

**TOXICITY OF SOME ACARICIDES AND SOME
INSECT GROWTH REGULATORS ON THE TWO
SPOTTED SPIDER MITE *TETRANYCHUS URURTICA*
KOCH AND ITS PREDATOR *PHYTOSEIULUS*
PERSIMILIS ATHIAS HENRIOT UNDER LABORATORY
CONDITION**

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ABSTRACT

The toxicity of Some Acaricides and some insect growth regulators

Oxymatrine, Flufenoxuron and Chlorofbazuron against the two-spotted spider mite, *Tetranychus urticae* Koch and the predatory mite *Phytoseiulus persimilis* Athias-Henriot was evaluated under laboratory conditions 25±2 °C and 70±5%.R.H. Embryonic development of *T. urticae* eggs laid (incubation period) on the leaf discs treated with Acaricides and some insect growth regulators were delayed. Flufenoxuron was more effective than Chlorofbazuron and Oxymatrine, as this period lasted 3.2, 2.7, 2.8 days for Oxymatrine, Flufenoxuron and Chlorofbazuron, respectively in compared with 2.5 days to untreated eggs . The current study indicated that the life cycle of *T. urticae* recorded 10.1, 10.6 and 10.3 days after application of Oxymatrine, Flufenoxuron and Chlorofbazuron, respectively compared with 7.6 days to the control. The rate of predator consumption to *T. urticae* differed according to the used compounds.

KEY WORDS: Acaricides and some insect growth regulators, *Tetranychus urticae*, *Phytoseiulus persimilis*

INTRODUCTION

The red spider mite two-spotted spider mite, *Tetranychus urticae* Koch is a worldwide pest of agricultural crops (Ho, 2000, Takafuji et al., 2000) and feeds on more than 180 host plants (Sim et al., 2003). Many predaceous Phytoseiid mites are now used in biological control and are important predators of phytophagous mite populations in IPM programs on outdoor and greenhouse crops. *Phytoseiulus persimilis* Athias-Henriot is one of the most important predator of tetranychid mites and is widely found on various crops as it is used in IPM in Egypt, (El-Sharabasy 2010). Due to harmful effect of the residual toxicity of the chemical neurotoxic insecticides on human and environment, control agents with comparative safety are recommended. The systemic synthetic mimics of the insect hormones, which are best known as Insect Growth Regulators (IGRs) have been reported to be potent control agents against a number of pests of

agriculture (Fox, 1990). Among the IGRs, Diflubenzuron and Triflumuron were programmed to test the bio-efficacy of some IGRs against the two spotted spider mite *Tetranychus urticae* Koch and its side effect on the predatory mite, *P. persimilis* under laboratory conditions 25 ± 2 °C and 75 ± 5 % R.H. The effect of some pesticides and IGRs on the behavior of phytoseiid mites were observed by Irigaray *et al.*, 2007 and Villanueva *et al.*, (2005). This study aimed to investigate the effect of one of the acaricides in addition to 2 of insect growth regulators on the biological aspects of the two spotted spider mites and its main predatory mite *Phytoseiulus persimilis* in the laboratory.

MATERIALS AND METHODS

Culture of mites : *Tetranychus urticae* Koch was imitated firstly by collecting randomly samples from cucurbits plantation in the previously season. Few numbers (8-10) of adult males and females were elected to rear in the laboratory along two successive generations on Kaster leaves in the laboratory. Enough numbers of the eggs of the second generation were taken, and the hatched individuals were reared to the main experimental assay. Two females of the predatory mite, *Phytoseiulus persimilis* were kept on disc for three hour. There after 5 eggs were maintained singly on 5 leaf discs. Development from egg to the adult stage was carried out on the leaf discs which were supplied with sufficient prey, *T. urticae*.

Toxicity Studies : A Leaf-Spray method has been used to evaluate the effect of tested Acaricides and some insect growth regulators on *T. urticae* and *P. persimilis*. Concerning the effect of Oxymatrine on biological aspects of both *T. urticae* and *P. persimilis*, twenty-five adult females, 1-2 days old were taken from cultures maintained in the laboratory for 4 generation in addition to control. Individuals were singly reared on mulberry leaves and placed in Petri-dishes, on wet cotton wool pads. The mulberry leaf discs in treated and control batches were changed with fresh treated ones for check when it was needed. The experiment was carried out under laboratory temperature about 25 - 30 °C and R.H. 70 ± 5 .

