EFFECT OF SPINOSAD BIOCIDE AS A BAIT AND CONTACT APPLICATIONS AGAINST THREE LAND SNAIL SPECIES

GABR, W.M., FATMA K.KHIDR AND A.S. YOUSSEF

Plant Protection Research Institute, ARC, Egypt

(Manuscript received 23 November 2005)

Abstract

The molluscicidal effect of Spinosad biocide 240 Sc was evaluated as a bait or contact against three land snail species i.e. *Monacha obstructa*, *Eobania vermiculata* and *Theba pisana* under laboratory and field conditions. Laboratory results showed that the tested compound when used as a bait proved more toxic to *Theba pisana* followed by *Monacha obstructa* and *Eobania vermiculata*. But when it was used as a contact, *Eobania vermiculata* was the most susceptible species to Spinosad followed by *Monacha obstructa* while *Theba pisana* was more tolerant. The field applications were in harmony with those obtained by laboratory trails as Spinosad bait was most efficient against *Theba pisana* followed by *Monacha obstructa* and *Eobania vermiculata* but when it was applied as a spray, *Eobania vermiculata* was more susceptible than *Monacha obstructa* while *Theba pisana* was the least effecttive.

INTRODUCTION

The terrestrial snails became an economic serious pest in Egypt during the last few years (Khidr *et al.,* 2005). Land snails attack the different kinds of plants e.g. cereal, vegetables, orchard trees and ornamental plants at the different growth stages and reducing their yield (El-Okda, 1980). They attract the attention because of the serious economic damage they do especially in horticulture and ornamental plants (Godan, 1983). These animal pests were controlled by different chemical compounds that cause many serious problems as environmental pollution in addition to the toxic effects to non-target organisms.

The present work was carried out to study the molluscicidal effect of the natural compound i.e. Spinosad biocide when used as a bait or spray against three land snail species i.e. the glassy clover snail, *Monacha obstructa*, brown garden snail, *Eobania vermiculata* and white garden snail, *Theba pisana.* They are the most common and harmful snail species in Egypt to the majority of the planted crops.

MATERIALS AND METHODS

1- Tested Compound

Spinosad biocide 240 Sc produced by the soil microorganism actinomycete, *Saccharopolyspora spinosa* was used in the present study. It was supplied by Dow Agro Scinences Company, Egypt.

2- Tested animals

Three species of land snails i.e. glassy clover snail, *Monacha obstructa,* brown garden snail, *Eobania vermiculata* and white garden snail, *Theba pisana* were used. The experimental snails were collected from the infested fields of Egyptian clover, orchard trees and ornamental plants, respectively at El-Shamarika village, Sakha district, Kafr El-Sheikh governorate. The collected animals were transferred to the laboratory, kept in glass boxes and fed on fresh lectuce leaves (El-Deeb *et al,* 2003). Forty adult animals of each species were divided into four replicates (each of 10 animals) for each test.

3- Laboratory Experiments

3-1- Baiting Technique

The toxic effect of the tested compound was evaluated as a poison bait. Different concentrations i.e. 1.5, 2.0, 2.5 and 3.0% of spinosad were prepared. The poison bait was prepared by mixing each concentration with 93% bran and 5% molasses (Ghamry *et al,* 1993). Five grams of poison bait were put on a plastic sheet placed on the surface of the soil inside each box. The investigated animals were exposed to the candidate concentration. A control test (untreated check) was conducted parallel with plain carriers. Mortality was recorded during the period of 72 hours after treatment and LC_{50} was determined according to Finney (1971).

3-2- Contact Technique

Thin layer film technique was used according to Ascher and Mirian (1981), whereas the tested concentrations 0.5, 1.0, 1.5 and 2.0% of Spinosad were applied in Petre-dishes using water. Two ml of each concentration of the tested compound were spread on inner surface of a Petre-dish by moving the dish gently in circles. Water was evaporated under room conditions in a few minutes leaving a thin layer film of the applied concentration of the tested compound. Snails were exposed to the candidate concentrations for 72h. A parallel control test was carried out using water only. The dead animals were daily counted and removed. The corrected mortality and LC_{50} were estimated.

4- Field Experiments

Field performance of Spinosad biocide was evaluated as a poison bait and spray against the three tested species of land snails at El-Shamarika village, Sakha district, Kafr El-Sheikh governorate.

4-1- Baiting Application

The poison bait of Spinosad was prepared by mixing 2 parts of Spinosad with 93 parts of bran and 5 parts of molasses. Three infested areas were chosen (each of one feddan) the first infested with *M. obstructa* and the second infested by *E. vermiculata* and the third area infested with *T. pisana.* Another area was left without treatment as a control. The poison bait was distributed on plastic trays (100 g for each one). The population of snails were counted daily in quadrate area (1 x 1 meter) and the population reduction percentages were recorded after 7 days post-treatment (El-Okda, 1984).

