

EVALUATION OF CERTAIN CHEMICALS AND INSECTICIDES AGAINST *Monacha cartusiana* SNAILS INFESTING SOME VEGETABLE CROPS AT SHARKIA, GOVERNORATE.

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ABSTRACT

The effect of seven chemicals namely, diafenthuron, carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos were tested as poisonous baits against *M. cartusiana* snails under laboratory conditions. Results revealed that carbosulfan exhibited the highest efficacy, while chlorpyrifos was the lowest one. On the other hand, six chemicals namely, methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate were evaluated against *M. cartusiana* snails under field conditions in two fields cultivated with onion and broad bean at Abo-Hakim village, Zagazig county. Results revealed that methomyl showed the highest effect while spinosad was the lowest one. On the other side, five chemicals namely, pirimicarb, carbosulfan, cyanophos, diafenthuron and metaldehyde were evaluated in three fields at Hehia county cultivated with lettuce intercropping on pepper, eggplant and okra. Results revealed that metaldehyde was the highest toxic action while cyanophos was the lowest toxic one against *M. cartusiana* snails in the two fields, lettuce intercropping on pepper and lettuce intercropping on eggplant whereas the third trial; it noticed that metaldehyde gave the highest order of toxicity while pirimicarb exhibited the lowest one.

INTRODUCTION

Land snails have been increased rapidly in the last few years in most Governorates of Egypt especially Sharkia Governorate Ghamry *et al.* 1993; Arafa 1997, Ismail 1997; El-Massry 1997; Hegab *et al.* 1999; Abdel All 2001, Mahrous *et al.* 2002 and Ismail 2004. There are many laboratory and field experiments have been carried out to evaluate certain chemicals against *Monacha cartusiana* snails. Most pesticides were applied as a spray, dust or granular formulation but only occasionally as baits. In contrast, molluscicides directed against terrestrial gastropods are only occasionally delivered as sprays or dusts but are more usually deployed in baits (Barker, 2002). For this reason, application technology is largely concerned with the composition of baits and how, where and when to apply them. The present study aim to evaluate the activity of various chemicals against *M. cartusiana* snails infesting severally vegetables crops .

MATERIALS AND METHODS

1-Tested animals:

Adults glassy clover snails *M. cartusiana* were collected from heavy infested field cultivated with Egyptian clover at Hehia county, Sharkia Governorate. Collected snails were transferred in plastic bag to the laboratory and fed on wheat bran to acclimatization (El-Okda, 1981).

2-Chemicals used:

Carbosulfan (Marshal), methomyl (Neameal), chlorpyrifos (Dursban), cyanophos (Cyanox), spinosad (Tracer), lufenuron (Match), diafenthiuron (Polo), metaldehyde (Gastrotox 5), pirimicarb (Aphox), copper sulfate and ferrous sulfate were obtained from Central Laboratory for Pesticides, Agricultural Research Center and El-Gomhouria Company for Chemicals.

3-Laboratory tests:

Tested chemicals were used with three concentrations, 1.250, 2.500 and 5 % as poisonous baits. Five grams of poisonous baits were spread into each plastic jar (3/4 Kg capacity) and then 10 adults snails were introduced. Boxes were closed with musline cloth and secured with rubber band to prevent snails from escaping (El-Okda, 1981). Each concentration was replicated four times. Control treatment was prepared using bran bait only without any chemicals. Mortality percentages were recorded 1, 3, 7, 14 and 21 days post-treatment. Observation of mortality entailed using stainless steel needle according to El-Okda (1981). Dead snails were removed after testing and mortality percentages were calculated until the end of experiments.

4-Field tests:

The field trails were conducted at Abo-Hakim villige, Zagazig and Hehia counties. At Zagazig county, two fields were chosen heavy infested with *M. cartusiana* cultivated with broad bean and the other one cultivated with onion. The second trail carried out at Hehia county, where three fields heavy infested with *M. cartusiana* cultivated with lettuce intercropping on pepper, lettuce intercropping on eggplant and lettuce intercropping on okra. Six chemicals i.e. methomyl, spinosad, chlorpyrifos, lufenuron, copper sulfate and ferrous sulfate were applied at Abo-Hakim villige, Zagazig county, while in the second trail, five chemicals were evaluated i.e. pirimicarb, carbosulfan, cyanophos, diafenthiuron and metaldehyde. All chemicals were used with one concentration (5%) as poisonous baits. Baits were prepared by incorporating the tested chemicals with wheat bran and 5 % black sugar cane syrup was added (5 % as attractant substance). About 100 gm of the baits were offered on plastic pieces. Control treatment was designed by the same manner without any chemicals. Each treatment was replicated 4 times. Alive snails were recorded in check and treatment before and after 1, 3, 7, 14 and 21 days post-treatments. Reduction percentages were calculated according to Henderson and Tilton equation (1955). Data were subjected to statistical analysis and treatment means were compared by L.S.D. test according to Little and Hills (1978).

