EFFECT OF TWO ACARICIDES ABAMECTIN AND CHLORFENAPYR ON BIOLOGICAL ASPECTS OF THE TWO SPOTTED SPIDER MITE *Tetranychus cucurbitacearum* (Sayed)

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ABSTRACT

The toxic effect of Challenger (36% SC) and Vapcomic (1.8% ES) on the two spotted spider mite *Tetranychus cucurbitacearum* (Sayed) was studied under laboratory conditions.

Results indicated that Vapcomic was the more toxic compound, where the LC_{50} value was 0.54 ppm, while Challenger was less and toxicant, the LC_{50} value was 10.0 ppm.

The influence of LC_{50} concentration of the two tested compounds on some biological aspects of *T. cucurbitacearum* was evaluated under laboratory conditions. The two tested compounds had the ability to elongate the pre-oviposition period while they were able to decrease the oviposition, post-oviposition period and the adult female longevity. Also, the average number of deposited eggs per female decreased from 51.8 to 12.6 and 3.6 eggs layed/female for Challenger and Vapcomic, respectively. Hatchability of mite's eggs decreased being 57.62% with Challenger and 76.47% with Vapcomic.

Total mortalities of mite immatures were 61.66% and 45.17% in Challenger and Vapcomic, respectively. On the other hand, the duration of immature stages and total life cycle of this mite were prolonged when adult females were treated with (LC_{50}) of two tested compounds compared with untreated ones.

INTRODUCTION

The two spotted spider mite *Tetranychus* spp. is causing high damage and complete deterioration to the quality and quantity of different crops (Youssef and Shehata, 1971; and El-Halawany *et al*., 1986) and used acaricides on the different crops caused resistance strain of the two spotted spider mite *T. urticae* Koch

These have been complains from the growers that acaricides are loosing their efficiency for the control of *T. urticae*.

So, the present study is to determine the effect of two tested acaricides Challenger 36% SC and Vapcomic 1.8% ES on *T. cucurbitacearum* under laboratory conditions and the effect of LC_{50} concentration on some biological aspects.

MATERIALS AND METHODS

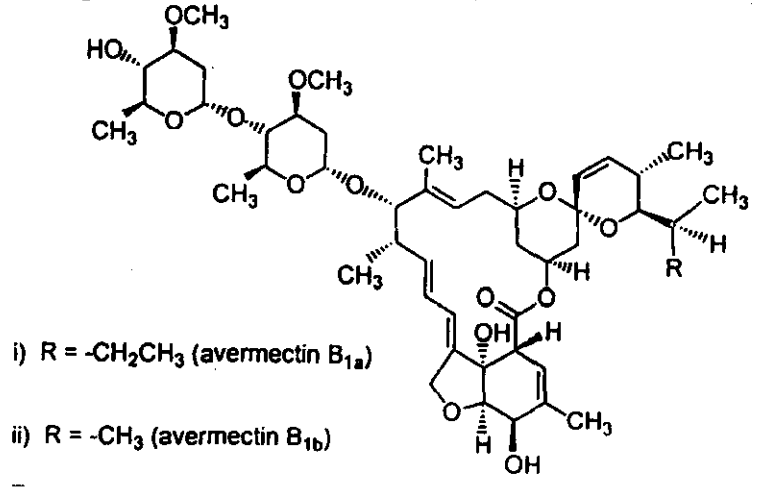
To study the effect of two tested acaricides (Challenger 36% SC and Vapcomic 1.8% ES) on adult stages of *T. cucurbitacearum*, ten individuals of the adult females of the same stage were taken from susceptible culture in the laboratory and transferred by means of a camel hair brush to each leaf disc of sweet potato (1 inch in diameter). These discs were dipped in different concentrations for the two tested compounds. The treated discs were placed onto wet cotton pods in petri-dishes. Four replicates of each concentration were used, untreated discs were dipped in water only. Mortality counts were made after 24 hours (Magouz, 2003).

Mortality percentages were corrected according to Abbott's formula (1925). The LC_{50} slope values and the confidence limits were statistically analysed according to Litchfield and Wilicoxon method (1949).

To study the effect of the tested compounds on adult longevity, fecundity, hatchability and the total life cycle of *T. cucurbitacearum* newly emerged adult females were transferred by means of camel hair to each leaf disc of sweet potato (1 inch in diameter), these discs were dipped in the LC_{50} concentrations resulted for the two tested compounds (susceptibility tests), while the untreated discs were dipped in water only, then, the discs were placed on their lower surface onto moist cotton pads in petri-dishes. Four replicates were used for each acaricide. Twenty four hours after treatment the survived females were separated singly on discs of sweet potato leaves. Then the hatched larva were transferred singly to untreated sweet potato leaf discs placed on wet cotton pads in new petri-dishes. These larva were allowed to develop till the adult stage. This study was conducted under laboratory conditions ($25 \pm 2^{o}C$ and $65 \pm 5\%$ R.H). Duration of every stage and mortality percentages were recorded twice daily, in the morning and before sunset.

