J. Product. & Dev., 12(1): 33 - 44 (2007)

EFFICACY OF ENTOMO-PATHOGENIC FUNGI, MINERAL OIL AND CARBOSULFAN AGAINST THE TWO SPOTTED MITE, *TETRANYCHUS URTICAE* AND ITS NATURAL ENEMIES IN SOME VEGETABLE CROPS

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ABSTRACT

Field tests were carried out in 2005-2006 growing season to determine the efficacy of Beauveria bassiana (Balsamo) Vuillemin, Metarhizium anisopliae (Metsch.) Sorokin, mineral oil and carbamate insecticide, carbosulfan on Tetranychus urticae at El-Arish, North Sinai Governorate.

Results showed that no significant differences of mite individuals and reduction of infestation appeared on tomato and eggplant between entomogenous fungi and mineral oil plants, while the difference was significant between treated plots and the untreated one. In watermelon cultivation, clear difference in mite individuals shown between mineral oil and bioranza, as well as, between mineral oil and carbosulfan after 7 days post-application. Slight difference in reduction percentage of mite infestation appeared between tested compounds. Reduction percentages of mite were 71.34, 77.10, 78.38 and 84.20% for biovar, bioranza, mineral oil and carbosulfan, respectively. Carbosulfan was less effective than entomogenous fungi and mineral oil in reducing the individuals of mites on qantalup plants at the different time intervals post-spray. There were no significant differences in natural enemies population on tomato between biovar, bioranza and mineral oil treated and untreated plots at different time intervals post-spray. The seasonal average of natural enemies in watermelon was not significantly differ between biovar, bioranza treated area and the untreated one. While mineral oil revealed the highest population of natural enemies, carbosulfan gave the lowest number and differed significantly with all treated and untreated plots.

Key words: Metarhizium anisopliae, Beauveria bssiana, Tetranychus urtica, mineral oil, and biological control.

INTRODUCTION

The phytophagous, *Tetranychus urticae* Koch, considered a serious pest for different vegetable, ornamental, and field crops in Egypt (Ahmed, 1988; Darwish, 1990). Mites feed on plant material by piercing plant tissue with their mouthparts and removing plant fluids. Some mite species inject a toxin from their saliva as they feed. Feeding damage varies with respect to mite and plant species. Feeding damage is often observable on the upper leaf surface as a characteristic mottled or speckled appearance.

Excessive reliance on pesticides has accompanied by the development of several problems such as development of insect resistance toward insecticides and problems of environmental pollution. Thus, there is a continuing need for environmentally safe alternatives to replace conventional hazarsdous insecticides (Sokolov, 1990).

Accordingly, during the last two decades, biological control has received more attention with the increased consciousness in environment issues and integrated pest management methods (Rao, *et al.* 1989) Catska, *et al.* (1989). Using the entomopathogenic fungi such as *Verticillium lecanii*, Metarhizium anisopliae and *B.bassiana* against aphid has investigated by Wich, (1990); Santiago, (1991); Birkmose, (1994) and Butt, *et al.* (1995); whitefly (Humphreys, *et al* 1990; and Wright, 1992). Also, entomogenous fungi have been used to control mites by many investigators (Weiser and Muma, 1966; Pelagatti, *et al.* 1988; Tamai *et al.* 1998; Tamai *et al.,* 1999, and Alves *et al.,* 1998.

Aim of the present investigation is to determine the efficacy of *Beauveria bassiana* (Balsamo) Vuillemin and Metarhizium anisopliae (Metsch.) Sorokin, mineral oil, and carbosulfan against *Tetranychus urticae* at El-Arish, North Sinai Governorate.

MATERIALS AND METHODS

Tested compounds and rates:

1- Microbial compounds.

a. **Biovar:** Biovar is commercial product under investigation provided by Insect Pathogen Unit, at Plant Protection Research Institute, Agriculture Research Center. It is a wettable powder formulation of the fungus of *Beauveria. bassiana* at 32 x 10^6 Spore/gm. It used at the rate of 200 gm /100 liter of water.

b. **Bioranza:** Bioranza is commercial product under investigation provided by Insect Pathogen Unit, at Plant Protection Research Institute, ARC It is a wettable powder formulation of the fungus of *Metarhizium. anisopliae* at 32 x 10^6 Spore/gm. It is used at the rate of 200 gm/100 liter of water.