RESULTS AND DISCUSSION

1-Laboratory experiments:

Data in Table (1) demonstrated the effect of certain chemicals i.e. diafenthiuron, carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos against *M. cartusiana* snails with three concentrations under laboratory conditions. Results revealed that all chemicals failed to exhibited molluscicidal activity during the first three days exception carbosulfan which gave 2.5, 5 and 7.5 mortality percentages for the three concentrations, respectively. On the other hand diafenthiuron did not exhibit any molluscicidal activity against *M. cartusiana* during the experimental period. As for the other chemicals, mortality percentages after 21 days reached 52.5, 17.5, 10, 5, 10, 15 for carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos at the highest concentration (5%), respectively. It is obvious of that carbosulfan (carbamate compound) gave the highest mortality percentages while chlorpyrifos (organophosphorus compound) gave the lowest one after 21 days post-treatment. Generally, the carbamate compounds were most active against *M. cartusiana* under laboratory conditions.

Table (1): Efficacy of some compounds against *Monacha cartusiana* snails under laboratory conditions

Chemicals	Conc.	Mortality percentages after indicated days					
		1 day	3 day	5 days	7day	14 day	21 day
Diafenthiuron	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	0 f	0 g
	5	0 b	0 d	0 d	0 e	0 f	0 g
Carbosulfan	1.25	0 b	2.5 c	7.5 b	7.5 d	7.5 d	15 c
	2.50	0 b	5.0 b	7.5 b	10 c	12.5 c	20 b
	5	2.5 a	7.5 a	40 a	42.5 a	42.5 a	52.5 a
Spinosal	1.25	0 b	0 d	0 d	0 e	2.5 e	5 ef
	2.50	0 b	0 d	0 d	0 e	2.5 e	7.5 de
	5	0 b	0 d	5.0 c	12.5 b	17.5 b	17.5 bc
Pirimicarb	1.25	0 b	0 d	0 d	0 e	2.5 e	5 ef
	2.50	0 b	0 d	0 d	0 e	2.5 e	7.5 de
	5	0 b	0 d	0 d	0 e	2.5 e	10 d
chlorpyrifos	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	2.5 e	2.5 fg
	5	0 b	0 d	0 d	0 e	2.5 e	5 ef
Lufenuron	1.25	0 b	0 d	0 d	0 e	0 f	2.5 fg
	2.50	0 b	0 d	0 d	0 e	0 f	5 e
	5	0 b	0 d	0 d	0 e	0 f	10 d
Cyanophos	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	2.5	5 ef
	5	0 b	0 d	0 d	0 e	7.5	15 c
L.S.D _{0.05%}		0.36	0.623	2.002	1.137	1.588	3.911

2-Field experiments:

Two field trails were conducted to evaluate the activity of certain chemicals against *M. cartusiana* snails, the predominant land snails at Sharkia Governorate as follows:

2-1: At Abo-Hakim villige, Zagazig county:

Six compounds i.e. methomyl, clorpyrifos, lufenuron, spinosad, copper sulfate, ferrous sulfate were evaluated under field conditions in two fields: the first one cultivated with onion while the other field cultivated with broad bean. Data illustrated in Table (2) showed the effect of these compounds against *M. cartusiana* infesting onion. Results revealed that the reduction percentages increased by passing the time. It noticed that methomyl exhibited the highest initial kill where gave 13.21 mortality percentage while ferrous sulfate was the lowest one where gave 1.49 mortality percentage. Regarding the residual effect of the previous mentioned compounds, showed that methomyl exhibited the highest reduction percentages (68.09) followed by with copper sulfate (44.21) while spinosad showed the lowest reduction percentage (11.65). Generally, the tested compounds can be arranged in descendingly order according to the general average of reductions as follow : 46.14, 31.82, 18.92, 14.41, 7.23 and 5.76, for methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate respectively.

Table (2): Efficacy of some compounds against *Monacha cartusiana* snails infesting onion at Abo-Hakim villige, Zagazig county, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							General average
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	
Methomyl	7.29	19.13	13.21a	48.31	70.97	85.00	68.09 a	46.14 a
Chlorpyrifos	4.58	11.20	7.86 b	16.69	18.80	20.76	18.75 d	14.41 d
Lufenuron	1.55	11.96	6.75 b	19.96	26.19	34.95	27.03 c	18.92 c
Spinosad	0.27	0.95	0.61 c	8.83	10.04	16.08	11.65 e	7.23 e
Copper sulfate	7.34	16.42	11.88 a	38.93	41.85	51.87	44.21 b	31.82 b
Ferrous sulfate	0.84	2.15	1.49 c	3.95	5.60	16.26	8.60 e	5.76 e
L.S.D _{0.05 %}			3.169				5.168	4.297

Data in Table (3) showed the efficacy of the same previous compounds on *M. carusiana* snails infesting broad bean at Zagazig County. Results revealed that the initial kill during the first three days were: 18.25, 9.09, 9.02, 3.06, 5.97 and 5.34 for methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate, respectively.

