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. Schaeffer, (Lepidoptera: Cosidae) 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 to late October to 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). Bacillus thuringiensis at the rate of 2.0, 1.5 and 1.0 cc/litre of water reduced larval infestation by 63.3-68.7, 70.0-73.3 and 46.7-56.7 %, respectively. Biflof (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. Schaeffer, (Lepidoptera: Cosidae) 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, 1968; 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 con-
ducted in vineyards by Tadros et al. (1993) and apple orchards by Kinawy et al. (1991).

Moreover, microbiological control was carried out on other codling borers (Zeaze-
ra pyrina) abroad by Sikura and Simchuk (1970), Desao 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 bio-
logical 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 ferdans, 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 pupa
skins protruding from the stem and branches of the selected trees which were count-
ed and removed simultaneously from January, 1996 until December, 1999 at weekly in-
tervals.

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 Au-
gust, 1998 and 1999). During June, fig branches infested with grown larvae were col-
lected 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 Bactospine 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 x 10^7 spores/mg) at the rate of 2.0, 3.0 or
4.0 cc per one liter of water. Extracted larvae were then introduced singly in each tun-
nel and each treatment was replicated 30 times in addition to 30 untreated replicates 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:

\[ \% \text{ Reduction of infestation} = \frac{(C-T)}{C} \times 100 \]

where:
C : the mean number of alive larvae or pupae in the untreated.
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.

<table>
<thead>
<tr>
<th>Abundance</th>
<th>Year</th>
<th>1996</th>
<th>1997</th>
<th>1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement date</td>
<td>3rd week of May</td>
<td>2nd week of April</td>
<td>1st week of May</td>
<td></td>
</tr>
<tr>
<td>Last date</td>
<td>4th week of October</td>
<td>1st week of November</td>
<td>3rd week of October</td>
<td></td>
</tr>
<tr>
<td>Peaks</td>
<td>1. 3rd week of August</td>
<td>1st week of July</td>
<td>2nd week of July</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. 4th week of August</td>
<td>4th week of August</td>
<td>1st week of September</td>
<td></td>
</tr>
<tr>
<td>Broods</td>
<td>1. From Early May To Early November</td>
<td>Late March Early September Late June Late November</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. From Early November To Early November</td>
<td>Early October Early July Early November</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 0.6523, 0.8804 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 : 0.8428, 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 Bactospelne (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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Bioinsecticide</th>
<th>Conc. cc/l. water</th>
<th>No. of alive individuals per 30 replicates</th>
<th>% Reduction of infestation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Larvae</td>
<td>Pupae*</td>
</tr>
<tr>
<td>1998</td>
<td>Bactospeine (Bacillus thuringiensis)</td>
<td>2.0</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td><em>F</em> value</td>
<td></td>
<td></td>
<td>4.38*</td>
</tr>
<tr>
<td></td>
<td>L.S.D. (0.05)</td>
<td></td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>L.S.D. (0.01)</td>
<td></td>
<td></td>
<td>0.78</td>
</tr>
<tr>
<td>1999</td>
<td>Bactospeine (Bacillus thuringiensis)</td>
<td>2.0</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>8</td>
<td>8</td>
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<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>16</td>
<td>16</td>
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<tr>
<td></td>
<td><em>F</em> value</td>
<td></td>
<td></td>
<td>8.50**</td>
</tr>
<tr>
<td></td>
<td>L.S.D. (0.05)</td>
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<td></td>
<td>0.13</td>
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<td></td>
<td>L.S.D. (0.01)</td>
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<td>0.2</td>
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<tr>
<td>1998</td>
<td>Bti (Bacillus thuringiensis)</td>
<td>4.0</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.0</td>
<td>23</td>
<td>22</td>
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<tr>
<td></td>
<td><em>F</em> value</td>
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<td></td>
<td>1.39</td>
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<tr>
<td>1999</td>
<td>Bti (Bacillus thuringiensis)</td>
<td>4.0</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>20</td>
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<td></td>
<td>2.0</td>
<td>24</td>
<td>24</td>
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<tr>
<td></td>
<td><em>F</em> value</td>
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<td></td>
<td>1.08</td>
</tr>
</tbody>
</table>

* Pupae resulted from treated larvae

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


بعض أشجار العنب

- تتبع تعداد و الكفاءة الميكروبية (البيوليتريا والفطر) لحفر ساق العنب في حدائق النخيل في الشام الغربي لمصر

وجيه أبو بكر شحاته، أنشود، محمد سنغنا، محمد حسن سنغنا

معهد بحوث و قياس الدبابات، مركز البحوث الزراعية، الدقى - الدبيبة

تم تتبع تعداد حفر ساق العنب من عائلة كوسبيد لكتابات لدبيبة حضريات الأجنحة في حدائق النخيل في منطقة أبو بكر في الشام الغربي (محافظة الإسكندرية) خلال ثلاثة أموات متتالية (1997 و 1998). بدأ شروط الفواكه من متخصص في الأبو بكار أو أفراد المأمون أو نهاية أوغر Boulevard، وكان للنحل شتخ ضاحك على أفراد المأمون، وأفراد المأمون أو أفراد للنحل. تم تقدير انتقال المعالجات الميكروبية بالبيوليتريا والفطر كمبيدات حيوية للكفاءة المحترفة في نفس المنطقة السابقة على أشجار العنب شاد عاملين متوازنين (1997 و 1998). استخدم الميكروبيسي (بكتيريا البيولوجيا وبيولوجيا البيولوجيا) بمعدل 2.0 و 1.0 1/س، لكل لتر ماء، حيث أدى إلى تقليل الإصابة ببكتيريا الفطر بنسبة 7 - 83.7 ٪ على النتر. كما أدأ استخدام البيوليتريا (فطر البيولوجيا البيولوجيا) بمعدل 2.0 و 1.0 1/س لكل لتر ماء، إلى تقليل الإصابة ببكتيريا الفطر بنسبة 7 - 83.7 ٪ على النتر. ويعتبر استخدام المعالجات الحيوية في الكفاءة الطيفية أمنية تقليل التلوث في البيئة مع تعزيز دور الأحياء البيولوجية في الحديقة.