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CERTAIN PESTS OF EDIBLE FIG TREES : 2 - MONITORING AND MICROBIAL CONTROL TREATMENTS (WITH BACTERIA AND FUNGUS) OF *PAROPTA PARADOXA* IN FIG ORCHARDS AT THE NORTHWESTERN COAST OF EGYPT

SHEHATA, W.A., A.W. TADROS AND M.H. SAAFAN

Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza, Egypt.

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Abstract

The solitary carpenter worm, *Paropta paradoxa* H. Schaeff. (Lepidoptera : Cossidae) was monitored in fig orchards at Abou-Yousef district in the northwestern coastal region (Alexandria governorate) during three successive years (1996, 1997 and 1998). Moths started flight from mid April/late May until late October/late November resulting in two peaks of activity during early July and late August/early September.

Two microbial control treatments with bacterial and fungus bioinsecticides were evaluated for their efficiency on the reduction of the larval population on fig trees. Trials were carried out during two successive seasons (1998 and 1999). Bactospeine (*Bacillus thuringiensis*) at the rate of 2.0, 1.5 and 1.0 cc/liter of water reduced larval infestation by 83.3-86.7, 70.0-73.3 and 46.7-56.7 %, respectively. Biofly (*Beauveria bassiana*) at the rate of 4.0, 3.0 and 2.0 cc/l. water reduced larval infestation by 43.3- 50.0, 33.3-36.7 and 20.0-23.3 %, respectively. Bio- treatments eliminate the environmental pollution and magnify the biological control agents in the orchards.

INTRODUCTION

In Egypt, the solitary carpenter worm, *Paropta paradoxa* H. Schaeff. (Lepidoptera: Cossidae) is an economic insect pest in fig., grapevine, apple and mandarin orchards as well as on some wood and ornamental trees (Kinawy, 1981 and Tadros, 1982). The larvae bore their destructive tunnels inside the stem and branches resulting in weakness, breakage and finally death of trees. Monitoring studies, however, help in planning successful control programmes.

Trials to control this pest was directed only towards chemical treatments with insecticides in vineyards (Plaut and Feldmann, 1966; Plaut and Mansour, 1975; tadros, 1982) and in fig orchards (Kinawy, 1981). Chemical control treatments have such side effects as polluting the environment and adversely affecting biological control agents, mainly parasites and predators. However, attempts to control the pest with alternative means of control such as horticultural, mechanical and chemical treatments were conducted in vineyards by Tadros *et al.* (1993) and apple orchards by Kinawy *et al.* (1991).

Moreover, microbiological control was carried out on other cossid borers (*Zeuzera pyrina*) abroad by Sikura and Simchuk (1970), Deseo *et al.* (1985), Deseo and Decci (1986) and Deseo (1990) and in Egypt by Shehata *et al.* (1995).

Therefore, the aim of the present study is to monitor moths activity all the year round and to evaluate the efficacy of alternative, safe mean of control with bio-agents (bacteria and fungus) which does not pollute the environment and magnifying the biological control agents in the environment.

MATERIALS AND METHODS

Monitoring studies were carried out during three successive years (1996, 1997 and 1998) at Abou-Yousef district in the northwestern coastal region of Egypt. A fig orchard of about 3 feddans, 15 years old and untreated with insecticides was selected. Thirty randomly distributed trees were marked with paints and the empty pupal skins were removed in December, 1995. The criterion of moth flight was the new empty pupal skins protruding on the stem and branches of the selected trees which were counted and removed simultaneously from January, 1996 until December, 1998 at weekly intervals.

The direct effect of the daily-maximum and minimum temperature and daily-mean relative humidity on moths activity was studied using simple correlation "r".