Table (3): Efficacy of some compounds against *Monacha cartusiana* snails infesting broad bean at Abo-Hakim villige, Zagazig County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							General average
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	
Methomyl	15.15	20.85	18.25 a	52.84	66.96	88.82	69.59 a	48.91 a
Chlorpyrifos	7.90	10.28	9.09 b	15.84	16.23	28.58	20.21 d	15.76 d
Lufenuron	0.41	17.63	9.02 b	23.78	26.94	39.68	30.13 c	21.69 c
Spinosad	1.91	4.22	3.06 d	7.16	12.23	19.45	12.94 e	8.99 e
Copper sulfate	6.71	5.23	5.97 c	34.21	36.97	50.88	40.68 b	26.80 b
Ferrous sulfate	2.78	7.90	5.34 c	13.30	17.07	24.66	18.34 d	13.14 d
L.S.D _{0.05 %}			2.179				4.926	4.044

On the other hand, the residual effects of the previous mentioned compounds were 69.59, 20.21, 30.13, 12.94, 40.68 and 18.34, respectively. The average reduction percentages of these compounds were, 48.91, 15.76, 21.69, 8.99, 26.80 and 13.14, respectively. Generally, it could be reported that methomyl (48.91%) was the most effective while spinosad (8.99%) was the lowest one.

2-2: At Hehia county:

Five chemicals i.e. pirimicarb, carbosulfan, cyanophos, diafenthiuron and metaldehyde were tested against *M. cartusiana* infested different vegetable crops. Data in Table (4) illustrated the efficacy of different chemicals against *M. cartusiana* infesting lettuce intercropping on pepper. Results revealed that mortality percentages were increased by increasing the time post-treatment. It noticed that metaldehyde exhibited the highest initial and residual effect with mortality percentages of 29.49 and 76.59 %, respectively. Regarding the general average, the tested compounds could be arranged descendingly as follow: metaldehyde, carbosulfan, diafenthiuron, pirimicarb and cyanophos. The reduction percentages were : 53.97, 38.42, 18.31, 14.58 and 7.91, respectively.

Table (4): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on pepper at Hehia county, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	7.40	3.7 d	17.28	22.97	25.26	21.83 c	14.58 c
Carbosulfan	0	24.11	12.05 b	36.76	61.87	69.37	56.00 b	38.42 b
Cyanophos	0	2.7	1.35 d	7.09	9.38	20.40	12.29 d	7.91 d
Diafenthiuron	4.89	9.57	7.23 c	16.37	24.43	36.38	25.72 c	18.32 c
Metaldehyde	23.80	35.18	29.49 a	62.69	74.27	92.82	76.59 a	53.97 a
L.S.D _{0.05} %			2.711				4.228	4.456

Data tabulated in Table (5) revealed the efficacy of some chemicals against *M. cartusiana* snails infesting lettuce intercropping on eggplant. Results revealed that the reduction percentages increased with increasing the time. The initial effect of the tested compounds appeared to demonstrated that metaldehyde was the most effective compound, while pirimicarb was the lowest one where reduction percentages were : 27.09 and 1.13, respectively.

Regarding residual effect, metaldehyde proved to be the most effective compound while cyanophos appeared to be the lowest effectiveness which gave reduction percentages of : 82.31 and 15.47, respectively. Regarding general average reduction, the same trend was noticed, where reduction percentages were: 60.22 and 10.59, respectively. The tested compounds can be arranged descendingly according to general average reduction as follows: metaldehyde, carbosulfan, diafenthiuron, pirimicarb and cyanophos where reduction percentages: 60.22, 28.45, 19.38, 14.76 and 10.59, respectively.

Table (5): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on eggplant at Hehia County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated day							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	2.27	1.13 b	16.66	18.03	36.84	23.84 d	14.76 d
Carbosulfan	0	7.53	3.76 b	17.00	51.49	66.25	44.91 b	28.45 b
Cyanophos	0	6.53	3.26 b	10.41	14.95	21.05	15.47 e	10.59 e
Diafenthiuron	3.94	5.80	4.84 b	13.15	31.40	42.65	29.06 c	19.38 c
Metaldehyde	22.38	31.81	27.09 a	71.67	81.13	94.13	82.31 a	60.22 a
L.S.D _{0.05 %}			3.986				4.744	4.149

Data in Table (6) demonstrated the efficacy of certain compounds against *M. cartusiana* snails infesting lettuce intercropping on okra. Data revealed that all tested chemicals failed to exhibited molluscicidal activity against *M. cartusiana* snails after one day post-treatment except, metaldehyde which gave reduction percentage 16.66. The initial effect of the tested compounds revealed 16.66 that metaldehyde was the most effective compound while pirimicarb was the lowest one reduction percentages were: 24.83 and 1.96, respectively. Concerning the residual effect of the tested compounds, the same trend was observed where reduction percentages were 80.59 and 22.42, respectively. Regarding general average reduction the tested compounds can be arranged descendingly follows: metaldehyde, carbosulfan, cyanophos, diafenthiuron and pirimicarb values of reduction percentages were: 58.29, 25.91, 17.77, 16.39 and 14.24, respectively.

