

COMPARATIVE MOLLUSCICIDAL ACTIVITY OF ABAMECTIN AND METHOMYL AGAINST *Eobania vermiculata* (Müller) AND *Theba pisana* (Müller)

Abdallah, E.A.¹; G. M. Abdelgalil²; F. A. Kassem¹; A. A. Asran² and H. S.abou-Elnasser³



(1)Pesticide Chemistry and Toxicology, Faculty of Agriculture, El-Shatby, Alexandria University.

(2)Department of Agriculture Animal Pests, Plant Protection Research Institute, Agriculture Research Center.

(3)National Institute of Oceanography and fisheries (NIOF). The Central Laboratory

ABSTRACT

The molluscicidal activity of abamectin were assessed compared with methomyl against the most two abundant snail species brown garden snail (BGS) *Eobania vermiculata* and white garden snail (WGS) *Theba pisana* under laboratory conditions. The results indicated that LC₅₀ values of methomyl were almost equal LC₅₀ values of abamectin indicating more molluscicidal potency of abamectin and methomyl. Results also revealed a complete consistency of correlation between the LC₅₀ values and exposed time intervals. The high molluscicidal activity of abamectin against *E. vermiculata* and *T. pisana* compared to methomyl using topical application technique could be used practically in the field of land snails control program and overcome some drawbacks of using bait forms in this respect. Comparing the LD₅₀ values indicate the significant variation of the molluscicidal activity between the two applications methods used in addition to the variation between the two species of chosen snails, the brown garden snail *E. vermiculata* were resistant species than the white garden snail *T. pisana*.

Keywords: Molluscicides, Abamectin, Methomyl, *Eobania vermiculata* and *Theba pisana*

INTRODUCTION

Terrestrial gastropods are from the most significant threats of sustainable agriculture in many parts of the world (Barker, 2002). From the terrestrial gastropods, land snails are considered as serious economic pests due to its considerable damage of several types of plants. Land snails attack leaves, flowers, roots, buds, and even the trunk of trees causing great damage to the cultivated plants. In Egypt, land snails are known as dangerous pests to field crops, vegetables, orchards and ornamental plants (Kassab and Daoud, 1964; El-Okda, 1979; Abo-Bakr., 1997; Abdallah *et al.*, 1998; Ibrahim 1995 and Mohamed 1995). Damage caused by snails is due mainly to feeding and to contamination with their bodies, faces or slime, leading to deterioration of the product quality besides, the financial loss (Lglesias *et al.*, 2003). The importance of land snails as pest organisms has drastically increased in the past few decades (Godan, 1983; Gathwaite and Thomas, 1996).

Carbamate and oximecarbamate pesticides have been found to possess high potential use as molluscicides against terrestrial gastropods (Judge, 1969; Hunter and Johnson, 1970; Godan, 1983; Miller *et al.*, 1988; El-Okda *et al.*, 1989; Radwan and El-Wakil, 1991; Abdallah *et al.*, 1992 and 1998 and Abo-Bakr 1997). Methomyl is one among the most potent oximecarbamates used especially in bait formulation forms against terrestrial slugs and snails.

However, growers and farmers often experience difficulty controlling land gastropods with conventional bait pellets containing molluscicides as in wet conditions the efficacy of these pellets can be very low leading to unsatisfactory control levels (Hata *et al.*, 1997 and Schuder *et al.*, 2003). In addition, poison baits can be toxic to other non-target life forms (Martin, 1993; Purvis, 1996).

Avermectins, a group of 16-membered macrocyclic lactones, are fermentation products from *Streptomyces avermitilis*, a naturally occurring soil actinomycete. From the fermentation, eight different avermectins were isolated, which comprise four pairs of homologues. One of these pairs, avermectin B1, that is the mixture of avermectins B1a (>80%) and B1b (<20%), is commercialized under the common name Abamectin (Pitterna *et al.*, 2009). Abamectin is currently the main avermectin compound used as a miticide/ insecticide in a great variety of crops.

The aim of this research is to assess the molluscicidal activity of non conventional pesticides as Abamectin as well as standard conventional molluscicide methomyl against the most two abundant species of the terrestrial snails brown garden snail (BGS) *Eobania vermiculata* and white garden snail (WGS) *Theba pisana* using both poison bait and topical application techniques under laboratory condition.