Chemicals: The recommended field concentration of Oxymatrine sl0.6% is 400 cm/feddan , Flufenoxuron dc 10% is 200 cm /feddan. water and chlorofluazuron5%ec 40 cm / feddan. For the preparation of stock solution distilled water of required volume was used with each tested compounds. (8Cl); Matrine, N-oxide (6Cl,7Cl); (+)-Matrine N-oxide; (+)-Oxymatrine; 1H,5H,10H-Dipyrido[2,1-f:3',2',1'-ij][1,6]naphthyridin-10-one, dodecahydro-, 4-oxide, [4R-(4a,7ab,13aa,13bb,13cb)]-; Ammothamnine; Kingbo; Matrine 1b-oxide; Matrine N1-oxide; Oxymatrine

Flufenoxuron 1[4-(2-chloro- α , α , α - tri fuoro-p-tolyloxy)-2-chlorophenyl]3-(2,6-difloropenzoyl) urea. Chlorofluazuron 1-[3,5 dichloro-4-(3-chloro-5-trifluoro methyl)-2-[(pyridyloxy)phenyl]-3(2,6-diflouropenzoyl)urea.

RESULTS AND DISCUSSION

1- Effect on the biological aspects of *T. urticae*

Developmental: Developmental durations of the two- spotted spider mite female immatures reared on discs treated with Chemical Compound were significantly elongated compared with their counterparts of the check.(Table 1).

Table (1):Effect of IGRs on the developmental period of *T. urticae* female

Compound	Duration developmental period of					
	Incubation period	Larva	Protonymph	Deutonymh	Total Immatures	Life cycle
Oxymatrine	3.2 +0.09 ^c	1.3 +0.05 ^a	2.4 +0.08 ^b	3.2 +0.89 ^b	6.92+0.94 ^b	10.1 +0.42 ^b
Indoxacarb	2.7 +0.09 ^b	1.2 +0.05 ^a	2.2 + 0.08 ^b	3.2 +0.9 ^b	6.43+0.90 ^b	10.6 +0.4 ^b
Chlorofbazuron	2.8 +0.07 ^b	1.3 +0.14 ^a	1.6 +0.07 ^a	2.6 +0.88 ^a	5.56+0.83 ^a	10.3 +0.3 ^b
Control	2.5 + 0.08 ^a	1.1 +0.0.8 ^a	1.5 +0.06 ^a	2.5 +0.79 ^a	5.13+0.78 ^a	7.6 +0.2 ^a

Means with the same letters do not differ significantly at P = 0.05 leve

2- Effect of different Chemical Compound on the biological aspects of *Phytoseiulus persimilis* when fed on eggs of *T. urticae*

As shown in Table (2) the different tested compounds had slightly significant effects on the different biological aspects of the predacous mite, *P. persimilis* when fed on *T. urticae*, where the different biological aspects of the predator when exposed to these Chemical Compound were decreased when compared with non-exposed individuals. The life cycle of the predatory mite was durated 7.55, 7.89 and 8.25 days for effect of Oxymatrine, Flufenoxuron and Chlorofbazuron, respectively in comparison with 8.55 days for untreated male individuals. However, the *P. persimilis* females took 7.0, 8.2 and 8.6 days for the same order of tested compounds, respectively in comparison with 8.0 days in case on untreated females.

