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EFFECT OF CERTAIN BIOCIDES ON *Myzus persicae* (SULKER), *Thrips tabaci* LIND., *Gosmylce baeticus* L. AND THEIR PREDATORS ON ALFALFA

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ABSTRACT

Three commercial biocides, Biovar® (entomopathogenic fungus, *Beauveria bassiana*), Protecto® (entomopathogenic bacterium, *Bacillus thuringiensis*) and Virotecto® (entomopathogenic virus), Granulosis virus were tested against *Myzus persicae* (Sulker), *Thrips tabaci* Lind and *Gosmlyce* (= *Polymmatus*) *baeticus* L. and their predators on alfalfa crop under field conditions. The biocides were sprayed three times. Ten alfalfa branches were sampled and checked from each treatment just prior to treatments and after 1, 3 and 5 days following application. Biovar was the most effective biocide that reduced the infestation of aphids, thrips and butterfly by 73.9, 55.9 and 53.6%, respectively. Protecto was more effective against butterfly reducing the infestation by 69.3% but it was less effective against aphids and thrips with infestation reduction of 36.5 and 31.6%. Virotecto was least effective formulation against the tested pests causing 41.8, 39.6 and 20.6% reduction of infestation with aphids, butterfly and thrips, respectively. Also, all tested biocides are broad spectrum and exhibited toxicity to the associated predators. Rate of mortality in the associated predators was biocide-dependent and differed from one biocide to the other.

INTRODUCTION

In the recent years, the concern about producing bioorganic crops, free from pesticides residues, environmental considerations and pollution has greatly increased. This, in turn, led to shifting research efforts to biological control programs. One of the requirements of this mission is using biocides specially in forage crops such as alfalfa and clover (Collier, 1999 and Sakurai *et al.*, 2001).

It is well known that the entomopathogenic fungus (*Beauveria bassiana*), the entomopathogenic bacterium (*Bacillus thuringiensis*) and granulose virus are widely used against scores of insect pest in different agreoecosystems, in general, and forage crop ecosystem in particular. These entomopathogenic microorganisms are available in markets in several commercials formulations (Leatheredale, 1970; Barson, 1977; Vail et al., 1991, Scoth et al., 1993; James and Ligghthart, 1994, and Lopez-Meza and Ibarra, 1996.

Alfalfa (*Medicago satival*) is a very important forage crop in Egypt. This crop is the main refuge and reservoir for hundreds of natural enemies such as anthocrorid, coccinellids, chrysopids, mantids, parasitic wasps and several insect pests that cause much damage. Of which, *Myzus persicae* (Sulker), (Homoptera: Aphididae), *Thrips tabaci* Lind (Thysanoptera: Thripidae) and *Gosmylce* (=*Polymmatus*) *baetricus* L. (Lepidoptera: Lycaenidae) are considered the most important and abundant pests on this crop.

This work aimed to evaluate the effectiveness of three biocides, entomopathogenic fungus, entomopathogenic bacterium and entomopathogenic virus against the alfalfa pests, *M. persicae*, *T. tabaci* and *G. baeticus* and their associated predators on alfalfa crop under field conditions.

MATERIALS AND METHODS

Biocides:

1- Biovar (*Beauveria bassiana*) at the rate of 200gm/100 L water
2- Protecto (*Bacillus thurineginsis* var.*Kurstaki*) at the rate of 300gm/400 L water.
3- Virotecto (granulosis virus) at the rate of 300 gm/feddan.

Experimental protocol

These experiments were carried out on the farm of Ismailia Agricultural Research Station (IARS) in 2005 on alfalfa crop using three commercial biocides. Four replicates were used for each treatment, each replicate was 10×10 m^2. A knapsack sprayer was used in applying the microbial insecticides as foliar treatments diluted with water. Four plots were left without any treatment as control. Ten alfalfa branches were randomly sampled from each plot and were checked by the aid of a stereomicroscope. The total numbers of aphids, thrips, butterfly and their associated predators were recorded before spraying and one, three and five days after application. The tested compounds were sprayed three times with five days between each application.