Generally, from the foregoing results, it can be concluded that metaldehyde and carbosulfan compounds were highly efficacy against *M. cartusiana* under field conditions while the organophosphorus compounds cyanophos appeared to be the least effect in this respect.

Table (6): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on okra at Hehia, Zagazig County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated day							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	3.92	1.96 b	17.64	20.23	29.41	22.42 c	14.24 c
Carbosulfan	0	7.51	3.75 b	26.00	46.01	50.05	40.68 b	25.91 b
Cyanophos	0	8.49	4.24 b	13.39	27.74	32.35	24.49 c	16.39 c
Diafenthiuron	0	6.44	3.22 b	7.56	26.68	33.19	22.47 c	14.77 c
Metaldehyde	16.66	33.00	24.83 a	64.05	82.65	95.09	80.59 a	58.29 a
L.S.D _{0.05 %}			2.301				5.397	4.095

Discussing the foregoing results, it is clear that our results are in harmony those obtained by many authors, Radwan and El-Wakil (1991) reported that thiodicarb, methomyl and cypermethrin were the most potent candidates whereas deltamethrin and cypermethrin were the least effective compounds against *Eobania vermiculata* snails when compared with other tested compounds.

Ghamry *et al.* (1993) revealed that metaldehyde compound was the most effective one against *M. cartusiana* and *E. vermiculata* followed by methiocarb, thiocarb, syanophos and monocrotofos. Nakhla and El-Sisi (1995) assured that copper sulfate gave high mortality against the white garden snails, *Theba pisana* under laboratory conditions that the other inorganic salts (Sodium floride, Sodium chlorate, Sodium pyrophosphate and Potassium cyanate).

Aioub *et al.* (2000) reported that carbamate compounds appeared to be the most highly toxic in the laboratory tests. Ismail *et al.* (2001) revealed that aldicarb was the most efficacy of the tested inorganic salts (copper sulfate, aluminium sulfate and magnesium sulfate) under laboratory and field conditions.

Glen *et al.* (2003) reported that the control of slug (*Derouras reticulatum* and *Arion circumscriptus*) damage is difficult in lettuce, where the presence of slugs, faces damage or slug pellets in unacceptable in harvested produce. They found that the treatments applied in mid-February had valuable effects in significantly reducing slug damage close to harvest by 64% for molluscicide and 74 % for herbicide used alone and by 91 % for both used in combination.

Port *et al.* (2003) applied an IPM strategy for slug in vegetable and salad crops in U.K. They establish that the very low thresholds for slug damage in many vegetable crops mean that some growers use molluscicides pellets as a routine treatment. They investigated a number of control tactics in lettuce and Brussels sprout crops. These tactics from the components of an integrated pest management strategy for slug and include, improved detection of slug problems, prediction of population changes and rotational timing of treatments including both cultivations and malluscicide application.

Daoud (2004) reported that newmeal exhibited the highest toxic action against *M. cartusiana* snails followed by Vertimec, Marshal, Dursban while Curacron was the least one. In respect of the activity of the same tested compounds against *E. vermiculata* snails, it's clear that Vertimec and Newmeal seem to be the same order of activity and exhibited the highest toxic action followed by Marshal, Dursban and Curacron under laboratory conditions.

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تقييم بعض الكيماويات و المبيدات الحشرية ضد قوقع موناكا كارتوسيانا الذى يصيب بعض محاصيل الخضر فى محافظة الشرقية
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اجريت عدة تجارب معملية لتقييم تأثير بعض المواد الكيماوية وهى مركبات النحاس و كبريتات الحديدوز بالاضافة الى سبعة مبيدات حشرية وهى ديافينزيورون ، كاربوسلفان ، سينوساد، بيريمكارب ، كلوربيريفوس ، ليفينيورون وسيانوفوس ضد قوقع موناكا كارتوسيانا. وقد اظهرت النتائج ان كاربوسلفان كان له تاثير سام على بينما كان كلوربيريفوس اقل المركبات المختبرة تأثيرا.

وفى المقابل اجريت تجربتان حقليتان الاولى كانت فى قرية ابو حاكم - مركز الزقازيق لتقييم تأثير ستة مركبات كيماوية وهى ميثوميل ، كلوربيريفوس ، ليفينيورون ، سينوساد ، كبريتات النحاس وكبريتات الحديدوز ضد نفس القوقع الذى يصيب كلا من محصولى البصل و الفول الاخضر .. وقد اتضح من النتائج ان ميثوميل كان اعلى المركبات تأثيرا على القوقع بينما كان سينوساد اقلها تأثيرا وكانت التجربة الحقلية الاخيرة فى مركز ههيا بمحافظة الشرقية لتقييم تأثير خمسة مركبات وهى بيريمكارب ، كاربوسلفان ، سيانوفوس ، ديافينزيورون وميتالدهيد ضد نفس القوقع على كلا من الخس المحمل على الفلفل ، الخس المحمل على البانجان و الخس المحمل على باميا فى ثلاث حقول مختلفة.

