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CONSIDERATIONS FOR THE USE OF CERTAIN ACARICIDES AGAINST THE TWO-SPOTTED SPIDER MITE *Tetranychus urticae* THROUGH INTEGRATED PEST MANAGEMENT

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ABSTRACT

Nine acaricides were tested to estimate their efficiency against the two-spotted spider mite and their toxicity on the predator *Orius albidipennis* (Reuter) before using these acaricides side by side the predator in controlling the mite through integrated pest management programs. The preferability among the tested acaricides based on the general selective toxicity ratio. The obtained results revealed that hexythiazox was the most effective acaricide at LC_{50} level and at profenofos LC_{90} level whereas; fenbutatin was the least effective at LC_{50} and bifenazate at LC_{90} level on the mite. Results also show that diafenthiuron had the highest toxicity effect while fenbutatin had the lowest on the predator *O. albidipennis*, at the same former levels.

The value of the general selective toxicity ratio recommended hexythiazox and bifenazate as the safest acaricides to the predator.

INTRODUCTION

Integrated pest management (IPM) programs had already carried out for management of key arthropod pests. The two-spotted spider mite is one of them (Cooley *et al* 1996). IPM programs remain firmly based on pesticides. The first step in IPM program is to move from preventive, calendar-based pesticide applications to pesticide applications made only when there is potential for significant crop damage (Gadoury 1993, Phipps 1993 and Stevenson 1993). A wide range of pesticide is available in the market. Selecting pesticides that are less harmful to predators and parasites may encourage the development the natural biological control. The increased use of natural enemies for the control of pests such as spider mites, aphids and whitefly (Gillespie 1989), make pesticides application critical decision. When pesticides are applied, care should be taken to ensure that the most important beneficial predators are not adversely affected (Tabashnik and Croft 1985, Waaga 1996). Using polyphagous anthrocorids of genus orius (Hemiptera: Anthocoridae) has proved promising. Orius species can feed on a wide rang of small arthropods (Salas and Ehler 1977 and Isenhour and Yeargan 1981).

The two-spotted spider mite has been reviewed as the most numerous and serious species. The two-spotted spider mites are prayed by different Orius species (Heitrnan *et al.* 1986).

The following study aims to transpire only one selective value of some acaricides by combination between LC_{50} and LC_{90} values.

MATERIALS AND METHODS

I. Maintenance of the colonies:

A. The two-spotted spider mite *Tetranychus urticae*:

Green beans *Phaseolus vulgaris* L. were used as host plants. Twenty pots were filled to three quarter sizes with a mixture of sand beet muse and vermiculite. Pots were planted with bean seeds of (5 seed/pot). The pots were kept in cages (10 pot/cage) surrounded with fine mesh screening in green house. The primary leaves were ready to use within couple of weeks following seeding, whereas the 1st trifoliate leaves took about three weeks. A two-spotted spider mite population was established by combing several strains from different districts in Ismailia governorate to ensure genotypic variation. The bean plants were infested with the admixed mite strain. The strain was reared for 4 generation before testing.

B. The predator *Orius albidipennis*:

The blossom of Berseem (Egyptian clover) were picked up in paper bag and transported to the Plant Protection Laboratory in Ismailia Agricultural Research Station. Each package was provided with a piece of cotton saturated with ether as anesthetic. Samples were checked well on a white plastic sheet. All the fallen predator *Orius albidipennis* were carefully sucked. The method of Isenhour and Yeargan (1981) was followed in rearing the predator. A pod of green bean as an ovipostional substrate was placed in glass tube (6 cm in diameters) covered with fastened muslin and provided with egg of *Anagosta kuehniella* (Zeller) as food supply. Twenty adult females of *O. albidipennis* were transferred individually to the glass tubes for three hours before being removed. The newly hatched nymphs were transferred to glass (20 nymph for each tube), containing a green bean pod and eggs of *A. kuehniella*. One hundred glass tubes were used to be incubated at 25°C. The pods that harbored egg were taken daily.