Bio-control studies were conducted during two successive seasons (June to August, 1998 and 1999). During June, fig branches infested with grown larvae were collected from a fig orchard in the same locality. Sound branches (4-5 cm thick and 15 cm long) were also collected and an artificial tunnel was made in each branch with a drill. Tunnels were contaminated with Bactospeine F.C. [a.i., *Bacillus thuringiensis* (Berliner), 8500 International Units AK/mg] at the rate of 1.0, 1.5 or 2.0 cc per one liter of water or Biofly F.C. (a.i., *Beauveria bassiana*, 3×10^7 spores/mg) at the rate of 2.0, 3.0 or 4.0 cc per one liter of water. Extracted larave were then introduced singly in each tunnel and each treatment was replicated 30 times in addition to 30 untreated replicats as control.

Tunnels were inspected 15 days after treatments and the alive larvae in each treatment were counted. Moreover, alive larvae were transferred into new branches until pupation. Pupae were then kept in Petri- dishes and the emerged moths were counted.

Efficiency of treatments was calculated according to the following formula :

% Reduction of infestation = (C-T)/C x 100
where :
C : the mean number of alive larvae or pupae in the untreatment.
T : the mean number of alive larvae or pupae in each treatment.

Differentiation between treatments was based on "F" test and the Least Significant Difference (L.S.D.) (Snedecor and Cochran, 1990).

RESULTS AND DISCUSSION

A. Monitoring Studies of *P. paradoxa*

Table 1 showed the dates of commencement, last, peaks and broods of *P. paradoxa* moths during three successive years (1996, 1997 and 1998) at Abou-Yousef district (Alexandria governorate) in the north western coastal region of Egypt.

1. Seasonal abundance : Moths started flight from the *2nd* week of April, 1997; the *1st* week of may, 1998 or the *3rd* week of may, 1996. Moths activity stopped during the *3rd* week of October, 1998; the *4th* week of October, 1996 or the *1st* week of November, 1997.

Peaks of moths activity were recorded during the *1st* week of July and the *4th* week of August, 1997; the *2nd* week of July and the *1st* week of September, 1998 or the *3rd* week of August, 1996.

In 1996, only one brood was noticed from early May to early November, while in 1997, two broods were recorded from late March to early September and from late June to late November. The two broods of 1998 were reported from late April to early October and from early July to early November, Fig. 1.

2. Progress of infestation : Fig. 1 further illustrated the seasonal cycle of *P. paradoxa* moths in fig orchards. The activity season prevailed from early April/late May to late October/early November (5.5 to 7.5 months) followed by inactivity season from early or late November to late March/early May (4.5 to 6.5 months).

Table 1. Dates of commencement, last, peaks and broods of *P. paradoxa* moths during three successive years (1996, 1997 and 1998) in fig orchards at the north-western coast of Egypt.

Year / Abundance	1996	1997	1998
Commencement date	3*rd* week of May	2*nd* week of April	1*st* week of May
Last date	4*th* week of October	1*st* week of November	3*rd* week of October
Peaks			
1.	3*rd* week of August	1*st* week of July	2*nd* week of July
2.		4*th* week of August	1*st* week of September
Broods			
1. From	Early May	Late March	Late April
To	Early November	Early September	Early October
2. From		Late June	Early July
To		Late November	Early November