وقد اظهرت النتائج ان الميتالدهيد كان اعلى المركبات تأثيرا على الاطلاق بينما كان سيانوفوس اقلها تأثيرا فى كلا من حقل الخس المحمل على فلفل والخس المحمل على بانجان ، بينما كان بيريمكارب اقل المركبات تأثيرا ضد القوقع فى حقل الخس المحمل على باميا. ولذا يمكن التوصية باستخدام كلا من الكاربوسلفان و الميثوميل و الميتالدهيد لمكافحة قوقع موناكا كارتوسيانا ضمن برامج مكافحة المتكاملة على محاصيل الخضر.

LABORATORY EVALUATION OF THREE DIFFERENT BIOCIDES AGAINST THE FIELD COTTON LEAF WORM STRAINS *Spodoptera littoralis* (Boisd.)

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ABSTRACT

Laboratory tests were conducted to determine the efficiency of Abamectin 1.8% EC, Xentari 10.3% Granule and MVP11 20% FL against the 2nd instar larvae of Monofia, Gharbya and Behera field strains of the cotton leafworm *Spodoptera littoralis*. Manshiat Ganzor, Ewasna and Etay El-Barod water were used for dilution of the biocides concentrations and were tested against for Gharbya, Monofia and Behera strains. The results indicate that Abamectin at the different concentrations caused high mortality after 14 days to the 2nd instar larvae of the three tested field strains. All larvae tested failed to reach successful pupation. Behera cotton leafworm strain was the most susceptible to MVP11 while Monofia strain was the least. The LT₅₀'s for Monofia, Behera and Gharbya strains were 7.46, 2.70 and 4.69 days at the concentration of 10.00ml/L. The data also revealed that the 2nd instar larvae of Behera strain was more susceptible to Xentari than the larvae of Monofia and Gharbya. The LT₅₀'s were 2.44, 1.99 and 4.74 days at the concentration of 0.6ml/L for Monofia, Behera and Gharbya strains, respectively.

Data showed that pH, conductivity and salinity for Behera (Etay El-Barod) water were higher than that of Gharbya (Manshiat Ganzor) and Monofia (Ewasna) water. The usage of Behera water for dilution resulted in increasing the toxicity of the tested biocides for the larvae of the cotton leafworm. This phenomenon can be benefits since the great majority of waters used for dilution in Egypt are alkaline. Increasing in toxicity as a result of increasing conductivity may be due to augmenting penetration of the toxicant.

INTRODUCTION

Environmental contamination of air, water, soil and food as affected by means's agricultural and social activities has become a threat to the continued existence of many plant and animal communities of the ecosystem and many ultimately threaten the human race. Therefore, the increasing concern among the environmental groups, the farmers and the general public about adverse effects of the chemical pesticides have been cited. Because of these concerns, many farmers in several places of the world have shifted away from the conventional farming systems to sustainable (agroecological, organic) systems. Controlling insects, weeds and diseases without chemicals is a goal of sustainable strategies, and evidence for its feasibility is encouraging.

A central component of sustainable farming is the biological control techniques. The concept of biopesticides is being ecofriendly as well as environmentally safe. Successful bioinsecticides products are based on *Bacillus Thuringiensis* Berliner that produces a selectivity toxic protein in the

form of inclusion or crystal within the cell. This protein crystal is the active component in *B.t.* products and consists of the protoxin from one or more delta endotoxins.

About 50 strains of *B.thuringiensis* have been isolated from different insects and classified into 12 groups by esterase patterns and by serological and biochemical tests *B.thuringiensis* and its relative have been tested against many insect species, mainly lepidoptera, many of them were found highly susceptible to these bacteria (Burges, 1981 and Feeby, 1999)

Therefore, the present investigation was carried out to study the efficiency of Abamectin, Xentari and MVPΠ against the 2nd instar larvae of the different field cotton leafworm strains.

MATERIALS AND METHODS

1-Maintenance of the strains:

The field strains of the cotton leafworm *Spodoptera littoralis* (Boisd.) were obtained from Monofia , Gharbeya and Behera governorates. These strains were kept under normal laboratory conditions at 25±2 °C and 70 ±5% relative humidity. The egg-masses were kept separately until eggs hatched and then provided with castor-oil leaves. The colonies were maintained for three generations.

2- Biocides used:

- a) Abamectin (vertimec 1.8% EC): A mixture containing a minimum of 80% avermectin B1a(5-o-demethyl avermectin A1a) and a maximum of 20% avermectin B1b(5-o-demethyl-25-de(1-methyl propyl-25-(1-methylethyl) avermectin A1a). A nature product produced by the soil microorganisms *Streptomyces avermitilis*.
- b) Xentari 10.3% (water dispersible granule) based on *Bacillus thuringiensis* sub. sp.. aizawai lepidoptera active toxin. Produced by Abbott Laboratories Nourth Chicago, USA.
- c) MVPΠ 20% aqueous flowable, a genetically engineered bacterium that produces delta endotoxin derived from *B.t.* sub. sp.. Kurstaki. The active ingredient consists of endotoxin protein crystals which are encapsulated in dead *Pseudomonas fluorescens* cells, produced by Mycogen USA.