Table (2):Effect of IGRs on the duration of *Phytoseiulus persimilis*

Compound	Duration developmental period of						
	Incubation period	Larva	Protonymph	Deutonymph	Total Immatures	Life cycle	Fecundity
	Male						
Oxymatrine	2.65 ± 0.05 ^d	1.30 ± 0.16 ^a	1.45 + 0.08 ^a	1.88 + 0.06 ^b	4.23+0.16 ^c	7.55 ± 0.45 ^c	-
Indoxacarb	3.0 ± 0.14 ^c	1.3 ± 0.11 ^a	1.4 ± 0.1 ^b	2.1 ± 0.07 ^b	4.81+0.17 ^b	7.89 ± 0.47 ^b	-
Chlorofbazuron	3.3 ± 0.07 ^b	1.4 ± 0.08 ^a	1.3 ± 0.11 ^c	2.4 ± 0.07 ^a	5.11+0.21 ^a	8.25 ± 0.88 ^a	-
Control	3.6a ± 0.07 ^a	1.4 ± 0.14 ^a	1.2 ± 0.08 ^c	2.4 ± 0.08 ^a	5.00+0.27 ^a	8.55 ± 0.69 ^a	-
	Female						
Oxymatrine	2.44 + 0.04 ^c	1.4 + 0.05 ^a	1.5 + 0.11 ^a	1.55 + 0.12 ^b	4.45+0.11 ^a	7.0 + 0.14 ^c	37.65±3.24
Indoxacarb	2.86 ± 0.05 ^b	1.2 ± 0.06 ^a	1.6 ± 0.07 ^a	2.2 ±0.09 ^b	5.00+0.16 ^a	8.2 ± 0.2 ^b	34.68±3.38
Chlorofbazuron	3.2 ± 0.07 ^a	1.2 ± 0.11 ^a	1.5 ± 0.08 ^a	2.2 ± 0.11 ^a	4.90+0.19 ^a	8.6 ± 0.09 ^a	35.64±2.68
Control	3.2 ± 0.1 ^a	1.3 ± 0.12 ^a	1.2 ± 0.1 ^b	2.2 ± 0.08 ^a	4.7+0.20 ^a	8.00 ± 0.11 ^b	32.5±2.24
L.S.D. at 0.05 level for sex	0.049	0.047	0.053	0.05	0.078	0.098	-

Means with the same letters do not differ significantly at P = 0.05 level.

Fecundity: The number of deposited eggs by the *P. persimilis* females were significantly increased after the individuals were exposed to the tested acaricides in the field. The number of eggs was 37.65 eggs in case of application of Oxymatrine, 34.68 eggs in case of Flufenoxuron and 35.64 eggs with application of Chlorofbazuron in comparison with those obtained in case of untreated females (32.5 eggs only). Generally, The present study revealed that the tested Chemical Compound had significant influence on the fecundity of *P. persimilis*, Table (2). **3- Effect of some Acaricides and some insect growth regulators**

on the longevity and life span of *Phytoseiulus persimilis*

As shown in Table (3), the longevity of adult male and female individuals of the predaceous mite, *P. persimilis* was slightly significantly affected with application of the compounds, Oxymatrine, Flufenoxuron and Chlorofbazuron in comparison with those of non-treated mites (control). The obtained data indicated that longevity of male mites took 12.89, 13.11 and 13.54 days for the previously mentioned order of the compounds but this period lasted 14.4 days in case on untreated mites. On the other hand these periods lasted 18.24, 18.65, 19.0 and 19.6 days for female individuals, respectively. However, the life span of the predaceous mite, *P. persimilis* males lasted 21.11, 21.48, 22.35 and 23.11 days for the effect of different Chemical Compound and control, respectively, changed to 27.06, 27.64, 28.0 and 28.32 days for female life span, respectively.

Table (3):Effect of some Acaricides and some insect growth regulators on the longevity and life span of *Phytoseiulus persimilis*

Compound	Longevity	Life span
Male		
Oxymatrine	12.89±0.98	21.11±0.97
Flufenoxuron	13.11±0.67	21.48±0.89
Chlorofbazuron	13.54±0.69	22.35±1.11
Control	14.4±0.67	23.11±1.54
Female		
Oxymatrine	18.24±0.089	27.06±1.67
Flufenoxuron	18.65±0.86	27.64±1.68
Chlorofbazuron	19.0±0.1.0	28.0±2.24
Control	19.6±1.36	28.32±1.59

4- Effect of the tested Chemical Compound on the feeding capacity of the predaceous mite, *Phytoseiulus persimilis*.

As shown in Table (4) the rate of predator male consumption on the two spotted spider mite, eggs was differed according to the compounds used. Oxymatrine was more potent on the predatory mite behavior as it consumed during the immature stages periods 11.0 eggs, and 12.6 eggs in case of Chlorofbazur treatment in compared with those

of the check ,13.2 eggs, the predatory male adults was 154.5, 165.2 and 185.5 eggs in case of Oxymatrine, Flufenoxuron and Chlorofbazuron treatment, respectively compared with 220.0 eggs in case of control. On the other hand the rate of consumption of *P. persimilis* females against eggs of *T. urticae*, the number

Table (4): The total consumption of the predaceous mite, *P. persimilis* when fed on eggs of *T. urticae* after exposure to different Chemical Compounds at 25 °C and 75 % R.H.

