

Effect of Certain Insecticides on Phytophagous, Predacious Mites and Yield of Three Cotton Cultivars

By

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ABSTRACT

The effect of certain insecticide treatments either alone or in sequence on the spider mite *tetranychus* spp. and its associated predatory mites were studied. Three cotton cultivars, Mc Nair 220 (Upland), Alexandria 4 (free gossypol barbadense) and Giza 70 (glanded barbadense) and their yield were also evaluated. Results showed that Mc Nair 220 was the most susceptible variety to the spider mite *Tetranychus* spp. compared with Alex.4 and Giza 70. *Tetranychus* spp. has two peaks of infestation on cotton, the lowest one appeared on the seedling stage and the highest one on the vegetative and flowering stages. Profenophos gave the highest percent reduction of *Tetranychus* spp. infestation, while Methomyl showed the lowest reduction. Sequential insecticide treatments showed moderate reduction throughout fifteen days of infestation. Moreover, there was no significant difference between the treatments on the cotton yield. However a significant difference was observed between Mc Nair 220 and Giza 70 or Alex.4 in their yields.

INTRODUCTION

Cotton is widely grown all over the world. It is intensively treated with insecticides in many countries. Much more insecticides are used on

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it than any other crop. Therefore, major cotton growing areas infested with severe pests came under a heavy blanket of insecticides. Spider mite infestation is one of those pests which became more frequent and more widespread as a result of the over use of pesticides. Apparently, the destruction of predators by pesticides is partially responsible for spider mite increasing population (David and Kumaraswamy, 1990). This widespread of spider mite which is considered among the most destructive pests to cotton has attracted the attention of many investigators (Boyer *et al.*, 1962; El-Sebae *et al.*, 1976; El-Enany and Zedan, 1989; Halford and Kinlay, 1985 and Moustafa, 1995).

Implementation of integrated pest control tactics will help to reduce pests and environmental hazard problems. This strategy involved use of the lowest possible level of a pesticide for controlling the target pest, restricting chemical application to part of the crop fields and timing the treatments to minimize damage to the natural enemy population (Rabb, *et al.* 1976).

The present investigation aimed to study the effect of insecticidal treatments either alone or in sequence on cotton yield, phytophagous and predatory mites. As an ultimate way to be implemented in the IPM of cotton.

MATERIALS AND METHODS

Chemicals:

- (Profenphos) Selecron 72% of EC at a rate of L/fed. was from Ciba Geigy, Limited, Basle, Switzerland.
- (methomyl) Lannate 90% SP at a rate of 300 g/fed., was from Dupont. Chem. Co., USA.
- (deltamethrin) Decis 2.5% EC at a rate of 750 ml/fed., was from Roussel Chemical Company, Paris, France.

Field Trial:

The experiment was carried out at Alexandria University Experiment Station in Abees during two successive years 1996 and 1997

cotton seasons. Three cotton varieties were selected and obtained from the Agronomy department, faculty of Agriculture, Alexandria univeristy Mc Nair 220 (a medium staple length of *Gossypium hersutum*, glanded upland), Alexandria 4 (a medium staple length of *Gossypium barbadense* free gossypol) and Giza 70 (an extra long staple of *Gossypium barbadense* glanded barbadens). The experiment was laid out in split-plot design with three replicates. Seven insecticide treatments occupied the main plots and cotton cultivars occupied the subplots. The sub plots consisted of four rows, each 5 m long and spaced 60 cm apart. Cultural practices were applied as recommended for commercial production of cotton. The susceptibility of the three cotton cultivars to *Tetranychus* spp. infestation and associated predatory mites was evaluated. The samples, each 10 cotton leaves, were collected weekly, early in the morning, started from June the first till 15 of October. The leaves were examined under dissecting microscope for counting the moving stages of mites, which were found on the lower surface of the examined leaves. The key of Krantez (1978) and Zaher (1986) was used to identify family, genus and species of the subject mites. Three pesticides and their consequences were evaluated under Egyptian field conditions. Pesticides were applied at the recommended rate, Table (1). Hand operated knapsack sprayer was used to apply the pesticides. Treatments were evaluated by counting the mobile stage on 10 leaves, taken at random from each plot. Counts were made just before treatment and at zero, 1, 3, 7 and 15 days after treatment. Reduction in the population was estimated using Henderson and Telton equation (1965).