3-Preparation of concentrations:

Formulated biocides Abamectin 1.8% , MVPΠ 20% and Xentari 10.3% were used in this study. The concentrations were 0.15, 0.30 and 0.60 ml/L 2.50, 5.00 and 10.00 ml/L and 0.60 1.20 and 2.40 ml/L for Abamectin, MVPΠ and Xentari respectively. The concentrations were prepared using field water dilution.

4- Method of application:

Castor-oil leaves were dipped for 15 seconds in the biocides solutions, then left to dry. Second instar larvae of *Spodoptera littoralis* of the experimental strains was used about 200±20 larvae were put in glass jars (1liter) and provided with treated castor-oil leaves. After 48 hours the larvae

were transferred to another jar and provided with untreated leaves until pupation. Moreover 200±20 larvae of tested field strains were used as control and provided with untreated castor-oil leaves until pupation.

Insects resulted from the treatments were maintained to determine the different biological criteria. These were percentage of mortality in larval and pupal span, percentage of emergency, percentage of deformation in pupa and in the adult, as well as egg hatchability and percentage sterility. For mating experiments, the resulting morphologically normal adults were grouped in pairs (male and female) and each pair was placed in small cage provided with tafla leaves *Nearium oleander* served as an oviposition site. The percentage of sterility was calculated according to the equation of Topozada and El-Defrawi (1966). The LT₅₀ values of candidate biocides were assessed (Finney, 1971).

5- The following Physico-Chemical properties of water used for dilution were determined:

- a- pH at 20°C using orien pH meter.
- b- Conductivity expressed as millsiemens meter (mS/m)
- c- Percentage of salinity employing the conductimeter (YSI).

Table (1): Some Physico-chemical properties of Gharbya (Mashiat Ganzor), Monofia (Ewasna) and Behera (Etay El-Barod) water used for dilution.

Water sample	pH at 20°C	Conductivity mS/m	% salinity
Gharbya Manshiat Ganzor	7.5	883	0.03
Monofia Ewasna	7.3	511	0.02
Behera Etay El- Barod	7.9	1386	0.20

RESULTS AND DISCUSSIONS

1. At Monofia Governorate :

1.1 Effect of Abamectin 1.8% EC:

Results in table 2 show that after 14 days of treatment, all the concentrations tested caused high mortality; 95.50%, 97.50% and 99.45%, occurred in the case of 0.15 ml/L., 0.30 ml/L. and 0.60 ml/L. respectively. The initial mortality were 70.00%, 75.00% and 80.90%. All the treated larvae failed to reach successful pupation.

1.2 Effect of MVP II 20% aqueous flowable:

The results in table 2 gave a very low percentage of mortality varied from 19.23 and 32.50%, and increased by the lapse of time .the percentages of pupation were 23.75, 20.63 and 21.26% and adult formation ranged between 15.00 and 10.00. The results show deformation of pupal by 1.88 and 3.88% in case of concentrations of 2.50 and 5.00 ml/L.

1.3 Effect of Xentari 10.3% granule:

As shown in table 2 during 14 days after the treatment, the mortality percentages increased by the lapse of time. the mortality percentages

were 79.00, 82.00 and 93.00%. after 14 days of treatment for the concentrations of 0.60, 1.20 and 2.40gm/L. The percentages of pupation were 7.33, 4.00 and 3.13% and adult formation ranged from 2.67 and 0.88% for the same concentrations, respectively.

2- At Behera Governorate:

2.1 Effect of Abamectin 1.8% EC:

Results in table 3 showed that 14 days after treatment, all the tested concentrations caused high mortality percentages among the 2nd instar larvae. The mortality percentages ranged between 95.00, 97.50 and 100.00% for 0.15, 0.30 and 0.60ml/L, respectively. All treated larvae failed to reach pupation.

2.2 Effect of MVP II 20% aqueous folwable:

Results obtained in table 3 revealed very few initial mortality larvae varied from zero, 12.50 and 45.00%, while it increased by the lapse of time reaching 70.00, 75.00 and 86.00% after two weeks of treatment with 2.50, 5.00 and 10.00ml/L. The data show that all treatments of larvae with the different concentrations drastically reduced percentage of pupation, percentage of emergency and caused 100% sterility.

2.3 Effect of Xentari 10.3% granule:

Results in table 3 indicate that the mortality percentages after 14 days from treatment were 83.50, 89.50 and 97.00% and the data also indicate that the sterility was 96.02, 98.37 and 100% for the concentrations of 0.60, 1.20 and 2.40gm/L respectively.

