

EFFICACY OF CERTAIN COMPOUNDS AGAINST SOME PIERCING SUCKING PESTS ON MEDICINAL AND ORNAMENTAL PLANTS

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ABSTRACT

This study was conducted to evaluate some compounds (Crater, Baiocao and Ashook) against *Tetranychus urticae* Koch. on peppermint plants and *Brevipalpus obovatus* Donn. on marigold plants under laboratory and field conditions. This study was carried out at the laboratory of plant protection research institute and at Damietta governorate during seasons 2007 and 2008. The results indicated that, Crater was the most effective compound against *T. urticae* with $Lc_{50} = 0.019$ ml and against *B. obovatus* with $Lc_{50} = 0.072$ ml. followed by Baiocao and Ashook after 24 hrs. under laboratory conditions. Crater also was the most effective compound against *T. urticae* and *B. obovatus* under field conditions. The general mean reduction of *T. urticae* can be arranged as follows Crater (87.88, 86.6; 81.52, 80.01 & 71.62, 73.3%) at (0.6, 0.3 & 0.1 ml/l) > Ashook (61.32, 63.1; 55.79, 55.4 & 47.07, 51.3) at (3.7, 1.7 & 0.9 ml/l). The general mean reduction of *B. obovatus* individuals can be arranged as follows Crater (78.58, 79.5; 65.88, 66.5 & 64.54, 63.8) at (0.6, 0.3 & 0.1 ml/l) > Ashook (56.83, 58.2; 42.57, 44.2 & 41.34, 42.1%) at (3.7, 1.7 & 0.9 ml/l). during 2007 and 2008 seasons.

INTRODUCTION

Medicinal and ornamental plants are considered as important crops in our agricultural production for human health as well as for export purposes outside the country. Various pests associated with medicinal and aromatic plants especially piercing sucking pests which may cause damage and yield loss. *Tetranychus urticae* and *Brevipalpus obovatus* are considered to be of great important pests Estebanes and Rodriguez (1991) and Abd- El-Rahman (1996) Rezk (2001), Anupam and Putatunda (2003). Feeding by Genus *Brevipalpus* mites devitalizes the plant and causes the collapse of the inner leaf tissue. Old damage is characterized by browning of the damaged leaf surface. In addition, some hosts exhibit deformed leave. When two potted spider mites remove the sap, the mesophyll tissue collapses and a small chlorotic spot forms at each feeding site. It is estimated that 18 to 22 cells are destroyed per minute. Continued feeding causes a stippled-bleached effect and later, the leaves turn yellow, gray or bronze. Complete defoliation may occur if the mites are not controlled.

MATERIALS AND METHODS

Three control agents were tested on the two-spotted spider mite, *T. urticae*, on marigold plants, and on *B. obovatus*, on peppermint plants. Diluted suspensions of (Crater, Baiocao and Ashook) were prepared in water for comparison between different concentrations (0.01, 0.3, 0.6 ml/l in 0.125, 0.25, 0.5 & 1.0 ; 0.4, 0.9, 1.7 & 3.7 and 0.05) under laboratory conditions. Leaf-dip technique (Siegler, 1947) was used for determination the effect of tested compounds by dipping peppermint and marigold leaves for 50 seconds

in the various concentrations of previous compounds, then the leaves were left to dry. Forty adult female of *T. urticae* were used, for each concentration divided into four replicates (10 adult females for each replicate) and transferred to each leaf disc of peppermint and marigold (one inch in diameter) by means of hair brush; these discs were placed on their lower surface on pads of moist cotton wool in Petri-dishes. Another group of adult females fed on untreated leaves and kept as control. They were maintained at room temperature of about $27\pm 1^{\circ}\text{C}$ and $75\pm 5\%$ RH), recording the mean number of the mites in the treatment compared with the control according the following equation, Abbott's formula, 1925..

Field experiment was carried at Damietta Governorate during the two successive seasons of 2007 and 2008 on peppermint and marigold plants. An area of 1/5 feddan was divided into two plots, the 1st one of them for cultivation the peppermint plants and the other for marigold plants. The plots were arranged in randomized block with three replicates for each treatment, and another three replicates as control. Each plot was sprayed with different tested agents using a knapsack sprayer. Control plots were sprayed with water only.