Statistical analysis was carried out according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Susceptibility of cotton cultivars to *Tetranychus* spp. infestation.

The suceptibility of Alex.4, Giza 70 and Mc Nair 220 to *Tetranychus* spp. infestation is shown in Table (2). These recorded data revealed that Mc Nair 220 was the most susceptible variety, while Giza

70 was the most tolerant to *Tetranychus* spp. infestation. Moreover, the associated predatory mites, *Tydiues californicus* (Banks), *Agistemus exertus* (Gonzales), and *Amblyseius gossipi* (El-Badry) were related to the existence of the host.

Dynamics of *Tetranychus* spp. and its predatory mites.

The dynamics of *Tetranychus* spp. and its predatory mites through the cotton season is illustrated in Figure 1 (A, B and C). The infestation of *Tetranychus* spp. was observed throughout the season. Two peaks of infestation were recorded, the first was in Juli (vegetative stage), and it was tiny, however, the second was in September, and It was large (fruiting and maturity stages). The associated predators were observed in pronounced number in September and October. Predators were accompanied by the high level of *Tetranychus* spp. infestation. These results agreed with those reported by El-Enany and Zedan (1989) who found that *Tetranychus* spp. predatory mites reached their peak in the beginning of October, therefore, timing of pesticide application is very important as a tool of integrated pest management. Moreover, Taha, *et al.* (1992) reported that the peak of *Tetranychus urticae* infestation occurred at the seedling stage and another peak was found during fruiting and maturity stages.

• Effect of insecticides treatments on *Tetranychus* spp. and its predators:

Cotton spraying programs involve using insecticides to control the piercing sucking pests, in addition to cotton leafworm and bollworms. Repeating spray starts, when the pest population reached economic thresholds.

The effect of certain insecticide treatments on *Tetranychus* spp. infestation and its predatory mites was studied. Three insecticides were chosen, Selecron, Lannate and Decis. These insecticides were recommended to control the piercing sucking pests, the cotton leafworm and the bollworms, respectively. These insecticides were applied either alone or in sequence.

Table (1) : Insecticides and their sequential treatments.

Treatment Control	Sprays		
	1 st	2 nd	3 rd
1	Selecron	-	-
2	-	Lannate	-
3	-	-	Decis
4	Selecron	Lannate	-
5	Selecron	-	Decis
6	-	Lannate	Decis
7	Selecron	Lannate	Decis

Each insecticide of 4, 5, 6 and 7 was applied separately (not in a mixture) in the same order shown in the table at the same plot of experiment on intervals of 15 days, for example, number 7, showed that Selecron was applied, after 15 days, Lannate was applied at the same plot have been treated by Selecron and finally, Decis was also applied at the same plot after 15 days of the previous one.

Table (2) : Susceptibility of three cotton varieties to spider mites *Tetranychus* spp. infestation and their associated predatory mites.

Mite species	Mean No. of mites on cotton variety $\pm$ S. D		
	Alex. 4	Giza 70	Mc Nair 22o
<i>Tetranychus Spp.</i>	31.38 $\pm$ 3.54	14.05 $\pm$ 1.11	40.47 $\pm$ 3.48
<i>T. californicus</i>	0.74 $\pm$ 0.18	0.99 $\pm$ 0.21	0.46 $\pm$ 0.11
<i>A. Exertus</i>	2.46 $\pm$ 0.51	1.96 $\pm$ 0.39	2.46 $\pm$ 0.46
<i>A. gossypi</i>	0.34 $\pm$ 0.16	0.17 $\pm$ 0.021	0.1 $\pm$ 0.03

Table (3) : Reduction percentage of *Tetranychus* spp. at different intervals of the insectidal treatments.

Treatments	% Reduction at different intervals (Days)					
	Zero	1	3	7	15	Mean
Selecron (Sel)	96.30	100.00	88.89	88.89	79.63	90.74 ^b
Lannate (Lan)	86.18	87.45	58.64	58.41	47.48	67.63 ^a
Decis (Des)	94.92	83.81	58.04	47.61	51.99	67.27 ^a
Sel. & Lan.	96.96	94.38	82.01	67.80	54.15	79.06 ^a
Sel. & Des.	95.46	94.96	75.26	67.01	49.52	75.44 ^a
Lan. & Des.	93.69	91.43	86.63	67.29	70.17	81.84 ^{ab}
Sel. & Lan & Des	89.29	90.57	70.85	53.25	52.73	71.34 ^a

LSD 0.05 treatments = 10.67

Table (4) : Reduction percentage of *T. Californicus*. at different intervals of the insecticidal treatments.

