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EFFICACY OF SOME MINERAL OIL AND BIO-ACARICIDE AGAINST TO THE SPOTTED SPIDER MITE, *Tetranychus cucurbitacearum* (Sayed)

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ABSTRACT

Experiment were carried out at Sakha Agric. Res. Station, Kafr El-Sheikh, Egypt in 2007 season to evaluate the toxic effect of mineral oil; Capl-2 (96.62% EC) and bio-acaricide; Challenger (36% SC) on the spotted spider mite *Tetranychus cucurbitacearum* (Sayed).

Laboratory tests indicated that LC_{50} values of Capl-2 (96.62% EC) were 3000 ppm and 2500 ppm against adult females and eggs, respectively, while hatchability of mites eggs treated with LC_{50} increased as the eggs got older, being 36.56, 61.60-and 72.53 for one, two and three-day old eggs, respectively. On the other hand duration of immature stages and total life cycle of this mite, were more prolonged when one, two and three days old eggs were treated with LC_{50} of Capl-2 oil compared with the untreated ones. Total mortalities of mite immatures were 46.89%, 53.33% and 57.03% when they developed from one, two and three days old eggs treated with LC_{50} of Capl-2 oil, respectively.

Under field conditions Challenger (36% SC) with concentration 45 cc/100 L. of water was satisfactory in controlling the mite *T. cucurbitacearum* on soybean plants (*Glycin max* Merr.) variety Crowford, since it gave 91.95% reduction in population density. On the other hand, Capl-2 (96.62% EC) at the rate of 1.5 liter/100 L. water gave 73.27% reduction in mite population.

INTRODUCTION

The spider mite *Tetranychus cucurbitacearum* infests a wide range of economic plants in the field such as soybean (Zaher *et al.,* 1980) and the wide use of the chemical compounds resulted many problems such as resistance strain of the two spotted spider mite, toxicity to mammals and pollution to the environment. So, it was necessary to use alternative compounds isolated from micro organism origin such as Challenger, also to use the bioactivity of other control such as mineral oil to avoid the deleterious effect of pesticides. Many trials were previously studied by the use of bio-pesticides and mineral oil to control mite pests by El-Monairy *et al.* (1994), Iskandar *et al.* (1993), Osman (1997), Gamieh and Saadoon (1998) and Gamieh *et al.* (2000). Also, El-Ghobashy and El-Sayed (2002), Abd El-Rahman *et al.* (2005) and Magouz and Saadoon (2005). Studied the bioactivity of some environmentally safe compounds against the two spotted spider mite.

The present work aims to study the effect of mineral oil Capl-2 (96.62% EC) against the eggs and adult females of *T. cucurbitacarum.* Also, to study the life cycle of this mite and hatchability of eggs after treating one, two and three-day old eggs with median lethal concentration (LC_{50}) of mineral oil under laboratory conditions. Also, to evaluate the efficiency of Capl-2 oil

(96.62% EC) and Challenger (36% SC) against the mottle stage of the mite T. *cucurbitacearum* in soybean field.

MATERIALS AND METHODS

1. Treatment of *T. cucurbitacearum* under laboratory conditions:

The effect of mineral oil namely; Capl-2 (96.62 EC) was investigated against *T. cucurbitacearum* under laboratory conditions. The oil was diluted with tap water.

1.1. Adulticidal activity:

Ten adult females of the same age were taken from the susceptible strain and transferred by means of camel hair brush to each leaf disc of sweet potato (one inch in diameter). These discs were dipped for 5 seconds in different concentration of mineral oil. Untreated checks were used for comparison by using water only. The discs were placed into pads of wet cotton in Petri-dishes. Four replicates of each concentration were used and kept under controlled laboratory conditions (25 $\pm$ 2°C and 65 $\pm$ 5% RH). Mortality percentage were made after 24 hours.

1.2. Ovicidal activity:

Newly emerged adult females of *T. cucurbitacearum* were transferred by means of a camel hair to each leaf disc of sweet potato (one inch in diameter) and left to lay eggs for 24 hours, then removed. The laid eggs were dipped into different oil concentration for 5 seconds while the untreated discs were dipped in water only. Four replicates were used for each concentration.

