited a high tolerance against the three tested compounds. On the other hand , contact technique was more effective .

INTRODUCTION

Control with chemical substances is today still regarded as the most useful method, particularly over large areas. Since terrestrial gastropods are more important in plant protection than freshwater snails, substances used against them will be considered first. Of the many substances for control of land gastropods which have been officially tested, those with the most useful practical application are carbamate and phosphorothioate, and they are the active ingredients in commercial formulations. Carbamate compounds have a wide range of effects . They are used as insecticides, herbicides and fungicides. Now they have also won a place as molluscicides (Godan,1983). They are little affected by environmental conditions and their toxicity increases in humid surroundings, which are optimal for gastropods. Molluscicidal properties are shown particularly by the methylcarbamates (Crowell, 1977). These are esters or salts of carbamic acids and toxic mainly to terrestrial pulmonates. They cause metabolic disturbances in insects and warm blooded animals , including man , and inhibit acetylcholine esterase in the nervous system (Casida , 1963). It is to be assumed that a similar effect occurs in molluscs – carbamates and synthetic pyrethroids are the major groups of pesticides being used for controlling insect pests on a large number of agricultural crops (Anonymous , 1987). The present work was carried out to study the toxic effect of some pesticides against certain species of land snails.

MATERIALS AND METHODS

1 – Pesticides used : -

- 1 – Bindicarb 10% wp : 2,2-dimethyl – 1,3 – benzodioxol – 4 – yl methyl carbamate .
- 2- Sumithion 50% EC : CA O,O-dimehtyl O-(3-methyl-4 nitrophenyl) phosphorothioate.
- 3- Machet 60 % EC : N – butoxymethyl – 2 – chloro – 2,6 – dimethyl – acetanlide .

2-Test animals

Individuals of three land snail species were subjected for laboratory tests i.e., *Monacha obstructa*, *Theba Pisana* and *Eobania vermiculata*. The animals of the first and third species were obtained from untreated fields and ornamental plants from Sharkia Governorate, while the second species was collected from Alexandria Governorate. The collected snails were transferred directly in muslin bags to the laboratory- Mean diameters of selected animals were 10-12mm, 13-15mm and 15-18mm, respectively. Healthy individuals snail were kept separately in a small plastic boxes containing 8-10 cm moist optimal soil provided with fresh green lettuce leaves for two weeks for acclimatization, covered with muslin secured with rubber band to prevent snails from escaping, and kept under laboratory conditions ($20 \pm 1^{\circ}$ c and 80 % R.H.) (Fouad-Maha, 1999) . The healthy snails were selected for each treatment and starved 24 hours before starting the experiments (Miller *et al.*, 1988).

3- Bioassay tests : -

1.Contact appication : -

water solutions of pesticides were prepared at concentrations of bindicarb (0.4, 0.8, 1.2, 1.6, 2.0 and 2.4 %) , sumithion (0.5, 1.0, 1.5, 2.0, 2.5, and 0.3 %) and machet (0.7, 1.4, 2.1, 2.8, 3.5 and 4.2 %) . The snails were sprayed with water before application to be active. Each concentration was prepared by diluting the appropriate amount of formulated Product with water. Three centimeter of aqueous pesticide solution was distributed on the bottom of glass vessel (Asran- Fawkyia, 2001) . After drying , five healthy adult snails with the same shell diameter were placed centrally on the bottom of glass vessel and covered with glass terrarium.

2.Baits application : -

By incorporating the concentration of pesticides into mixture of bran with black sugar cane syrup at concentrations of bindicarb (1.0, 1.5, 2.0, 2.5, 3.0& 3.5%), sumithion (2.0, 2.4, 2.8,3.2 ,3.6 , and 4.0 %) and machet (1.5, 2.0, 2.6, 3.2, 3.8and 4.4%) . Two grams of each bait were spread on the bottom of the glass vessel and exposed to five individuals from adult snails of each species and closed with muslin cloth (Abdel- Karim- Nehmedo, 2000) .

Five replicates were prepared for each treatment plus another one left without pesticides treatment to be used as a check control . Mortality

percentages were counted after 72 hours (El – Deeb *et al* , 2003) and corrected using Abbott's formula (Abbott, 1925) . The LC₅₀ values were estimated as adopted by finney (1971) .

RESULTS AND DISCUSSION.

Data in table (1 & 2) revealed that , on the base of LC₅₀ value , bindiocarb proved to be the most toxic one for the three tested snail species either when it was used as contact or by bait technique . The three tested pesticides toxicity as contact or bait could be descendingly arranged as follows : bindiocarb > sumithion > machet . The corresponding LC₅₀'s values when applied as contact or bait technique were 1.12 & 2.26 , 1.77 & 2.53 and 1.87 & 3.17 & , respectively. Sumithion came in the second order recording LC₅₀'s values of 1.91 & 3.57 , 2.31 & 3.66 and 2.47 & 3.80 % , respectively. On the other hand , snail of the three tested species exhibited a comparably high tolerance for machet as LC₅₀'s values were 3.19 & 3.48 , 3.69 & 3.64 and 4.08 & 4.18 % for the two methods of application , respectively. Also, the present results show that *M. obstructa*, snails were comparatively sensitive for the three tested compounds than *T. pisana* ; while *E.vermiculata* was the highest tolerant. Contact technique was more effective than bait technique.

