Side Effect of some Acaricides on Three Predators of *Tetranychus urticae* Koch

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Abstract: The toxicity of six acaricides namely, ethion, bifenazate, chlorfenapyr, abamectin, diafenthiuron and hexythiazox, presented different chemical groups, were determined on each of the two spotted spider mites *Tetranychus urticae* Koch (Acari: Tetranychidae) and three of its predators; *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae), *Scolothrips longicornis* Priesner (Thysanoptera: Thripidae) and *Stethorus gilvifrons* Mulsant (Coleoptera: Coccinellidae).The obtained results revealed that abamectin (0.53 ppm), ethion (15.2 ppm), abamectin, (19.0 ppm) and diafenthiuron (14.0 ppm) were the most toxic acaricides on *T. urticae, P. persimilis, S. longicornis* and *S. gilvifrons*, respectively at LC_{50} level. Based on LC_{50} and LC_{90} of the tested acaricides on the studied predators, selective toxicity ratios were calculated at the same former levels. All the tested acaricides were safe except ethion at LC_{50} and bifenazate at LC_{90} on *P.persimilis*, bifenazate and hexythiazox were harmful at LC_{50}; whereas chlorfenapyr and abamectin were safe at LC_{90} on *S. longicornis*. Regarding *S. gilvifrons*, all tested acaricides were safe at LC_{90} except bifenazate and diafenthiuron at LC_{50} and bifenazate at LC_{90}. The selectivity ratios (s.r) at LC_{50} and LC_{90} levels were incorporated in one parameter as general selective toxicity ratio. The obtained values were 2.04, 1.35, 0.28, 0.006, 1.74 and 0.41 for *P. persimilis* inethion, bifenazate, chlorfenapyr, abamectin, diafenthiuron and hexythiazox treatments, respectively. The respective values were 0.506, 0.715, 4.0, 3.78, 0.025 and 1.496 for *S. longicornis* and 0.01, 0.53, 1.68, 1.59, 0.04 and 0.59 for *S. gilvifrons*.

Keywords:Acaricides, *Tetranychus urticae*, *Phytoseiulus persimilis*, *Scolothrips longicornis*, *Stethorus gilvifrons*

INTRODUCTION

The two-spotted spider mite (TSSM), *Tetranychus urticae* Koch (Acari: Tetranychidae) is one of the most serious pests, causing yield losses to many horticultural, ornamental and agronomic crops. A major problem in controlling *T. urticae* is its resistance to many acaricides (Puinean *et al.,* 2010). Resistance to acaricides in *T. urticae* spreads rapidly. So, biological control tactics are crucial to manage spider mite populations (Gerson and Weintraub, 2006). *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae) is an effective predator for controlling *T. urticae*. Therefore, it is required to evaluate the effect of frequent application of acaricides on some biological parameters of this predator (Sanatgar *et al,*. 2011). Also, *Scolothrips longicornis* Priesner (Thysanoptera: Thripidae) is an important predator and a good candidate for biological control of several spider mites (Nakagawa, 1993; Kishimoto, 2002; Zhang *et al.,* 2005). Many species of *Stethorus* spp. (Coleoptera: Coccinellidae) feed on wide range of tetranychid species. *Stethorus keralicus* Kapur and *Stethorus gilvifrons* (Mulsant) are considered as specialists that feed on *T. urticae* (Aydemir and Toros, 1990).

The aim of the present study is to clarify the side effect of certain common use acaricides on *P. persimilis, S. longicornis* and *S. gilvifrons* and to determine the safest acaricides to use in IPM program of *T. urticae*.

MATERIALS AND METHODS

1. Chemical used:

1.1- Ethion
Trade name: Endo 50 %
Common name: Ethion
IUPAC name: O, O, O, O'- tetraethyl S, S'- methylene bis (phosphorodithioate).
Recommended concentration: 600 ml / 100 L.w

1.2- Bifenazate
Trade name: Acramite 48 %
Common Name: Bifenazate.
IUPAC name: isopropyl 3-(4- methoxybiphenyl – 3-yl) carbazate.
Recommended concentration: 50 ml/100 L.

1.3- Chlorfenapyr
Trade name: Challenger 36% S.C
Common name: Chlorfenapyr
IUPAC name: 4-bromo-2- (4-chlorophenyl)-1-(ethoxymethyl)-5-trifluoromethylpyrrole -3 – carbonitrile.
Recommended concentration:45 ml/100L.

