

**EVALUATION OF CERTAIN CHEMICAL AND BIOCHEMICAL
COMPOUNDS ON RED SPIDER MITE, *TETRANYCHUS URTICAE*
KOCH (ACARINA : TETRANYCHIDAE)
INFESTING COTTON PLANTS**

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Abstract

The tetranychid mite is considered one of the important mite pests attacking cotton plants in Egypt. The present work was carried out to study the efficacy of the tested compounds against the two-spotted spider mite, *Tetranychus urticae* under field conditions.

First season (2005):

The cotton plants were sprayed by using the recommended concentration of seven compounds, namely (Agrin, Vertemic, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur) to study the effectiveness on the adult stages of the two-spotted spider mite, *Tetranychus urticae*.

Vertemic gave highly reduction percent (85.11%) in infestation against the adult stages of *T. urticae*, while Agrin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur gave approximately similar results 66.20, 77.10, 72.16, 70.96, 71.73 and 70.29, respectively.

Second season (2006):

Vertemic gave highly percent reduction (88.32%) in infestation against the adult stages of *T. urticae*, while, agrin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur gave approximately similar results 69.17, 83.67, 75.71, 75.10, 69.15 and 72.02, respectively.

INTRODUCTION

The tetranychid mites are the most important pests and plant feeders of considerable economic important attacking field crops, fruits and vegetable crops (Wafa *et al.*, 1968). The two spotted- red spider mite, *Tetranychus urticae* Koch (Acarina : Tetranychidae), is a major economic pest attacking field crops especially cotton plants, vegetables as well as strawberry, cucumber and cantaloupe and horticultural crops in addition to the medicinal plants.

The total cotton cultivated area in Egypt reached 436.719 Feddan distributed in a good soil. Since the discovery of the injury of cotton by spider mites at the beginning of the second decade of the twentieth century, the spider mite infestation has become more frequent and more widespread. The outbreak of spider mites is due to

destruction of spider mite predators by the pesticides, together with the tendency of this mite to develop resistance. These mites usually feed on the leaves injuring the epidermis and resulting in blotching stippling or bronzing and sometime accompanied by leaf fall. Some of the species are most specific but the majority are phytophagous and has a wide range of hosts. Severe mites feeding result in economic reduction in the quality and quantity of crop production.

Continuous use of acute acaricides has caused serious suppression in natural economic population, residual contamination of human foods, mammalian toxicity and pollution of the environment. Therefore, new approaches in pest control, particularly use of natural compounds has received recently a considerable attention, in different localities of the world.

The present work aimed to evaluate the efficacy of different compounds against the two-spotted spider mite, *Tetranychus urticae* under field conditions.

MATERIALS AND METHODS

1. Experimental design:

The present study was conducted on cotton plants (Giza 80) grown in Beni-Sueif Governorate. Two experiments were conducted during May of the two successive years 2005 and 2006 when pest population density was high. An area of one feddan was divided into eight plots, each of approximately 50 m². The plots were arranged in complete randomized block with four replicates for each treatment, and another four replicates as control. The plots were sprayed with different tested agents using a knapsack sprayer. Control plots were sprayed with water only.

One spray was conducted during each year on May. To evaluate the efficacy of tested compounds the number of adults was recorded at pre-treatment and after 3, 7, 14 and 21 days of treatment. Each sample consisted of 80 cotton leaves taken randomly from each plot. The sampled leaves were collected in paper bags and transferred directly to the laboratory for careful examination. Adult females were counted under a stereomicroscope, and both surfaces of each leaf were inspected.

2. Tested compounds:

The compounds used in the present experiments were:

A. Agrin 32000 IU/mg (*Bacillus thuringiensis* var *kurstaki*):

A commercial microbial products used in these trails in which the active ingredients based on bacterium *Bacillus thuringiensis* var *kurstaki* (Bt) formulated by BioAgro International, Egypt.

B. Vertemic 1.8% EC (abamectin):

A commercial product used in these trails in which the active ingredients based on formulated by International, Egypt.

C. Consult 10% EC (hexaflumuron):

A commercial product used in these trails in which the active ingredients based on formulated by Dow AgroSciences, 9330 Zionsville Rd.Indianapolis, IN 46268-1054, USA.

D. Cascade 10% EC (flufenoxuron):

A water dispersible concentrate, formulated by American Cyanamid Co..