3- At Gharbya Governorate:

3.1 Effect of Abamectin 1.8%:

Data in table 4 showed that, Abamectin at the rate of 0.60 ml/L caused 45.50% initial kill. The highest mortality percentage obtained after 14 days from treatment were 94.00, 94.50 and 96.00% for 0.15, 0.30 and 0.60 ml/L. All the treated larvae with these concentrations failed to reach successful pupation.

3.2 Effect of MVP II 20%:

Results obtained in table 4 revealed low percentage of mortality varied from 19.50, 21.50 and 38.50% increased after 14 days from treatment to 43.00, 71.00 and 83.00% with 2.50, 5.00 and 10.00 ml/L. The pupation were 42.50, 34.50 and 3.50 for the tested concentrations. Also the treatments reduced egg production and percentage of sterility ranged between 98.20, and 100%.

3.3 Effect of Xentari 10.3%:

Results in table 4 indicate that the mortality percentages after 14 days from treatment were 80.00, 86.00 and 93.50% with 0.60, 1.20 and 2.4gm/L respectively and the data also indicate that the sterility were 99.16, 100 and 100%.

Xentari treatment causes certain pathological effects in the mid-gut of larvae. Cross sections of mid-gut showed separation of the epithelial cells from the basement membrane as well as elongation, vaculization and break down of larval epithelium mid gut. Moreover Xentari causes disorganization and disintegration of pretrophic membrane (El-Lakwah *et al.* 1999). However,

El-Gemeiy (1992) reported that although the bacterial formulations (Dipel-2x, Florbac, Delfin and Bactospeino) showed high virulent action against the spiny bollworm larvae, only slight effect was reported on pupation and adult emergence from surviving larvae. It is also noted that the delayed effects of *Bt.* extended to the adults resulting from treated larvae, but some concentrations of former biocides had no effect on percent of pupation and adult emergence.

The discovery and development of avermectin endectocides, of which ivermectin is perhaps the foremost example (Hoston 1982), has provided the opportunity for evaluation of these compounds for the control and management of livestock ectoparasites. The avermectines offer the double advantage of having broad spectrum activity and efficiency at extremely low concentrations (Putter *et al.* 1981). There is little doubt that ivermectin levels in the blood serum of the animals acted to produce a very strong selective pressure on the ticks that survived (Ronald *et al.* 2001). Abamectin is an effective compound for controlling the cotton leafworm *S. littoralis*. Under standard laboratory conditions, the compound resulted in a total suppression of pupa and adult formation at the tested concentrations. In this respect, the effect of Emamectin against the cotton pests were studied by Isaac Ishaaya *et al.* (2002). They found that castor bean leaves treated with various concentrations of Emamectin and offered to 3rd instar *S. littoralis* resulted in 97% and 73% mortality at the concentrations of 0.4 and 0.08 mg AI/litre after 6 days of treatment.

The data in table 5 show that Behera cotton leafworm strain was the most susceptible to MVP11 while Monofia strain was the least. The LT_{50} 's were 7.46, 2.70 and 4.69 days at the concentration of 10.0 ml/l for Monofia, Behera and Gharbya strains, respectively. The susceptibility of the 2nd instar larvae of *S. littoralis* to Xentari in Monofia, Behera and Gharbya strains are shown in table 6 indicating that the larvae of Behera strain was more susceptible to Xentari than the larvae of Monofia and Gharbya. The LT_{50} 's were 2.44, 1.99 and 4.74 days at the concentration of 0.6 ml/l.

Data in table 1 show that pH, conductivity and salinity for Behera (Etay El-Barod) water were higher than those of Gharbya (Manshiat Ganzor) and Monofia (Ewasna). pH, conductivity and salinity were 7.9, 1386 mS/m and 0.20%, 7.5, 883 mS/m and 0.03% and 7.3, 511 mS/m and 0.02% for Behera, Gharbya and Monofia water respectively.

Data in tables 5 and 6 indicate that using Behera water for dilution resulted in increasing the toxicity of the biocides. Salama *et al.* (1989) reported that the combination of Dipel 2X with potassium carbonate significantly increased the efficiency of Dipel 2X. The delta-endotoxine effect was increased as increased from the pH 8 to 10 (Gringorten *et al.*, 1992). High activity of *B.t.* at pH 10 corresponds to the alkaline conditions in larval gut Tanada and Kaya, (1993). Furthermore Behle *et al.* (1997) represented that the activity of *B.t.* against the neonate European corn borer, *Ostrinia nubilalis* was decreased rapidly when exposed to field conditions. The degradation can be minimized by improving the formulation by adding alkaline gluten to spray formulations.

The selectivity of action is a key advantage offered by *B.t.* products, particularly when they are used in IPM programs. This specificity means that *B.t.* products can be used to regulate pest populations without direct toxicity to the natural enemies of the target and secondary pests.

