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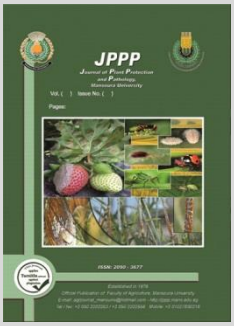
Controlling the Chocolate Banded Snail, *Eobania vermiculata* by Using some Insecticides at Minia Governrate, Egypt

Ali, A. M.; A. S. M. H. El Roby* and H. M. Hassan

Plant Protection Department, Faculty of Agriculture, Minia University, Minia, Egypt.



ABSTRACT

The initial mortality of the tested insecticides showed significant superiority of methomyl, abamectin, and thiamethoxam in their effect against *Eobania vermiculata* wich causing 100% snail mortality and 100% reduction in food consumed by this snail. Acetamiprid SP, azadirachtin and imidacloprid recorded 95.74, 87.23, and 87.23% reduction in food consumption and acute mortality 90, 85, and 80%, respectively. While as acetamiprid SL, amitraz and the mixture of pymetrozine 50% + cyantraniliprole10% gave the least effect in their initial effect and food consumption (70, 65 and 60 % initial mortality % and.74.76, 55.3 and 55.31% in food consumption respectively). The residual effect of the tested insecticides on, *E. vermiculata* after three days from the field treatment showed also the superiority of methomyl, abamectin, thiamethoxam, and acetamiprid SP in their effects against *E. vermiculata* causing mortality of 90, 90, 85, and 85 % and highly reduction % in food consumption as compared with control treatment gave 96.07, 96.07, 92.15 and 96.07 reduction %, respectively followed by azadirachtin, imidacloprid and acetamiprid SL that recorded mortality 75, 70 and 65 %, respectively while amitraz and the mixture of (pymetrozine50%+ cyantraniliprole 10% recorded 50 and 45 % mortality. The residual effect after seven days was in descending order as follows 85, 85, 80, 75, 70, 65, 55, 40, and 37 % with methomyl, abamectin, acetamiprid SP, thiamethoxam, azadirachtin, imidacloprid, acetamiprid SL, amitraz and the mixture of pymetrozine50%+ cyantraniliprole 10%), respectively. From these results, it could be concluded that these insecticides can give excellent protection against the chocolate banded snail, *E. vermiculata.*

***Keywords*:** Chocolate banded snail, *Eobania vermiculata*, Food consumption, Field treatments, Residual effect.

INTRODUCTION

Land snails consider serious pests attacking the vegetable, horticultural plants, and field crops all over Egypt. Among the most serious land snails, the chocolate banded snail, *E. vermiculata*, belongs to the family Helicidae and is distributed worldwide especially in the Mediterranean area (El-Okda, 1983, Singh *et al*., 2015, Radwan *et al*., 2008, Kandil *et al*.2020). It damages most vegetables and ornamental plants. Some studies for testing the effect of certain pesticides on snails had been done (Crue *et al*, 1997,). The chemical control of pest snails through the application of pesticides is still the most effective approach, particularly over large areas. The use of methomyl is common for the land snail control. (Kidd and James, 1991, and Khalil, 2016). In Egypt, other trails for testing insecticides for controlling of snails were carried out (El-Bolkiny *et al*., 2000; Heiba *et al*., 2002; Radwan *et al*., 2008; Essawy *et al*. 2009; Al-Sarar, *et al*. 2012; Abdallah, *et al*., 2015; Shaker *et al*., 2015; Hussein and Sabry, 2019). The aim of this research was conducted for testing certain insecticides (which privously used to control tomato pests in the Ministry of Agriculture program) against the chocolate banded snails, *E. vermiculata*, under Minia Governrate conditions.