Chemicals used:

1. **Vapcomic 1.8% ES (Abamectin)**



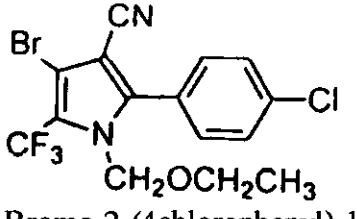
i) R = -CH_2CH_3 (avermectin B_{1a})

ii) R = -CH_3 (avermectin B_{1b})

Chemical name: 5-O-demethylavermectin A_{1a}(i) mixture with 5-O-demethyl-25-de(1-methylpropyl-25-(1-methylethyl)avermectin A_{1a}(ii).

It was isolated from fermentation of *Streptomyces avermitilis*. by Merck Sharp & Dohme Agvet. Manufacturers Gilmore; Jingma; Sinon; Syngenta; Tide. It was supplied from Vapco company, Egypt.

2. **Challenger 36% SC** Chlorfenapyr:



Chemical name: 4-Bromo-2-(4chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1G-pyrrole-3-carbonitrile.

It consists of several pyrrolomycins (1,2).Dioxapyrrolomycin isolated from a fermentation culture of *Streptomyces fummanus* by Lederle laboratories of American Cyanamid company.

It was supplied by BASF AGRO. S.A.S., France.

RESULTS AND DISCUSSION

1. Toxicity of Vapcomic and Challenger to adult female mite *T. cucurbitacearum*:

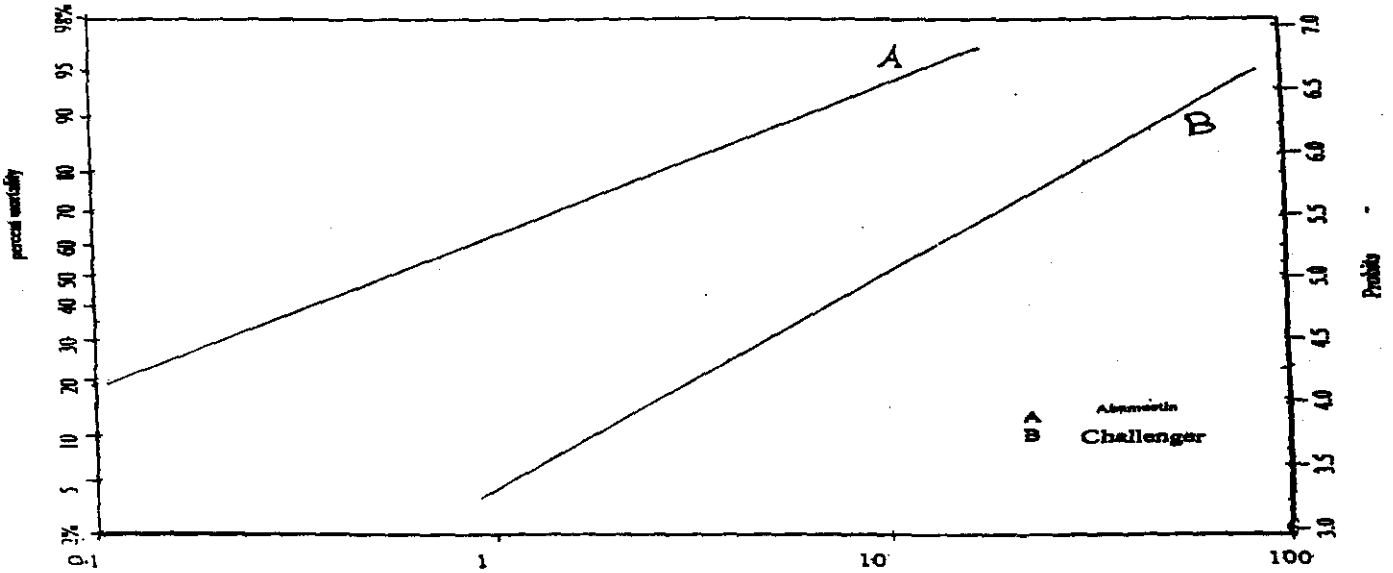
Data in Table (1) illustrated the toxicity of two bio-acaricides (Challenger 36% SC and Vapcomic 1.8% ES) to adult stages of two spotted spider mite *T. cucurbitacearum*. It was clear that Vapcomic was more toxic as LC_{50} value was 0.54 ppm, while Challenger was the less toxic with LC_{50} 10.0 ppm.