2- ***Mineral oil:*** KZ oil 95% EC manufactured by Kafr El-Zayat for pesticicides and fertilizer Company, Kafr El-Zayat, Egypt and used at the rate of 11 /100 liter of water.

*3- **Chemical insecticides*:** Carbosulfan (Marshall, 25% w.p.): 2,3-dihydro- 2.2-dimethyl -7- benzo furanyl [dibutyl amino)-thio] methyl carbamate.

Methodology:

The tested compounds were sprayed on tomato, eggplants, watermelon and cantalup plants with the mentioned rates at El-Arish, North Sinai, 2005 season. An area of half feddan of different crops was divided into 16 plots (120 m^2 each) in a randomized block design. Spraying was carried out against the different stages of the mites, *Tetranychus urticae*. A knapsack sprayer equipped with one nozzle was used.

Inspection was made before spraying and at 3 and 7 days after tested compounds application. Four leaves were picked from the different levels of each plant. Twenty five plants were chosen at random for each plot in each inspection. The total number of mite individuals and natural enemies per 10 leaves were recorded.

Statistical analysis:

To determine the differences between treatments, Duncan Multiple Range Test (DMRT) was used, as well as, the percentage reduction in animal population after spraying was calculated according to Handerson and Tilton (1955).

RESULTS AND DISCUSSION

I- Efficacy of entomogenous fungi, mineral oil and carbamate insecticide (carbosulfan) against *T. urticae* in vegetable crops.

I-1- Tomato infestation:

Data in Table (1) show that there were no significant differences in mites individuals in all treatments of tomato plants before spray while the average number ranged between 75 and 87.1 individual/10 leaflets. Infestation level in the treated areas was highly decreased after 3 days post-application compared to the untreated area. There were no significant differences between treatments in mite individuals, while the difference was significant between the untreated area and the treated one at LSD 7.93 (P = 0.05 %).

Levels of infection after 7 days post-spray in the untreated plots were higher than the treated one. In treated plots, mineral oil revealed the lowest level of mites infestation followed by biovar and bioranza, respectively. No significant difference in mite individuals/10 leaflets was found between both fungus compounds, while the difference was significant between fungus compounds and mineral oil, as well as, between treated and untreated plots at LSD value of 7.93 and P = 0.05% level.

Taking into consideration the seasonal average of mites on tomato plants, it is appeared from obtained results that no significant differences in mite individuals between different treatments, while the difference was significant between treated plots and the untreated one (Table 1).

As for reduction in mite infestation, it is appear that all tested compounds revealed reduction in mite infestation on tomato plants ranged between 81.49 - 83.48 and 73.07 - 75.60% after 3 and 7 days, respectively (Table 2).

Considering the seasonal average of reduction infestation with mite, data represent that slight difference in reduction percent of mite infestation on tomato plant appeared between different treatments (Table 2).

I-2- Egg plants infestation:

Data in Table (1) indicate that the level of infestation in eggplant canopy was higher than that was obtained in tomato plants. No significant difference in mite individuals between different plots before spray was noticed. After 3 days of spray, all tested compounds reduced significantly mite individuals in eggplant leaves compared to the untreated one. The average number of mite individuals in mineral oil was 21 individual /10 leaves, but it was 27.9 and 34.3 individual/10 leaves for biovar and bioranza, respectively.

After 7 days of application, it is obvious that no significant difference in mite individuals between all tested compounds, but the difference appeared between treated and untreated plots at LSD value of 21.81 and P= 0.05% level.

Regarding the seasonal average of mites on eggplant leaves, it is appeared from obtained results that no significant differences in mite individuals between different treatments, while the difference was significant between treated plots and the untreated one (Table, 1).

Taking into account reduction in mite infestation in eggplant canopy, it is appear that all tested compounds revealed reduction in mite infestation on eggplant leaves compared to the untreated plots. After 3 days of application, reduction percentages were 79.9, 82.8 and 87.7 % for biovar, bioranza and mineral oil, respectively. Reduction percentage ranged between 69.07 and 77.22 % after 7 days post-spray (Table, 2). Seasonal average of reduction percentage in mite infestation in Eggplant leaves was 74.49, 77.21, 82.46% for biovar, bioranza and mineral oil, respectively (Table 2).