MATERIALS AND METHODS

Tested Pesticides:

Abamectin:

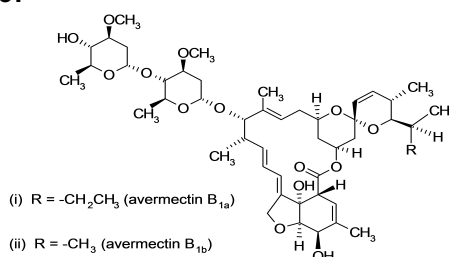
Common name : Abamectin

Molecular formula: C₄₈H₇₂O₁₄ (avermectin B1a); C₄₇H₇₀O₁₄ (avermectin B1b).

Chemical name: 5-O-demethylavermectin A1a (i) mixture with 5-O-demethyl-25-de (1-methylpropyl)-25-(1-methylethyl) avermectin A1a (ii)

Source: Technical were supplied by Syngenta and formulated (Demectin® 1.8% EC) were supplied by Agrochem.

Chemical structure:



Methomyl:

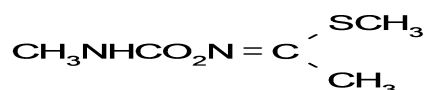
Common name : Methomyl

Molecular formula: C₅H₁₀N₂O₂S

Chemical name : methyl N-[[[(methylamino) carbonyl]oxy]ethanimidothioate

Source: Both technical and formulated methomyl were supplied by E.I. du Pont de Nemours & Co.

Chemical structure:



Experimental snails:

Adults of the brown garden snail, *Eobania vermiculata* (Müller) and the white garden snail, *Theba pisana* (Müller) having approximately the same age and size were collected for laboratory experiments. These snails were collected during September from El-Maamoura locality, Alexandria. These snails were transferred to plastic cups covered with cloth netting and maintained under laboratory conditions of 27 °C and 65% R.H. The snails were daily fed on lettuce leaves up to the initiation of tests. The snails were allowed to be acclimatized to these conditions for two weeks. Dead snails were excluded as soon as possible, whenever needed.

Laboratory bioassay:

Toxicity of abamectin and methomyl against *E. vermiculata* and *T. pisana* snails was evaluated by two techniques:

Wheat-bran bait:

Local poison baits containing 0.05% methylene blue and 2% molasses as attractant were formulated in the laboratory, for the tested compounds in addition to the control (Bourne, *et al.*, 1988). Methomyl (Kuik® 90% SP) were tested at the concentrations of (0.25, 0.5, 1.0, 1.5 and 2.0%) whereas abamectin (Demectin® 1.8%EC) were tested at concentrations of (0.25, 0.5, 1 and 1.5%) wheat bran (w/w). For each treatment, 30 animals were used and kept in three boxes (10 animals for each replicate). Five grams of bait was introduced to snails in each box. 30 animals in three boxes were used as control group containing wheat bran bait with 0.05% methylene blue, 2% molasses. Formulated of pesticides were dissolved in water. Mortality counts were recorded after 24, 48 and 72 hr of treatment, Mortality percentages were calculated and corrected according to Abbott equation (Abbott, 1925)

and subjected to probit analysis (Finney, 1971). The dead animals were detected by probing the snails with a needle to elicit typical withdrawal movement according to WHO, (1965).

Topical application:

Topical application technique was used according to the method of Abdallah *et al.*, (1992). In this method, technical grades of abamectin (Technical 92%), and methomyl (Technical 97%) were dissolved in dimethyl sulfoxide (DMSO). DMSO has been shown to be the most appropriate solvent for topical application as it causes little distress to snails (Young and Wilkins, 1989). The stock solutions of these compounds were serially diluted with the same solvent to achieve the desired concentrations. The tested doses of abamectin were (0.077, 0.155, 0.232, 0.310, 0.388, 0.776 and 1.55 µg/gm b. w) whereas methomyl, were (0.776, 3.105, 6.211, 9.316, 9.316, 15.52, 23.29 and 31.05 µg/gm b.w) *E. vermiculata*. Methomyl doses were (0.851, 3.404, 6.808, 10.212, 17.021, 25.531 and 34.042 µg/gm b. w) *T. pisana*, while abamectin doses were (0.085, 0.170, 0.255, 0.340, 0.425 and 0.892 µg/gm b. w). For each treatment, 30 animals were used and kept in three plastic boxes (10 animals for each replicate) that were covered with cloth netting secured with rubber bands to prevent snails from escaping.. The tested doses were gently applied once on the surface of the snail body inside the shell using a micropipette. Positive controls were exposed to DMSO. Mortality counts were recorded after 24, 48 and 72 hr of treatment and mortality percentages were calculated, corrected according to Abbott equation (Abbott, 1925) and subjected to probit analysis (Finney, 1971). The dead animals were detected by probing the snails with a needle to elicit typical withdrawal movement according to WHO, (1965).

