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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Effect of Eight Acaricides Against the Date Dust Mite, *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae)

Mohammed A. Al-Doghairi
College of Agriculture and Veterinary Medicine at Gassim,
King Saud University, P.O. Box 1482, Buraydah, Saudi Arabia

Abstract: Eight commercial acaricides were evaluated in date palm plantations in Al-Gassim, Saudi Arabia, against the date mite *Oligonychus afrasiaticus* (McGregor). Neoron (bromopropylate 25% EC), Kelthane (dicofol 18.5% EC), Tedion (tetradifon 75.2 g L⁻¹), Top Cop (73% S + 6.4% Cu, w/v), Microthiol Special (Sulfur 80% WP, Ekatin (thiometon 25% EC), were applied in sites 1 and 2. Peropal (azocyclotin 25% WP) and Transact (abamectin 1.8% EC), in addition to Kelthane, Tedion and Neoron were used in site 3. Based on the percentage of web formation on date bunches all treatments, except Ekatin, reduced mite infestations significantly below that of the untreated check by the 7th, 27th and 21st days after treatment (DAT) in sites 1, 2 and 3, respectively. Kelthane and Neoron significantly reduced mite infestation in the 3 sites after the second week from application and continued until the termination of the experiment. The effect of Microthiol Special was excellent until 35 DAT in site 1, when it gradually declined up to the end of the trial. Top Cop's action was clear from week 3, however, it declined from the 5th week in site 1. Ekatin knocked down initial infestations in both sites but rapid build up of infestation was observed in 13 and 28 DAT in sites 2 and 1, respectively. Best control obtained in site 3 was in the Neoron, Kelthane and Transact treatments, followed by Peropal and Tedion whose effect did not sustain to the end. The overall performance of the acaricides, determined according to their ability to reduce the mite infestation, compared to the control throughout the experiment, was 96.8, 96.3, 95.2, 83.8, 81.7, 80.6, 79.0 and 30.2%, for Transact, Kelthane, Neoron, Peropal, Tedion, Microthiol, Top Cop and Ekatin, respectively. No significant differences were found in date weights between treatments.

Key words: *Oligonychus afrasiaticus*, date palm, acaricides, neoron, kelthane, transact, microthiol

INTRODUCTION

The date mite *Oligonychus afrasiaticus* (McGregor) has become a major pest on date palm, *Phoenix dactylifera*, affecting the date fruits in Saudi Arabia. Talhouk^[1] reported that this mite is not abundant in the date palm groves of Saudi Arabia, but when present, it can cause very serious damage to fruits as he observed in orchards in Dirab, Unayzah and Al Sulayell districts. The bionomics of such mite has not been thoroughly studied, however, Hussain^[2] reported that it has 6 generations/year, its peak infestation in Iraq occurs around the middle of July and that it prefers dryer areas. The infestation of this mite usually starts around mid-May to June when it builds dusty, creamy silken webs on date bunches around strands and date fruits, where adults and immatures live. Dust and sand grains adhere to the webs on the date fruits making the environment under such webbing suitable for reproduction, development and survival of mites. The attacked fruits lose their green colour and turn to dull silvery-white. Scarring and

reddish-brown appearance of the fruits was a result of mites' feeding^[3] making such fruits unmarketable.

The mites spend the winter in the tree crown, between leaf bases and perhaps on grasses. Gerson *et al.*^[4] observed that *O. afrasiaticus* has been found on the grasses *Cynodon dactylon* (L.) Pers. and *Imperata cylindrica* (L.) Raeusch growing among date palms in Israel.

O. afrasiaticus infestations has caused increasing concern in recent years to date palm growers in Al-Gassim region where it was evident in almost about every date palm orchard. Producers complained of control failures, malformed and decreased yields. Control measures include application of fine Microthiol dust and other acaricides^[1]. Elmer^[5] reported that Microthiol sprays on date bunches as well as carbophenothion, tetradifon and dicofol were effective in control of The Banks Grass Mite, *Oligonychus partensis*, on dates in California. Ho^[6] reported that although fifty acaricides are currently registered in Taiwan, however, acaricide resistance is forming a serious problem. Nauen *et al.*^[7] stated that a

Corresponding Author: Dr. Mohammed Al-Doghairi, Department of Crop Protection, College of Agriculture and Veterinary Medicine, King Saud University, P.O. Box 1482, Bureidah, Saudi Arabia Tel: (06) 380-0050 (X2035) Fax: 06 380-1360 Mobile: 054895028 E-mail: mdoghair@hotmail.com

major problem in the control of mites is their ability to develop resistance rapidly to many important acaricides, their high reproductive potential and extremely short life cycle. Bynum and Archer^[8] mentioned that mite outbreaks following pesticide applications are attributed to chemical repellency, which causes mite dispersion and mortality of predators. Control failures have been reported for organophosphorous compounds for many decades and more recently to the newer compounds such as hexythiazox, clofentezine^[9] abamectin^[10] and tebufenpyrad^[11].