II. Toxicity testes:

A. Chemicals:

1. Bay-Bay (amitraz EC 20%)
(N-2, 4- dimethylphenyl)-N-[[(2, 4- dimethylphenyl) amino] methyl] - N-methylmethanimidamide

2. Acramite (bifenazate SC 48%)
1-methylethyl 2.(4-methoxy[1,1-biphenyl]-3-yl)hydrozine carboxylate

3. Pegasos (diafenthuron SC 25%)
1-tert-butyl-3-(2, 6-di-isopropyl-4-phenoxyphenyl) thiourea

4. Acarelte (dinobuton EC 40%)
1 – Methylethyl 2 - (1- methylpropyl) - 4, 6 - dinitrophenyl carbonate

5. Fenoxide (fenbutatin – oxide SC 55%)
di (tri - (2, 2- dimethyl-2- phenylethyl) tin) oxide

6. Nussorun (hexythiazox EC 5%)
trans-5-(4-chlorophenyl)-N-cyclohexyl-4-methyl-2-oxothiazolidinone-3-carboxamide

7. Selecron (profenofos EC 75%)
O-(2-chloro-4-bromo-phenyl)- O- ethyl- S- N- propyl phosphorothioate

8. Pyromite (pyridaban WP 75%)
2- tert-butyl-5-(4-tert-butylbenzylthio)-4-chloropyridazin-3 (2H) - one
9. Oberon (spiromesifen SC 45%)
3-mesityl-2-oxo-1-oxaspiro [4-4] non-3-en-4-yl 3,3-dimethylbutyrate

B. Laboratory tests:

Direct spraying technique was employed to estimate the toxicity of the former mentioned acaricides against each of the predator *O. albidipennis* and its prey the two-spotted spider mite *Tetranychus urticae*. In this respect, twenty five females of mite were transferred by a fine brush to the lower surface of small circular leaf disc (1 inch in diameters) punched from sweet potato leaves. Petri-dishes were lined with water saturated cotton wool. Each Petri-dish contained 4 discs. The discs were surrounded by alight repellent tangle foot. Four Petri-dishes represented replicates. Each dish was sprayed with a constant amount of the toxicant solution as an aqueous dilution determined by spraying pressure for 5 seconds by means of a glass manual atomizer. Five concentration of each tested acaricides were used to draw the toxicity line. All leaf treated discs likewise untreated control were maintained in the laboratory at 25±2 °C and 65±5% relative humidity. Mortalities were recorded after 24 hours of treatment. The criterion of mortality was the failure of mite to respond positively by leg movement following light prodding with a fine brush. The same former method was used to test the toxicity of the tested compounds against the nymphs of the predators. Each disc was provided with enough numbers of mites as food supply for the predator.

Abbot's formula (1925) was used to get correction for natural mortality. The toxicity lines were statistically analyzed according to the method described by Finney (1952).

The equation of Abd-El-Aal *et al.* (1979) and El-adawy *et al.* (2000) was applied to calculate the general selective toxicity ratios of the tested acaricides as follow:

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

Where:
G. S. T. R. = General Selective Toxicity Ratio.
s. r. = selective ratio.
bp = slop of the toxicity line on the predator.
bm = slop of the toxicity line on the mite.

RESULTS AND DISCUSSION

Of the nine tested acaricides, hexythiazox had the most significant effect; whereas fenbutatin had the lowest effect at LC_{50} level on the moving stages of the two-spotted spider mite. The values were 20.7 and 126.2 ppm for the aforementioned acaricides, respectively. The other values of the tested acaricides came between the two former acaricides.

Table (1): Toxicity of certain acaricides to the two-spotted spider mite, *T. urticae* and the predator, *O. albidipennis*.