Reviewing the above mentioned results, it could be concluded that both tested entomogenous fungi as well as mineral oil reduced significantly the incidence of *T. urticae* on tomato and eggplant cultivations. The efficacy of the three tested compounds slightly decreased after 7 days post-spray. This is due to adverse effect of environmental conditions e.g. UV, temperature and relative humidity. So, continued modification in entomogenous fungi products is needed to increase the half life of the pathogens under field conditions.

Generally, entomogenous fungi revealed promising results in controlling *T. urticae* on tomato and eggplant which could help in banning the chemical pesticides to reduce the environmental hazards. These results agree with the results obtained by Charnley (1984) using *B. bassiana* to control. *T. urticae* on kidney bean. He found that a dust containing 0.5% *B. bassiana* spores gave a mortality of 71% of *T. urticae*.

Table (1): Effect of entomopathogenic fungi and mineral oil on *T. urticae* individuals on tomato and eggplant canopy at El-Arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/feedan	Population before spray	Population at indicated days post-spray		Average population/10 leaf
			3 days	7 days	
Tomato					
Biovar	200 gm	87.1[a]	15.8[b]	18.0[b]	40.30[b]
Bioranza	200 gm	85.0[a]	14.1[b]	19.0[b]	39.37[b]
Mieral oil	1 litre	78.0[a]	13.4[b]	7.8[b]	33.07[b]
Control	0	75.0[a]	73.8[a]	63.7[a]	70.83[a]
LSD		12.01	7.23	7.93	11.14
Eggplants					
Biovar	200 gm	209.8[a]	34.3[b]	38.4[b]	94.17[b]
Bioranza	200 gm	200.0[a]	27.9[b]	33.6[b]	87.17[b]
Mieral oil	1 litre	210.0[a]	21.0[b]	28.3[b]	86.43[b]
Control	0	203.0[a]	162.0[a]	120.0[a]	161.67[a]
LSD		61.59	12.98	21.81	21.07

Values in columns having the same letter are not significantly differ at *P*= 0.05% level.

Table (2): Reduction percentage of *T. urticae* individuals on tomato and eggplant canopy after application of entomopathogenic fungi and mineral oil at El-Arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/ feedan	Reduction % of population at indicated days post-spray		Average reduction %
		3	7	
Tomato				
Biovar	200 gm	81.49	75.60	78.55
Bioranza	200 gm	83.48	73.62	78.55
Mieral oil	1 litre	82.47	73.07	77.77
Eggplant				
Biovar	200 gm	79.9	69.07	47.49
Bioranza	200 gm	82.8	71.61	77.21
Mieral oil	1 litre	87.7	77.22	82.46

I-3- Watermelon infestation:

Effect of entompathogenic fungi, mineral oil and carbosulfan on *Tetranychus urticae* individuals on watermelon are shown in Table (3). It is appear that there were no significant differences in the average of *T. urticae* on watermelon leaves before spraying in all experimental plots except in mineral oil plots whereas the difference was significant compared to the other plots.

After 3 days of spray, inspect of the mite individuals in the untreated plots was almost the same as before application, all tested compounds reduced significantly mite individuals on watermelon leaves. The average number of mite individuals ranged between 1.1 and 10.1 individual /10 leaves in treated plots, while it was 25.1 individual/10 leaves in the untreated one.

No significant differences in mite individuals after 7 days post-spray appeared between both entomogenous fungi, as well as between tested fungi and the tested insecticide carbosulfan at LSD value of 6.55 (P = 0.05 %). Clear difference in mite individuals was shown between mineral oil and bioranza, as well as, between mineral oil and carbosulfan.

Regarding the seasonal average of mite individuals, data in Table (4) indicated that no significant difference in mite individuals was found between both entomogenous fungi and the carbamate insecticide (carbosulfan), while the difference was clear between mineral oil and the other three tested compounds. Also, the difference between treated plots with mineral oil and the untreated one was not significant (Table 3).

Considering the reduction of mite individuals, after 3 days post-spray, data in Table (4) show that carbosulfan represented the highest level of reduction percentage of mite individuals on watermelon plants followed by bioranza, biovar and mineral oil, respectively. Reduction percentage of mite after 7 days of application decreased in all treated plots compared to the first inspection at 3 days of spray.