1.4-Abamectin
Trade name: Avermectin 3.6% E.C
Common name: Abamectin
IUPAC name: 5-0 dimethyl-25-de-1 methylpropyl-25-(1-methylethyl) Avermectins A1a (R=CH3)-B1b
Recommended concentration: 45 ml/100L.W

1.5-Dafenthiuron
Trade name: Pegasus 50% W.P
Common name: Diafenthiuron
IUPAC name: 1-tert- butyl- 3- (2, 6 di-isopropyl -4-phenoxyphenyl) thiourea.
Recommended concentration:120 ml/100 L.W

1.6- Hexythiazox
Trade name: Nissorun 50% W.P
Common name: Hexythiazox
IUPAC name: (4RS, 5RS)-5-(4- Chlorophenyl)- N-cyclohexyl-4- methyl- 2- oxo-1,3 thiazolidine-3 – carboxamide.
Recommended concentration: 40 ml / 100 L.W

2- Maintenance of the colonies:

***a. T. urticae*:**

For establishing a colony of *T. urticae* in the laboratory, the technique of Guirguis *et al.* (1977) was

followed. The mites were collected from infested leaves of the castor bean, *Ricinus communis* trees grown at the Experimental Farm of Ismailia Agricultural Research Station, Ismailia, Egypt.

One hundred adult females of *T. urticae* were transferred with a fine brush (Pelikan brush No. 000) to sweet potato leaves. Sweet potato cuttings, each holding about 8 leaves, were washed under running tap water and then the basal portion of these cuttings was inserted in water in 250 ml glass jar. Each jar contained three sweet potato cuttings. The colony was established with three jars. The sweet potato cuttings were changed twice a week in summer, and once a week in winter or when it was necessary.

The colony was kept in special cage (60x60x60cm) under laboratory conditions of 25±2ºC; 65±5% relative humidity and 12 hrs daily illuminations by using fluorescent tubes of 40–60 watt. The colony was kept away from any pesticide contamination for six months before used in experiment.

b. P. persimilis

The original samples of *P. persimilis* were received from the Plant Protection Division, Faculty of Environmental and Agricultural Sciences, Al-Arish, Suez Canal University, Egypt. The methodology of Shaw (1982) was used for rearing *P. persimilis*. *P. persimilis* was transferred with a fine brush on the sweet potato cutting harboring *T. urticae*. The colony of the predator was supplied with TSSM, when it was necessary.

c. S. longicornis

S. longicornis was collected from castor plants, at Ismailia Agricultural Research Station. Infested castor bean leaves with *T. urticae* that accompanied with *S. longicornis* were cut and transferred to the laboratory of Plant Protection in Ismailia Agricultural Research station. Each glass tube (35 cm diameter ×10 cm high), was provided with a piece of cabbage leaf as an ovipositional substrate. Ten adult females of *S. longicornis* were collected from infested castor leaves and transferred to each tube, which contained a sweet potato leaf heavily infested with *T. urticae*. These tubes were covered with a fastened muslin piece. Cabbage leaves harboring deposited eggs were kept in Petri dishes (9 cm diameter) under laboratory conditions of 25±2ºC and 65±5% (R.H).

d. S. gilvifrons

The original samples of *S. gilvifrons* were collected from the wild trees of castor bean, at Ismailia district. The heavily infested leaves with *T. urticae*, and associated with the coccinellid predator *S. gilvifrons* were picked and placed in paper bags and transferred to the laboratory of Plant Protection Division, Agricultural Research Station, Ismailia. The method proposed by Sarhan *et al.* (1989) was followed for rearing of this predator. Adults of *S. gilvifrons* were kept in glass tubes (2×8 cm) covered with muslin. Each tube was provided with sweet potato leaves heavily infested with *T. urticae* as a food supply for the enclosed predator individuals. Leaves, harboring newly deposited eggs of the predator, were collected and kept in Petri dishes (9 cm in diameter), and examined daily until hatching. Each newly hatched larva was placed in a Petri dish and provided with pieces of sweet potato leaf infested with *T. urticae*. The amount of food was increased daily with the larval development until pupation took place. Pupae were kept separately in glass tubes (2 × 8 cm) covered with a piece of muslin till adult emergence. Newly emerged adults were sexed and each couple was kept in a petri–dish.