Compound	*T. urticae*			*O. albidipennis*			Selectivity ratio		General selectivity ratio*
	LC_{50}	LC_{90}	Slope b (m)	LC_{50}	LC_{90}	Slope b (m)	LC_{50}	LC_{90}	
Amitraz	65.8	308.9	1.9	62.3	359.2	1.7	1.1	0.9	2.5*
bifenazate	39.9	661.2	1.1	78.9	822.3	1.3	0.5	0.8	0.8
diafenthiuron	23.8	120.8	1.8	22.2	111.2	1.8	1.1	1.1	2.0*
dinobuton	35.8	146.6	2.1	67.8	372.0	1.7	0.5	0.4	1.1*
fenbutatin	126.2	389.5	2.6	298.8	1060.2	2.3	0.4	0.4	1.2*
hexythiazox	20.7	167.2	1.4	116.8	555.6	1.9	0.2	0.3	0.2
profenofos	22.9	111.7	1.9	22.3	120.0	1.8	1.0	0.9	3.2*
Pyridaben	35.1	131.8	2.2	29.9	131.9	2.0	1.2	1.0	3.1*
spiromesifen	57.5	455.8	1.4	53.9	313.9	1.6	1.1	1.5	2.4*

* Values greater than 1 indicate unsafe to the predator.

The ascending order of the toxicity values at LC_{50} level were 22.9, 23.8, 35.1, 35.8, 39.9, 57.5 and 65.8 ppm for profenofos, diafenthiuron, pyridaben, dinobuton, bifenazate, spiromesifen and amitraz; respectively (table 1 and fig.1). As regards the slope values, results show that fenbutatin had the steepest toxicity line (2.6); whereas bifenazate had the flattest line (1.1). The other toxicity lines values of the remaining acaricides came between the former two mentioned values.

The corresponding LC_{90} values were profenofos (111.7), diafenthiuron (120.8), pyridaben (131.8), dinobuton (146.6), hexythiazox (167.2), amitraz (308.9), fenbutatin (389.5) spiromesifen (455.8) and bifenazate (661.2) ppm.

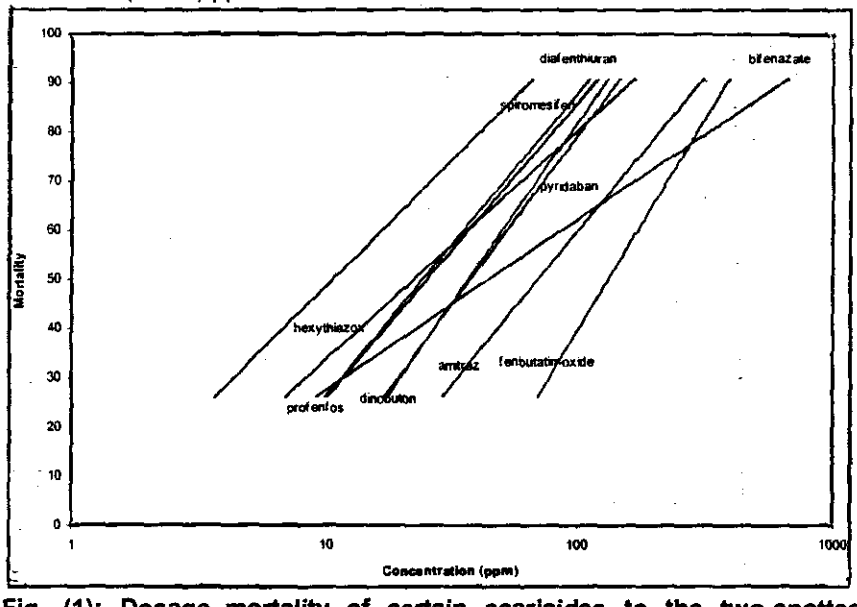

Fig. (1): Dosage–mortality of certain acaricides to the two-spotted spider mite, *T. urticae*.

Concerning the toxicity of the tested acaricides on the predator *O. albidipennis*, results in table (1) and fig. (2) show that the most toxic acaricide at LC_{50} was diafenthiuron (22.2), whereas the least toxic one was fenbutatin (298.8) ppm. The LC_{50} values of the other acaricides came in between the descending order was profenofos (22.3), pyridaben (29.9), spiromesifen (53.9), amitraz (62.3), dinobuton (67.8), bifenazate (78.9) and hexythiathox (116.8) ppm.