RESULTS AND DISCUSSION

The molluscicidal activity of abamectin were assessed under laboratory conditions against the most two abundant snails species brown garden snail (BGS) *Eobania vermiculata* and white garden snail (WGS) *Theba pisana* compared with methomyl the most patent pesticide known against terrestrial gastropods.

Effect of tested pesticides on BGS and WGS using wheat bran bait:

The molluscicidal activity of abamectin tested insecticides against both BGS and WGS using wheat bran bait technique are recorded in Tables (1,2) and Figures (1,2). The results indicated that LC₅₀ values of methomyl (the standard conventional molluscicide) used especially in bait formulation form were lower than LC₅₀ values of abamectin. The results of abamectin indicating more molluscicidal potency of methomyl. Results also revealed a complete consistency of correlation between the LC₅₀ values and exposed time intervals. The lower LC₅₀ values were obtained always with increasing exposure time; however LC₅₀ values of methomyl were 2.062, 0.952 and 0.564% after 24, 48 and 72 hrs, respectively. The other LC₅₀ values of abamectin were higher than those corresponding each time interval of methomyl. Toxicity indices values indicated lower values than methomyl

using wheat bran bait technique; however the toxicity indices decreased remarkably by increasing time for abamectin compared with methomyl.

Table (1): Efficacy of Abamectin (Demectin® 1.8% EC) against *Eobania vermiculata* (BGS) and *Theba pisana* (WGS) snails using wheat bran bait technique, shown as mortality percentage % and LC₅₀ values, at 24, 48 and 72 hr.

Hours	% Mortality at indicated concentration (%)				LC ₅₀	Conf. Limits 95%		Slope
	0.25	0.5	1.0	1.5		Upper	Lower	
<i>Eobania vermiculata</i>								
24	5	14	25	42	2.091	3.346	1.589	1.796
48	18	33	48	70	0.885	1.085	0.746	1.753
72	27	47	65	84	0.541	0.633	0.454	1.936
<i>Theba pisana</i>								
24	22	38	55	73	0.742	0.895	0.623	1.711
48	40	53	68	78	0.412	0.521	0.292	1.296
72	55	73	85	93	0.204	0.279	0.105	1.518

Fig :(1) .Probit regression lines representing the effect of abamectin wheat bran bait against terrestrial snails: A- *Eobania vermiculata* (BGS) and B- *Theba pisana* (WGS).

Table (2): Efficacy of Methomyl (Kuik® 90% SP) against *Eobania vermiculata* (BGS) and *Theba pisana* (WGS) snails using wheat bran bait technique, shown as mortality percentage % and LC₅₀ values, at 24, 48 and 72 hr.

Hours	% Mortality at indicated concentration (%)					LC ₅₀	Conf. Limits 95%		Slope
	0.25	0.5	1	1.5	2		Upper	Lower	
<i>Eobania vermiculata</i>									
24	6	17	31	43	48	2.062	3.17	1.63	1.54
48	19	32	53	63	66	0.952	1.148	0.799	1.51
72	22	48	69	81	87	0.564	0.648	0.481	2.068
<i>Theba pisana</i>									
24	13	23	33	40	46	2.421	4.304	1.749	1.12
48	35	48	60	67	72	0.571	0.731	0.41	1.06
72	50	70	83	86	90	0.233	0.313	0.146	1.422

Fig. (2): Probit regression lines representing the effect of methomyl wheat bran bait against terrestrial snails: A- *Eobania vermiculata* (BGS) and B- *Theba pisana* (WGS).