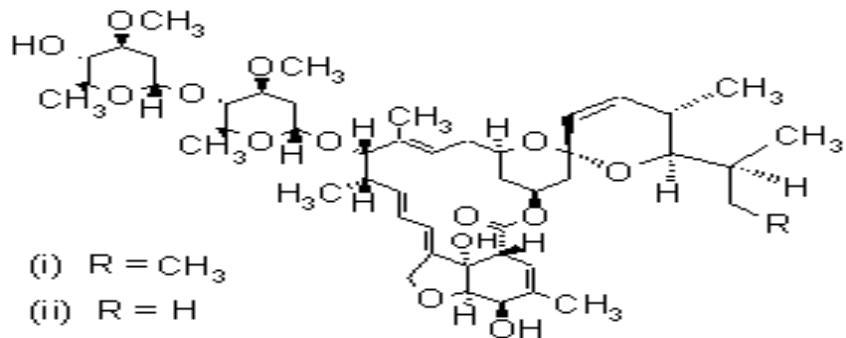
sprays were conducted during Apr.2007 and 2008 seasons on peppermint and marigold plants. Two natural compounds, which gave the good reduction under laboratory tests and were more safe to the predators (Crater with three concentrations 0.1, 0.3 and 0.6 ml/l and Ashook also, with concentrations 3.7, 1.7 and 3.1 ml/l) were sprayed under field conditions. To evaluate the efficacy of these compounds on the number of individuals; the samples were taken before spraying as a pre-count and then after 1, 3, 5 and 7 days as a post count. Each sample was consisted of 30 plants taken randomly from each treatment for peppermint plant; thirty leaves were collected from each treatment for marigold plant. The samples were collected in paper bags and transferred to the laboratory for examination. Individuals were counted under a stereomicroscope, and both surfaces of each leaf were inspected.

Tested compounds:

1-Crater (Afrasa), Vamectin 1.8 EC at the rate of 30 ml./100 liter water.

Chemical name: Abamectin: a mixture containing a minimum 80% Avermectin B, a (5-0-demethyl- Avermectin A, a) and maximum of 20% Avermectin B, b (5-0-demethyl – 25 – de – (1-methylpropyl – 25 – (1-methyl) Avermectin A, a)

Chemical structure:-



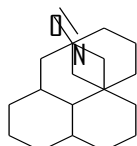
Trade names: Avid – Acri – Mek – Vertemic – Avomec.

2- Baiocao No.1 (0.36% matrine aqueous solution) at the rate of 100ml/ 100 liter water.

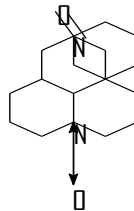
Chemical name:- Matrine.SOPHOCARPIDINE(CALLCULATEDAAS OXYMATRINE).

Chemical formula: - C₁₅H₂₄N₂O-C₁₅H₂₄N₂O₂.

Chemical structure:-

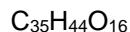
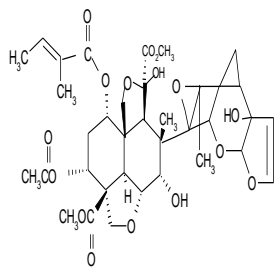


MATRINE



OXYMATRINE

3- Azadirachtin 1500 ppm (Achook 0.15%) [neem kernel based EC containing Azadirachtin 0.15%ww (1500ppm), *Azadirachta indica* A., Fam: Meliaceae]. Produced by Bahar Agrochem and Foods Pvt. Ltd., India.



The corrected percent mortalities were statistically analyzed according to Finney (1952). The tested compounds were compared for their

efficiency according to their LC₅₀ and LC₉₀ of the toxicity lines.

Under field conditions the reduction percentages of infestation by compounds and by predators 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.

RESULTS

Results indicated that in Table (1), Crater was the most toxic pesticide against *T. urticae* with reduction percentage 100 % and 75 % at 0.1, 0.3, 0.6 and 0.05 ml \ L, respectively.

Table (1): Efficacy on certain compounds against movable stages of *Tetranychusurticae* , 24 hours following treatment under laboratory conditions .

Treatments	Conc.	Corrected mortality	Lc50	Lc90	Slope \pm S.D	Toxicity index	
						Lc50	Lc90
Crater	0.05	75.0	0.0002	0.0006	2.0	100	100
	0.1	100			\pm		
	0.3	100					
	0.6	100			0.431		
Baicao	0.125	6.66	0.375	1.137	2.657	0.05	0.05
	0.25	40.0			\pm		
	0.5	60.0					
	1.0	86.66			0.237		
Ashook	0.4	33.0	1.371	29.933	0.957	0.014	0.002
	0.9	37.0			\pm		
	1.7	57.0					
	3.7	66.0			0.183		

Lc₅₀ and Lc₉₀ values for Crater were 0.019 and 0.082 ml, respectively, while Toxicity index at (Lc₅₀ and Lc₉₀) was 100 % and slope value was 2.0 \pm 0.437 respectively.