E. Super Misrona oil 94% EC (light mineral oil):

Super Misrona oil miscible formulated by Masrona Co., containing 94% praffinic oil w/w and 6% inert ingredients, unslufonated residue content reached 94%.

F. Micronized sulfur 80% WP:

Micronized sulfur formulated by Kafr El-Zayat Co., containing 80% sulfur and 20% inert ingredients.

G. Liquid sulfur 30%:

Liquid sulfur formulated by Kafr El-Zayat Co., containing 30% sulfur and 70% inert ingredients.

5. Statistical analysis:

The reduction percentages of infestation by *T. urticae* were calculated according to the equation of Henderson and Tilton (1955). The data was subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS program (SAS, 1988).

RESULTS AND DISCUSSION**First season (2005):**

The average maximum and minimum temperatures in the field were 33.46 and 17.63°C and the maximum and minimum relative humidity were 79.19 and 22.94%, respectively.

The cotton plants were sprayed by using the recommended concentration of seven compounds, namely (Agrin, abamectin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur) to study the effectiveness on the adult stages of the two-spotted spider mite, *Tetranychus urticae* Koch.

The average numbers of *T. urticae* pre-spraying counts were 145.00, 145.30, 146.50, 145.50, 144.25, 147.50 and 146.75 adults/leaf recorded in Agrin, abamectin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur plots, respectively and reached 143.00 adults/leaf in control (Table, 1).

Table 1. Effect of tested compounds on the average number of adults of the two-spotted spider mite, *Tetranychus urticae* Koch/leaf of cotton plants (Giza 80, strain 2000) during 2005 season under field conditions.

Treatments	Rate of application/ 100 L.Water	Pre-spraying count	Number of adult at different days after application				Average number
			3	7	15	21	
Vertimec 1.8% EC	40 ml	145.30	33.50 ^d	20.50 ^e	20.25 ^e	31.00 ^e	26.31
Agrin 32000 IU/mg	100 gm	145.00	55.00 ^b	46.50 ^c	62.50 ^b	78.25 ^d	60.56
Flufenoxuron 10% WDC	200 ml	146.50	40.75 ^c	33.75 ^d	37.75 ^d	53.25 ^c	41.37
Hexaflumuron 10% EC	200 ml	145.50	29.25 ^e	53.50 ^b	58.50 ^{bc}	60.50 ^c	50.43
Liquid sulfur 30%	250 ml	146.75	39.25 ^c	49.75 ^{bc}	56.50 ^{bc}	69.25 ^c	43.66
Micronized sulfur 80% WP	250 gm	147.50	34.75 ^d	44.75 ^c	53.50 ^c	76.50 ^b	52.37
Super Misrona oil 94% EC	1500 ml	144.25	38.75 ^c	48.75 ^{bc}	58.00 ^{bc}	67.50 ^c	53.25
Control	-	143.00	152.30 ^a	175.42 ^a	168.57 ^a	209.28 ^a	176.39
F at 0.05	-	-	118.59 ***	721.38 ***	282.42 ***	591.04 ***	-
LSD	-	-	3.66	5.38	7.82	7.04	-

Means bearing different subscripts are significantly different at $P < 0.05$, Duncan's multiple range tests.

80, strain 2000) during 2002 season under field conditions.

Table 2. Effect of tested compounds on percent reduction of adults of the two-spotted spider mite, *Tetranychus urticae* Koch/leaf of cotton plants (Giza)

Average % reduction	% reduction				Rate of application 100 L.W.	Treatment
	21	12	7	3		
82.11	82.45	88.18	88.49	78.32	40 ml	Vertimec 1.8% EC
66.50	63.13	63.43	73.82	64.39	100 gm	Agri 32000 IU/gm
77.10	72.16	78.14	81.55	73.88	200 ml	Flufenoxuron 10% WDC
75.16	71.28	62.89	70.03	81.15	200 ml	Hexflumuron 10% EC
70.96	69.52	67.34	75.36	74.88	250 ml	Liquid sulfur 30%
71.73	64.26	69.53	72.56	77.88	250 gm	Micronized sulfur 80% WP
70.59	68.06	62.89	75.42	74.77	1200 ml	Super Misona oil 94% EC

Abamectin (Vertimec) gave highly reduction percent (85.11%) of population against the adult stages of *T. urticae*, while Agrin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur gave approximately similar reduction rates, i.e. 66.20, 77.10, 72.16, 70.96, 71.73 and 70.29, respectively (Table, 2).

The above mentioned results indicate that the efficacy of tested compounds was varied due to the nature of compounds and the concentrations used.