Table (1): The toxicity of two tested acaricides on adult stages of *Tetranychus cucurbitacearum* (Sayed) using leaf disc-dip technique.

Acaricides	LC_{50} ppm	Confidence limits of LC_{50}		Slope
		Upper	Lower	
Challenger 36% SC	10.0	13.55	7.38	1.66
Vapcomic 1.8% ES	0.54	0.8	0.36	1.15

Slope values of the log-concentration probit lines showed that Challenger has the highest slope value (1.66) while Vapcomic has the lowest value (1.21%). It is known that the slope value of log-concentration probit line is considered as reaction indicator between the chemical and affected organism, as the highest slope value means more homogeneity in reaction or response of the organism towards the acaricide used and in the same time the acaricide is acting as selection factor producing an organisms strain as pure genetically as possible.

These results were in agreement with the El-Halawany *et al.* (1987) and El-Monairy *et al.* (1994); they reported that abamectin is toxic to adult female of *T. urticae* and the motile stages was more susceptible than the different ages of eggs stage.



Log concentration

Probit-log concentration regression lines for the tested acaricides against adult females *T. cucurbitacearum*

2. Female fecundity:

The influence of LC_{50} of tested compound on the longevity and hatchability of *T. cucurbitacearum* is shown in Table (2). It is clear that the two tested compounds had the ability to elongate the pre-oviposition period where as this period increased from 1.3 days in the case of untreated females to 1.42, 1.75 days for Challenger and Vapcomic, respectively.

Table (2): Effect of two acaricides on longevity and hatchability of *T. cucurbitacearum* after treatment of adult females.

Acaricides	Concentration	No. of female tested	Average duration in days					No. of eggs tested	Hatchability %	% of reduction in hatchability
			Pre-oviposition period	Ovi-position period	Post-ovi-position period	Longevity	% of reduction in longevity			
Control	Water	15	1.3± 0.12	8.4± 0.24	2.8± 0.49	12.5± 0.27	-	360	96.29	-
Challenger	LC_{50}	40	1.42± 0.19	2.25± 0.37	1.25± 0.20	4.92± 0.46	60.64	210	57.62	40.15
Vapcomic	LC_{50}	40	1.75± 0.15	1.45± 0.22	2.7± 0.25	5.90± 0.35	52.80	50	76.47	20.58

On the other hand, these compounds were able to decrease the adult female longevity from 12.5 days to 4.92, 5.90 days for Challenger and Vapcomic respectively, the post-oviposition period was shorter for females treated by the two tested compounds. This period averaged 1.25 and 2.70 days for Challenger an Vapcomic, respectively, compared with untreated females (2.80 days).

Also, it was obvious that the two tested compounds had the ability to decrease the longevity period for female, and Vapcomic was able to reduce this period than Challenger. Also, it is clear that the bio-acaricides reduced the hatchability of eggs produced by the treated females comparative with the control treatment. However, Challenger was more effective (40.15% reduction) than Vapcomic (20.58% reduction).

The present results agree with those of El-Atrouzy *et al.*, 1989; Abdel-Samad *et al.*, 1994; Nassar *et al.*, 1995 and Gamieh and Saadoon (1998), they found that acaricides and biochemical compounds increased the pre-oviposition period and decreased

oviposition, post-oviposition period, longevity, egg laying capacity and egg hatch of *Tetranychus* spp.

Table (3) show that the effect of LC_{50} of the two tested compounds on female fecundity, it was obvious that Vapcomic proved to be most effective than Challenger, and fewer eggs were deposited from females treated by it, also the highest reduction in female fecundity was accompanied with the use of Vapcomic at LC_{50} level (92.66%). In addition, it is worth to note that 48.0 and 16.0 percent of the treated females at the level of LC_{50} concentration did not layed any eggs for Vapcomic and Challenger, respectively.

Table (3): Effect of LC_{50} concentration of two tested compounds on the fecundity of adult females of *T. cucurbitacearum*.