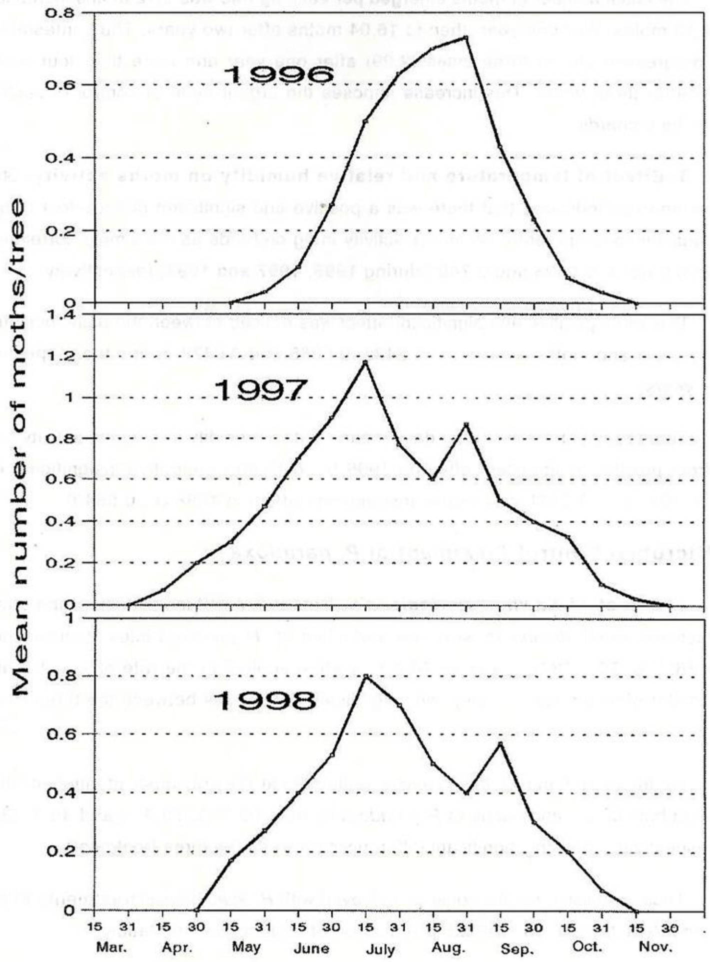

Fig. 1. Mean number of *Paropta paradoxa* moths in fig orchards at north-western coastal region during 1996, 1997, and 1998 seasons.

The initial number of moths emerged per each fig tree was 3.72 moths increased to 11.13 moths after one year, then to 16.04 moths after two years. Thus, infestation was progressed almost three times (2.99) after one year and more than four times (4.31) after three years. This increase imposes the urgent need of control of such a pest in fig orchards.

3. Effect of temperature and relative humidity on moths activity: Statistical analysis indicated that there was a positive and significant direct effect of the daily-maximum temperature on moths activity in fig orchards as the simple correlation showed 0.6323, 0.8808 and 0.7405 during 1996, 1997 and 1998, respectively.

The same positive and significant effect was noticed between the daily minimum temperature and moths activity (r : 0.8482, 0.8365 and 0.6478 during the respective three years).

The correlation between the daily-mean relative humidity and moths activity varied from positive insignificant effect in 1996 (r : 0.1536) to negative insignificant effect in 1997 (r : -0.5371) to positive insignificant effect in 1998 (r : 0.5540).

B. Microbial Control Treatment of *P. paradoxa*

1. Effect of *Bacillus thuringiensis* : Data in Table 2 indicated that the effect of Bactospeine (*B. thuringiensis*) on the reduction of *P. paradoxa* infestation reached 83.3-86.7 %, 70.0-73.3 % and 46.7-56.7 % when applied at the rate of 2.0, 1.5 and 1.0 cc/liter of water, respectively, with significant differences between the three treatments.

On the other hand, *B. thuringiensis* treatments at the previously mentioned rates reduced both larvae and pupae of *P. paradoxa* by 90.0-93.3 %, 73.3 % and 46.7- 56.7 %, respectively, showing significant differences between the three treatments.

Thus, promising results could be achieved with *B. thuringiensis* treatments at the rate of 2.0 cc/l. water (83.3-93.3 % reduction of *P. paradoxa* infestation).

2. Effect of *Beauveria bassiana* : Table 2 also clarified that applying Biofly (*B. bassiana*) at the rate of 4.0, 3.0 and 2.0 cc/liter of water slightly reduced *P. paradoxa* infestation without significant differences. The respective rates of application resulted in 43.3-50.0 %, 33.3-36.7 % and 20.0-23.3 % reduction in larval infestation. The same respective rates reduced both larval and pupal infestation by 56.7-60.0 %, 43.3-46.7 % and 20.0-26.7 %.