MATERIALS AND METHODS

A homogeneous population of *E. vermiculata* was collected manually from an untreated ornamental plant nursery located in the Faculty of Agriculture, Minia University in the summer of 2019. Homogeneous snails were homogenous (24.5 ± 0.46 mm in shell length and 2.74 ± 0.22 g in body weight), was transferred in plastic bags to the laboratory and maintained under laboratory conditions (22 ± 2 ºC and a light, dark photoperiod of 12:12 h) in plastic boxes (40 10 cm) filled with moist sterilized sandy loamy soil 1:1 (v: v) and fed on fresh leaves of lettuce for 10 days for acclimatization. They were identified according to the key given by Goden (1983). Tomato, *Lycopersicon esculentum* (cv. Super jackal) planted in the Faculty of Agriculture farm was sprayed by the tested insecticides. Field applications by different insecticides repeated in four plots. Each plot (21 m^2) was served as a replicate. Twenty-five leaves were taken randomly from each plot and transferred to the laboratory after treatment (0.0 time, three, and seven days' post-treatment). Five snails from each tested size maintained in the laboratory were put in a Jar (1000 cm) as a replicate. The jars covered with pore covers and examined after 24 hrs. Corrected mortality was determined according to Abbot's formula (Abbot, 1925). The reduction in food consumption was determined according to the following equation

$$\text{Reduction \% of food consumption} = \frac{\text{Weight food consumed in control} - \text{weight food consumed in treatment}}{\text{Weight food consumed in control}} \text{X100}$$

All the field and laboratory experiments were replicated twice during 2019 season.

* **Corresponding author.**
E-mail address: elrobyahmed1980@Gmail.com
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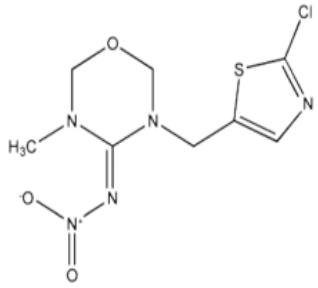
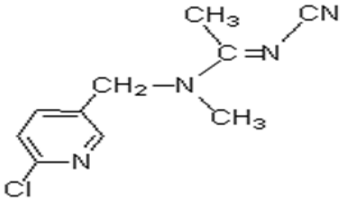
Tested insecticides: -

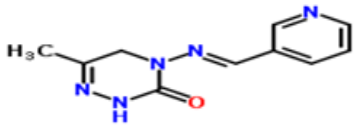
1-thiomethoxam25% WDG



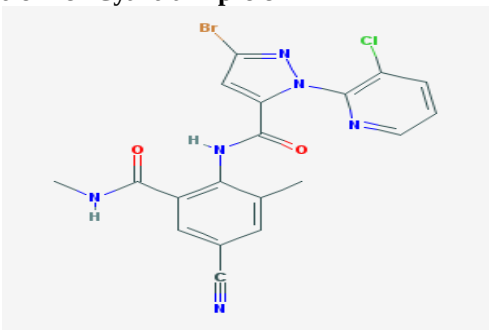
2-acetamiprid SP 20% **3-acetamiprid SL 20%**



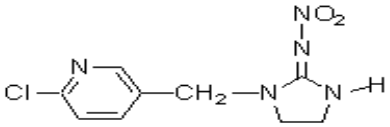
4- pymetrozine 50% +cyantraniliprole 10% WG 60%