Percent reduction in the population of aphids, thrips and butterfly were calculated according to Henderson and Tilton equation (1955).

$$\text{Percentage reduction in infestation} = \left(1 - \frac{A \times B}{C \times D} \times 100\right)$$

While:
A= the Average number in untreated plot before treatment.
B= the Average number in treated plot after treatment.
C= the Average number in untreated plot after treatment.
D= the Average number in treated plot before treatment.

Statistical analyses

All data were subjected to statistical analysis using split-split plot design. Means were separated using LSD at 0.05 level of significance (SAS, 1999)

RESULTS AND DISCUSSION

Effects of some biocides against the target pests

Data presented in Tables (1- 3) show that all applied biocides reduced the mean numbers of aphids, thrips and butterfly compared with that of untreated control. Biovar was the most effective formulation against *M. persicae*. The average numbers of 1st, 2nd and 3rd sprays was 5.1, 5.8 and 4.2 individuals/ branch. Virotecto was the second effective compound against

aphids, the average numbers of were 7.9, 8.7 and 8.9 individuals/branch in the 1st, 2nd and 3rd sprays, respectively. On the other hand, Protecto was the least effective compound against aphids.The respective values in the control treatment were 7.9, 11.7 and 12.6, respectively.

The results indicated that *Beauveria bassiana* had a toxic effect after five days during 1st spray of treatment and this effect may be due to toxin secretion by the fungus and fungal hyphae. Schaerffinberg (1957) mentioned that *Beauveria bassiana* kills its insect host by the action of hyphae that germinate from spores and destroy the internal tissues. This results also agree with those of Feng *et al.* (1990) who confirmed pathogenicity of fungal species on aphids and he added that *B. bassiana* was virulent and tending to kill aphids more rapidly.

As presented in Table (2), Biovar, Protecto and Virotecto were effective formulations against *T. tabaci* and Biovar being the most effective formulation against thrips. with average numbers of 3.1, 2.4 and 1.5 individuals/branch of 1st, 2nd and 3rd sprays, respectively. The results agree with Van-Lenteren and Oomans (1999) who mentioned that pathogenic fungi useful as additional control agents against thrips.

Virotecto came second in controlling thrips. The average numbers were 2.2, 2.4 and 2.8 individuals of 1st, 2nd and 3rd sprays, respectively followed by Protecto with average numbers of 3.0, 3.1 and 3.3 during 1st, 2nd and 3rd sprays, respectively.

Data in Table (3) indicated that Protecto was the most effective formulation against *G. baeticus* with an average number of 2.9, 3.8 and 2.5 individuals/branch of 1st, 2nd and 3rd sprays. It obvious that *B. thuringiensis* was toxic during 1st spray, this results agree with data recorded by Walgenbach *et al.* (1991) who confirmed that *B. thuringiensis* was toxic after very short periods (less than 48 h after application). It could be noticed that the effect of Biovar against *G. baeticus* was active during the 2nd and 3rd sprays, with average number of 6.1 and 3.3 individuals, respectively. Whereas no effect was observed when using Virotecto against *G. baeticus* after 1st and 2nd sprays, but its effect was observed after 3rd spray with average of 7.6 individuals.

Percent reduction was calculated referring to the population size in the control treatment. Showed that Biovar treatment gave the highest effect against aphids with percent reduction of (73.9 %), followed by Virotecto (41.8 %) and Protecto (36.5%) Fig.(1). Data in Fig (2) showed that Biovar treatment was the highest effect against *T. tabaci* (55.6%) followed by protecto (31.6%) and Virotecto (20.6%).

Results in Fig (3) indicated that Protecto was the most effective formulation against *G. baeticus* (69.3%), followed by Biovar (53.6%) and Virotecto (39.6%).