These discs were kept under laboratory conditions till the untreated eggs (control) were hatched, the number of unhatched eggs were counted. The percentages of mortality for treated adult females and eggs were calculated according to Abbott's formula (1925).

The median lethal concentration (LC_{50}), slope value and confidence limits were statistically analysed according to Litchfield and Wilcoxon methods (1949).

1.3. Effect of LC_{50} of mineral oil on life cycle of *T. cucurbitacearum*:

To get homogeneous eggs, with the same age, ten adult females were transferred to sweet potato leaf discs on pad of wet cotton in Petri-dishes to lay eggs for 24 hours, then removed. The laid eggs were divided into four groups, three groups of these discs (1, 2- and 3-day-old eggs) were dipped in the median lethal concentrations (LC_{50}) of Capl-2 oil (96.62% EC) for 5 seconds, while the fourth group was dipped into water. The hatched larvae were transferred singly to untreated sweet potato leaves discs placed on pads of wet cotton in new Petri-dishes. These larvae were allowed to develop till the adult stage under laboratory conditions (25 $\pm$ 2°C and 65 $\pm$ 5 RH). Duration of every stage and mortality percentages were recoded. Examination took place twice daily, in the early morning and before sunset.

2. Treatment of *T. cucurbiacearum* under field conditions:

The experiment was carried out at the farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt, on soybean plants (*Glycin max* Merr.) variety Crowford. This experiment was conducted to

evaluate the effect of Capl-2 (96.62% EC) and Challenger (36% SC) on the moving stages of *T cucurbitacearum*.

The experiments design was randomized complete blocks in four replicates, each replicate 42 square meters. Spraying was done on June 10th 2007 using the knapsack sprayer. Forty leaflets were picked up from each plot, just before spraying and after 3 days, 1, 2, 3 and 4 weeks from spraying. All the moving stages present on the lower surface of the leaflets were counted, reduction percentage in mite population was assessed according to the equation of Henderson and Tilton (1955).

$$\left[1-\left(\frac{\text{Population in the control before spraying}}{\text{Population in the control after spraying}} \times \frac{\text{Population in the treatment after spraying}}{\text{Population in the treatment before spraying}}\right)\right] \times 100$$

3. Compounds used and rate of application:

Challenger (36% SC): It consists of several pyrrolomycins (1,2) Dioxapyrrolomycin isolated from a Fermentation culture of *Streptomyces fainmanus* by Lederle laboratories of American Cyanamid Company. It applied at 45 cc/100 L. of water.

Capl-2 (96.62% EC) mineral oil:

It applied at 1.5 liter/100 liter of water.

RESULTS AND DISCUSSION

1. Treatment of *T. cucurbitacearum* under laboratory conditions:

1.1. Adulticidal and ovicidal activity:

Data in Table (1) clearly show that the effect of Capl-2 (96.62% EC) against adult female stages of *T. cucurbitacearum*, the LC_{50} values for the oil was 3000 ppm, and the same table apparent that the LC_{50} values was 2500 ppm for the mineral oil Capl-2 against the mite eggs, this clearly that the eggs were more sensitive to mineral oil than the adult females. These results are in agreement with El-Halawany and El-Naggar (1984), Iskandar *et al.* (1993), Osman (1997) and Gamieh *et al.* (2000). They stated that the eggs were more sensitive to mineral oil than the adult stage.

Table (1): Efficacy of Capl-2 against the egg and adult stages of *T cucurbitacearum* using leaf disc-dip technique.

Mineral oil	Adults				Eggs			
	LC_{50} ppm	Confidence limits of LC_{50}		Slope	LC_{50} ppm	Confidence limits of LC_{50}		Slope
		Upper	Lower			Upper	Lower	
Capl-2 96.62% EC	3000	3971.70	2266.03	1.36	2500	3108.22	2010.77	2.53

1.2. Hatchability of mite eggs as influenced by Capl-2:

Table (2) show that the hatchability of eggs as affected by egg ages when treated with median lethal concentration LC_{50} of Capl-2 (96.62% EC). It is indicated that one-day old eggs were more susceptible than 2-day and 3-day old-eggs. As for Capl-2 treatments hatchability percentages were 36.56,

60.14 and 72.53 for 1, 2 and 3 days old eggs, respectively, and the reduction of hatchability were 61.60, 37.35 and 23.30 for the previous old eggs when eggs were treated after 1, 2 and 3 days of egg laying, respectively.