2- **The toxicity of the tested acaricides:**

Direct spray technique was used to test the toxicity of the tested acaricides to *T. urticae* and its tested predators. In this respect, small circular leaf disc (1 inch in diameter) was taken from sweet potato leaves and placed in Petridishes lined with water saturated cotton wool. Twenty females of *T. urticae* were transferred on the lower surface of each disc. As for the tested predators, twenty adults of each tested predator were separately transferred on the lower surface of each leaf disc heavily infested with *T. urticae*. Each Petridish contained four discs. Five concentrations of the tested acaricides were used to draw toxicity line. Discs were sprayed with a constant amount of the acaricides solution determined by spraying pressure for three seconds by means of glass manual atomizer. These Petri dishes were kept under laboratory conditions of 25±2ºC and 65±5% R.H. The criterion for mortality was failure of mite to respond positively by leg movement following light prodding with a fine brush. Untreated leaf discs served as control. Four Petri dishes were used for each treated and untreated discs as replicates. The mortality was recorded 48 hours after treatment.

Abbot's formula (1925) was used to get correction for natural mortality. Lines of toxicity were statistically analyzed according to the method described by Finney (1952). The relative efficiency of the tested compounds was determined according to Sun (1950) as follows

$$\text{Toxicity index} = \frac{LC50\ of\ the\ compound\ A}{LC50\ of\ the\ compound\ B} \times 100$$

A ⟶ the most effective compound

B ⟶ the other tested compound

To calculate the general selective toxicity ratio of the tested acaricides, the method of Abdel-Aal *et al.* (1979) modified by El-Adawy *et al.* (2000) was used as follow:

The selectivity ratio (s.r) at LC_{90} level can be combined with LC_{50} in one parameter (general selective toxicity ratio) by employing the following equation:

$$G.S.T.R = \text{experimental s.r at LC } 50 \times (10)^{1.28 \frac{bp - bm}{bp \times bm}}$$

Where are:

G.S.T.R ⟶ general selective toxicity ratio.

s.r ⟶ selectivity ratio

b*p* ⟶ slop of the toxicity line on the predator

bm ⟶ slop of the toxicity line on the mites

To calculated the selectivity ratio (s.r) of the tested acaricides at LC_{50} level used:

Selectivity ratio (at LC $_{50}$ level) = $LC_{50}m$/ LC $_{50}P$

m ⟶ mite

P ⟶ predator.

RESULTS AND DISCUSSION

Toxicity of acaricides to *T. urticae*:

Data in Table (1) showed the descending order of the toxicity of the tested acaricides on *T. urticae*. The LC_{50} values were 0.53, 5.9, 20.6, 23.7, 24.7 and 39.9 ppm for abamectin, chlorfenapyr, hexythiazox, diafenthiuron, ethion and bifenazate, respectively.

Concerning the LC_{90}, the most effective compound against *T. urticae* was abamectin (4.26 ppm), followed by chlorfenapyr (52.4 ppm), diafenthiuron (120.7 ppm), ethion (125.9 ppm), hexythiazox (167.2 ppm), and bifenazate (661.1 ppm). The order of the tested acaricides at LC_{90} differed to that observed based on the LC_{50} values. This refers to the variation of slop values of the tested acaricides. On the bases of slope values, diafenthiuron had the steepest toxicity line (1.81 ppm), whereas bifenazate had the flattest one (1.05 ppm). The other values came between the two former values, (1.41 ppm) for each of abamectin and hexythiazox, (1.76 ppm) for chlorfenapyr and (1.8 ppm) for ethion.

Concerning the toxicity index at LC_{50},the most effective compound was abamectin (toxicity index = 100) followed descendingly by chlorfenapyr (8.96 ppm), hexythiazox (2.56 ppm), diafenthiuron (2.22 ppm), ethion (2.14 ppm) and bifenazate (1.32 ppm); whereas the values at LC_{90} level were 100, 8.12, 3.52, 3.38, 2.54 and 0.64 ppm for abamectin, chlorfenapyr, diafenthiuron, ethion, hexythiazox and bifenazate ,respectively. The toxicity index reflects the differences among the tested acaricides in their toxicity.

Clearly, abamectin had the most toxic effect against the adult females of TSSM; whereas the bifenazate had the lowest effect. Such results are in agreement with those obtained by Szwejda (1993) and El-Adawy *et al.* (1995). Szwejda (1993) stated that Abamectin, Fenapyred, Acrinatrin and Difenthiuron achieved excellent control with percentage of mortality reached more than 98%, against *Tetranychus urticae* and *Tetranychus cinnabarinus* Boisd. Also, El-Adawy *et al.* (1995) reported that Abamectin reduced TSSM population by 79.8% through 21 days.