Treatments	% Reduction at different intervals (Days)					
	Zero	1	3	7	15	Mean
Selecron	100.00	100.00	100.00	100.00	100.00	100.00 ^b
Lannate	100.00	100.00	100.00	88.89	77.78	93.33 ^b
Decis	100.00	100.00	100.00	88.89	77.78	93.33 ^b
Sel. & Lan.	88.88	100.00	100.00	61.11	46.62	74.32 ^a
Sel. & Des.	100.00	100.00	50.00	16.67	60.56	65.45 ^a
Lan. & Des.	100.00	100.00	61.11	33.33	44.14	67.72 ^a
Sel. & Lan & Des	100.00	100.00	44.44	44.44	44.93	66.67 ^a

LSD 0.05 treatments = 10.83

Table (5) : Reduction percentage of *A. gossypi.* at different intervals of the insecticidal treatments.

Treatments	% Reduction at different intervals (Days)					
	Zero	1	3	7	15	Mean
Selecron	100.00	100.0	88.89	100.00	100.00	97.78 ^a
Lannate	100.00	100.00	100.00	100.00	88.89	97.78 ^a
Decis	100.00	100.00	100.00	100.00	100.00	100.00 ^a
Sel. & Lan.	100.00	88.89	100.00	88.89	98.15	95.19 ^a
Sel. & Des.	100.00	100.00	100.00	100.00	100.00	100.00 ^a
Lan. & Des.	100.00	100.00	88.89	100.00	66.67	91.11 ^a
Sel. & Lan & Des	100.00	100.00	100.00	66.67	100.00	93.33 ^a

LSD 0.05 treatments = 8.12

Table (6) : Reduction percentage of *A. exertus.* at different intervals of the insecticidal treatments.

Treatments	% Reduction at different intervals					
	Zero	1	3	7	15	Mean
Selecron	100.00	100.00	100.00	100.00	100.00	100.00 ^c
Lannate	100.00	100.00	100.00	100.00	77.78	95.56 ^c
Decis	100.00	100.00	100.00	100.00	88.89	97.78 ^c
Sel. & Lan.	100.00	100.00	77.78	61.11	79.77	83.73 ^b
Sel. & Des.	100.00	100.00	50.00	16.67	60.56	65.45 ^a
Lan. & Des.	100.00	100.00	61.11	33.33	44.14	67.72 ^a
Sel. & Lan & Des	100.00	100.00	44.44	44.44	44.93	66.67 ^a

LSD 0.05 treatments = 10.83

The reduction percent for *Tetranychus* spp. and its predatory mites was estimated at various intervals, zero, 1, 3, 7, and 15 days post insecticides application, Tables (3, 4, 5, and 6). The recorded data showed that selecron treatment had the highest reduction effect on *Tetranychus* spp. infestation, while Lannate showed the lowest reduction effect throughout fifteen days of inspection. No significant differences were observed in the reduction sequence of two or three insecticides (Tables 4 & 5). The reduction percent was also estimated for the predatory mites. The data revealed that there were no significant differences between treatments, except for treatment 5 (Selecron + Decis), which showed the lowest reduction of *T. californicus* (Table 4). All insecticides treatments showed severe effect on *A. gossipi* (Table 5), whereas the reduction range was 88.98-100%. The predatory mite *A. exertus*, was the least one affected by the insecticides treatments (Table 6). Helyer and Ledien (1987), reported that heptenophos with its systemic and short persistence properties, was useful in integrated programs involving biological control of *T. urticae*. In the mean time Moustafa, (1995) reported that tedifol was the most effective pesticide on spider mite, moreover it has small effect against predatory mites. El-Enany and Zedan (1989), reported the side effect of 23 insecticides against *T. urticae* in cotton fields.

The percent reduction in mite population after four weeks of application amounted not more than 67% in comparison with the control. Moreover Decis gave 60.2% reduction of *Tetranychus* spp. also, David and Kumaraswami, (1990), reported that pyrethroids residues stimulate reproduction of *T. urticae* to varying degree. The resurgence level of *T. urticae* population in pyrethroids treated field was higher than untreated one.