The increase in efficiency in case of Behera water may be attributed to presence of certain nutrients which enhanced the penetration of candidate bioicides through biological tissues and consequently increased their effectiveness. Abdel-Hai N.S. (2001) indicated that using alkaline water of artesian well for dilution the bio insecticides was correlated with increasing the toxicity of Dipel 2X, Ecotech and MVP11 for the larval span and pupal span. Percentage mortalities to larval span of *S. littoralis* were 93.00, 92.50 and 89.50% increased to 98.00, 96.50 and 92.50% when tap and artesian well waters were used for dilution, respectively. The results revealed that tested bioicides drastically reduced egg production and hatchability of eggs especially when the artesian well water was used for dilution the tested

Strain	Concentration gm/L	LT ₅₀ (days) 5%fiducial limits	Slope
Monofia	0.60 1.20	2.44(1.77-2.98) 1.89(1.07-2.52)	1.28±0.20 1.03±0.20
Ewasna	2.40	0.75(0.23-1.17)	1.59±0.32
Behera	0.60 1.20	1.99(1.39-2.47) 1.13(0.62-1.58)	1.39±0.21 1.39±0.22
Barod	2.40	1.15(0.70-1.51)	1.99±0.32
Gharbha	0.60 1.20	4.74(2.53-8.59) 1.19(0.65-1.66)	2.35±0.41 1.53±0.22
Manshat	2.40	1.22(0.76-1.63)	1.59±0.23

Table (6): The susceptibility of the 2nd instar larvae of *S. littoralis* to Xentari in Monofia, Behera and Gharbha strains.

Strain	Concentration m/L	LT ₅₀ (days) 5%fiducial limits	Slope
Monofia	2.50 5.00 10.00	16.04(12.29-24.57) 12.48(-----) 7.46(5.88-9.76)	1.01±0.15 1.00±0.27 0.86±0.14
Behera	2.50 5.00 10.00	10.01(9.28-10.85) 8.12(4.41-19.53) 2.70(2.01-3.34)	3.21±0.36 2.03±0.35 1.28±0.15
Gharbha	2.50 5.00 10.00	29.41(18.31-38.39) 7.12(6.21-8.20) 4.69(-----)	0.76±0.15 1.53±0.15 1.20±0.55

Table (5): The susceptibility of the 2nd instar larvae of *S. littoralis* to MVP11 in Monofia, Behera and Gharbha strains.

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التقييم المعملی لثلاثة مركبات حيوية ضد السلالات الحقلية لدودة ورق القطن هالة محمد أبويوسف ، نيروز رزق جرجس وأميمة كمال مصطفى المعمل المركزي للمبيدات، مركز البحوث الزراعية

تم تقويم كفاءة المبيدات الحيوية إمامكتين ١٨ القابل للاستحلاب والزنتاري ٣٠١ %
المحبب و كذلك أم في بي تو القابل للتدفق المهندس وراثيا ضد العمر اليرقي الثاني لثلاثة سلالات
حقلية لدودة ورق القطن وهى سلالة المنوفيه و الغربية و البحيره معمليا .
تم تحضير محاليل المركبات الحيوية المختبرة باستعمال الماء الحقلى من منشية الجنزور
محافظة الغربية وقويسنا محافظة المنوفيه و ايتاى البارود محافظة البحيره .
ولقد وجد أن المركب الميكروبي إمامكتين أكثر المركبات الحيوية فعاليه ضد دودة ورق
القطن حيث أعطى أعلى نسبة موت للعمر اليرقي الثاني للثلاثة سلالات الحقلية المستخدمه . ولقد
وجد ان اليرقات المختبرة لهذه السلالات فشلت أن تكمل دورة حياتها وأن تصل الى طور العذراء .
ولقد وجد أن يرقات العمر الثانى لسلالة البحيره أكثر سلالات حساسيه للمركب الحيوى
أم في بي تو فى حين كانت سلالة المنوفيه أقلهم حساسيه . وكان التركيز الوقتى النصفى
المميت LT₅₀ لسلالات المنوفيه و البحيره والغريه ٧٦٤ ، ٢٧٧ ، ٤٩٦ يوم عند استخدام
التركيز ١٠ سم^٢/لتر .
وكذلك وجد أن العمر اليرقى الثانى لسلالة البحيره أكثر حساسيه لمركب زنتاري عن
يرقات المنوفيه و الغربية حيث كان التركيز الوقتى النصفى المميت LT₅₀ ٢٧٤ ، ١٦٩ ،
٤٩٧ يوم عند استخدام التركيز ٦ سم^٢/لتر لكل من سلالات المنوفيه والبحيره و الغربية .
ولقد أظهرت النتائج أن الأس الهيدروجينى pH و التوصيل الكهربى و الملوحة لمياه
التخفيف المستخدمه من محافظة البحيره (ايتاى البارود) أنها أعلى من مياه الغربية (منشية
الجنزور) و المنوفيه (قويسنا) .
ومن هذا يتضح أن استخدام مياه التخفيف ذات الأس الهيدروجينى pH يميل الى
القلويه يزيد من فعالية المركبات الحيوية ضد دودة ورق القطن . وهذه الظاهره يمكن اعتبارها مفيده
لأن أغلب المياه التى تستخدم فى التخفيف فى مصر تميل الى القلوية .