The decreasing order of toxicity of the tested toxicants at LC_{90} level was diafenthiuron (111.2), profenofos (120.0), pyridaben (131.9), spiromesifen (313.9), amitraz (359.2), dinobuton (372.0), hexythiathox (555.6), bifenazate (822.3) and fenbutatin (1060.2) ppm.

Considering the slope values (table 1 and fig. 2) bifenazate had the flattest toxicity line (1.3); whereas fenbutatin had steepest toxicity line (2.3).

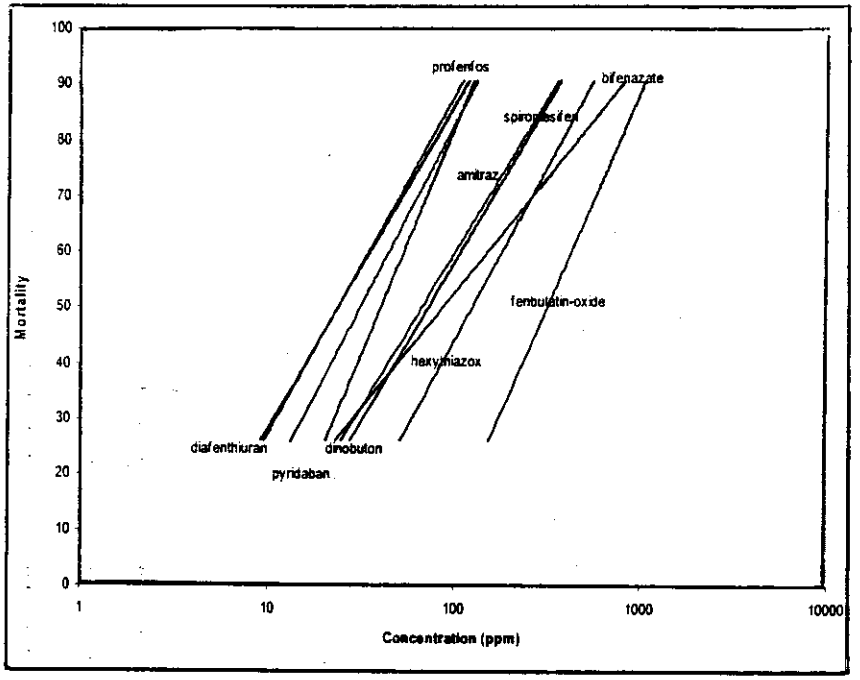

Fig. (1): Dosage–mortality of certain acaricides to the predator, *O. albidipennis*

The selective toxicity ratio is listed in table (1). The least toxic ratio was found for hexythiathox, 0.2 and 0.3 ppm at each of LC_{50} and LC_{90} levels respectively, whereas the highest toxic ratio was shown by pyridaben (1.2 ppm) at LC_{50} level and spiromesifen (1.5 ppm) at LC_{90} level. The rest of the tested compounds lie the two extremes. Owing to the non consistency in the order of the tested compounds based on the selectivity ratio at two levels LC_{50} and LC_{90} two selectivity ratios are not adroit to decide which compound is considered safe for natural enemies under application.

The general selective toxicity ratio resulting from combining the two levels of LC_{50} and LC_{90} probably more proper. Data in table (1) show that hexythiathox had the lowest general selectivity ratio (0.2) whereas; pyridaben had the highest (3.1 ppm). Based on the general selectivity ratio, it is clear that hexythiathox and bifenazate can be considered as the safest on the predator *O. albidipennis*. This result devices us to use the safes groups as acaricides to *O. albidipennis* though IPM programs.

REFERENCES

Abbot, W.S.(1925). A method of computing effectiveness of an insecticides.J.Econ.Entomol; 18:265-267.

Abdel-Aal, Y.A.I; A.M.K.El-sayed, A.A.Negm, M.H.Hossein and A, H. El-Sebae.(1979). The relative toxicity of certain insecticides to *Spodoptera littoralis* (Boisd) and *Coccinella undecimpunctata* L. International Pest Control, July/ August, 79:82.

Cooly, D. R.; W. F. Wilcox; J. Novach and S. G. Schloemann (1996). Integrated pest management programs for strawberries: in Northeastern United States. Plant Dis. 80 (3): 228-237.