Compound	Immature stages \pm S.D.	Adult stage of the predator \pm S.D.
Males		
Oxymatrine	11.0 \pm 2.2 ^d	154.5 \pm 14.25 ^d
Flufenoxuron	11.8 \pm 1.59 ^c	165.2 \pm 10.25 ^c
Chlorofbazuron	12.6 \pm 1.2 ^b	185.5 \pm 14.26 ^b
Control	13.2 \pm 2.3 ^a	220.2 \pm 12.5 ^a
Females		
Oxymatrine	14.8 \pm 1.1 ^a	180.0 \pm 13.25 ^b
Flufenoxuron	15.9 \pm 2.5 ^c	168.2 \pm 15.62 ^c
Chlorofbazuron	17.65 \pm 2.2 ^b	150 \pm 14.23 ^d
Control	19.54 \pm 3.23 ^a	250.0 \pm 20.2 ^a
L.S.D. at 0.05 level for sex	0.063	1.278

Means with the same letters do not differ significantly at P = 0.05 level.

of prey was highly differed according to the type of used compound and was obviously significantly increased than male individuals. The number of consumed *T. urticae* egg as shown in Table (4) was 14.8, 15.9, and 17.65 eggs for immature stages and 180, 168.2 and 150.0 eggs in case of adult females with Oxymatrine, Flufenoxuron and Chlorofbazuron, were used respectively. Similar results were obtained by **Naher et al.**, (2006) when evaluated the effects of two IGRs diflubenzuron and triflumuron on the development of *T. urticae*. The two IGRs significantly extended the duration of different developmental stages except that of deutonymph. **Saenz de Cabenzon et al.**, (2002) studied the effect of triflumuron on the developing stages of *T. urticae* and found no toxicity on the egg stage of that mite. But, they mentioned that the immatures are more susceptible to triflumuron than the adults. They also commented that triflumuron could be an interesting incorporation in the integrated pest programs of *T. urticae*. Also, Diflubenzuron causes the inhibition of embryogenesis in the egg of several citrus root weevils when they fed on the treated foliage (**Lovstran and Beavers**, 1980 . **Saenz de Cabenzon et al.**, (2006) observed that the net reproduction rate, the intrinsic rate of increase and finite rate of *T. urticae* female treated with triflumuron were lower than in those untreated, resulting in a reduction of population growth. Therefore we concluded that Oxymatrine, Flufenoxuron and chlorofbazuron are suitable for use in mite management program for spider mites and *P. persimilis* is more tolerant to the tested Chemical Compound.

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المخلص العربى

سمية بعض المركبات الاكاروسية وبعض منظمات النمو الحشرية على العنكبوت الاحمر العادي *Tetranychus urticae* والعدو الطبيعي له *Phytoseiulus persimilis* تحت ظروف المعمل

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أجريت تجربة لاختبار تأثير بعض المركبات ضد العنكبوت الاحمر العادى *T. urticae* والاكاروس المقترس *Phytoseiulus persimilis* وذلك تحت ظروف المعمل ٢٥ + ٢٠ م ورطوبة نسبية مقدارها ٧٠ + ٥ % وكانت هذه المركبات تشمل Oxymatrine ومن منظمات النمو Flufenoxuron و Chlorofbazuron ولقد دلت النتائج المتحصل عليها ان فترة حضامة البيض للعنكبوت الاحمر عندما تغذت على الاوراق النباتية المعاملة قد تأخرت مقارنة بالفترة التي سجلت على الاوراق الغير معاملة وكان مركب Flufenoxuron كان أقوى هذه المركبات حيث استغرقت هذه الفترة زما مقداره ٣,٢ يوما تلتها ٢,٧ يوما عند تأثير مركب Oxymatrine ثم ٢,٨ يوما عند اختبار مركب Chlorofbazuron وذلك بالمقارنة بفترة مقدارها ٢,٥ يوما فقط بدون معاملة ومن ناحية أخرى تأثرت دورة الحياة للاكاروس النباتي بنوع المعاملة حيث سجلت ١٠,١ و ١٠,٦ و ١٠,٣ يوما عند استخدام مركبات Oxymatrine و Flufenoxuron و Chlorofbazuron على الترتيب. ولقد تأثر معدل افتراس الاكاروس المقترس *Phytoseiulus persimilis* بعد التعرض لهذه المركبات حيث كان مركب Chlorofbazuron افضل المركبات استخداما للمقترس حيث قام بزيادة عدد لبيض الخاص بالعنكبوت الاحمر والتي تم افتراسه بواسطة المقترس يليه مركب Flufenoxuron ثم مركب Oxymatrine.