Crater pesticide followed by Baiocao with reduction percentages 86.66, 60, 40 and 6.66% at 1,0.,0.5, 0.25 and 0.125m\N for Baiocao respectively.

The mortality percentages for Ashook were 66, 57, 37 and 33% at 3.7, 1.7, 0.9 and 0.4 ml \ L respectively. The recorded LC₅₀ and LC₉₀ values for Baiocao were 0.375 and 1.137 ml\ L, respectively, while they were 1.371 and 29.933 ml\ L for Ashook, respectively.

Baiocao recorded slope value 2.657 while it was 0.957 for Ashook. Toxicity index (Ti =100%) at LC₅₀ and LC₉₀ were 0.05 and 0.06% for - Baiocao, while they were 0.014 and 0.002% for Ashook, respectively. These results were agreement with Dybas and Green (1984) Wright *et al.* (1985)

In Table (2) results indicated that, the Crater was the most toxic biotic pesticide against *B. obovatus* adults with reduction percentage 100, 100, 53.3 and 40.6 at 0. 6; 0.3; 0.1 and 0.05, m\N, respectively.

LC₅₀ and LC₉₀ values for Crater was (0.072 and 0.23 ml), respectively, while slope value and Toxicity index at (Lc₅₀ and Lc₉₀) (Ti = 100 %) were 2.552 \pm 0.341 and 100; 100% respectively.

Table (2): Efficacy of certain compounds against *Brevipalpus obovatus* 24 hours following treatment under laboratory conditions .

Treatments	Conc.	Corrected mortality	Lc50	Lc90	Slope ± S. D	Toxicity index	
						Lc50	Lc90
Crater	0.05	40.6	0.0005	0.0009	2.941 ± 0.352	100	100
	0.1	53.3					
	0.3	100					
	0.6	100					
Baicao	0.125	86.66	0.16	0.27	1.052 ± 0.299	0.31	0.33
	0.25	93.33					
	0.5	99					
	1.0	100					
Ashook	0.4	33.3	1.346	28.824	0.963 ± 0.183	0.037	0.003
	0.9	36.3					
	1.7	58.6					
	3.7	65.9					

Crater pesticide followed by Baicao and Ashook with reduction percentages 100, 99, 93.33 and 86.66 % at 1,0.,0.5, 0.25 and 0.125ml/L for Baicao respectively.

The mortality percentages for Ashook were 65.9, 58.6, 36.3 and 33.3 % at 3.7, 1.7, 0.9 and 0.4 ml \ L respectively. The recorded LC₅₀ and LC₉₀ values for Baicao were 0.16 and 0.27ml\ L, respectively, while they were 1.346 and 28.824 ml\ L for Ashook, respectively.

Baicao recorded slope value 1.052 while it was 0.963 for Ashook. Toxicity index (Ti =100%) at LC₅₀ and LC₉₀ were 0.31 and 0.33 % for Baicao, respectively, while they were 0.037 and 0.003 % for Ashook, respectively.

Results revealed that; mean number of *T. urtica* was clearly decreased during the three days after treatments to reach (0.90, 1.7 & 3.7) and (10.0; 8.5 & 7.5 individuals /leaf) at the three concentrations tested for Crater and Ashook, respectively. The corresponding reduction rates were (95.78,93.6; 92.40,91.4 & 83.32,84.7%) and (72.24,73.02; 66.53,65.5& 55.25,59.3%) for the two compounds during two seasons, respectively. However, the mean number of *T. urtica* movable stage was slightly increased from the 5th day after spraying to reach (5.0,7.0; 9.3,8.5 & 8.8,10.0) and (11.5,12.4; 11.66,11.9 & 12.5,13.5 individuals /leaf) to the 7th day followed the treatment for the two control agents, at the three concentrations, respectively. On country, reduction rates of *T. urtica* movable stage were decreased and mounted (73.26,69.6; 61.60,60.3 & 52.17,53.3%) and (51.45,53.6; 47.63,44.3 & 36.2,38.9%) for the treatments, respectively. The general mean reduction of *T. urtica* was (87.88,86.6; 81.52,80.01& 71.62, 73.3%) without significant difference between the three concentrations and (61.32,63.1; 55.79, 55.37&47.07,51.38) with a significant difference between the third and the first & second concentrations for the two pesticides, respectively. The general mean numbers of movable stage of *T. urtica* were (2.37,3.45; 4.7,4.77 &

5.47,6.37) and (9.7,11.025; 10.44,10.65&11.03,12.0 individuals /leaf) during 2007 and 2008 seasons,(in Tables 3and 4).