- **Effect of insecticides treatments on cotton yield.**

The effect of insecticide treatments on cotton yield is shown in Table (7). The data showed no significant difference between the insecticide treatments on lint cotton yield. However a significant difference was observed between the Mc Nair and Giza 70 or Alex.4 in their yields (lint and seed cotton). These results reflect that, the studied

treatment could be applied alone or in sequence without risk on cotton yield. Mourad *et al*, (1993), reported that insecticides in sequential treatments had no significant effect on the flowering rate and the total number of shedded fruiting elements. Moreover, defoliant after the insecticides could be used without risk on yield and fiber properties of cotton crop.

Table (7): Effect of insecticidal treatments on yield of the three cotton cultivars.

Treatments	Mc Nair 220		Giza 70		Alex. 4		Mean	
	Cotton/ plot		Cotton/ plot		Cotton/ plot		Cotton/ plot	
	Seed	lint	Seed	lint	Seed	lint	Seed	Lint
Control	345.0*	120.0	106.5	35.0	185.0	85.0	212.2 ^b	80.0 ^a
Selecron	276.7	91.7	100.0	33.3	38.3	11.7	138.3 ^a	45.6 ^a
Lannate	330.0	116.0	76.7	33.3	86.7	41.6	164.4 ^a	61.7 ^a
Decis	180.0	60.0	106.7	41.7	103.3	40.0	130.0 ^a	47.2 ^a
Sel & Lan.	346.7	117.7	153.3	50.0	120.0	40.0	206.7 ^a	69.2 ^a
Sel. & Des.	336.7	116.7	136.7	48.3	121.7	61.7	198.3 ^a	75.6 ^a
Lan & Des.	176.7	60.0	83.3	28.3	161.7	68.3	140.6 ^a	52.2 ^a
Sel., Lan., Des.	166.7	60.0	113.3	81.7	196.7	123.3	158.9 ^a	88.3 ^a

* Numbers in grams.

LSD 0.05 Treatments (seed) = 78.8

LSD 0.05 Treatments (Lint) = 50.4

The present data conclude the following points. The upland cotton Mc Nair 220 variety was more susceptible to *Tetranychus* spp. than the Egyptian cottons, Giza 70 and Alex.4.

Tetranychus spp. has two peaks on cotton, the lower one on the small plant (vegetative stage) and the higher on the fruiting and maturity stages.

Selecron treatment gave the highest percent of reduction in *Tetranychus* spp. infestation during 15 days interval compared with other treatments. Moreover, the predatory mites were affected by the used insecticides mainly two weeks after treatments.

Generally, management of pesticide use could be useful in preventing misuse of pesticides in pest management strategy, in other words to enhance the biological control effectiveness. Predators should be conserved, whether by reducing the rate of pesticide application, or number of sprays during the season. Also the economic threshold of the pest should be considered for good application timing. Although, considerable progress has been made in recent years to integrate chemical and biological control however much still remains to be done.

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الملخص العربي

تأثير بعض المبيدات على العنكبوت الأحمر ومفترساته
من الحلم والمحصول الناتج على ثلاثة أصناف من القطن.

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تمت دراسة تأثير معاملات بعض المبيدات سواء كانت هذه المبيدات منفردة أو في
تتابع على العنكبوت الأحمر ومفترساته من الحلم على ثلاثة أصناف من القطن هي
الماكثير ٢٢٠، الاسكندرية ٤ وجيزة ٧٠ وقد أظهرت النتائج ما يلي:-
- صنف القطن ماكثير ٢٢٠ كان أكثر أصناف القطن المختبرة حساسية للإصابة
بالعنكبوت الأحمر مقارنة الاسكندرية ٤ وجيزة ٧٠.
- العنكبوت الأحمر له قمتين من الإصابة على القطن تظهر أقلهما في طور البساتين
بينما تكون الأعلى في مرحلة النمو الخضري والإزدهار.
- أعطى مركب البروفينوفوس (السليكرون) أعلى نسبة خفض في الإصابة بالعنكبوت
الأحمر بينما أعطى المينوميل (اللانيت) أقل نسبة في خفض الإصابة.
- أظهر تتابع استخدام المبيدات خفض متوسط في قيم الإصابة لمدة ١٥ يوم من بداية
المعاملة.
- لا توجد فروق معنوية بين معاملات المبيدات على ناتج محصول القطن بينما يوجد
فرق بين ناتج أصناف القطن المختبرة.