The molluscicidal effect against *T. pisana* of the two tested pesticides was much higher than their effect against the other snail species *E. vermiculata*. The LC₅₀ values against WGS of the two insecticides were lower than the corresponding LC₅₀ values of BGS at the two time intervals 48 and 72 hrs except 24hr in case methomyl treatment. The toxicity indices were less than 100% proving the superiority of methomyl using wheat bran bait technique than other tested pesticides (Table 2).

Topical application technique:

The molluscicidal efficacy of the abamectin and methomyl against both BGS and WGS using topical application technique are recorded in Tables (3,4) and illustrated in Figs. (3,4). The results showed remarkable increase of molluscicidal activity of abamectin compared to methomyl. The following points could be deduced clearly as recorded in Tables (3,4).

- 1- All toxicity indices for abamectin at 24, 48 and 72 hrs were highly more than 100% indicating much potent molluscicidal activity compared to the standard molluscicide methomyl.
- 2- Increasing toxicity was in range of three and four orders of magnitudes for BGS and WGS, respectively, in case of abamectin. The results confirmed the superiority of abamectin compared with methomyl. Using topical application technique emphasized the chance of using pesticide abamectin as spray against terrestrial gastropods and substitute the most common control method used in the field against land snails using poison baits and overcome all known drawbacks of using baits against these types of pests with major disadvantage of bait application that could be used only during the activity period of gastropods which is mainly short in both spring and autumn seasons. (Abdallah *et al*, 1992 and Abo-Bakr 2004).
- 3- Comparing the LD₅₀ values indicate the significant variation of the molluscicidal activity between the two application methods used in addition to the variation between the two species of chosen snails, the brown garden snail *E. vermiculata* were resistant species than the white garden snail *T. pisana*. All LC₅₀ and LD₅₀ values of the two tested insecticides within the time intervals measured throughout the experiment were lower in the case of WGS compared with the corresponding values of BGS as late recorded in Table (3,4).
- 4- There was a consistency in Tables (1, 2, 3 and 4) using both methods of applications either poisoned wheat bran bait or topical application technique that the slope values obtained of LD-P line (dosage-response curve) of BGS were lower than the corresponding slope values of WGS indicating more homogeneity population of WGS toward the two tested pesticides under both methods of applications than these of BGS. The high slope value means homogeneity in response of the tested snails species towards the toxic compound and at the same time the pesticides is activity as a selection factor producing on snails species, while the low slope value indicate heterogeneous snails populations.

Table (3): Efficacy of abamectin against *Eobania vermiculata* (BGS) and *Theba pisana* (WGS) snails using topical application technique, shown as mortality percentage % and LD₅₀ values, at 24, 48 and 72 hr.

Hours	% Mortality at indicated dose (µg/ gm b. w)							LD ₅₀ (µg/ gm b. w)	Conf. Limits 95%		Slope
	0.077	0.155	0.232	0.310	0.388	0.776	1.552		Upper	Lower	
<i>Eobania vermiculata</i>											
24	0	20	33	45	55	73	86	0.376	0.428	0.33	1.946
48	14	27	40	48	60	80	94	0.305	0.349	0.269	1.99
72	19	33	46	57	68	86	100	0.238	0.269	0.209	2.014
<i>Theba pisana</i>											
Hours	% Mortality at indicated dose (µg/ gm b. w)						LD ₅₀ (µg/ gm b. w)	Conf. Limits 95%		Slope	
	0.085	0.170	0.255	0.340	0.425	0.892		Upper	Lower		
24	25	40	58	67	79	100	0.199	0.226	0.173	2.065	
48	30	50	70	80	93	100	0.153	0.174	0.13	2.274	
72	35	60	80	86	93	100	0.125	1.42	0.105	2.524	

Fig. (3): Probit regression lines representing the effect of Abamectin topical application against terrestrial snails: A- *Eobania vermiculata* (BGS) and B- *Theba pisana* (WGS).

Table (4): Efficacy of methomyl against *Eobania vermiculata* (BGS) and *Theba pisana* (WGS) snails using topical application technique, As mortality percentage % and LD₅₀ values, at 24, 48 and 72 hr.