Table (1) : LC50's Values of bindiocarb, sumithion and machet against the three land snail species , using contact technique under laboratory conditions.

| Pesticides | Tested snails | LC ₅₀ % | 95 % fiducial limits | | Slope |
|------------|-----------------------|-----------------------|----------------------|-------|-------|
| | | | Lower | Upper | |
| Bindiocarb | <i>M. obstructa</i> | 1.12 | 0.71 | 1.58 | 2.79 |
| | <i>T. pisana</i> | 1.77 | 1.44 | 2.47 | 2.99 |
| | <i>E. vermiculata</i> | 1.87 | 1.48 | 2.23 | 4.76 |
| Sumithion | <i>M. obstructa</i> | 1.91 | 1.40 | 2.95 | 2.58 |
| | <i>T. pisana</i> | 2.31 | 2.17 | 2.48 | 4.63 |
| | <i>E. vermiculata</i> | 2.47 | 2.08 | 3.77 | 4.42 |
| Machet | <i>M. obstructa</i> | 3.19 | 2.95 | 3.50 | 3.49 |
| | <i>T. pisana</i> | 3.69 | 3.41 | 4.07 | 4.08 |
| | <i>E. vermiculata</i> | 4.08 | 3.68 | 4.74 | 3.35 |

Mohamed and Hamdy (1991) studied the side effects of three carbamate and five synthetic pyrethroids insecticides on the non-target terrestrial, snail *Eobania vermiculata*. They found that thiodicarb, methomyl and cypermethrin were the most potent candidates, displaying LT₅₀ 's of 1.23, 1.28 and 2.58 days, respectively, whereas deltamethrin and permethrin were the least effective compounds against the snails, when compared with other tested compounds. A possible explanation based on the structure-activity relationship of these compounds has been given, and Asran, Fawkyia (2001) who showed that the copper sulfate, sumithion, sethoxydim and thiophanate – methyl against adult stage of three land snail species ; *M. obstructa*, *T. pisana* and *E. vermiculata* were studied under laboratory

conditions using residue film and leaf – dipping technique. Copper sulfate proved to be the most toxic one for the three tested snails. The LC₅₀'s were of 0.44 & 1.37 ; 0.68 & 1.52 and 0.77 & 1.72 % while thiophanate – methyl gave the lowest efficacy LC₅₀'s 2.46 & 3.15 , 2.70 & 3.69 and 3.04 & 3.71 % for the three tested snail species as residue film and leaf – dipping technique, respectively , and *M. obstructa*, was the most sensitive ; while *E. vermiculata* was the highest tolerant .

Table (2) : LC₅₀'s Values of bindiocarb, sumithion and machet against the three land snail species , using bait technique under laboratory conditions.

| Pesticides | Tested snails | LC ₅₀ % | 95 % fiducial limits | | Slope |
|------------|-----------------------|-----------------------|----------------------|-------|-------|
| | | | Lower | Upper | |
| Biodiocarb | <i>M. obstructa</i> | 2.26 | 2.13 | 2.37 | 7.37 |
| | <i>T. pisana</i> | 2.53 | 2.32 | 2.64 | 9.94 |
| | <i>E. vermiculata</i> | 3.17 | 3.04 | 3.35 | 8.21 |
| Sumithion | <i>M. obstructa</i> | 3.57 | 3.45 | 3.71 | 9.26 |
| | <i>T. pisana</i> | 3.66 | 3.53 | 3.84 | 8.45 |
| | <i>E. vermiculata</i> | 3.80 | 3.65 | 4.06 | 8.57 |
| Machet | <i>M. obstructa</i> | 3.48 | 3.34 | 3.63 | 7.49 |
| | <i>T. pisana</i> | 3.64 | 3.50 | 3.79 | 8.06 |
| | <i>E. vermiculata</i> | 4.18 | 3.98 | 4.51 | 7.53 |

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دراسات معملية على التأثير السام للبندوكارب والسوميثون والماشيت على ثلاث أنواع من القواقع الأرضية .

مها فؤاد محمود – فاطمة كامل خضر – إبراهيم قطب إبراهيم – أحمد محمود سليمان
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اجريت دراسة معملية لتقييم فعالية بعض المبيدات مثل البندوكارب والسوميثون

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ثلاث أنواع من القواقع الأرضية وهي قوقع البرسيم الزجاجى *M. obstructa* وقوقع الحدائق الأبيض *T. pisana* وقوقع الحدائق البنى ذو الشقة *E.vermiculata* وذلك بطريقتين هما الملامسة والطعوم . أكدت النتائج على أن طريقة الملامسة للمبيد كانت أكثر فعالية عن طريقة الطعوم . وأظهرت النتائج أن البندوكارب كان أكثر هذه المركبات فعالية سواء بطريقة الملامسة أو الطعوم وكانت قيم التركيز النصف مميت (١,١٢ ، ٢,٢٦) ، (١,٧٧ ، ٢,٥٣) ، (١,٨٧ ، ٣,١٧) لكل من القواقع الثلاثة بطريقتي الملامسة والطعوم على التوالي ويليه مبيد السوميثون حيث كانت قيم التركيز النصف مميت (١,٩١ ، ٣,٥٧) ، (٢,٣١ ، ٣,٦٦) ، (٢,٤٧ ، ٣,٨٠) لنفس القواقع السابقة بطريقتي الملامسة والطعوم على التوالي أما مبيد الماشيت فكان أقلهم تأثير على القواقع الأرضية المستخدمة حيث كانت قيم التركيز النصف مميت (٣,١٩ ، ٣,٤٨) ، (٣,٦٩ ، ٣,٦٤) ، (٣,٠٨ ، ٤,١٨) لنفس القواقع على التوالي ، وكان قوقع البرسيم الزجاجى *M. obstructa* أكثر حساسية لهذه المبيدات من القواقع الأخرين وكان قوقع الحدائق البنى *E.vermiculata* أكثر احتمالا .