4-2- Spray Application

Spinosad biocide was tested as a spray against the three tested land snail species. The tested areas were chosen by the same technique mentioned above. The tested compound was applied as a spray at rate of 2% (20 ml/L) on plants using hand sprayer (Gabr *et al.,* 2005). The population reduction percentage of snails was recorded after 7 days post-treatment (El-Okda, 1984).

RESULTS AND DISCUSSION

1- Laboratory Tests

Data in Table (1) show the efficacy of Spinosad biocide when used as a bait against the three land snail species *Monacha obstructa*, *Eobania vermiculata* and *Theba pisana*. Results showed that mortality percentage increased gradually with increasing the compound concentration for the three tested snail species. The tested concentrations 1.5, 2.0, 2.5 and 3.0 % caused 6.3, 12.5, 18.8 and 37.5 % mortality for *M. obstructa*, 0.0, 6.3, 12.5 and 25.0 % for *E. vermiculata* and 18.8, 25, 31.3 and 43.8% for *T. pisana*, respectively. Based on LC_{50} values, *T. pisana* proved the most susceptible species followed by *M. obstructa* and *E. vermiculata* showing 3.72, 3.79 and 3.87 %, respectively.

Table (2) revealed the toxic effect of Spinosad biocide when used as a contact (thin film) against the three tested snail species. Data indicate that mortality percentage increased with increasing the compound concentration. Spinosad was more toxic to *E. vermiculata* as 2 % concentration gave 50 % mortality in comparison with 25 and 18.8 % mortality for *M. obstructa* and *T. pisana* , respectively. The LC_{50} values were 1.83, 4.78 and 5.84 % for the three land snail species, respectively. As a

general trend *E. vermiculata* proved to be the most susceptible while *T. pisana* was the most tolerant one. Recently, Gabr *et al.* (2005) found that LC_{50} of Vertimec biocide was 1.9 and 2.7 % for*M. obstructa* and *E. vermiculata* when used as a bait while it was 2.1 and 2.7 % when used as a contact for the two species, respectively. Zidan *et al* (2001) recorded that LC_{50} of Neem plant extract was 71.2 and 84.0 ppm for *M. obstructa* and *E. vermiculata*, consecutively.

Reviewing the aforementioned data, it is obvious that there are different susceptibility levels between the three tested snail species for the tested compound according to the method of application (bait or contact).

2- Field Evaluation

Data in Table (3) showed the comparative effect of Spinosad biocide when applied as a bait against the three land snail species under the field conditions. Results indicate that the tested compound achieve the highest population reduction percentage for *Thiba pisana* showing 59.3 % while it induced 39.1% for *Monacha obstructa* . The lowest effect was 30.1% in case of *Eobania vermiculata*.

Table (4) show the field performance of Spinosad biocide when applied as a spray against the three tested land snail species. Data indicate that Spinosad was more efficient against *E. vermiculata* than the other two species whereas it caused 27.5 % population reduction for *Eobania sp.* while it achieve 16.3 and 11.4 % reduction only in case of *M. obstructa* and *Thiba pisana*, respectively. The field performance of Spinosad was relatively weak when used as a spray compared with bait treatment. Also, the field results were in harmony with those which obtained by laboratory trails. Similar results were obtained by Gabr *et al.* (2005).

Form the previous results, it could be concluded that the susceptibility level of the three species of land snail differed for Spinosad biocide according to the method of application (bait or spray). These differences in the sensitivity levels may be attribute to the physiological state of the snail which changes from species to another. Godan (1983) mentioned that the phases of greater or lesser sensitivity are differ form species to another with shorter or longer life spans, but the general pattern of changing susceptibility was attributed with physiological conditions. Therefore, definition the snail species is very important for land snail control.

Table 1 . Effect of Spinosad biocide as a bait against three land snail species

% Concentration	*Monacha obstructa*		*Eobania vermiculata*		*Theba pisana*	
	% Mortality	LC_{50} ppm.	% Mortality	LC_{50} ppm.	% Mortality	LC_{50} ppm.
1.5	6.3	3.79	0.0	3.87	18.8	3.72
2.0	12.5		6.3		25.0	
2.5	18.8		12.5		31.3	
3.0	37.5		25.0		43.8	
L.S.D.	23.2					

Table 2 . Effect of Spinosad biocide as a contact against three land snail species

% Concentration	*Monacha obstructa*		*Eobania vermiculata*		*Theba pisana*	
	% Mortality	LC_{50} ppm.	% Mortality	LC_{50} ppm.	% Mortality	LC_{50} ppm.
0.5	0.0	4.78	18.8	1.83	0.0	5.84
1.0	6.3		31.3		6.3	
1.5	18.8		37.3		12.5	
2.0	25.0		50.0		18.8	
L.S.D.	25.5					

Table 3 . Efficacy of Spinosad biocide as a bait against three land snail species under field conditions.