These results were agreement with Osman (1997), Gamieh *et al.* (2000), they stated that one-day old eggs are more susceptible to petroleum oil formulations than other ages.

Table (2): Effect of median lethal concentration of Capl-2 on hatchability (%) of *T. cucurbitacearum* eggs at three ages.

Mineral oil & formulation	LC_{50} ppm	Eggs age (in days)					
		1		2		3	
		Hatchability %	Reduction	Hatchability %	Reduction	Hatchability %	Reduction
Capl-2 96.62% EC	2500	36.56	61.60	60.14	37.35	72.53	23.30
Untreated (control)		95.22	-	96.0	-	94.44	-

1.3. Effect of LC_{50} of the tested mineral oil on the life cycle of *T. cucurbitacearum*:

Table (3) show that the effect of the LC_{50} value (2500 ppm) of Capl-2 oil on the life cycle of mites from the treated eggs. Data indicated that the periods of total immature stages were 6.95, 7.58 and 6.50 days for 1, 2 and 3 day-old treated eggs, respectively. While the period of immature stages developed from untreated eggs was 6.24 days only and the average period of life cycle were 11.9, 12.41 and 11.67 for individuals resulted from 1, 2 and 3-day-old treated eggs, while untreated eggs was 10.49 days only.

Also, it was found that mortality percentages increased as the egg ages increased. It were 46.89%, 53.33% and 57.03% for 1,2 and 3-day-old treated eggs, respectively. These results were agreement with Ebrahim *et al.* (1993), Abd El-Samed *et al.* (1994) and Abd El-Samed (1998). They stated that the life cycle of the two spotted spider mite was long when the egg stage was treated with mineral oils or biochemical compounds.

2. Effect of Challenger and Capl-2 on *T. cucurbitacearum* under field conditions:

Effect of the bio-acaricide Challenger (36% SC) at the recommended concentration of 45 cc/100 L of water and the mineral oil of Capl-2 (96.62% EC) at the recommended concentration of 1.5 liter/100 L of water against the motile stages of *T. cucurbitacearum* were tested under field conditions.

Data in Table (4) indicated that the recommended dose of Challenger (36% SC) resulted 94.54, 92.97, 83.90, 89.70 and 90.20 percentage reduction in the population of *T. cucurbitacearum* after 3 days, 1, 2, 3 and 4 weeks of application, respectively, with an average reduction 91.95%. On the other hand, Capl-2 (96.62%) gave reduction in population of mottle stages of mite averaged 75.40, 76.59, 72.47, 69.18 and 77.20 at the same period respectively, with an average reduction of 73.27%.

Table (3): Latent effect of Capl-2 oil on the life cycle of *T. cucurbitacearum* after treating eggs of different ages with the LC_{50} (2500 ppm).

Development stages	Ages of treated eggs						Untreated eggs (duration in days)
	1-day old		2-day old		3-day old		
	Duration (in days)	Mortality %	Duration (in days)	Mortality %	Duration (in days)	Mortality %	
Incubation period	4.95±0.12	-	4.83±0.21	-	5.17±0.17	-	4.25±0.09
Active larva	1.95±0.12	31.43	1.92±0.2	33.33	1.51±0.18	21.43	1.75±0.09
Quiescent larva	0.8±0.08	2.85	0.75±0.34	-	0.92±0.15	-	0.56±0.06
Active proto nymph	0 95±0.05	5.71	1.08±0.02	-	0.83±0.11	-	0.8±0.13
Quiescent protonymph	1.0±0.13	-	1.33±0.25	-	1.0±0.13	8.33	0.88±0.08
Active deuto nymph	1.05±0.05	-	1.17±0.11	13.33	1.08±0.08	18.18	1.06±0.06
Quiescent deuto nymph	1.2±0.11	6.90	1.33±0.17	6.67	1.17±0.17	9.09	1.18±0.19
Total immature stages	6.95±0.17	46.89	7.58±0.37	53.33	6.50±0.22	57.03	6.24±0.38
Life cycle duration	11.9±0.27	-	12.41±0.21	-	11.67±0.21	-	10.49±0.31

Table (4): Effect of Capl-2 and Challenger against motile stages of *T. cucurbitacearum* in soybean field during 2007 season.