Effect of biocides on the associated predators:

The predators associated with the aphids were *Hippodamia tredecimpunctata* L.(Coleopetra: Coccinellidae), *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae) and *Phaenobremia aphidivora* (Rusaaman) (Diptera: Cecidomyiidae). While, only *Orius albidipennis* (Reut.), (Hemiptera: Anthocoridae) was associated with *T. tabaci*.

Table (1): Average numbers (individual/branch), *M. persicae* on alfalfa crop treated with some biocides under field conditions

Treat.	Rate of applic.	Aver. .no . of individuals collected before and after treatment													Overall mean
		Days after treatment													
		0	1st spray				2nd spray				3rd spray				
			1	3	5	Aver.	1	3	5	Aver.	1	3	5	Aver	
Control	-	2	3.7	9.5	10.7	7.9	15.2	11.7	8.2	11.7	9.5	22.2	6.2	12.6	10.7
Biovar	200g/100 L	4	3.2	7.5	4.7	5.1	8.7	4.7	4.2	5.8	5.2	5.7	1.7	4.2	5.0
Protecto	300g/400 L	3.7	5	17	12.5	11.5	22	13.7	7.7	14.4	10.2	20.2	5.5	11.9	12.6
Virotecto	300g/400 L	2.8	3.7	10	10	7.9	14	7.5	4.7	8.7	7.5	15.5	3.7	8.9	8.5

O: before treatment LSD 5% = 1.59

Table (2) Average numbers (individual/branch) of *T. tabaci* on alfalfa crop treated with some biocides under field conditions

Treatment	Rate of applic.	Average .no . of individuals collected before and after treatment													Overall mean
		Days after treatment													
		0	1st spray				2nd spray				3rd spray				
			1	3	5	Aver	1	3	5	Aver	1	3	5	Aver	
Control	-	4.7	6	6.7	5.7	6.1	6.2	7.7	6.5	6.8	7.2	11.3	11.8	10.1	7.6
Biovar	200g/100L	3.7	3.2	3.5	2.7	3.1	2.2	2.5	2.7	2.4	1.5	2.7	0.5	1.5	2.3
Protecto	300g/400L	3	3	3.2	3	3.0	2.5	4	3	3.1	2.7	3.7	3.5	3.3	3.1
Virotecto	300g/400L	2	2.2	2.2	2.2	2.2	2	3	2.2	2.4	2.2	3.2	3	2.8	2.4

0: before treatment LSD 5% = 0.989

Table (3) Average numbers (individual/branch) of *G. baeticus* worms on alfalfa crop treated sprayed with some biocides under field conditions

Treatment	Rate of applic.	Average .no . of individuals collected before and after treatment													Overall mean
		Days after treatment													
		0	1st spray				2nd spray				3rd spray				
			1	3	5	Aver	1	3	5	Aver	1	3	5	Aver	
Control	-	4.7	4	6.7	5.7	5.4	9.7	8.5	9.7	9.3	11.8	9.5	10.5	10.6	8.4
Biovar	200g/100L	7	5	6.7	5.2	5.6	6.2	6.2	6	6.1	3.5	3.7	2.7	3.3	5
Protecto	300g/400L	6.2	2.7	3.2	3	2.9	4.2	3.2	4.2	3.8	4.5	2	1	2.5	3.1
Virotecto	300g/400L	8.2	6.5	9.5	6.2	7.4	9.5	8.2	11.8	9.8	9	8	6	7.6	8.2

0: before treatment LSD 5% = 1.99

Data in Fig (4) showed that Protecto formulation was less toxic to aphid predators. The average numbers of individuals of the 1st, 2nd and 3rd sprays were 0.6, 2.6 and 1 individuals for *H. tredecimpunctata*; 1.3, 2.3 and zero for *C. carnea* and 0.6, 1.6 and 0.6 individuals for *P. aphidivora*.