Regarding seasonal average of reduction percentage in mite individuals, slight difference in reduction percentage of mite infestation appeared between tested compounds. Reduction percentages of mite were 71.34, 77.10, 78.38 and 84.20% for biovar, bioranza, mineral oil and carbosulfan, respectively (Table 4).

I-4- Qantalup infestation:

Effect of entomopathogenic fungi, mineral oil and carbosulfan on *Tetranychus urticae* individuals on Qantalup canopy at El-Arish Valley, Saina Governorate, 2005 season are shown in Table (3). Data in Table (3) indicate that there were no significant differences in mite infestation between tested compounds at different time intervals. All tested compounds reduced significantly the incidence of mite on Qantalup canopy compared to the untreated plots. Mite individuals after 3 days post-application ranged between 4.7 and 6 individuals/ 10 leaves, while it ranged between 7 and 10.9 individuals/ 10 leaves after 7 days of spray. Mite individuals in the untreated plots were 68.2 and 55 individuals/ 10 leaves after 3 and 7 days after application respectively.

Table (3): Effect of entomopathogenic fungi, mineral oil and chemical insecticide on *Tetranychus urticae* individuals on watermelon and Qantalup canopy at El-Arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/feedan	Population before spray	Population at indicated days post-spray		Average population/10 leaf
			3 days	7 days	
Watermelon					
Biovar	200 gm	19.5[b]	1.9[c]	8.6[bc]	10.00[b]
Bioranza	200 gm	23.0[b]	2.0[c]	7.0[c]	10.66[b]
Mieral oil	1 litre	65.9[a]	10.1[b]	14.4[b]	30.13[a]
Carbosulfan	125 gm	20.0[b]	1.1[c]	4.3[c]	8.47[b]
Control	0	26.5[b]	25.1[a]	22.0[a]	24.53[a]
LSD		10.51	5.59	6.55	7.7
Qantalup					
Biovar	200 gm	45.0[bc]	6.0[b]	9.3[b]	20.10[b]
Bioranza	200 gm	46.3[bc]	5.0[b]	8.6[b]	19.97[b]
Mieral oil	1 litre	25.0[c]	5.0[b]	10.9[b]	13.63b
Carbosulfan	125 gm	50.0[ab]	4.7[b]	7.0[b]	20.57[b]
Control	0	70.0[a]	68.2[a]	55.0[a]	64.4[a]
LSD	-	22.64	16.79	17.69	26.24

Values in columns having the same letter are not significantly differ at *P*= 0.05% level.

Table (4): Reduction percentage of *Tetranychus urticae* individuals on watermelon and Qantalup canopy after apllication of entomopathogenic fungi and mineral oil at El-Arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/ feedan	Reduction % of population at indicated days post-spray		Average reduction %
		3 days	7 days	
Watermelon				
Biovar	200 gm	89.76	52.92	71.34
Bioranza	200 gm	90.86	63.34	77.10
Mieral oil	1 litre	83.39	73.38	78.38
Carbosulfan	125 gm	94.22	74.20	84.20
Qantalup				
Biovar	200 gm	86.40	73.75	80.07
Bioranza	200 gm	88.98	76.41	82.69
Mieral oil	1 litre	90.41	82.22	86.32
Carbosulfan	125 gm	79.60	44.62	62.10

Regarding reduction percentage of mites on Qantalup, it is appear from data in Table (4) that carbosulfan was less effective than entomogenous fungi and mineral oil in reducing the individuals of mites on Qantalup plants at the different time intervals post-spray.

Reviewing a foreword results, it could be found there were slight differences between the two entomogenous compounds, mineral oil and the carbamate insecticide (carbosulfan) against *T. urticae* on watermelon and Qantalup. Obtained results of entomogenous fungi against mites agree with research was being conducted in Brazil to evaluate several Deuteromycetes as possible control agent of the two-spotted spider mite. Tamai *et al.* (1998) tested 152 different isolates of the fungi *B. bassiana, B. brongniartii, Beauveria* sp., *Metarhizium* sp., *Paecilomyces lilacnus* and *P.farinosus* against *T. urticae.* Only the *Beauveria* spp. the isolates tested caused mortality between 35 and 95%. The patho-genicity of one of the *B. bassiana* isolates (447), was further tested in the laboratory against *T. urticae* on leaf disks of the jack bean *Canavalia ensiformis* at a temperature of 25ºC, at 70% relative humidity and a photoperiod of 12 h (Tamai *et al.*, 1999). The pathogen was applied in a concentration range from 5 x 10^6 to 1 x 10^9 conidia per milliliter. Mortality higher than 50% was not reached at any of the concentrations after 6 days following the application. Another *B. bassiana* isolate was tested in a semi-field experiment on two spotted spider mites in chrysanthemum. The isolate, PL-63, was applied in a concentration of 2-108 conidia per milliliter and gave good control when four treatments were carried out in a period of 14 days . Results were even better than those obtained with chemical control. The fungus was also effective against other pests in chrysanthemum, such as thrips and aphids (Alves *et al*., 1998).