Acaricides	Conc.	No. of female tested	Non-oviposition female %	Mean No. of eggs layed/female ± SE	Mean No. of eggs layed female/day	Reduction %
Control	Water	15	-	51.8 ± 5.73	6.17	-
Challenger	LC_{50}	40	16.0	12.6 ± 1.44	5.6	75.68
Vapcomic	LC_{50}	40	48.0	3.8 ± 0.66	2.62	92.66

The present results are in agreement with El-Atrouzy *et al.* (1989); El-Banhawy and Amer (1992); Abd El-Samad *et al.* (1994) and Gamieh and Saadoon (1998), they found that egg viability and female fecundity of two spotted spider mite were adversely affected by treatment with acaricides.

3. Effect of Challenger and Vapcomic on the life cycle of *T. cucurbitacearum* after treatment adult females:

The results indicated that (Table 4), the treatment of *T. cucurbitacearum* females with LC_{50} values of the tested compounds prolonged the periods of total immature stages and the life cycle compared with untreated female. The duration of immature stage increased from 8.85 days, for control to 9.63 and 9.85 days for Challenger and Vapcomic, respectively.

The same trend was observed in duration of life cycle which reached its maximum for Vapcomic 17.65 days, while in

Challenger and control were 16.04 and 13.35 days, respectively. The accumulated mortality percentage during immature stage were 61.66 and 45.17 in Challenger and Vapcomic respectively. These results agree with Abdel-Samad *et al.* (1994), Abdel Samad (1998), Gamieh *et al.* (2000) and Magouz *et al.*, 2005, they reported that treatment adult females of two spotted spider mite with sub-lethal concentration of acaricides and alternative compounds prolonged the total immature stages and duration of life cycle.

Table (4): Latent effect of two tested acaricides on life cycle of *T. cucurbitacearum* after treating adult females with LC_{50} values.

Development stages	Challenger		Vapcomic		Control
	Duration (days)	Mortality (%)	Duration (days)	Mortality (%)	Duration (days)
Incubation period	6.42 ± 0.26	-	7.8 ± 0.33	-	4.5 ± 0.25
Active larva	1.29 ± 0.07	20	1.8 ± 0.11	32.26	1.1 ± 0.06
Quiescent larva	1.96 ± 6.11	6.76	1.50 ± 0.17	9.68	1.5 ± 0.10
Active proto-nymph	1.21 ± 0.09	3.33	1.3 ± 0.11	3.23	1.2 ± 0.11
Quiescent proto-nymph	1.54 ± 0.14	8.33	1.45 ± 0.12	-	1.75 ± 0.13
Active deuto-nymph	1.38 ± 0.11	15	1.55 ± 0.12	-	1.50 ± 0.10
Quiescent deuto-nymph	2.25 ± 0.14	8.33	2.25 ± 0.08	-	1.8 ± 0.15
Total immature stages	9.63 ± 0.26	61.66	9.85 ± 0.24	45.17	8.85 ± 0.22
Life cycle duration	16.04 ± 0.35		17.65 ± 0.33	-	13.35 ± 0.26

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الملخص العربى

تأثير بعض المبيدات الاكاروسيه على المظاهر البيولوجية للعنكبوت الاحمر العادى

سهير السيد سعدون

معهد بحوث وقاية النباتات ــ محطة البحوث الزراعية ــ سخا كفرالشيخ

عند دراسة تأثير كلا من فابكوميك ١,٨% EC وشالنجر ٣٦% SC على المظاهر البيولوجية للعنكبوت الاحمر العادى تحت الظروف المعملية وجد ان فابكوميك اكثر سميه حيث بلغت التركيزات القاتلة لـ ٥٠% من الافراد ٠,٥٤ جزء فى المليون بينما بلغت ١٠ جزء فى المليون فى الشالنجر ضد الاناث الكاملة.

وعند دراسة تأثير التركيز القاتل لـ ٥٠% (LC_{50}) على بعض الصور البيولوجية للعنكبوت الاحمر العادى عند معاملة الاناث وجد ان المركبات المستخدمة تطيل من فترة ما قبل وضع البيض وانخفضت فترة وضع البيض وفتره ما بعد وضع البيض لجميع الاناث المعاملة ، كما تأثرت حيوية وخصوبه الاناث تأثيرا كبيرا حيث كان فابكوميك اشد تأثيرا من الشالنجر. كما حدث ايضا انخفاض كبير فى نسبة فقس البيض حيث بلغت نسبة الخفض ٥٧,٦٢% فى الشالنجر بينما سجلت ٧٦,٤٧% فى فابكوميك ، من ناحية اخرى طالت مراحل نمو الاطوارالغير كاملة ودوره حياه الاكاروس. كما بلغت نسبة الموت فى مراحل نمو الاطوار الغير كاملة ٦١,٦٦% ، ٤٥,١٧% فى كلا من الشالنجر وفابكوميك على التوالى.