Statistical analysis in Table (1) showed highly significant differences between the average numbers of adults for *T. urticae* after application of seven compounds (Agrin, Vertemic, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur) after 3, 7, 15 and 21 days indicating ($F = 118.59, 721.38, 282.42$ and 591.04 at $P < 0.05$), and $LSD = 3.66, 5.38, 7.82$ and 7.04 , respectively.

The obtained results are agree with those obtained by several authors, Rote *et al.* (1981) studied the effectiveness of wettable sulfur and sulfur dust applied together with carbaryl with that of dicofol against *Tetranychus cinnabarinus* (Boisd.) on Hybrid-4 cotton. Highest mortality was obtained in plots treated with 0.03% dicofol, and sulfur dust and 0.2% wettable sulfur plus 0.2% carbaryl were almost as effective, respectively. It was concluded that sulfur in both formulations appeared to be compatible with carbaryl in controlling the pest if used at the recommended dosages.

Mani *et al.* (2003) determine the suitable acaricide against *Tetranychus urticae*. They found that plants treated with 200 ml flufenoxuron/ha showed maximum reduction in colonies per leaf (18.26% in Mirandy and 35.76% in Arjuna). Percent reduction in infestation per leaf was highest after 30 days from spraying with 200 ml flufenoxuron/ha (18.42% in Mirandy and 26.48% in Arjuna). However, percent reduction in infestation per plant was highest in Mirandy (18.68%) and Arjuna (19.34%) when 200 ml flufenoxuron/ha was sprayed.

Second season (2006):

The average maximum and minimum temperatures in the field were 33.08 and 19.01°C and the maximum and minimum relative humidity were 81.1 and 14.84%, respectively.

The average numbers of *T. urticae* pre-spraying counts were 122.75, 119.75, 121.50, 116.50, 119.75, 118.50 and 114.75 adults/leaf for Agrin, Vertemic, flufenoxuron, hexaflumuron, Super Misrona oil, Micronized sulfur, and Liquid sulfur adults/leaf, respectively but it reached 116.86 adults/leaf in control (Table, 3).

Table 3. Effect of tested compounds on the average number of adults of the two-spotted spider mite, *Tetranychus urticae* Koch/leaf of cotton plants (Giza 80, strain 2000) during 2006 season under field conditions.

Treatment	Rate of application/ 100 L.Water	Pre-spraying count	Number of adult at different days after application				Average number
			3	7	15	21	
Vertimec 1.8% EC	40 ml	119.75	15.50 ^e	13.50 ^g	17.50 ^g	29.00 ^e	18.87
Agrin 32000 IU/mg	100 gm	122.75	46.00 ^b	48.75 ^b	44.50 ^d	64.00 ^b	50.81
Flufenoxuron 10% WDC	200 ml	121.50	36.25 ^c	30.50 ^f	18.75 ^g	22.25 ^f	33.67
Hexaflumuron 10% EC	200 ml	116.50	37.00 ^c	39.50 ^{cd}	27.25 ^f	48.50 ^d	38.06
Liquid sulfur 30%	250 ml	114.75	29.25 ^c	34.25 ^e	39.00 ^e	50.25 ^d	38.18
Micronized sulfur 80% WP	250 gm	118.50	39.75 ^c	41.50 ^c	48.00 ^c	67.00 ^b	49.06
Super Misrona oil 94% EC	1500 ml	119.75	31.25 ^d	39.00 ^d	51.25 ^b	57.00 ^c	44.63
Control	-	116.86	185.42 ^a	139.00 ^a	150.30 ^a	159.80 ^a	143.63
F at 0.05	-	-	187.05 ***	253.93 ***	135.83 ***	124.4 ***	-
LSD	-	-	3.77	2.27	2.91	3.49	-

Means bearing different subscripts are significantly different at $P < 0.05$, Duncan's multiple range tests.

Table 4. Effect of tested compounds on percent reduction of compounds on average number of adults the two-spotted spider mite, *Tetranychus urticae* Koch/leaf of cotton plants (Giza 80, strain 2000) during 2006 season under field conditions.