Land snail species	No. animals before treatment	No. alive animals after treatment	% Population reduction	L.S.D.
Monacha obstructa	156	95	39.1	12.8
Eobania vermiculata	196	137	30.1	
Theba pisana	177	72	59.3	

Table 4 . Efficacy of Spinosad biocide as a spray against three land snail species under field conditions.

Land snail species	No. animals before treatment	No. alive animals after treatment	% Population reduction	L.S.D.
Monacha obstructa	166	139	16.3	19.4
Eobania vermiculata	138	100	27.5	
Theba pisana	123	109	11.4	

REFERENCES

1. Ascher, R.S. and F. Mirian. 1981. The residual contact toxicity of Bay Sir 8514 to *Spodopetra littoralis* larva. Phytoparasitica., 9 (2) : 133-137.

2. El-Deeb, H.I., E.A. Eweis, M.A. Kandil, W.M. Gabr and Soha A. Mobarak. 2003. Toxicity and biochemical studies of Methomyl and Diazinon on different ages of the land gastropod species *Monacha obstructa*. J. Agric. Sci. Mansoura Univ. 28 (9) : 7011-7023.

3. El-Okda, M.K. 1980. Land snails economic importance on vegetable crops at Alexandria and neighboring regions. J. Agric. Res. Rev., 58 (1) : 79-86.

4. El-Okda, M.K. 1984. Land snails infestation and chemical control in El-Ismaelia governorate. J. Agric. Res. Rev., 62 (1) : 87-91.

5. Finney, D.J. 1971. Probit analysis. 3rd Ed., Cambrige Univ. Press, London.

6. Gabr, W.M., A.S. Youssef and Fatma K. Khidr. 2005. Molluscicidal effect of certain compounds against two land snail species, *Monacha obstructa* and *Eobania vermiculata* under laboratory and field conditions. Egypt. J. Agric. Res. (In Press).

7. Ghamry, E.M., H.I. El-Deeb and S.M. Abd El All. 1993. Efficacy of certain pesticides against some land snails under field conditions of Sharkia Governorate. Egypt. J. Appl. Sci., 8 (6) : 764-774.

8. Godan, D. 1983. Pest slugs and snails, biology and control. Springer-Verlg Berlin Heidelberg. New. York.

9. Khidr, F.K., W.M. Gabr, A.S. Youssef and S.S. Hussien. 2005. Biochemical effects of two natural pesticides on the brown garden snail *Eobania vermiculata*. Egypt. J. Agric. Res. (In Press).

10. Zidan, Z.H., H.I. El-Deeb, Sobeiha A.K., Setaita H.A., Fawkia D.A. and Maha F.M. 2001. Molluscicidal and antifeedant effect of certain plant extracts against land snails *Monacha contiana* and *Eobania vermiculata* under laboratory conditions. J. Agric. Sci. Mansoura Univ., 26 (2) : 1161-1167.

تأثير المبيد الحيوي سباينوساد كطعم و بالملامسة ضد ثلاثة أنواع من القواقع الأرضية

وحيد محمد جبر ، فاطمة كامل خضر ، عبد النبي سند يوسف

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – جيزة

تم تقييم تأثير المبيد الحيوي سباينوساد كطعم و بالملامسة ضد ثلاثة أنواع من القواقع هي قوقع البرسيم الزجاجي *Monacha obstructa* وقوقع الحدائق البني *Eobania vermiculata* وقوقع الحدائق الأبيض *Theba pisana* تحت الظروف المعملية والحقلية. وأظهرت النتائج المعملية أن المبيد المختبر عند إستخدامه كطعم كان أكثر سمية لقوقع الحدائق الأبيض يليه قوقع البرسيم الزجاجي ثم قوقع الحدائق البني ، ولكن عند إستخدامه بالملامسة كان قوقع الحدائق البني هو الأكثر حساسية للمركب يليه قوقع البرسيم الزجاجي بينما كان قوقع الحدائق الأبيض الأكثر تحملاً للمركب. وقد توافقت النتائج الحقلية مع النتائج المعملية حيث كان سباينوساد عند إستخدامه كطعم أعلي كفاءة ضد قوقع الحدائق الأبيض يليه قوقع البرسيم الزجاجي ثم قوقع الحدائق البني ولكن عند إستخدامه رشاً علي النباتات كان قوقع الحدائق البني هو الأكثر حساسية يليه قوقع البرسيم الزجاجي وأخيراً قوقع الحدائق الأبيض.