Many acaricide products with varying qualities and modes of action are available in the Saudi market but their efficacy against the date mite is questionable. In the present study evaluation trials were made to rate the performance of eight such products against the *O. afrasiaticus* based on: web formation made by mites on date fruits bunches and weight of dates taken from the acaricides treated trees.

MATERIALS AND METHODS

The study was conducted using three different sites, at two date palm plantations in Al-Qassim area, during the period from 30 June through 1st of August 2000. These three sites labeled site 1 and site 2 (Al Rajhi Trading Company with 64,000 date palm trees) and sites 3 (Al Rajhi Endowment with 236,000 date palm trees) were selected for this study. The trials were arranged in a randomized complete block design with four replicates in which each single date palm tree represented a plot. In all three sites, five treatments and an untreated control were randomly replicated four times. The trees were sprayed, on May 30 in site 1, Jun. 7 in site 2 and Jun. 26 in site 3, to the point of run-off using a hydraulic P.T.O. driven sprayer with 1000 L tank capacity.

The acaricides tested included: Neoron (bromopropylate 25% EC) at the rate of 150 ml 100 L⁻¹ of water; Kelthane (dicofol 18.5% EC) at the rate of 250 ml 100L⁻¹; Tediion (tetradifon 75.2 g L⁻¹, EC) at the rate of 150 ml 100 L⁻¹; Peropal (azocyclotin 25% WP) at the rate of 80 g; Top Cop (Sulphur 73% + Copper 6.4% w/v) at the rate of 250 ml 100 L⁻¹; Microthiol Special (Sulphur 80% WP) at the rate of 250 g 100 L⁻¹; Ekatin (thiometon 25% EC) at the rate of 100 ml 100 L⁻¹ and Transact (abamectin 1.8% EC) at the rate of 50 ml 100 L⁻¹.

Evaluation was based on the intensity of mite web formation on date fruits judged as visual scoring on a scale from 0 to 5 where 0=0% (no web formation), 1=10%, 2=30%, 3=50%, 4=80% and 5=100% web formation where all fruits were covered with the silk. A pre-spray count sample was made on each site before acaricide applications, which were carried out on the same day. Thereafter, weekly counts were made up to the 9th week

in site 1, 8th week in site 2 and the 6th week in site 3, by taking the mean reading from 4 directions of each treatment. An additional count was made after 22-26 days in sites 3 and 2, respectively. At date maturity, fruit samples from each site were harvested and records of individual fruit weights from each treatment were determined. The data was analyzed using General Linear Model procedure (GLM) and means were separated using Duncan's multiple range test^[12].

RESULTS AND DISCUSSION

Table 1 represents the mean percentage of mite web formation on date bunches as observed in plots in site 1. The degree of *O. afrasiaticus* web formations in the control throughout the course of the trial, starting from the first week after treatment, were 7.5, 14.7, 35.0, 21.3, 36.3, 44.4, 65.6, 66.3 and 67.5%, upto the 9th week, respectively. The pre-spraying infestation levels ranged from 8.1 to 45.6% in the different treatment plots. All the acaricides tested had a significant (P<0.05) effect in reducing infestations in the first post-spray counts. These reductions ranged from 83.9% (Neoron) and 100% (Kelthane and Ekatin), whereas Microthiol and Top Cop reduced the infestations by 95.3 and 90.8%, respectively, as compared to the pre-spray counts.

As infestations were well suppressed in the Kelthane, Neoron and Microthiol during the 2nd-4th weeks, a slight increase was observed in web building up in the Ekatin, Microthiol and Top Cop treatments, as from the 5th week. Generally, no significant differences were observed between infestations in the Ekatin, Microthiol and Top Cop treatments and the control as from week 5 to the end of the trial. On the contrary, the infestations in Kelthane and Neoron treatments were consistently suppressed to the end of the trial. In fact, the degree of infestation in the Ekatin treatment exceeded that in the control by 114.8% in the last week of the trial. Infestation levels in the last week did not differ significantly between Microthiol, Ekatin and Top Cop, on the one hand, from those in the untreated control on the other hand. There were no significant differences in date weights as compared to the control.