Hours	% Mortality at indicated dose (µg/ gm b. w)							LD ₅₀ (µg/ gm b. w)	Conf. Limits 95%		Slope
	0.776	3.105	6.211	9.316	15.528	23.29	31.05		Upper	Lower	
<i>Eobania vermiculata</i>											
24	26	40	46	55	66	66	73	5.898	7.805	4.3	0.787
48	30	53	60	66	73	83	86	2.883	3.769	2.044	0.971
72	35	60	68	76	86	90	93	1.88	2.48	1.301	1.107
<i>Theba pisana</i>											
Hours	% Mortality at indicated dose (µg/ gm b. w)							LD ₅₀ (µg/ gm b. w)	Conf. Limits 95%		Slope
	0.851	3.404	6.808	10.21	17.021	25.53	34.04		Upper	Lower	
24	23	40	53	60	73	80	86	4.944	6.095	3.878	1.136
48	28	53	63	68	80	86	93	3.059	3.913	2.246	1.093
72	30	53	66	73	86	86	93	2.644	3.379	1.938	1.159

Fig. (4): Probit regression lines representing the effect of Abamectin topical application against terrestrial snails: A- *Eobania vermiculata* (BGS) and B- *Theba pisana* (WGS).

The high molluscicidal activity of abamectin against *E. vermiculata* and *T. pisana* compared to methomyl was expected. The introduction of ivermectin in the early 1980s brought a revolution in the control of animal parasites and was accepted as a potent anthelmintic (Campbell and Benz, 1984). In addition, avermectins have found wide application as pesticides and antiparasitic drugs for humans and animals (Burg *et al.*, 1979; Campbell, 1989; Ostlind and Long, 1979). The most extensively used compounds of this class are avermectin B1 (abamectin). Abamectin were effectively used for control of the ectoparasite sea lice, the cause of serious problem for the salmon (primarily *Salmo salar*) aquaculture industry (Westcott *et al.*, 2004). Campbell, (1989) stated that, the mechanism by which avermectins produce the pesticide and antiparasitic effects in invertebrates and a neurotoxic effect in vertebrates is the release of γ -aminobutyric acid (GABA) and the enhancement of its inhibitory action. Also, (Yamazaki *et al*, 1989) reported that ivermectin is an agonist for the GABA neurotransmitter. Our results is in agreement with Abdelgalil (2011). From the previous results, it can be concluded that molluscicidal activity of methomyl on both types of snails BGS and WGS may be at least in part attributed to the inhibition of AChE that comes in agreement with (Abdallah *et al*, 1998 and Kassem *et al*, 1992).

REFERENCES

- Abbott, W. S. (1925). A method of computing the effectiveness of an insecticide. *J. Econ. Entomol.*, 18: 265-267.
- Abdallah, E. A. M.; F. A. Kassem and E. A. Kadous (1992). Laboratory and field evaluation of local bait formulations of certain pesticides against mollusk species. *J. Pest Control Environ. Sci.*, 46: 179-192.
- Abdallah, E. A. M.; F. A. Kassem, H. B. El-Wakil and Y. Abo-Bakr (1998). Molluscicidal potentiality of several pesticides against *Eobania vermiculata* and *Theba pisana* terrestrial snails. *Annals Agric. Sci.*, Cairo, 1: 263-276.
- Abdelgalil, G. M. (2011). Integrated Control of Economic Pulmonata Species. Ms. Sci. Thesis of Agric. Faculty. Alex. Univ.
- Abo-Bakr, Y. (1997). Toxicological and Environmental Studies on Some Terrestrial Gastropods. Ms. Sci. thesis of Agric. Faculty. Alex. Univ.
- Abo-Bakr, Y. (2004). Reproductive, Hematological and Molecular Changes in *Theba pisana* and *Biomphalaria alexandrina* as target or non target organisms for pesticides. Ph. D. Thesis, Alex. Univ., Egypt.
- Barker, G. M. (2002). Molluscs as crop pests. CAB, International, Walling Forti Oxon 10 DE.UK, 468 pp.
- Bourne, N. B.; G.W. Jones and I. D. Bowen (1988). Slug feeding behaviour in relation to control with molluscicidal baits. *Journal of Molluscan Studies* 54, 327–338.