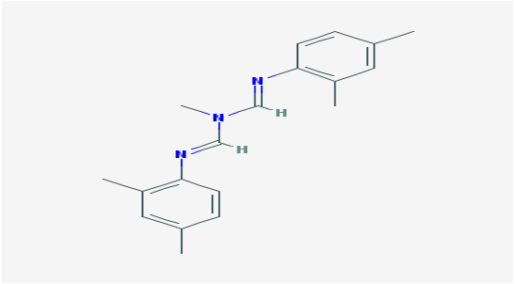
5- pymetrozine+ Cyantraniliprole



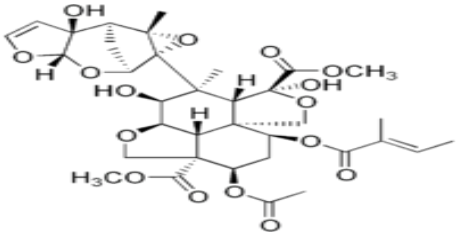
5-imidacloprid SC 35%



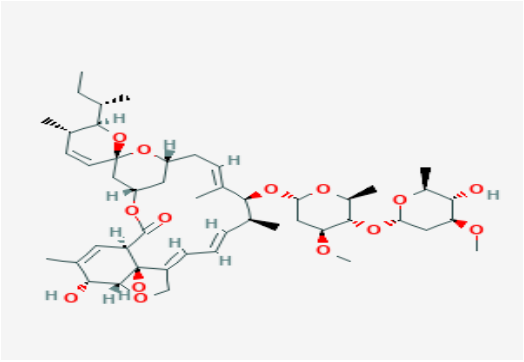
6- amitraz EC 20%



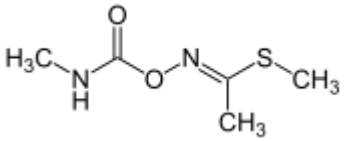
7-azadirachtin 4.5% EC



8-abamectin



9- methomyl SP 90%



RESULTS AND DISCUSSION

The initial mortality % of the tested insecticides against *Eobania vermiculata* and the reduction % in food consumption after 24 hr post treatment are shown in Table (1). Results showed significant superior of methomyl SP 90%, abamectin, and thiamethoxam WDG 25% against *E. vermiculata* causing 100% mortality and 100% reduction in food consumption. This result agrees with the finding of Radwan *et al.* (2008) who stated that Lannate exhibited a greater efficacy against *E. vermiculata*. Also, these results similar with results of (Radwan *et al.*, 1992) who found that carbamate compounds lead to a significant elevation of the activity of (AST and ALT) enzymes when applied against the land snail *Theba pisana*. Thus, the deviation of both enzymes' activities out of the normal range could lead to biochemical impairment and lesions of the tissues and cellular functions of the snails.

On the other hand, thiamethoxam belongs to Neo-nicotinoids with widespread use in crop protection. The neonicotinoid insecticides include imidacloprid, acetamiprid, thiamethoxam, clothianidin, and dinotefuran, They have a relatively low risk for non-target organisms and the environment and high-target specificity to pests. neonicotinoid compounds are highly specific for subtypes of nicotinic receptors that occur in arthropods and snails (Zhurov *et al.*, 2008). The neonicotinoids do not readily pass the blood-brain barrier, further reducing the potential for mammalian toxicity. The neonicotinoids act on postsynaptic

nicotinic receptors. Also from the same group, acetamiprid SP 20%, and imidacloprid SC35%, recorded mortality of 90, and 80% and reduction in consumed food 95.74and 87.23%, respectively.

Mean while, azadirachtin showed the highest potency gave 85% initial mortality after 24 hours and 87.23% reduction in food consumption. As reported in previous studies, azadirachtin was a feeding deterrent that does not kill the test organism directly but inhibits feeding, the test organism then possibly dying through starvation (Hassan, *et al*., 2010; Hasan and Ansari, 2011). Neem extracts were significantly effective against golden apple snail however, neem works as a systemic pesticide that is absorbed into the plant and penetrated throughout the tissues to be ingested by snails when they feed on the plant (Senthil-Nathan *et al.*, 2007). Azadirachtin reported as antifeedant, repellant, and growth disrupting against many insect pests (Sinha *et al*, 1999). Morever, the evaluation of the insecticidal efficiency of azadirachtin was carried out mostly on insects and there are only a few works against the snail species. Ploomi *et al.*, (2009), Massaguni, and Latip, (2012), evaluated the molluscicidal toxicity of aqueous neem seed and leaves extract and showed that the small size of golden apple snail was susceptible to the treatment than the large size of a snail. In the same time, least initial effect was observed in the treatments of acetamiprid SL 20%, amitraz EC 20%, and the mixture of (pymnetrozine 50% + cyantraniliprole 10% WG 60%).(Table, 1).

