Egypt. J. Agric. Res., 71 (2), 1993.

EFFECT OF CERTAIN CHEMICALS ON DIFFERENT DEVELOPMENTAL STAGES OF SOME PHYTOPHAGOUS AND PREDACEOUS MITE SPECIES.

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(Manuscript received 30 January 1991)

Abstract

A laboratory study was carried out to evaluate the effect of the naturally derived miticide Abamectin, dicofol and three local mineral oils (Super Shokrona, Shokrona and Star oil) on different developmental stages of the two phytophagous mite species, *Eutetranychus orientalis* (klein) and *Brevipalpus californicus*, (Banks) and the predatory mite, *Amblyseius scutalis* (Athias Henriot) (= *Amblyseius gossipi* El -Badry).

Abamectin and dicofol were the most effective compounds against all the developmental stages of the two phytophagous mites while eggs and adults of the predatory mite were less susceptible to the same compounds. Eggs of *E.orientalis* were more susceptible to the three local mineral oils than eggs of *B. californicus*. Super - Shokrona was more effective on the two phytophagous mites than Star and Shokrona oils . The three local mineral oils were less toxic on eggs of the predatory mite, *A. scutalis*. Immature stages of *B. californicus* seemed to be more susceptible to the mineral oils than those of *E. orientalis* . The three local mineral oils were found to be less toxic on adult females of the predatory mite than on those of the two phytophagous ones.

INTRODUCTION

Citrus crops represent the most important fruit crops in Egypt. Phytophagous mites are considered among the most important pests infesting citrus trees and frequently cause considerable losses in yield. However, the increasing use of pesticides

had reduced the population of natural enemies and caused resistance development .

The aim of the present work is to evaluate the efficiency of the naturally derived miticide Abamectin, three local mineral oils and dicofol on different developmental stages of two phtophagous mite species, *Eutetranychus orientalis* (Klein) and *Brevipalpus californius* (Banks) and one species of the predatory mite, *Amblyseius scutalis* Athias -Henriot.

MATERIALS AND METHODS

The chemical compounds used in the present work were: Abamectin (1.8% EC) (a natural product produced by the soil microorganism, *Streptomyces avermitilis*) and its mixture containing a minimum of 80% avermectin B_1 a (5-0- dimethyl avermectin A_1 a) and a maximum of 20 % avermectin B_1 b (5-0- dimethyl- 25 - de - (1 - methyl propy1 - 25 - (I- methlethyl) avermectin A_1 a), dicofol (kelthane 185 gm a.i. /L.EC) , 2, 2, 2 - trichloro - 1, 1-bis (4-chlorophenyl) ethanol. Three local mineral oils formulated as EC by the Central Agricultural Pesticides Laboratory at Dokki were also tested . These oils were super- Shokrona (95% EC), Shokrona (95%EC) and Star oil (95% EC). The difference between the three local oils include the receipe and some specifications such as unsulfonated residues.

The chemical compounds were tested in water solutions which were diluted to the appropriate concentrations needed. The required concentrations were calcutated on the basis of ppm of the active ingredient present in the formulation.

The citrus brown mite, *Eutetranychus orientalis* (klein) was obtained from a natural infestation on citrus trees in Kaha (Qalyobia Governorate). The collected mites were allowed to propagate as small cultures on sweet potato cuttings placed in glass bottles filled with water at 28 $\pm$ 2 ^{o}C and R. H. 65 $\pm$ 5 %.

Leaves and fruits of mandarin highly infested with *Brevipalpus californicus* (Banks) were brought to the laboratory from Kaha. Fresh leaves of peppermint were selected to be used as a host for rearing this mite species under controlled conditions as mentioned before.

Individuals of *Amblyseius scutalis* Athias - Henriot were brought to the laboratory from castor oil leaves grown in Dokki region. The predacious mites were

reared on the moving stages of *Tertanychus arabicus* Attiah under laboratory conditions. For rearing the predator , fresh leaves of sweet potato infested with the moving stages of *T. arabicus* were placed on moist cotton wool pads placed in Petri dish (14 cm in diameter). Water was added to maintain suitable moisture.