Treatment	Rate of application/100 liter water	No. of motile stages/40 leaflet and % reduction after treatment												Average reduction %
		Pre-spray	3 days		1st week		2nd week		3rd week		4th week		Mean	
			No.	R.	No.	R.	No.	R.	No.	R.	No.	R.		
Capl-2 (96.62%)	1.5 liter	1800	250	75.4	160	76.59	72	72.47	48	69.18	56	77.2	117.2	73.27
Challenger36% SC	45 cc	1795	46	94.54	48	92.97	42	83.9	16	89.70	24	90.2	35.21	91.95
Control	-	1803	846	-	686	-	262	-	156	-	246	-	439.2	-

El-Ghobashy and El-Sayed (2002), and Abd El-Ruhman *et al.* (2005), reported that the bioacaricide compounds were more toxic against several phytophagous mite than another chemical compound and bio-acaricide Challenger (36% SC) gave 92.6% reduction in population density of mite, while Osman (1997) found that the local petroleum oil Shakrona and Shakrona super gave satisfactory effectiveness against phytophagous mites on fruit trees, as they gave 82% and 87% reduction in mite population of *T. urticae*, respectively. Gamieh *et al.* (2000) reported that KZ oil 95% EC and super Masrona oil (95% EC) gave 66.09 and 70.25% reduction in the population density of *T. cucurbitacearum*, respectively.

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تأثير بعض الزيوت المعدنية والمبيدات الأكاروسية على العنكبوت الأحمر ذو البقعتين

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** المعمل المركزى للمبيدات ـ الدقى

أجريت التجربة فى محطة البحوث الزراعية بسخا فى موسم ٢٠٠٧م لتقييم تأثير أحد الزيوت المعدنية (كابل ـ ٢) والمبيد الأكاروسى (شالنجر) على العنكبوت الأحمر ذو البقعتين.

وقد أظهرت النتائج أن التركيز القاتل لـ ٥٠% (ت ق ٥٠) نتيجة استخدام الزيت المعدنى كابل ـ ٢ (٩٦,٦٢%) بلغت ٣٠٠٠ و ٢٥٠٠ جزء فى المليون ضد الإناث الكاملة والبيض على التوالى. كذلك أدى معاملة البيض بالتركيز النصف قاتل إلى زيادة نسبة الفقس بزيادة عمر البيض حيث بلغت ٣٦,٥٦ ، ٦١,٦٠ ، ٧٢,٥٣ للبيض عمر يوم ويومين وثلاثة أيام على التوالى.

وعند دراسة تأثير الجرعة النصف قاتلة للزيت المعدنى كابل ـ ٢ على العنكبوت الأحمر ذو البقعتين تحت الظروف المعملية وجد أن استخدام الزيت المعدنى يطيل من مراحل نمو الأطوار غير الكاملة ودورة الحياة للأكاروس عند معاملة البيض عمر يوم ويومين وثلاثة ايام بالتركيز القاتل لـ ٥٠% من الزيت مقارنة بالبيض الغير معامل. كما اختلفت نسبة الموت التراكمى فى مراحل نمو الأطوار غير الكاملة حيث بلغت ٤٦,٨٩% ، ٥٣,٣٣% ، ٥٧,٠٣% للبيض عمر يوم ويومين وثلاثة أيام على التوالى. وقد أظهرت النتائج تحت الظروف الحقلية لدراسة تأثير كلا من المبيد الأكاروسى الشالنجر (٣٦% Sc) والزيت المعدنى كابل ـ ٢ (٩٦,٦٢ Ec) على العنكبوت الأحمر ذو البقعتين أن الشالنجر أكثر تأثيرا على العنكبوت الأحمر حيث أعطى نسبة إبادة قدرها ٩١,٩٥% بينما المعاملة بالزيت المعدنى كابل ـ ٢ أقل فعالية حيث أعطت نسبة خفض فى التعداد قدرها ٧٣,٢٧%.