Table (1): Toxicity of certain acaricides to the adult females of *T. urticae*

Acaricides	LC_{50} ppm	LC_{90} ppm	Slope	Toxicity index	
				LC_{50}	LC_{90}
Ethion	24.7	125.9	1.8	2.14	3.38
Bifenazate	39.9	661.1	1.05	1.32	0.64
Chlorfenapyr	5.9	52.4	1.76	8.96	8.12
Abamectin	0.53	4.26	1.41	100	100
Diafenthiuron	23.7	120.7	1.81	2.22	3.52
Hexythiazox	20.6	167.2	1.41	2.56	2.54

The selectivity of the tested acaricides
On *P. persimilis*

Data in Table (2) showed that ethion is the most toxic compound to *P. persimilis* at LC_{50} (15.2ppm) followed by abamectin (30.9 ppm), bifenazate (45.6 ppm), chlorfenapyr (45.8 ppm), hexythiazox (74.3 ppm) and diafenthiuron (76.6 ppm). At $LC_{90,}$ the value were ethion (170.5 ppm), chlorfenapyr (280.6 ppm), bifenazate(383.3 ppm), hexythiazox (736.0 ppm), diafenthiuron (886.1 ppm) and abamectin (1020.4 ppm).

On the bases of slope values, chlorfenapyr had the steepest toxicity line (1.6); whereas abamectin had the flattest one (0.8).

According the selectivity ratio, the least toxic ratio was found for abamectin at 0.01 and 0.004 ppm at for LC_{50} and LC_{90} levels, respectively; whereas the highest toxic ratio was shown by ethion 1.6 ppm at LC_{50} level and bifenazate 1.7 ppm at LC_{90} Level.

The values of the general selectivity ratio to *P. persimilis* were 0.006, 0.28, 0.41, 1.35, 1.74 and 2.04 ppm for Abamectin, Chlorfenapyr, Hexythiazox, Bifenazate, Diafenthiuron and Ethion, respectively. It is obvious that abamectin had the lowest general selective ratio (0.006 ppm); whereas ethion had the highest value (2.04 ppm) for *P. persimilis*.

Based on the general selective ratio, it is clear that abamectin, Chlorfenapyr, and hexythiazox can be considered as the safest tested acaricides for *P. persimilis* since the values were less than 1%. Such results are in agreement with those obtained earlier (Ahn*et al.,* 2004; Kim and Yoo, 2002; White, 2004).

Also, Acramite (bifenazate) wad less toxic to adult females and immature stages of *P. persimilis* than to adult female and immature stages of TSSM.

Table (2): The toxicity of certain acaricides to *T. urticae* and its predator *P. persimilis*.

Acaricides	*T. urticae*			*P. persimilis*			*Selectivity ratio**		*General selective ratio*
	LC_{50}	LC_{90}	Slope (b)	LC_{50}	LC_{90}	Slope (b)	LC_{50}	LC_{90}	
Ethion	24.7	125.9	1.8	15.2	170.5	1.2	1.6	0.7	2.04
Bifenazate	39.9	661.1	1.05	45.6	383.3	1.3	0.8	1.7	1.35
Chlorfenapyr	5.9	52.4	1.76	45.8	280.6	1.6	0.1	0.2	0.28
Abamectin	0.53	4.26	1.41	30.9	1020.4	0.8	0.01	0.004	0.006
Diafenthiuron	23.7	120.7	1.81	76.6	886.1	1.2	0.3	0.1	1.74
Hexythiazox	20.6	167.2	1.41	74.3	736.0	1.2	0.2	0.2	0.41

*s.r (selectivity ratio)= $LC_{50}$of m. / LC_{50} of P.

On *S. longicornis*

Concerning the side effect of the tested acaricides on *S. longicornis,* data in Table (3) showed that abamectin had the highest toxicity at the LC_{50} (19.0 ppm), followed by hexythiazox (20.3 ppm), diafenthiuron (27.2 ppm), ethion (27.7 ppm), chlorfenapyr (28.4 ppm) and bifenazate (35.9 ppm); Whereas the LC_{90} Values were 75.11, 105.0, 105.0, 128.3, 169.2 and 271.0 ppm for hexythiazox, ethion, diafenthiuron, abamectin, chlorfenapyr and bifenazate, respectively. On the basis of slope values, hexythiazox had the steepest toxicity line (2.2); whereas bifenazate had the flattest one (1.4).