Treatment	Rate of application/ 100 L.W.	% reduction				Average % reduction
		3	7	15	21	
Vertimec 1.8% EC	40 ml	91.84	90.52	88.64	82.29	88.32
Agriin 32000 IU/mg	100 gm	76.38	66.61	71.81	61.87	69.17
Flufenoxuron 10% WDC	200 ml	81.19	78.89	88.00	86.61	83.67
Hexaflumuron 10% EC	200 ml	79.98	71.49	81.81	69.56	75.71
Liquid sulfur 30%	250 ml	83.93	74.91	73.57	67.98	75.10
Micronized sulfur 80% WP	250 gm	78.86	70.56	68.51	58.65	69.15
Super Misrona oil 94% EC	1500 ml	83.55	72.62	66.72	65.19	72.02

Also, Vertemic gave highly percent reduction (88.32%) in infestation against the adult stages of *T. urticae*, while, Agrin, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur gave approximately similar reduction, showing 69.17, 83.67, 75.71, 75.10, 69.15 and 72.02, respectively (Table, 4).

As mentioned above the potency of different compounds varied due to the nature of compounds and the used concentrations.

Statistical analysis in Table (3) show that highly significant differences between the average numbers of adults for *T. urticae* after application of seven compounds (Agrin, Vertemic, flufenoxuron, hexaflumuron, Super Misrona Oil, Micronized Sulfur, and Liquid Sulfur) after 3, 7, 15 and 21 days were (F = 187.05, 253.93, 135.83 and 124.4 at P<0.05), and LSD = 3.77, 2.27, 2.91 and 3.49, respectively.

The obtained results are agree with those obtained by several authors, Akashe (2004) tested sulfur at 0.2% against *T. urticae* infesting rose under field conditions. Sulfur gave lower efficacy (55.56%). Nangia and Channa (1983) when 0.05-0.15% sulfur and 0.002-0.01% dicofol were applied in sprays in field, mortality reached 80.7-41.8% followed in 24 h in the pest *Tetranychus ludeni* Zacher and 14.47-24.85% in its predator *Amblyseius tetranychivorus* (Gupta).

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تقييم بعض المركبات الكيميائية والحيوية علي العنكبوت الأحمر علي نباتات القطن تحت الظروف الحقلية

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يعتبر العنكبوت الأحمر العادي من أهم الآفات الأكاروسية التي تصيب نباتات القطن في مصر وقد تم دراسة فعالية مجموعة من المركبات علي الأفراد الكاملة للعنكبوت الأحمر العادي تحت الظروف الحقلية.

الموسم الأول (٢٠٠٥):

تم رش نباتات القطن بمعدلات مختلفة (ربع حقلي- نصف حقلي - تركيز حقلي) للمركبات الأتية: أجرين ، فيرتميك ، الفلوفينوكسيرون، الهكسافلوميرون، زيت سوبر مصرونا ، الكبريت الميكروني ، الكبريت السائل لدراسة فعالية هذه المركبات علي العنكبوت الأحمر العادي. أثبتت النتائج أن مركب فيرتميك أعطي أعلى فعالية في خفض نسبة الإصابة حيث أعطي ٨٥,١١% بينما حققت المركبات أجرين، الفلوفينوكسيرون، الهكسافلوميرون، زيت سوبر مصرونا ، الكبريت الميكروني ، الكبريت السائل نسبة خفض في الإصابة وصلت الي ٦٦,٢٠، ٧٧,١٠، ٧٢,١٦، ٧٠,٩٦، ٧١,٧٣، ٧٠,٢٩% علي الترتيب.

الموسم الثاني (٢٠٠٦):

تم تكرار رش نباتات القطن بمعدلات مختلفة (ربع حقلي- نصف حقلي - تركيز حقلي) للمركبات الأتية: أجرين ، فيرتميك ، الفلوفينوكسيرون، الهكسافلوميرون، زيت سوبر مصرونا ، الكبريت الميكروني ، الكبريت السائل لدراسة فعالية هذه المركبات علي العنكبوت الأحمر العادي. أثبتت النتائج أيضا أن مركب فيرتميك أعطي أعلى فعالية في خفض نسبة الإصابة حيث أعطي ٨٨,٣٢% بينما حققت المركبات فيرتميك ، الفلوفينوكسيرون، الهكسافلوميرون، زيت سوبر مصرونا ، الكبريت الميكروني ، الكبريت السائل نسبة خفض في الإصابة وصلت الي ٦٩,١٧، ٨٣,٦٧، ٧٥,٧١، ٧٥,١٠، ٦٩,١٥، ٧٢,٠٢% علي الترتيب.

مما سبق يمكن استخدام بعض المركبات الحيوية في مكافحة العنكبوت الاحمر العادي على نباتات القطن من خلال برامج مكافحة المتكاملة.