The residual effect of the tested insecticides on chocolate banded snails, *Eobania vermiculata* mortality, and reduction in food consumption of tomato leaves under laboratory conditions after three days from the field treatment are shown in Table (2). It was also obvious significant superiority of methomyl SP 90%, abamectin, thiamethoxam WDG 25%, and acetamiprid SP 20% against *E. vermiculata* causing mortality of 90, 90, 85 and 85 %, and reduction % in food intake was.96.07, 96.07, 92.15 and 96.07, respectively followed by azadirachtin EC 4.5%, imidacloprid SC 35 % and acetamiprid SL 20% that recorded mortality of 75, 70 and 65 % and reduction % in food consumption of 82.35, 80.39 and 68.62%, respectively. While as amitraz EC 20% and (pymetrozine50%+ cyantraniliprole 10% WDG 35 %) recorded the least residual effect after 3 days post treatments causing 50 and 45 % mortality and also the least reduction % in food consumption recorded 39.21 and 37.25, 5 respectively. These results showed that amitraz EC 20% and the mixture of (pymetrozine50%+ cyantraniliprole 10% WDG 35 %) when applicate to control tomato pests cannot give protection to the crop tomatoes against *E. vermiculata* while methomyl SP 90%, abamectin, thiamethoxam, WDG 25%, azadirachtin EC 4.5%, imidacloprid SC 35 % and acetamiprid SL 20% can give good protection when applied on tomato crop to control insect or mites as well snails of *E. vermiculata.* These results agree with the finding of (Radwan *et al.*, 2008) who stated that methomyl exhibited a greater efficacy against *E. vermiculata*. On the other hand, Hussein and Sabry, 2019, found that the chocolate banded snail, *E. vermiculata* was affected by methyloxamyl, acetamiprid, and lambda-cyhalothrin pesticides. Also, all tested pesticides considered insecticides and miticides can be used as molluscicides successfully.

Data in Table (3) cleared the residual effect of the tested insecticides after seven days from application against *E. vermiculata*. The recorded mortalities percentages were in descending order as follows 85, 85, 80, 75, 70, 65, 55, 40 and 37 % by using methomyl SP 90%, abamectin EC 1.8 %, acetamiprid SP 20%, thiamethoxam WDG, azadirachtin EC 4.5%, imidacloprid SC 35%, acetamiprid SL 20%, amitraz EC 20% and (pymetrozine50%+ cyantraniliprole 10% WDG 35 %), respectively. On the other hand, it was obvious the reduction % in the food consumption with *E. vermiculata* exposed to tomato leaves after seven days from the field treatment recording, 85.71, 85.71, 83.92, 83.92, 76.78, 71.42, 60.71, 37.5 and 30.35%with the previously mentioned insecticides, Moreover, the previous studies confirmed that abamectin was more effective against the chocolate snail (Essawy *et al.* 2009; Abdallah *et al.* 2015 and Hemmaid *et al.* 2017).From this study, it could be concluded that methomyl, abamectin, acetamiprid SP, thiamethoxam, and azadirachtin which used in the program of the Egyptian Ministery of Agriculture to control tomato pests in Egypt with the same dose can give good protection from the chocolate banded snail, *E. vermiculata*

Table 1. Initial effect of certain insecticides on the snail, *E. vermiculata* mortality and Reduction % in food consumption under laboratory conditions after 24 hr post-treatment.