As for selectivite ratio at LC_{50}, data in Table (3) showed that ethion, chlorfenapyr, abamectin and diafenthiuron have s.rvalues less than one, which indicated that the tested acaricides are safe to the predators. However, at LC_{90} level,all tested acaricides had values morethan one except chlorfenapyr (0.30) and abamectin (0.03).

Regarding the general selective toxicity ratio, these values were 0.025, 0.506, 0.715, 1.496, 3.78 and 4.0 ppm for Diafenthiuron, ethion, bifenazate, hexythiazox, abamectin and chlorfenapyr, respectively. It is obvious that diafenthiuron had the lowest general selective ratio (0.025 ppm); whereas Chlorfenapyr had the highest one (4.0 ppm).

So, it is clear that all tested acaricides except abamectin, Chlorfenapyr, and hexythiazox can be considered as safe acaricides for *S. longicornis*.

El–Esnawy (2006) showed that abamectin was the most effective acaricides on *T. urticae* and had the highest toxicity on its predator *S. longicornis.*

Table (3): The toxicity of certain acaricides to *T. urticae* and its predator *S. longicornis*.

Acaricides	*T. urticae*			*S. longicornis*			Selectivity ratio *		General selective ratio
	LC_{50}	LC_{90}	Slope (b)	LC_{50}	LC_{90}	Slope(b)	LC_{50}	LC_{90}	
Ethion	24.7	125.9	1.8	27.7	105.0	2.1	0.8	1.19	0.506
Bifenazate	39.9	661.1	1.05	35.9	271.0	1.4	1.11	2.43	0.715
Chlorfenapyr	5.9	52.4	1.76	28.4	169.2	1.6	0.19	0.30	4.0
Abamectin	0.53	4.26	1.41	19.0	128.3	1.5	0.02	0.03	3.78
Diafenthiuron	23.7	120.7	1.81	27.2	105.0	2.1	0.87	1.14	0.025
Hexythiazox	20.6	167.2	1.41	20.3	75.11	2.2	1.01	2.22	1.496

*s.r (selectivity ratio)= LC_{50}ofm. / LC_{50} of P.

On *S. gilvifrons*

Data in Table (4) showed the values of LC_{50} for *S. gilvifrons* were 14.0, 24.1, 32.7, 38.7, 56.6 and 62.2 ppm for diafenthiuron, abamectin, bifenazate, chlorfenapyr, ethion and hexythiazox, respectively; Whereas, values at LC_{90} level indicated that abamectin was the most toxiccompound (102.0 ppm), followed bychlorfenapyr (109.9 ppm), bifenazate (152.9 ppm), diafenthiuron (153.1 ppm), hexythiazox (263.9 ppm) and ethion (2633.3ppm). As for the slope values, ethion had the flattest slope (0.7 ppm); whereas chlorfenapyr had the steepest one (2.8 ppm).

According to the selectivity ratio, the least toxic ratio was found for abamectin 0.02 ppm at LC_{50} level; whereas ethion and abamectin (0.04 ppm) were the least at LC_{90} level. The highest toxic ratio was shown by diafenthiuron 1.69 ppm at LC_{50} and bifenazate 4.32 ppm at LC_{90}.

About the general selective ratio, the values of ethion, bifenazate, chlorfenapyr, abamectin, diafenthiuron, and hexythiazox were 0.01, 0.53, 1.68, 1.59, 0.04, and 0.59 ppm, respectively. It is obvious that ethion had the lowest general selective ratio (0.01 ppm); whereas chlorfenapyr had the highest one (1.68 ppm).

So, it is clear that all tested acaricides except abamectin and chlorfenapyr can be considered safe for *S. gilvifrons*.

It could be concluded that abamectin, chlorfenapyr, and hexythiazox could be used to control TSSM in the presence of *P. persimilis.* In the presence of *S. longicornis* with *T. urticae*, ethion, bifenazate, and diafenthiuron were the most recommended acaricides for TSSM control. Meanwhile, ethion, bifenazate, diafenthiuron, hexythiazox are preferable to be applied on the presence of *S. gilvifrons*.

Table (4): The toxicity of certain acaricides to *T. urticae* and its predator *S. gilvifrons*.