Eggs of both *E. orientalis* and *B. californicus* were obtained by transferring twenty females of each species on the upper surface of sweet potato leaf. The diameter of the leaf was approximately 3 cm in case of *E. orientalis* and that of peppermint was 3 x 1.5 cm. The discs were placed in Petri dishes on moist cotton. Each Petri dish contained 3 discs (each disc was considered as a replicate) . The adult females were removed affter 24h and the deposited eggs were counted. The disc surfaces carrying the eggs of the same age were sprayed with the aqueous dilution of the tested chemicals using a manual atomizer (Mostafa, 1980) . Five concentrations of each chemical were used to assess slope and LC_{50}'s . The treated eggs as well as the control were kept under controlled conditions as mentioned above. In all cases, hatchability percentages were assessed 6 days from egg laying.

For studying the effect of the previous compounds on larvae, nymphs and adults of the two phytophagous mites, twenty newly hatched individuals of each of these stages were treated as mentioned before.

To study the action of the five chemical compounds on the eggs and adult females of *A. scutalis* , ten adult females were allowed to lay eggs on the lower surface of the sweet potato leaf discs provided with a suitable number of *T. arabicus* moving stages. The discs' surface carrying the eggs were sprayed by the tested chemical compounds using the previous procedure.

To study the effect of these compounds on *A. scutalis* adult females, ten adult female individuals of the same age were sprayed with the same concentrations of each compound. Individuals which responded to touch with a fine brush were considered alive and the control mortality was corrected by using Abbott's formula (1925) . The estimated LC_{50}'s and slopes were determined according to Finney's method (1952) . The efficacy of the different compounds were determined as described by Sun (1950), as follows :

$$\text{Toxicity index} = \frac{LC_{50} \text{ of compound A}}{LC_{50} \text{ of compound B}} \times 100$$

Where A is the most effective compound and B is the less effective .

RESULTS AND DISCUSSION

Effect of the five chemical compounds on eggs of *E. orientalis, B. californicus* and *A. scutalis*

The action of the tested compounds on the egg stage of the three mite species varied considerably (Table1). Abamectin and dicofol exhibited a high degree of efficiency against eggs of *E. orientalis* and *B. californicus*. The LC_{50} values of these compounds were 0.163 and 0.867 ppm, respectively . On the other hand , dicofol was less effetive on the eggs of *A. scutalis* than Abamectin. The LC_{50} values were 1278.50 and 16.51 ppm, respectively.

It was evident that eggs of *E. orientalis* were more susceptible to the three local mineral oils than *B. californicus* eggs. Super Shokrona oil was more effective on eggs of the two phytopagous mites than Star oil and Shokrona oil . Moreover, the three mineral oils were less toxic on *A. scutalis* eggs.

The toxicity index of LC_{50} values as shown in Table 1, revealed that Abamectin was the most potent compound against eggs of phytophagous mites than those of the predator, followed by dicofol, super Shokrona, Star and Shokrona oils , respectively.

It could be concluded therefore that Abamectin and dicofol were more toxic against eggs of *E. orientalis* and *B. californicus* than on eggs of *A. scutalis*. These findings are in agreement with those of Zohdy *et al.*, (1987) who found that Avermectin B_1 was highly effective on eggs of *E. orientalis*. They further indicated that *A. scutalis* eggs were more tolerant to Kelthane and Albumin than eggs of *E.orientalis* .

Effect of the five chemicals on immature stages of *E. orientalis* and *B. californicus*.

The toxicity of the tested compounds against larvae and nymphs of the two phytophagous mites are presented in Tables 2 and 3 . Data revealed that Abamectin and dicofol were the most effective compounds against the immature stages of

Table 1. Sensitivity of eggs and adult females of *Eutetranychus orientalis*, *Brevipalpus californicus* and *Amblyseius scutalis* to certain chemicals .