- Burg, R.W; B. M. Miller.; E. E. Baker; J. Birnbaum; S. A. Currie; R. Hartman, Y. L. Kong; R. L. Monaghan; G. Olson; I. Putter; J. B. Tunac; H. Wallick; E. O. Stapley; R. Oiwa and S. Omura (1979). Avermectins, new family of potent anthelmintic agents: producing organism and fermentation. *Antimicrob. Agents Chemother.* 15, 361–367.
- Campbell, W. C. (1989). Ivermectin and Abamectin. Springer, NewYork.
- Campbell, W. C. and G. W. Benz (1984). Ivermectin: a review of efficacy and safety. *J. Vet. Pharmacol. Ther.* 7, 1–16.
- El-Okda, M. M K.; M. E. Mokhtar and A. M. Selim (1989). The response of the harmful and useful terrestrial mollusca towards several toxicants : i. Efficacy of six toxicants under laboratory conditions. *Alex. Sci. Exch.* No1. 10. No. 3.
- El-Okda, M. M. K. (1979). Laboratory Studies on the Molluscicidal Toxicity of Methomyl and aldicarb against some land snails. *Agric. Res. Rev.*, 1:199-206.
- Finney, D. J. (1971). Probit analysis. 3 rd edition, Cambridge Univ. Press, Cambridge, pp. 333.
- Gathwaite, D. G. and M. R. Thomas. (1996). The usage of molluscicides in agriculture and horticulture in Great Britain over the last 30 years. In: Henderson, British Crop Protection Council, Farnham, pp. 39–46.
- Godan, D. (1983). Pest slugs and snails, biology and control. Springer Verlag- Berlin, Heidelberg. 445 pp
- Hata, T. Y.; Hara, H. Arnold; B. K. S. Hu (1997). Molluscicides and mechanical barriers against slugs, *Vaginula plebeia*
- Hunter, P. J. and D. L. Johnston (1970). Screening carbamates for toxicity against slugs. *J. Econ. Entom.*, 63: 305-306.
- Ibrahim, H. A. (1995). Natural extracts as tools for pest control M. Sc. Thesis. Fac. Agric. Alex. Univ., Egypt.
- Judge, F. D. (1969). Preliminary screening of candidate molluscicides. *J. Econ Entomol*; 62(6): 1393-1397.
- Kassab, A. and H. Daoud (1964). Notes on the biology and control of land snails of economic importance in the U. A. R. *Agric Res. Rev.*, 42: 77-98.
- Kassem, F. A. and E. A. M. Abdallah (1992). Toxicity of certain pesticides against terrestrial snails *Eobania vermiculata* and *Theba* sp. *Alex. Sci. Exch.* 13 (4): 775-786.
- Lglesias, J.; C. Jose and R. Castro (2003). The effects of reported applications of the molluscicide metaldehyde and biocontrol nematodes *Phasmarhabditis hermaphrodita* on molluscs, earthworm, nematodes, acarids and collembolans : a two year study in north west Spain *pest manag Sci* 59: 1217-1224.
- Martin, T.J., (1993). The ecobiological effects of arable cropping including the non-target effects of pesticides with special reference to methiocarb pellets (Draza, Mesurol) used for slug control. *Pflanzenschutz-Nachr. Bayer.* 46, 49–102
- Miller, E.; S. Swail; D. Swail; F. O. Lson, and R. T. Statan (1988). White garden snail *Theba pisana* (Muller); Efficacy o selected bait and sprayble molluscicides. *J. of Agric. Ent.* 5 (3): 189-197.