Data presented indicated that, the mean number of *B.obovatus* individuals decreased at the first day followed the treatment to reach (18.33,15.00 &126.00) and (51.10, 67.10&95.10) individual/plant, for Crater and Ashook at the three concentrations, respectively, (in Tables 5 and 6).

The corresponding reduction rates were (87.49, 86.86 &45.89%) and (63.11, 45.13 & 38.59%) for the two compounds, respectively. The reduction percentages reached the highest rate at the third day after the treatment to reach (81.33, 70.39 & 73.95 %) at the three concentrations, respectively for Crater. It recorded (68.43, 62.45 & 67.93) for Ashook at (3.7, 1.8 and 0.9 ml) concentrations, respectively. The reduction rate of mite individuals decreased at the 5th day to reach (75.35, 58.88 &69.22%) for crater While, it recorded (60.90, 30.59, 35.88) for Ashook at the three concentrations, respectively.

The reduction rate at the 7th day for crater recorded (70.16,72.86; 47.39,45.77 & 69.12,67.2%) at the three concentrations, during two seasons respectively. The corresponding mean number at the 7th day after treatment for crater at the three concentrations were (95.83,90.4; 131.66,130 &157.66,129) individual/ plant, during two seasons respectively. Data also indicated that, the reduction percentages of mite individuals decreased at 7th day after application than the 5th day to reach (34.90,40.8; 25.13,26.02& 22.98,25.64%) for Ashook at the three concentrations, during two seasons respectively.

The general mean number of mite individuals recorded (58.35,58.75; 74.58,73.5&133.16,110.6) and (108.35,119.25; 124.73,124.6& 135.28,149.37) for the two compounds, at the three concentrations, during two seasons respectively.

The general mean of reductions were (78.58,79.5; 65.88,66.5 & 64.54,63.8) and (56.83,58.2; 42.5744.2 & 41.34,42.1%) with a significant difference between the first and second concentrations and the first and third concentrations of Crater. from these results. Crater was more toxic against mites' individuals than Ashook. during two seasons these results were agreement with Brown and Jesser (1981), Putter *et al.* (1981) and Baranowski (1996).

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تقييم بعض المركبات ضد بعض الافات الثاقبة الماصة على بعض النباتات الطبية والعطرية

حورية على عبد الوهاب ، حسن حسن شلبي و نيفين فوزى معوض
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة

أجريت تجربتان أحدهما فى معمل معهد بحوث وقاية النباتات بالدقى على بعض المركبات الطبيعية (كرتر وبيوكا وأشك) ضد أكاروس العنكبوت الاحمر وأكاروس الموالح الكاذب فى محافظة دمياط خلال السنتين ٢٠٠٧ ، ٢٠٠٨ .
أظهرت الدراسة أن مبيد الكراتر كان أكثر المركبات تأثيرا حيث أعطى نسبة خفض ١٠٠ % عند الثلاث تركيزات الاولى ٠,١ و ٠,٣ و ٠,٦ مل/لتر و ٧٥ % عند ٠,٠٥ مل/لتر يلية بيوكا بنسبة خفض ٦٦.٨٦ و ٦٠.٤٠ و ٦٦.٦ % عند تركيزات ١ , ٠,٥ , ٠,٢٥ و ٠,١٢٥ مل/لتر على التوالي وأخيرا مبيد أشوك بنسبة خفض ٥٧'٦٦ و ٣٧' و ٣٣ % عند تركيزات ٣,٧ ' ١,٧ ' ٠,٩ و ٠,٣ مل/لتر على التوالي على الاكاروس العنكبوت الاحمر بعد ٢٤ ساعة من المعاملة

وأن مبيد كراتر كان أكثر المركبات تأثيرا حيث أعطى نسبة خفض ١٠٠ % عند التركيزات ٠,٣ و ٠,٦ مل/لتر على التوالي و ٥٣,٣ و ٤٠,٦ % عند التركيزات ٠,١ و ٠,٠٥ مل/لتر على التوالي يلية بيوكا بنسبة خفض ١٠٠ ' ٩٩ ' ٩٣,٣٣ و ٨٦,٦٦ % عند تركيزات ١ , ٠,٥ , ٠,٢٥ و ٠,١٢٥ مل/لتر على التوالي وأخيرا مبيد أشوك بنسبة خفض ٦٥,٩ ' ٥٨,٦ ' ٣٦,٣ و ٣٣,٣ % عند تركيزات ٣,٧ ' ٧.١ ' ٠,٩ و ٠,٤ مل/لتر على التوالي على الاكاروس الموالح الكاذب بعد ٢٤ ساعة من المعاملة فى المعمل.