Virotecto came second in the affect on the predators with average numbers of the 1st , 2nd and 3rd spray of 2, 1.6 and zero, individuals for *H. tredicimpunctata*; 1, 2 and zero, respectively.for *C. carnea* and 1.6, 0.6 and zero individuals for *P. aphidivora*. Our results agree with results of Vail *et al.* (1991) who mentioned that granulosis virus formulation had little or no effect on beneficial species.

For Biovar, the average number of ptredators after 1st, 2nd and 3rd sprays were 1.3, 1.6 and 0.3 individuals for *H. tredicimpunctata*; 1.3, 1.3 and zero individuals for *C. carnea* and 0.3, 0.3 and 0.6 individuals for *P. aphidivora*. On the other hand the respective values in the control treatment were 3.0, 1.6 and 1.6 individuals for *H. tredicimpunctata*; 0.6, 1.6 and 2.6 individuals for *C. carnea* and 0.3, 2.6 and 1.3 individuals for *P. aphidivora*

For *Orius albidipennis*, Biovar was very toxic formulation to this predator. The respective average numbers of 1st, 2nd and 3rd sprays were 0.5, 2.3 and 1.3 individuals. Virotecto was the second toxic biocide to *O. albidipennis* with average numbers of 0.2, 2.4 and 1.4 individuals, while protecto was least toxic compound with averages of 0.8, 2.4 and 1.6 individuals, respectively Fig. On the other hand the respective values in the control treatment were 2.2, 2.2 and 1.8 individuals. Fig (5).

It is obvious that Biovar (*B. bassiana*) had significant effect on the non target organisms such as insect predators. These data agree with those of James and Lighthart (1994) and Gomaa *et al.* (2005) who mentioned that entomopathogenic fungi had broad ranges and effect of non target organism. However, Brook *et al.* (1999) observed that natural enemies had been persist in presence of *B. bassiana*

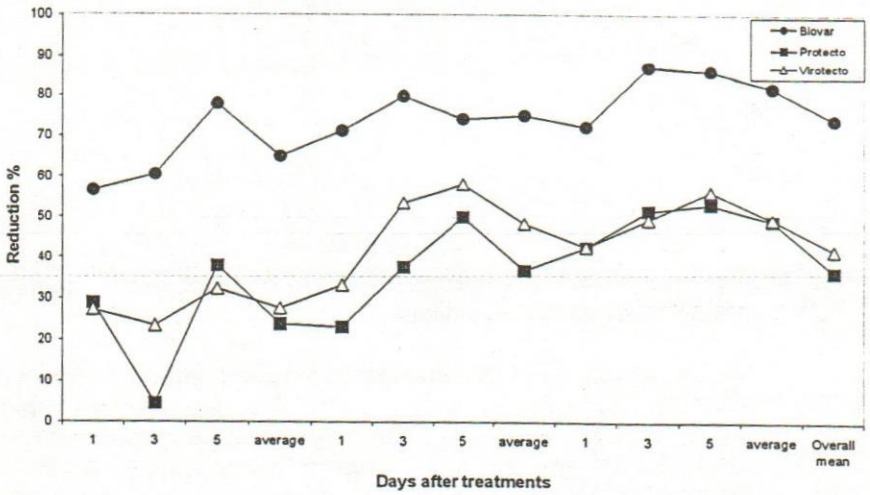

Fig. (1): Effect of some biocides on the reduction % of *M. persicae* on alfalfa under field conditions