- Mohamed, M. A. M. (1995). Toxicological Studies on Pulmonata Species. Ms. Sci. Thesis of Agric. Faculty. Alex. Univ.
- Ostlind, S. C. and R. Long (1979). Insecticidal activity of the antiparasitic avermectins. *Vet. Rec.* 105, 168– 173.
- Pitterna, T.; J. Cassayre; O. F. Hüter; P. M. J. Jung; P. Maienfisch; F. M. Kessabi; Inc., Cary.(2009). Management practices and sea lice sampling methods on Atlantic salmon farms in the Bay of Fundy, New Brunswick, Canada. *Aqua*.
- Purvis, G. (1996). The hazard posed by methiocarb slug pellets to carabid beetles: understanding population effects in the field. BCPC Monograph No. 66 'Slug & Snail Pests In Agriculture', pp. 189–196.
- Radwan, M. A. and H. B. El-Wakil (1991). Impact of certain carbamate and synthetic pyrethroid insecticides on the non target terrestrial snail *Eobania vermiculata*. *Alex. Sci. Exch.* 12 (2): 129-139.
- Schuder, I.; G. Porta and J. Bennisonb. (2003). Barriers, repellents and antifeedants for slug and snail control. *Crop Protection* 1033–1038
- Westcott, J. D.; K. L. Hammell; J. F Burka (2004). Sea lice treatments, management practices and sea lice sampling methods on Atlanticsalmon farms in the Bay of Fundy, New Brunswick, Canada. *Aqua.Res.* 35, 784–792.
- WHO (1965). Molluscicidal screening and evaluation. *Bull.*, 38: 507-581.
- Yamazaki, J.; K. Matsumoto; H. Ono, and H. Fukuda (1989). Macrolide compounds, ivermectin and milbemycin D, stimulate chloride channels sensitive to GABAergic drugs in cultured chick spinal neurons. *Comp. Biochem. Physiol. C.* 93: 97-104.
- Young, A. G. and M. R. Wilkins (1989). The response of invertebrate acetylcholinesterase to molluscicides. Monograph British Crop Protection council, 41: 121-128.

مقارنة الكفاءة الابدائية للقواقع للابامكتين والميثوميل ضد قواقع الحدائق البني
وقوق الحدائق الابيض
السيد أحمد عبدالله^(١) ، جابر ممدوح عبد الجليل^(٢) ، فهمي أحمد قاسم^(١) ،
عبدالموجود عبد الله عسران^(٢) و حمزة سمير ابو النصر^(٣)
(١) كيمياء وسمية مبيدات الآفات كلية الزراعة (الشاطبي) - جامعة الإسكندرية
(٢) قسم بحوث الحيوانات الضارة بالزراعة - معهد بحوث وقاية النباتات - مركز البحوث
الزراعية
(٣) المعهد القومي لعلوم البحار والمصايد

تم مقارنة النشاط الابدائي لمركب الابامكتين تحت الظروف المعملية بطريقتي الطعوم السامة
والمعاملة السطحية ضد أكثر أنواع القواقع الأرضية انتشارا وهما قواقع الحدائق البني (ايوانيا فيرميكولاتا)
وقوق الحدائق الأبيض (تيا بيساننا) مع المقارنة بمركب الميثوميل.
طريقة الطعوم السامة : أشارت النتائج أن قيمة LC₅₀ للميثوميل كانت متقاربة مع قيم الابامكتين مما تشير
الى انه يوجد نشاط ابدائي للابامكتين والميثوميل. وأوضحت النتائج وجود علاقة بين قيم LC₅₀
وزمن التعرض حيث تقل قيمة LC₅₀ مع الزيادة في زمن التعرض.
التأثير الابدائي لكلا المبيدين المختبرين كانا أكثر تأثيرا ضد التيا بيساننا من تأثيرهما ضد القواقع
ايوانيا فيرميكولاتا على مدار الثلاث فترات الزمنية ٢٤ ، ٤٨ ، ٧٢ ساعة بعد المعاملة.
طريقة المعاملة السطحية: أوضحت النتائج زيادة فائقة للنشاط الابدائي لمركب الابامكتين عن الميثوميل
للقواقع ويستدل على ذلك بالنقاط التالية:-
١- سمية الابامكتين للقواقع بعد ٢٤ ، ٤٨ ، ٧٢ ساعة كانت اعلى من الميثوميل الذي يعد كمبيد قواقع.
٢- مقارنة قيم LC₅₀ LD₅₀ تشير الى اختلافات معنوية للنشاط الابدائي بين طريقتي المعاملة المستخدمة
بالاضافة الى الاختلافات بين النوعين المختارين من القواقع حيث كان القوقع البني ايوانيا فيرميكولاتا اكثر
مقاومة من القوقع الابيض تيا بيساننا للمبيدات المختبرة.