وأن مبيد الكراتر أعطى أعلى نسبة خفض حيث كانت نسبة متوسط الخفض عموما ٨٨.٨٧ , ٦٨.٨٦ و ٥٢.٨١ , ٠١.٨٠ و ٦٢.٧١ , ٣.٧٣ % عند تركيزات ٦.٠ , ٣.٠٠ و ١.٠ مل/لتر على التوالي على الاكاروس العنكبوت الاحمر على نبات الاقحوان خلال السنتين ٢٠٠٧ و ٢٠٠٨ فى الحقل.

بينما كانت نسبة متوسط الخفض لمبيد أشوك ٣٢.٦١ , ١.٦٣ و ٧٩.٥٥ , ٣٧.٥٥ و ٠٧.٤٧ , ٣٨.٥١ % عند ٧.٣ , ١.٠ و ٩.٠ مل/لتر على التوالي على العنكبوت الاحمر على نبات الاقحوان خلال السنتين ٢٠٠٧ و ٢٠٠٨ فى الحقل .

وأن مبيد الكراتر أعطى أعلى نسبة خفض حيث كانت نسبة متوسط الخفض عموما ٧٨,٥٨ , ٧٩,٥٥ و ٦٥,٨٨ , ٦٦,٥٥ و ٦٤,٥٤ , ٦٣,٨٨ % عند تركيزات ٠,٦ , ٠,٣ , ٠,١ و ٠,١٢٥ مل/لتر على التوالي على اكاروس الموالح الكاذب على نبات النعناع خلال السنتين ٢٠٠٧ و ٢٠٠٨ فى الحقل.

بينما كان متوسط نسبة الخفض لمبيد اشوك ٥٦,٨٣ , ٨٥,٢٠ و ٤٢,٥٧ , ٤٤,٢٠ و ٤١,٣٤ , ٤٢,١٠ % عند تركيزات ٣,٧ , ١,٧٠ و ٠,٩ مل/لتر على التوالي على اكاروس الموالح الكاذب على نبات النعناع خلال السنتين ٢٠٠٧ و ٢٠٠٨ فى الحقل.

Table (3): The mean numbers of movable stages of *T. urticae*/leaf infesting marigold plants before and after application of two different compounds and their corresponding reduction percentages during 2007 season.

Compound	Concentration	Reduction	Pre-count	Days after treatment				Number/leaf		Reduction (%)
				1 st day	3 rd day	5 th day	7 th day	General Mean	L.S.D.	General Mean
Crater	0.6	Mean No./leaf	10.50	1.00	0.90	2.60	5.00	2.37a	4.17	87.88a
		R. %		94.75	95.78	87.73	73.26			
	0.3	Mean No./leaf	13.60	2.40	2.10	5.00	9.30	4.70a		81.52a
		R. %		90.27	92.40	81.79	61.60			
	0.1	Mean No./leaf	10.33	5.50	3.50	4.10	8.80	5.47a		71.62a
		R. %		70.65	83.32	80.34	52.17			
Ashook	3.7	Mean No./leaf	13.30	10.83	7.50	9.00	11.50	9.70a	2.46	61.32a
		R. %		55.11	72.24	66.48	51.45			
	1.7	Mean No./leaf	12.50	11.83	8.50	9.80	11.66	10.44a		55.79a
		R. %		47.83	66.53	61.16	47.63			
	0.9	Mean No./leaf	11.00	11.33	10.00	10.30	12.50	11.03a		47.07b
		R. %		43.22	55.25	53.61	36.20			
Control (Mean No./leaf)			15.16	27.50	30.80	30.60	27.00	28.97		

The means with the same letters at the same column for the same compound are not significantly different at 0.05% level.

Table (4): The mean numbers of movable stages of *T. urticae*/leaf infesting marigold plants before and after application of two different compounds and their corresponding reduction percentages during 2008 season.