II- Efficacy of entomogenous fungi, mineral oil and carbamate insecticide (carbosulfan) against natural enemies in vegetable crops.

The natural enemies found on the tomato and eggplant crops were the *Chrysoperla carne* (Chrysopidae), *Paederus alfierii* (Staphylinidae) and *Coccinella* spp.

II-1- Natural enemies population in tomato and eggplant crops:

Effect of entomogenous fungi and mineral oil on natural enemies population in tomato and eggplant cultivations are shown in (Table 5). For tomato plantation, data in Table (5) show that there were no significant differences in natural enemies population between biovar, bioranza and mineral oil treated and untreated plots at different time intervals post-spray. Natural enemies population ranged between 6.4 and 12.7 individual/ 10 leaves before spray, while ranged between 6-14 and 9.4 – 17.2 individaul/10 leaves after 3 and 7 days post-spray, respectively.

As for eggplant cultivation, data indicate that there were no significant differences in natural enemies population between different plots before spray. The same phenomena was found between biovar, bioranza and mineral oil after 3 days of application, but significant difference appeared between mineral oil treated and untreated plots, as well as between biovar and the untreated area (Table 5). After 7

Table (5): Effect of entomopathogenic fungi and mineral oil on natural enemies population of watermelon and cantalup canopy at El-arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/feedan	Population before spray	Population at indicated days post-spray		Average population/10 leaf
			3 days	7 days	
Tomato					
Biovar	200 gm	8.6[a]	7.3[a]	11.4[a]	9.1[a]
Bioranza	200 gm	6.4[a]	6.0[a]	9.4[a]	7.3[a]
Mieral oil	1 litre	12.7[a]	10.0[a]	11.6[a]	11.4[a]
Control	0	10.0[a]	14.0[a]	17.2[a]	13.7[a]
LSD		6.45	9.0	7.87	6.31
Eggplants					
Biovar	200 gm	5.4[a]	6.9[b]	8.8[bc]	7.0[b]
Bioranza	200 gm	7.2[a]	12.7[ab]	23.0[a]	14.3[a]
Mieral oil	1 litre	8.1[a]	6.0[b]	7.0[c]	7.0[b]
Control	0	7.9[a]	14.0[a]	15.0[b]	12.3[b]
LSD		6.91	6.45	6.65	7.84

Values in columns having the same letter are not significantly differ at P= 0.05% level.

days of spray, bioranza had the highest level of natural enemies population followed by the untreated plots, biovar and mineral oil treated plots, respectively. Seasonal average of natural enemies was 7, 14.3, 7 and 12.3 individual/ 10 leaves for biovar, bioranza, mineral oil treated and untreated areas, respectively.

II-2- Natural enemies population in watermelon and qantalup crops:

Data in Table (6) represent the side effect of antogenous compounds, and mineral oil compared to the carbamate insecticide (carbofuran) on the population of natural enemies on watermelon and qantlup cultivation. Data indicate that there were no significant differences in the total number of natural enemies on watermelon plant between different plots before spray.

At three days post application, the average number of natural enemies in biovar, bioranza and carbosulfan treated plots was not significantly differ than the untreated one at LSD value of 10.85 and P= 0.05% whereas, it ranged between 7 and 18.6 individual /10 leaves. In contrast, natural enemies population in mineral oil treatment increased dramatically and represented significant difference with the other compounds and untreated area (Table, 6).

After one week of application, mineral oil revealed the highest population of natural enemies followed disendingly by the untreated area, and the area sprayed with bioranza, and biovar, while carbosulfan resulted in high reduction in natural enemies population. There were significant differences in natural enemies population was found between biovar, bioranza, mineral oil and carbosulfan, but the difference between bioranza and control treatment was not significant.