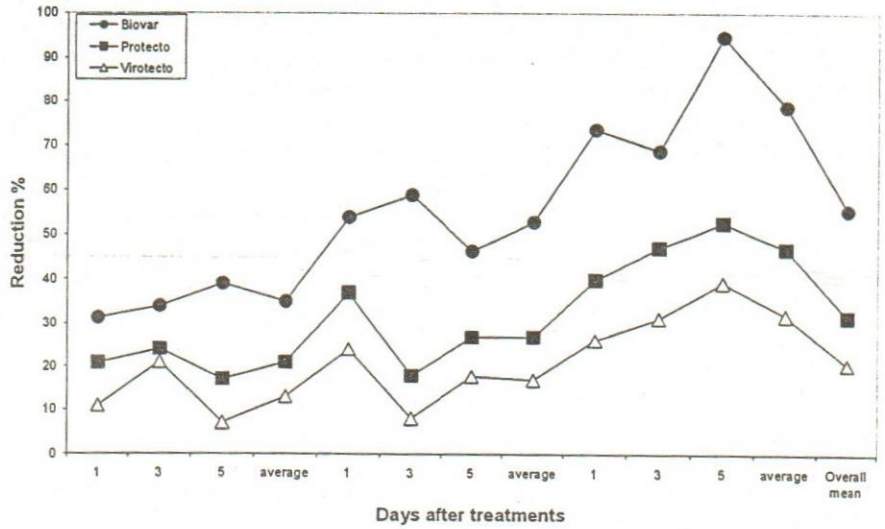

Fig. (2): Effect of some biocides on the reduction % of *T. tabaci* on Alfalfa under field conditions

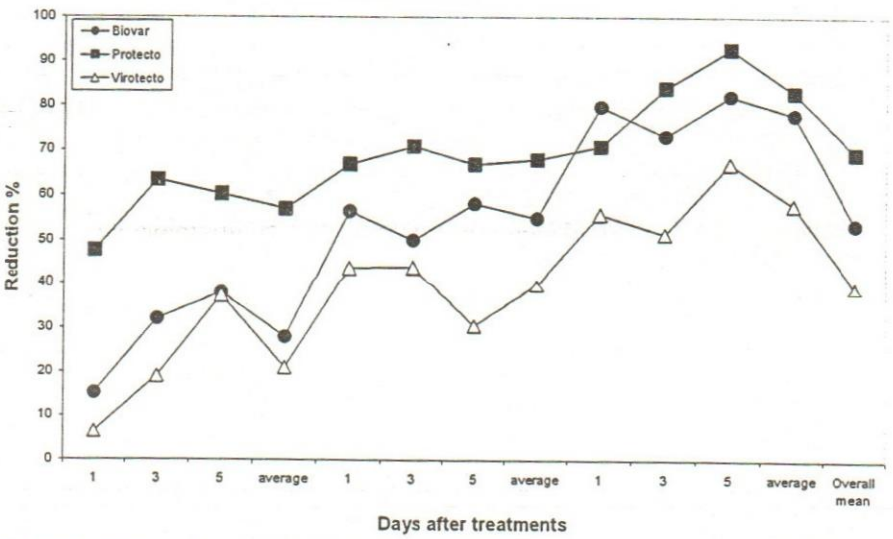

Fig. (3): Effect of some biocides on the reduction % of *G. baeticus* on alfalfa under field conditions

It could be concluded that, the tested biocides differed in their toxicity to the target pests. While Biovar and virotecto were very effective against *M. persicae* and *T. tabaci*, Protecto was the most effective biopesticide against *G. baeticus*. Also, these biocides were, to some extent, toxic to the associated predators, However, the employment of both biotactics (biocides and predators) together in insect control program is still promising.

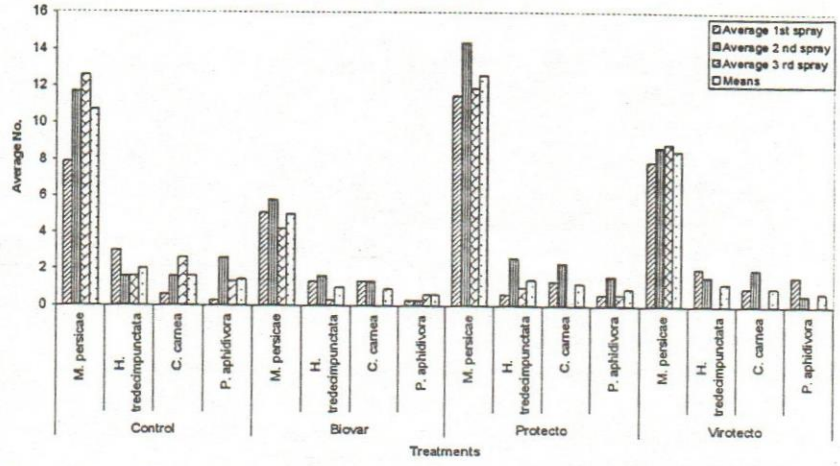

Fig. (4): Effect of some biocides on *M. persicae* and its associated predators under field conditions.