Compound	Concentration	Reduction	Pre-count	Days after treatment				Number/leaf		Reduction (%)
				1 st day	3 rd day	5 th day	7 th day	General Mean	L.S.D.	General Mean
Crater	0.6	Mean No./leaf	12.50	2.00	1.8	3.0	7.0	3.45a	5.33	86.6a
		R. %		91.4	93.6	89.5	69.6			
	0.3	Mean No./leaf	11.60	2.80	2.5	5.3	8.5	4.77a		80.01a
		R. %		87.9	91.4	80.01	60.3			
	0.1	Mean No./leaf	11.6	6.0	4.0	5.5	10.0	6.37a		73.3a
		R. %		72.14	84.7	79.3	53.3			
Ashook	3.7	Mean No./leaf	14.5	11.0	8.8	11.9	12.4	11.025a	3.9	63.1a
		R. %		59.2	73.02	64.1	53.6			
	1.7	Mean No./leaf	11.60	11.2	9.0	10.5	11.9	10.65a		55.37a
		R. %		48.0	65.5	60.4	44.3			
	0.9	Mean No./leaf	12.00	11.5	11.0	12.0	13.5	12.0a		51.38b
		R. %		48.1	59.3	56.3	38.9			
Control (Mean No./leaf)			14.0	26.00	31.50	32.00	25.80	28.8		

The means with the same letters at the same column for the same compound are not significantly different at 0.05% level.

Table (5): The mean numbers of movable stages of *Brvipalpus obovatus*/plant infesting peppermint plants before and after application of two different compounds and their corresponding reduction percentages during 2007 season.

Compou	Concentra-tion	Reduction	Pre-count	Days after treatment				Number/plant		Reduction (%)
				1 st day	3 rd day	5 th day	7 th day	General Mean	L.S.D.	General Mean
Crater	0.6	Mean No./plant	180.30	18.33	52.60	66.66	95.83	58.35b	56.09	78.58b
		R. %		87.49	81.33	75.35	70.16			
	0.3	Mean No./plant	140.50	15.00	65.00	86.66	131.66	74.58b		65.88a
		R. %		86.86	70.39	58.88	47.39			
	0.1	Mean No./plant	286.60	126.00	116.66	132.33	157.66	133.16a		64.54a
		R. %		45.89	73.95	69.22	69.12			
Ashook	3.7	Mean No./plant	170.50	51.10	84.10	100.00	198.20	108.35a	109.53	56.83a
		R. %		63.11	68.43	60.90	34.90			
	1.8	Mean No./plant	150.50	67.10	88.30	142.33	201.21	124.73a		42.57a
		R. %		45.13	62.45	37.58	25.13			
	0.9	Mean No./plant	190.60	95.10	95.50	183.33	262.31	135.28a		41.34a
		R. %		38.59	67.93	35.88	22.98			
Control (Mean No./plant)			266.66	216.66	416.66	400.00	475.00	377.08		

The means with the same letters at the same column for the same compound are not significantly different at 0.05% level.

Table (6): The mean numbers of movable stages of *Brvipalpus obovatus*/plant infesting peppermint plants before and after application of two different compounds and their corresponding reduction percentages during 2008 season.

Compou	Concentra- tion	Reduction	Pre-count	Days after treatment				Number/plant		Reduction (%)
				1 st day	3 rd day	5 th day	7 th day	General Mean	L.S.D.	General Mean
Crater	0.6	Mean No./plant	185.5	19.5	55.0	70.5	90.4	58.75b	55.3	79.50b
		R. %		87.44	80.97	76.8	72.86			
	0.3	Mean No./plant	133.50	16	57	91.0	130.0	73.50b		66.5a
		R. %		85.69	72.6	58.4	45.77			
	0.1	Mean No./plant	226.00	101.0	91.5	121.0	129.0	110.6a		63.8a
		R. %		46.67	74.01	67.33	67.2			
Ashook	3.7	Mean No./plant	190.50	59	93.0	123.5	201.5	119.25a	111.4	58.2a
		R. %		63.04	68.67	60.45	40.8			
	1.8	Mean No./plant	149.8	64.5	89.0	146.0	199.0	124.6a		44.2a
		R. %		48.6	61.8	40.5	26.02			
	0.9	Mean No./plant	176.0	90.0	92.0	180.5	235.0	149.37a		42.1a
		R. %		38.97	66.45	37.43	25.64			
Control (Mean No./plant)			250.6	210.0	390.5	410.8	451.00	365.57		

The means with the same letters at the same column for the same compound are not significantly different