El- adawy, A. M.; H. Yousri; Y.M. Ahmed; K. Tiilikkala and T. A. El-Shrkawy (2000). Estimation of general selective toxicity ratios of certain acaricides to *Stethorus gilvifrons* (Mulsant) and its prey *Tetranychus urticae* Koch. Egypt. J. Agric. Res. 78 (3): 1081-1089.

Finney, D.J.(1952). Probit analysis-statistical treatment of the sigmoid response curve. Cambridge University Press.

Gadoury, D. M. (1993). Integrating management decisions for several in fruit production. Plant Dis. 77: 299-302.

Gillespie, D. R. (1989). Biological control of thrips (Thysanoptera: Thripidae) on green house cucumber by *Amblyseus cucumeris*. Entomophaga. 34: 185-192.

Heitmans, W. R. B; W. P. J. Overeer and L. P. S. Van Der Geest (1986). The role of *Orius vicinus* (Heteroptera: Anthocoridae) as a predator of phytophagous and predacious mites in a Dutch orchard. J. Appl. Entomol., 102: 391-402.

Isenhour, D.J. and K. V. Yeargan (1981). Effect of temperature on the development of *Orius insidiosus* with notes on laboratory rearing. Ann. Entomol. Soc. Am. 74: 114-116.

Phipps, P. M. (1993). IPM in peanuts: Developing and delivering working IPM system. Plant Dis. 77: 307-309.

Salas, A. J. and L. E. Ehler (1977). Feeding habits of *Orius tristicolor*. Ann. Entomol. Soc. Am. 70: 60-62.

Stevenson, S. (1993). IPM for potatoes: A multifaceted approach to disease management and information delivery. Plant Dis.77:309-311.

Tabashink, B. E. and B. A. Croft (1985). Evaluation of pesticide resistance in apple pests and their natural enemies. Entomophaga. 30: 37-49.

Waaga, j. (1996). Yes, but does it works in the field? The challenge of technology transfer in biological control. Entomophaga.41:315-332.

إعتبارات إستخدام بعض المبيدات الأكاروسية ضد العنكبوت الأحمر ذو البقعتين خلال برنامج المكافحة المتكاملة للآفة

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درست فاعلية تسعة مبيدات أكاروسية ضد العنكبوت الأحمر ذو البقعتين كما قدرت سمية هذه المبيدات على المفترس *Orius albidipennis* لتقدير إمكانية استخدامها جنبا الى جنب فى عملية مكافحة العنكبوت الأحمر ذو البقعتين خلال برنامج المكافحة المتكاملة للآفة. وقد أستند فى عملية المفاضلة بين هذه المركبات على قيم النسبة العامة للسمية الاختيارية لها.

أوضحت النتائج المتحصل عليها أن مركب hexythiazox حقق أعلى فاعلية ضد العنكبوت الأحمر ذو البقعتين عند مستوى التركيز القاتل ل ٥٠ % ، profenofos عند مستوى التركيز القاتل ل ٩٠% وأقلها مركب fenbutatin عند مستوى ٥٠% bifenazate عند التركيز القاتل ل ٩٠%.

أوضحت النتائج أيضا ان مركب diafenthiuron سبب أعلى سمية على المفترس ومركب fenbutatin أقل سمية عند المستويين ٩٠،٥٠%.

من حيث نسب السميه الإختاريه المتحصل عليها عند كل من مستوى التركيز القاتل ل ٥٠، و مستوى التركيز القاتل ل ٩٠% أشارت النتائج إلى إحتمال وجود إختاريه لمركب عند أحد مستويى التركيز القاتل وعدم وجود هذه الإختياريه عند التركيز القاتل الآخر.

ترشح قيم النسبة العامة للسمية الاختيارية للمبيدات الأكاروسية المختبرة كل من المركب هكسا ثيوكس، الباى فينزوات لمكافحة العنكبوت الأحمر ذو البقعتين جنبا الى جنب مفترس *Orius albidipennis* خلال برنامج المكافحة المتكاملة للآفة حيث أنها الأكثر أمانا والأقل سمية على المفترس.