Compound		*E. orientalis*			*B. californicus*			*A. scutalis*		
		LC 50 PPm	Slope	Toxicity index at LC_{50} value	LC 50 PPm	Slope	Toxicity index at LC_{50} value	LC 50 PPm	Slope	Toxicity index at LC_{50} value
Abamectin (1.8 % EC)	Eggs	0.163	1.68	100.000	0.867	1.80	100.000	16.51	1.92	100.000
	Adult ♀	0.118	1.42	100.000	0.293	1.67	100.000	3.08	1.65	100.000
Dicofol (18.5 % EC)	Eggs	0.883	1.44	18.440	1.720	1.68	50.440	1278.50	1.41	1.290
	Adult ♀	0.226	1.35	5.214	0.564	1.78	51.920	67.82	1.91	4.010
Super Shokrona (95% EC)	Eggs	371.790	1.52	0.043	561.050	2.64	0.155	92776.72	1.83	0.018
	Adult ♀	162.370	1.91	0.073	24.190	1.76	1.210	2806.02	2.08	0.110
Star oil (95 % EC)	Eggs	408.600	1.49	0.039	709.250	1.88	0.122	113742.75	1.59	0.015
	Adult ♀	230.360	0.54	0.051	37.870	2.36	0.773	3636.94	2.25	0.085
Shokrona oil (95 % EC)	Eggs	585.230	1.54	0.028	751.450	2.01	0.115	124795.81	1.92	0.013
	Adult ♀	344.030	1.78	0.034	55.000	2.02	0.532	4675.69	2.60	0.066

Table 2. Sensitivity of larvae of *E. orientalis* and *B. californicus* to certain chemicals.

Compound	*E. orientalis*			*B. californicus*		
	LC_{50} PPm	Slope	Toxicity index at LC_{50} value	LC_{50} PPm	Slope	Toxicity index at LC_{50} value
Abamectin (1.8 % EC)	0.007	1.45	100.000	0.043	1.69	100.000
Dicofol (18.5 % EC)	0.057	1.51	11.520	0.342	2.54	12.610
Super Shokrona (95% EC)	35.010	2.70	0.019	11.72	1.66	0.368
Star oil (95 % EC)	93.320	1.76	0.007	19.33	1.75	0.223
Shokrona oil (95 % EC)	134.390	2.34	0.005	25.74	0.76	0.167

Table 3. Sensitivity of nymphs of *E. orientalis* and *B. californicus* to certain chemicals.

Compound	*E. orientalis*			*B. californicus*		
	LC_{50} PPm	Slope	Toxicity index at LC_{50} value	LC_{50} PPm	Slope	Toxicity index at LC_{50} value
Abamectin (1.8 % EC)	0.033	1.42	100.000	0.258	1.87	100.000
Dicofol (18.5 % EC)	0.125	1.38	26.140	0.428	1.95	60.340
Super Shokrona (95% EC)	86.570	1.63	0.38	16.78	1.58	1.540
Star oil (95 % EC)	158.020	1.64	0.021	27.55	0.90	0.938
Shokrona oil (95 % EC)	231.820	2.41	0.014	38.99	2.29	0.662

E. orientalis and *B. californicus.* The LC_{50} valuses of these compounds were 0.007, and 0.057 ppm, 0.033 and 0.125 ppm for larvae and nymphs of the two species , respectively . Also , Super Shokrona oil was the more toxic compound against larvae and nymphs of *B. californicus* and *E. orientalis* than the other two oils . The LC_{50} values of super shokrona oil were 11.72 and 16.78 ppm, 35.01 and 86.57 ppm for larvae and nymphs of the two mite species , respectively. Star and Shokrona oils seemed to be less effective .

On the basis of toxicity index, Abamectin was the most toxic followed by dicofol, Super Shokrona and Star oils against immatures of the two phytophagous mites. Shokrona oil however was the least toxic.

From the above mentioned results it could be concluded that the immature stages of *B. californicus* were more susceptible to the three local mineral oils than those of *E. orientalis.* These reults are in agreement with Mialloux and Morrison (1962) who indicated that Kelthane was effective against the immature stages of

Tetranychus telarius (L.) and Sugawara and Wakou (1967) who showed that dicofol was effective against the developmental stages of *Tetranychus urticae* Koch.