Table 2. Effect of bioinsecticide treatments on the reduction of *P. paradoxa* larval and pupal stages.

Year	Bioinsecticide	Conc. cc/l. water	No. of alive individuals per 30 replicates		% Reduction of infestation	
			Larvae	Pupae*	Larvae	Larvae + pupae
1998	Bactospeine (*Bacillus thuringiensis*)	2.0	4	3	86.7	90.0
		1.5	9	8	70.0	73.3
		1.0	13	13	56.7	56.7
"F" value			4.36*			
L.S.D. (0.05)			0.50			
L.S.D. (0.01)			0.78			
1999	Bactospeine (*Bacillus thuringiensis*)	2.0	5	2	83.3	93.3
		1.5	8	8	73.3	73.3
		1.0	16	16	46.7	46.7
"F" value			8.50**			
L.S.D. (0.05)			0.13			
L.S.D. (0.01)			0.2			
1998	Biofly (*Beauveria bassiana*)	4.0	17	13	43.3	56.7
		3.0	19	16	36.7	46.7
		2.0	23	22	23.3	26.7
"F" value			1.39			
1999	Biofly (*Beauveria bassiana*)	4.0	15	12	50.0	60.0
		3.0	20	17	33.3	43.3
		2.0	24	24	20.0	20.0
"F" value			1.93			
Control			30			

* Pupae resulted from treated larvae

So, we can not depend on *B. bassiana* as a sufficient mean of reducing *P. paradoxa* infestation.

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بعض افات أشجار التين
٢- تتبع تعداد والمكافحة الميكروبية (بالبكتريا والفطر) لحفار ساق العنب فى حدائق التين فى الساحل الشمالى الغربى لمصر

وجيه أيوب شحاته ، أنطون ولسن تادرس ، محمد حسن سعفان

معهد بحوث وقاية النباتات، مركز البحوث الزراعية، الدقى - الجيزة.

تم تتبع تعداد حفار ساق العنب من عائلة كوسيدى التابعة لرتبة حرشفية الأجنحة فى حدائق التين فى منطقة أبويوسف فى الساحل الشمالى الغربى (محافظة الاسكندرية) خلال ثلاثة أعوام متتالية (١٩٩٦ و ١٩٩٧ و ١٩٩٨). بدأ خروج الفراشات من منتصف أبريل/أواخر مايو حتى نهاية أكتوبر/أوائل نوفمبر، وكان للحشرة قمتى نشاط خلال أوائل يوليو، وأواخر أغسطس/أوائل سبتمبر. تم تقييم فعالية معاملات ميكروبية بالبكتريا والفطر كمبيدات حيوية لمكافحة الحفار فى نفس المنطقة السابقة على أشجار التين خلال عامين متتاليين (١٩٩٨، و ١٩٩٩). أستخدم الباكتوسبين (بكتيريا الباسيلس ثيورينجينسس) بمعدل ٢,٠ و ١,٥ و ١,٠ سم٣ لكل لتر ماء حيث أدى إلى تقليل الإصابة بيرقات الحفار بنسبة ٨٣,٣ - ٨٦,٧ و ٧٠,٠ - ٧٣,٣ و٤٦,٧ - ٥٦,٧ ٪، على الترتيب. كما أدى إستخدام البيوفلاى (فطر البيوفاريا باسيانا) بمعدل ٤,٠، و ٣,٠، و ٢,٠ سم٣ لكل لتر ماء إلى تقليل الإصابة بيرقات الحفار بنسبة ٤٣,٣ - ٥٠,٠ و ٣٣,٣ - ٣٦,٧ و ٢٠,٠ - ٢٣,٣ ٪ على الترتيب. ويعتبر إستخدام المعاملات الحيوية فى المكافحة طريقة امنة لتقليل التلوث فى البيئة مع تعظيم دور الأعداء الحيوية فى الحدائق.