Table 2 represents the mean percentage of mite web formation recorded on date fruit bunches from site 2. The degree of *O. afrasiaticus* infestations in the control throughout the course of the trial, starting from the first week after treatment through the 8th week, were as follows: 41.9, 61.9, 74.4, 82.5, 82.5, 82.5, 95.6 and 84.2 and 90%, respectively (Table 2). The pre-spray infestation levels in the acaricide treatments were: Neoron 55.0%, Ekatin 68.1%, Microthiol 21.3%, Kelthane 77.9%, Top Cop 60.8 and 43.1% in the control (Table 2).

Table 1: Effect of selected acaricides on date dust mite, *O. afrasiaticus*, infestation: Site 1

Treatment and rate 100 L ⁻¹ water	Sampling date and Mean (%) web formation									
	30-May Pre-spray	06-Jun 7-DAT	3-Jun 14-DAT	20-Jun 21-DAT	27-Jun 28-DAT	04-Jul 35-DAT	12-Jul 43-DAT	18-Jul 49-DAT	25-Jul 56-DAT	01-Aug 63-DAT
Sulfur (250 g 100 L ⁻¹)	15.0b	0.7b	0.0b	2.6b	0.7b	3.2abc	10.7ab	14.4b	32.5ab	41.9ab
Ekatin (100 ml 100 L ⁻¹)	10.0b	0.0b	3.2ab	5.1b	6.3ab	28.1a	34.4a	33.1a	68.1a	77.5a
Top cop (250 ml 100 L ⁻¹)	16.3b	1.5b	7.5ab	0.7b	1.3b	13.2abc	11.9ab	16.3b	36.3ab	45.6ab
Neoron (150 ml 100 L ⁻¹)	8.1b	1.3b	1.3ab	0.0b	0.0b	0.0c	2.6b	0.7c	3.2b	7.5b
Kelthane (250 ml 100 L ⁻¹)	45.6a	0.0b	6.3ab	0.0b	0.0b	1.3bc	3.8b	0.0c	2.6b	11.9b
Control	15.0b	7.5a	14.7a	35.0a	21.3a	36.3ab	44.4a	65.6a	66.3a	67.5a

Table 2: Effect of selected acaricides on date dust mite, *O. afrasiaticus*, infestation: Site 2

Treatment and rate 100 L ⁻¹ water	Sampling date and Mean (%) web formation									
	30-May Pre-spray	06-Jun 6-DAT	3-Jun 13-DAT	20-Jun 20-DAT	27-Jun 27-DAT	04-Jul 34-DAT	12-Jul 40-DAT	18-Jul 47-DAT	25-Jul 54-DAT	01-Aug 74-DAT
Neoron (150 ml)	55.0a	3.4ab	5.0ab	5.0b	4.2b	3.2b	5.7b	4.4bc	7.5c	10.0bc
Ekatin (100 ml)	68.1a	6.7ab	17.5ab	30.0a	31.9a	64.4a	89.4a	88.1a	81.7a	100.0a
Sulfur (250 g)	21.3a	6.7ab	5.0ab	2.1b	3.2b	2.7b	7.3b	8.8b	23.8b	18.1b
Kelthane (250 ml)	77.9a	3.4ab	0.0b	4.2b	2.6b	2.5b	1.3b	0.0c	4.4c	1.2c
Top cop (250 ml)	60.8a	0.0b	15.0ab	2.6b	1.9b	2.3b	4.4b	5.0bc	9.4bc	11.2bc
Control	43.1a	41.9a	61.9a	74.4a	82.5a	82.5a	82.5a	95.6a	84.2a	90.0a

Table 3: Effect of selected acaricides on date dust mite, *O. afrasiaticus*, infestation: Site 3

Treatment and rate 100 L ⁻¹ water	Sampling date and Mean (%) web formation									
	26-Jun Pre-spray	03-Jul 7-DAT	10-Jul 14-DAT	17-Jul 21-DAT	24-Jul 28-DAT	31-Jul 35-DAT	07-Aug 42-DAT	29-Aug 64-DAT		
Neoron (150 ml 100 L ⁻¹)	1.3a	0.0b	0.0a	0.0b	0.7b	0.7c	1.3c	1.3b		
Kelthane (250 ml 100 L ⁻¹)	25.0a	0.6ab	0.0a	0.0b	0.7b	1.9bc	1.3c	0.0b		
Tedion (150 g 100 L ⁻¹)	16.3a	1.3ab	1.9a	0.7b	1.5b	3.8bc	22.5b	25.1b		
Peropal (azocyclotin) (80 gr 100 L ⁻¹)	10.0a	3.1ab	1.3a	0.0b	3.8b	10.0b	9.4bc	22.5a		
Transact (abamectin) (50 ml 100 L ⁻¹)	6.3a	0.0b	0.7a	0.0b	0.7b	3.8bc	3.1bc	1.3b		
Control	0.0a	18.8a	18.2a	26.3a	33.8a	43.8a	70.0a	95.0a		