Effect of the five compounds on adult females of *E. orientalis, B. californicus* and *A. scutalis*

The susceptibility of adult females of *E. orientalis*, *B. californicus* and *A. scutalis* to the previous compounds revealed a great variation in effectivencess (Table1).

Abamectin caused a higher mortality to adult females of *E. orientalis* and *B. californicus* than to those of *A. scutalis.* The LC_{50} values were 0.118, 0.293 and 76.82 ppm , respectively . With regard to dicofol , the LC_{50} values were 0.226, 0.654 and 76.82 ppm for *E. orientalis* , *B. californicus* and *A. scutalis*, respectively. On the other hand , the three tested oils were found to be less toxic on adult females of the predatory mite *A. scutalis* .

Taking the toxicity index into consideration, Abamectin was the most effective against adult females of *E. orientalis* and *B. californicus.* It is of interest to denote that the chlorinated hydrocarbon dicofol was more effective against adult females of *E. orientalis* and *B. californicus* than on *A. scutalis.*

These results are in agreement with those obtained by El-Banhawy (1976) who indicated that Kelthane was the least toxic material against *Amblyseius brazilli* El - Banhawy. McCoy *et al.*, (1982) found that Avermectin B_1 was toxic to the adult stage of the Texas citurs mite *Eutetranychus banksi* McGregor. Hoy and Cave (1985) indicated that MK- 936 Abamectin was significantly more toxic in the laboratory to *T. urticae* Koch than to the predacious mite *Metaseiulus occidentalis* (Nesbitt). El Halawany *et al.*, (1987 a) showed that Avermectin B_1 was highly effective on *E. orientalis* and *T. urticae* while *A. scutalis* (Athias - Henroit) (=A. gossipi El - Badry) was not much affected by its toxic action.They further added that Albumin was toxic to *E. orientalis* while had a lower toxicity to the predatory mite *A. scutalis.* (El - Halawany 1987 b).

In conclusion , Abamectin and dicofol were highly effective against eggs and moving stages of phytophagous mites while being safe to the predaceous mites. Mineral oils also exhibited a higher degree of efficacy against phytophagous mites than on the predaceous mite. These results might contribute to the development of integrated pest management programmes on citrus trees.

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تأثير بعض الكيماويات علي الأطوار البيولوجية المختلفة لبعض أنواع الأكاروسات المتطفلة والمفترسة

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أجريت دراسة معملية لتقييم فاعلية بعض المبيدات الأكاروسية مثل الأباميكتين ، الديكوفول، وثلاث زيوت محلية هي السوبر شكرونا، شكرونا ، ستار أويل علي الأطوار المختلفة للأكاروسيبن النباتيين : اكاروس الموالح البني *Eutetranychus orientalis* Klein وأكاروس الموالح المبطط *Brevipalpus californicus* (Banks) والأكاروس المفترس *Amblyseius Scutalis* (Athias - Henriot) .

وقد أظهرت النتائج أن مادتي الأباميكتين والديكوفول كانتا من المركبات الأكثر فاعليه ضد كل الأطوار المختلفة للأكاروسيين نباتيي التغذية، بينما كان البيض والأطوار الكاملة للمفترس الأكاروسي أقل حساسيه لهذين المركبين . واتضح أن بيض أكاروس الموالح البني كان أكثر حساسيه للزيوت المحليه الثلاثة بالمقارنة ببيض أكاروس الموالح المبطط، وبمقارنة تأثير الزيوت المحلية علي الأكاروسيين النباتيين أوضحت النتائج أن زيت السوبر شكرونا كان أكثر فعالية من زيت شكرونا وستار أويل.

واتضح من النتائج أن الثلاثة زيوت المحليه كانت أقل سمية علي بيض المفترس الأكاروسي ، وظهر من النتائج أيضاً أن الأطوار غير الكاملة لأكاروس الموالح المبطط كانت أقل حساسية للزيوت المحليه بالمقارنة بالأطوار غير الكاملة لأكاروس الموالح البني، بينما كانت الثلاثة زيوت المحلية أقل سمية علي طور الإناث الكاملة للمفترس الأكاروسي بالمقارنة بتأثيرها الضار علي الأكاروسيين النباتيين .