Acaricides	*T. urticae*			*S. gilvifrons*			Selectivity ratio*		General selective ratio
	LC_{50}	LC_{90}	Slope (b)	LC_{50}	LC_{90}	Slope (b)	LC_{50}	LC_{90}	
Ethion	24.7	125.9	1.8	56.5	2633.3	0.7	0.43	0.04	0.01
Bifenazate	39.9	661.1	1.05	32.7	152.9	1.9	1.22	4.32	0.53
Chlorfenapyr	5.9	52.4	1.76	38.7	109.9	2.8	0.15	0.47	1.68
Abamectin	0.53	4.26	1.41	24.1	102.0	2.0	0.02	0.04	1.59
Diafenthiuron	23.7	120.7	1.81	14.0	153.1	1.2	1.69	0.78	0.04
Hexythiazox	20.6	167.2	1.41	62.2	263.9	2.0	0.33	0.63	0.59

*s.r (selectivity ratio)= LC_{50}ofm. / LC_{50} of P.

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التأثير الجانبي لبعض مبيدات الأكاروس علي ثلاثة مفترسات لأكاروس العنكبوت الأحمر ذو البقعتين

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تم تقدير سمية بعض المبيدات الأكاروسية التابعة لمجاميع كيميائيه متنوعة (الايثيون وبيفينزات وكلورفينبير وأبامكيتن ودايفنيثريون وهيكسيوزيكس) علي كل من العنكبوت الأحمر ذو البقعتين *Tetranychus urticae* وبعض المفترسات المفترسة له وهي *Phytoseiulus persimilis, Scolothrips longicornis, Stethorus gilvifrons*. أوضحت النتائج المتحصل عليها أن أبامكيتن (٠.٥٣ جزء في المليون) والايثيون (١٥.٢ جزء في المليون) والأبامكيتن (١٩.٠ جزء في المليون) والدايفنثيريون (١٤.٠ جزء في المليون) أكثر المبيدات سمية علي كل من *T. urticae* و *P. persimilis* و *S.longicornis* و *S. Gilvifrons* علي الترتيب عند مستوي LC_{50}، بينما كان الأبامكتين (٤.٢٦ جزء في المليون) الإيثيون (١٧٠.٥ جزء في المليون) والهكسيوزيكس (٧٥.١١ جزء في المليون) والأبامكتين (١٠٢.٠ جزء في المليون) أكثر المبيدات سميه علي كل من *T. urticae* و *P. persimilis* و *S.longicornis* و *S. gilvifrons* علي الترتيب عند مستوى LC_{90}. وبناءا علي كل مستوى من مستويات الفاعلية للتركيز القاتل لـ ٥٠%من الأفراد والتركيز القاتل لـ ٩٠% من الأفراد للمبيدات الأكاروسيه المختبرة علي المفترسات المختارة تم حساب السمية الإختيارية لهذه المبيدات علي نفس المستويين السابقين. وجد أن جميع المبيدات المختبرة آمنه عدا الايثيون عند مستوى التركيز القاتل لـ ٥٠ من الأفراد، بيفنزات عند مستوى التركيز القاتل لـ٩٠% من الافراد علي المفترس *P. persimilis*. في حين بيفنزات، هيكسيزوكس كانا غير أمنين عند مستوى التركيز القاتل لـ ٥٠% من الافراد، أما كلوروفينبير، ابامكتين كانا أمنين عند مستوى التركيز القاتل لـ ٩٠ من الأفراد علي المفترس *S. longicornis*. أما المبيدات الآمنة علي *S. gilvifrons* فجميع المركبات المختبرة كانت أمنه عدا بيفينزات ـ دايفينثريون عند المستوي التركيز القاتل لـ ٥٠%من الأفراد بيفينزات عند المستوي التركيز القاتل لـ ٩٠% من الأفراد. عند دمج نسب السمية الاختيارية المتحصل عليها عند كل من مستوي LC_{50}, LC_{90} كنسبه سميه اختياريه عامه كانت النتائج كالآتي *P. persimilis* (٢.٠٤، ١.٣٥، ٠.٢٨، ٠.٠٠٦، ١.٧٤، ٠.٤١) *S. longicornis*, (٠.٥٠٦، ٠.٧١٥، ٠.٤٠، ٣.٧٨، ٠.٠٢٥، ١.٤٩٦). *S. gilvifrons* (٠.٠١، ٠.٥٣، ١.٦٨، ١.٥٩، ٠.٠٤، ٠.٥٩) لكل من ايثيون، الهيكسيزوكس، الدايفنثيريون، أباماكتين، كلورفينبير، بيفينزات.