*Means in vertical columns followed by the same letter are not statistically different

Table 4: Overall performance of eight Acaricides used for Control of the date dust mite, *O. afrasiaticus* in Gassim

Treatments	% infestation									
	Site 1			Site 2			Site 3			Overall mean % effect
	Pre-spray	Season's mean	Mean effect	Perfor.* pre-spray	Season's mean	Mean effect	Perfor. pre-spray	Season's mean	Mean effect	
Kelthane	45.6	2.9	93.2	77.9	2.2	97.2	25.0	0.64	98.5	96.3
Neoron	8.1	2.6	93.9	55.0	5.4	93.0	1.3	0.57	98.7	95.2
Sulfur	15.0	11.9	72.2	21.3	8.6	88.9	--	--	--	80.6
Top cop	16.3	14.9	65.2	60.8	5.8	92.5	--	--	--	79.0
Ekatin	10.0	28.4	33.6	68.1	56.6	26.8	--	--	--	30.2
Transact	--	--	--	--	--	--	6.3	1.4	96.8	96.8
Tedion	--	--	--	--	--	--	16.3	8.0	81.7	81.7
Peropal	--	--	--	--	--	--	10.0	7.1	83.8	83.8
Control	15.0	42.8	0.0	43.1	77.3	0.0	0.0	43.7	0.0	0.0

* Mean performance was calculated by the equation: $\frac{\text{Control mean-treatment mean}}{\text{control mean}} \times 100$

Only Top Cop significantly (P<0.05) reduced the mite infestation in the first week after treatment, whereas all the acaricides tested (except Ekatin) were significantly effective in reducing infestations from the 3rd week after treatment throughout the trial. A slight decline in the performance of Microthiol and Top Cop was noticed as from the 6th week, which may indicate that they lost their efficacy, however, Kelthane ranked number one and was effective throughout the experiment. Ekatin was very weak

in exerting any observed influence on mite infestation and in fact the mites incidence exceeded that of the control when the experiment commenced. No significant differences were found in date weights as compared to the control.

In site 3 the degree of *Oligonychus* infestations in the control throughout the course of this trial, starting from the first week after treatment, through week 7, was: 18.8, 18.2, 26.3, 33.8, 43.8, 70.0 and 95.0%, respectively

(Table 3). Neoron, Kelthane and transact were effective in significantly ($P < 0.05$) knocking down the initial infestation in the first week after treatment, however, all treatments were significant in reducing infestation in the 3rd week after treatment where it approached zero%, compared to 26.3% in the control. The infestation rose gradually as from the 5th week and onwards in the Tedion and Peropal treatments, whereas it stayed sufficiently low in the Neoron, Kelthane and Transact treatments. No significant differences were found in date weights as compared to the control.

Statistical analysis indicated that mite infestation in the 3rd week after application, in all acaricide treatments, in three sites, (except Ekatin in site 2) were significantly lower as compared to the control. The best results were obtained in the Kelthane and Neoron treatments in sites 1 and 2 and Neoron, Kelthane and Transact in site 3, with Top Cop and Microthiol ranking third. The first two acaricides were most effective one week after application and throughout the course of the trial. The overall performance of the eight acaricides is displayed in Table 4. Transact came first in its effectiveness in reducing web formation, by 96.8%, followed by Kelthane (96.3%), Neoron (95.2%), Peropal (83.8%), Tedion (81.7%), Microthiol (80.6%), Top Cop (79.0%) and Ekatin (30.2%). Neoron and Kelthane were superior in all the three sites of trial. Ekatin gave the poorest results; the mite infestation was steadily increasing in this treatment as in the check, in sites 1 and 2. Kelthane is being used as an effective acaricide since the sixties, DePew^[13] reported that Kelthane and Trithion provided high initial mortality of *O. pratensis* and were superior to all other acaricides 14 days after treatment. Nettleton *et al.*^[12] found dimethoate, ethion, dicofol and carbophenothion most effective, among 13 acaricides, in the control of *O. ununguis*. Elmer^[5] found that sulphur used as spray applied to date bunches; Kelthane, carbophenothion and tetradifon gave good control of *O. partensis* on dates. Recently, Herron and Rophail^[14] mentioned Kelthane among 9 effective acaricides that killed the southern red mite, *O. ilicis*.

The possibility of *O. afrasiaticus* developing resistance to organophosphates is not remote, to explain the very poor performance of Ekatin. Dimethoate, Malathion and Diazinon has long been repeatedly applied on date palms for different purposes. More research is needed to emphasize this fact.

We recommend a winter spray or sulphur dusting in the crown area against the over-wintering mites. This has proved to be very effective in lowering the infestation in the preceding season, in those orchards where this is practice.

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