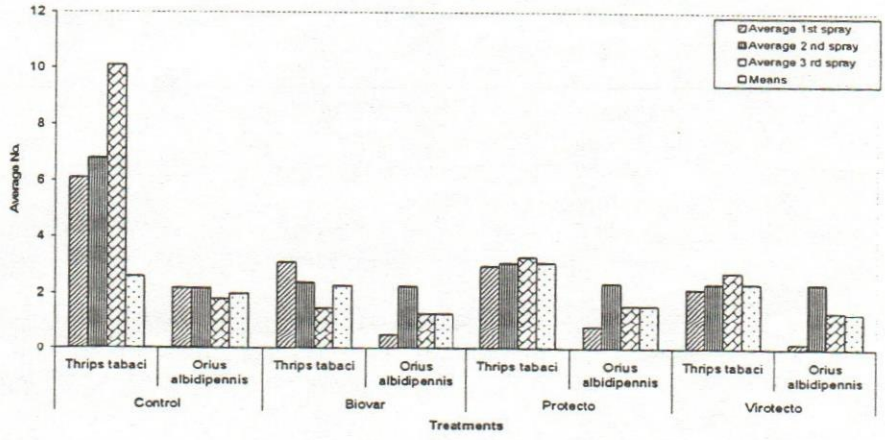

Fig. (5) Effect of some biocides on *T. tabaci* and its predators, *O. albidipennis* under field conditions.

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تأثير المركبات الحيوية على آفات البرسيم الحجازى والمفترسات المرتبطة بها

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أجريت هذه التجربة لدراسة تأثير ثلاث مركبات حيوية، المركب الفطرى الممرض للحشرات بيوفار والمركب البكتيرى الممرض للحشرات بروتكتو والمركب الفيروسى الممرض للحشرات فيروتكتو وذلك على آفات المن والتربس وأبى دقيق البقوليات والتى تصيب محصول البرسيم الحجازى بالإسماعيلية وكذلك تأثيرها على بعض المفترسات المرتبطة بالآفات السابقة. تم رش المحصول ثلاث رشات أخذت العينات (١٠ أفرع) قبل المعاملة مباشرة وبعد ١، ٣ ، ٥ أيام من كل معاملة. تم فحص العينات معمليا وتسجيل النتائج بعد التحليل الاحصائى. أوضحت النتائج أن مركب الفطر الممرض بيوفار كان أكثر المركبات في خفض تعداد حشرة المن والتربس وأبى دقيق بنسبة ٧٣,٩% ، ٥٥,٩%، ٥٣,٦% على التوالى كما أظهر مركب البكتيريا الممرض للحشرات بروتكتو كفاءة عالية وأعلى نسبة خفض في التعداد على آفة أبى دقيق بنسبة ٦٩,٣% وأقل كفاءة على المن والتربس بنسبة ٣٦,٥%، ٣١,٦% على التوالى. بينما كان المركب الفيروسى الممرض للحشرات فيروتكتو أقل المركبات كفاءة فكانت نسبة الخفض فى التعداد ٤١,٨% ، ٣٩,٦%، ٢٠,٤% على حشرات المن وأبى دقيق والتربس على التوالى. على الرغم من أن المركبات الحيوية لها تأثير على الكائنات النافعة ألا أنه اتضح وجود المفترسات فى وجود المركبات الحيوية لذا يوصى باستخدام المركبات الحيوية والتى تلعب هى والمفترسات دورا هاما فى برامج مكافحة الآفات.