The tested insecticides (Common name)	Rate of field application	Average food weight (leave weights) / replicate before exposure	Food weight after 24 hr after application	Aveg. food consumption g/replicate	Reduction % in food consumption after 24 hr of application	Initial mortality
acetamipridSP 20%	25 g. / 100L.	5.76	5.74	0.02	95.74b	90.00 b
thiomethoxam WDG 25%	200g/fed.	4.26	4.26	0.00	100.00a	100.00a
azadirachtin EC.5%	75 ml/ 100L.	5.91	5.85	0.06	87.23bc	85.00bc
acetamiprid SL 20%	240ml/ Fed	4.47	4.35	0.12	74.76c	70.00d
imidaclopridSC35%	75 ml/100 L.	4.84	4.78	0.06	87.23c	80.00 c
amitraz EC 20%	750 ml/ Fed.	3.55	3.34	0.21	55.31d	65.00 de
pymetrozine+ Cyantraniliprol WG 60%	170 g/Fed	4.31	4.10	0.21	55.31d	6000e
abamectin	30 ml / 100L.	4.32	4.32	0.00	100.00a	100 .00a
methomyl SP 90%	300g/ fed.	4.20	4.20	0.00	100.00a	100.00 a
Control		4.00	3.53	0.47	0.00	0.00

In each column the percentages of mortality or reduction followed by the same letters are not significantly differences according to Duncans test (Duncan, 1955).

Table 2. Effect of certain insecticides on the snail, *Eobania vermiculata* mortality and their effect on reduction % in food consumption of tomato leaves under laboratory conditions after three days post- treatment

The tested insecticides (Common name)	Rate of field application	Average food weight (leave weights) /g/ replicate) before exposure	Food weight after24 hr from exposure g/replicate	food consumption g./ replicate	% reduction in food consumption	Corrected Mortality % Corrected
acetamipridSP 20%	25 g. / 100L.	5.68 g	5.64	0.04	92.15a	85 a
thiomethoxam WDG 25%	200 g/feddan	4.72 g	4.70	0.02	96.07a	85 a
azadirachtin EC 4.5%	75 ml/ 100L.	5.60 g	5.51	0.09	82.35b	75 b
acetamiprid SL 20%	240ml/ feddan	4.70 g	4.54	0.16	68.62c	65 c
imidaclopridSC 35%	75 ml/100 L.	4.37 g	4.27	0.10	80.39b	70bc
amitraz EC 20%	750 ml/ feddan	4.14 g	3.83	0.31	39.21d	50 d
pymetrozine+ cyantraniliprol WG 60%	170 g/feddan	4.85	4.53	0.32	37.25d	45 d
abamectin	30 ml / 100L.	4.64	4.62	0.02	96.07a	90 a
methomyl SP 90%	300g/ feddan	4.93	4.93	0.02	96.07a	90 a
Control	-	4.2 g	3.69	0.51	0.0	0.0

Mortality or reduction percentages followed by the same letters are not-significantly differences according to Duncan's test (Duncan, 1955).

Table 3. Effect of certain insecticides on the snail, *Eobania vermiculata* mortality and their effect on reduction % in food consumption of tomato leaves under laboratory conditions after seven days from the field application

The tested insecticides (Common name)	Rate of field application	Average food weight (leave weights) /g/ replicate) before exposure	Food weight after24 hrfrom exposure g/replicate	food consumption g./ replicate	% reduction in food consumption after seven days	Corrected Mortality % Corrected
acetamipridSP 20%	25 g. / 100L.	4.64	4.56	0.09	83.92a	80c
thiomethoxam WDG 25%	200g/fed.	5.30	5.21	0.09	83.92a	75ac
azadirachtin EC 4.5%	75 ml/ 100L.	5.38	5.25	0.13	76.78b	70ab
acetamiprid SL 20%	240ml/ fed.	4.92	4.70	0.22	60.71c	55d
imidaclopridSC 35%	75 ml/100 L.	4.73	4.57	0.16	71.42b	65e
amitraz EC 20%	750 ml/ fed.	4.90	3.90	0.35	37.5d	40f
pymetrozine+ cyantraniliprol WG 60%	170 g/fed.	4.25	4.51	0.39	30.35d	37f
Abamectin???	30 ml / 100L.	5.00	4.02	0.08	85.71a	85cg
methomyl SP 90%	300g/ fed.	4.82	4.74	0.08	85.71a	85cg
Control		4.70	4.14	0.56	00.00	0.0

Mortality or reduction percentages followed by the same letters are not-significantly differences according to Duncan's test (Duncan, 1955).