Table (6): Effect of entompathogenic fungi and mineral oil on natural enemies population of watermelon and Qantalup canopy at El-Arish Valley, North Sinai Governorate, 2005 season.

Compound	Rate of application gm.a.i/feedan	Population before spray	Population at indicated days post-spray		Average population/10 leaf
			3 days	7 days	
Watermelon					
Biovar	200 gm	13.2^{a}	10.2^{b}	12.6^{c}	12.0^{bc}
Bioranza	200 gm	17.6^{a}	15.0^{b}	22.6^{b}	18.2^{bc}
Mineral oil	1 litre	15.8^{a}	79.0^{a}	47.68^{a}	47.49^{a}
Carbosulfan	125 gm	14.6^{a}	7.0^{b}	2.2^{d}	7.73^{b}
Control	0	13.9^{a}	18.6^{b}	26.7^{b}	19.73^{b}
LSD	-	8.46	10.85	9.59	10.89
Cantalup					
Biovar	200 gm	9.0^{a}	10.0^{a}	8.0^{ab}	9.0^{ab}
Bioranza	200 gm	10.3^{a}	12.2^{a}	15.0^{a}	12.5^{a}
Mineral oil	1 litre	12.0^{a}	6.0^{ab}	8.2^{ab}	8.73^{ab}
Carbosulfan	125 gm	12.8^{a}	2.0^{b}	3.9^{b}	6.23^{b}
Control	0	7.4^{a}	12.0^{a}	16.2^{a}	11.87^{a}
LSD	-	7.50	7.50	8.01	4.94

Values in columns having the same letter are not significantly differ at P = 0.05 % level.

Generally, the seasonal average of natural enemies was not significantly differ between biovar, bioranza treated area and the untreated one. While mineral oil revealed the highest population of natural enemies, carbosulfan gave the lowest number and differed significantly with all treated and untreated plots.

Considering the natural enemies in qantalup cultivation, data in Table (6) show that no significant differences in natural enemies population was found between entogenous fungi (*B. bassiana, M. anisopliae)*, mineral oil and the control treatment at different time intervals. In contrast, carbosulfan reduced significantly natural enemies population in comparison with the untreated area.

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تأثير الفطريات الممرضة للحشرات والزيت المعدنى والكاربوسلفان على حلم العنكبوت الأحمر ذو البقعتين

وفاء الغتورى

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أجريت التجارب في عام ٢٠٠٥، ٢٠٠٦ لدراسة تأثير كل من المركبين الفطريين البيوفار (بيوفاريا باسينا) والبيورانز (ميتا ريزيم أنسويلين) وزيت معدني ومبيد كارباماتى (كاربوسولفان) على العنكبوت الأحمر ذو البقعتين بمنطقة العريش شمال سيناء.

النتائج أوضحت أنه لا يوجد فروق في تعداد العناكب وخفض نسبة الإصابة كانت واضحة في الطماطم والباذنجان ما بين المركبات الفطرية والزيوت المعدنية بينما كان واضحاً في زراعات البطيخ . حيث كان الفرق واضحاً في تعداد العناكب ما بين الزيت المعدني ومركب البيورانز وما بين الزيت المعدني والمبيد المستخدم كاربوسولفان بعد ٧ يوم من الرش .

حيث توجد فروق طفيفة في نسب التعداد بين المركبات المستخدمة . حيث كان نسب الخفض في التعداد ٧١.٣٤ ، ٧٧.١ ، ٧٨.٣٨ ، ٨٤.٢٠ لكل من البيوفار والبيورانز والزيت المعدني والكاربوسولفان بالترتيب . وكان الكاربوسولفان أقل تأثير من المركبات الفطرية والزيت المعدني في خفض التدمير للمحصول نتيجة الإصابة في الكانتالوب خلال الأوقات التي تلي عملية الرش .

وليس هناك فروق معنوية في تعداد الأعداء الحيوية في الطماطم ما بين المركبات الفطرية والزيت المعدني في الوحدات المعاملة عن الوحدات الغير معاملة كما أن متوسط تعداد الأعداء الحيوية في البطيخ لا يوجد فرق معنوي ما بين البيوفار والبيورانز بعد الرش بينما كان التعداد قليلاً جداً عند استخدام الكاربوسولفان في كل المعاملات .