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مكافحة قوقع إيبونيا فيرميكيولاتا باستخدام بعض المبيدات الحشرية تحت ظروف محافظة المنيا_مصر

على مصطفى على، أحمد صلاح محمد حسين الروبى* و حسن محمد حسن

قسم وقاية النبات ، كلية الزراعة ، جامعة المنيا

أوضحت نتائج التغذية على أوراق الطماطم بعد معاملتها مباشرة أظهر بعض المبيدات تأثيرا فوريا وتفوقًا كبيرًا مثل الميثوميل والأبامكتين والثيوميثوكسام ضد *E. vermiculata* حيث تسببت في موت القوقع بنسبة 100 ٪ وانخفاض في نسبة الغذاء الذي تستهلكه القواقع. سجل الأسيتاميبريد SP والأزاديراكتين وإيميداكلوبريد انخفاضاً بنسبة 95.74 و 87.23 و 87.23٪ في استهلاك الغذاء ونسب موت تصل إلي90 و 85 و 80٪ على التوالي. في حين أن الأسيتاميبريد SL ، فإن الأميتراز وخليط من البيميتروزين 50 ٪ + سيانترانيليبرول 10 ٪ اظهروا أقل تأثير في تأثيرهم الأولي ونسبة الخفض في استهلاكهم الغذائي ، (70 و 65 و 60 ٪ من القتل الأولي ٪ و 74.76.55.3 و 55.31٪ على التوالي). أظهر التأثير المتبقي للمبيدات الحشرية التي تم اختبارها على *E. vermiculata* بعد ثلاثة أيام من المعاملة تفوق methomyl و abamectin و thiomethoxam و acetamipridSP في أثرها المتبقي بعد ثلاثة ايام من المعاملة الحقلية على *E. vermiculata* كانت نسبة الموت للقوقع المتغذي علي الاوراق لمدة 24 ساعة 90 و 90 و 85 و 85٪ ، ونسبة خفض في معدل الاستهلاك الغذائي مقارنة بمعاملة الكنترول حيث أعطت انخفاضًا بنسبة 96.07 و 96.07 و 92.15 و 96.07٪ على التوالي ، يليها أزاديراكتين وإيميداكلوبريد وأسيتاميبريد SL الذي سجل نسب موت 75 و 70 و 65٪ ، على التوالي ، بينما سجل الأميتراز وخليط (بيميتروزين 50٪ + سيانترانيليبرول 10٪ نسب موت 50 و 45٪. وكان التأثير المتبقي بعد سبعة أيام بترتيب تنازلي كما يلي 85 ، 85 ، 80 ، 75 ، 70 ، 65 ، 55 ، 40 و 37٪ مع ميثوميل ، أبامكتين ، أسيتاميبريد SP ، ثيوميثوكسام ، أزادراختين ، إيميداكلوبريد ، أسيتاميبريد SL ، أميتراز وخليط من بيميتروزين 50٪ + سيانترانيليبرول 10٪) ، على التوالي. أوضحت النتائج أن الميثوميل والأبامكتين والأسيتامبراید SP والثيوميثوكسام والأزادراكتين المستخدم في برنامج وزارة الزراعة لمكافحة آفات الطماطم في مصر بنفس الجرعة يمكن أن يوفر حماية ممتازة من قوقع ، *E. vermiculata* ولا نحتاج لبرنامج لمكافحته كما انها تقلل من الخسائر للمحصول عن طريق منع القواقع من التغذية كما يمكن اعتبارها مبيدات قواقع.