Pathogenicity of *Paecilomyces Lilicanus* Fungus Toward Sucking Insects Pests of Okra Crops and Their Predators

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ABSTRACT
The present work targeted to evaluate the role of entomopathogenic *P. lilicanus* fungus in overcoming the major okra sucking pests besides the side effect toward their predator. The targeted entomopathogenic fungus was cultured on Sabouraud dextrose yeast agar and prepared three Serial dilutions concentration suspensions to test their efficacy toward *Aphis gossypii* under laboratory and field conditions, while leafhopper was tested under field condition only.

The obtained results were cleared that the high concentration $1 \times 10^8$ spore/ml, caused the best mortality percentage toward *Aphis gossypii* after 7 days of post-treatment. While under field conditions, the treatments were caused reduction ranged between 72.7% and 63.0% toward *A. gossypii* population and 88.7%, 86.7% in leafhopper population, respectively. On the other side, the predators’ population (F/coccinellidae) was also affected due to reducing the population of their prey.

INTRODUCTION

Okra, *Abelmoschus esculentus* L. Moench (Malvaceae) is a commonly grown green vegetable cultivated throughout the year and it is attacked by as many as 44 insect pests. Among them, sucking pests like leafhopper (*Amrasca biguttula* Ishida) and whitefly (*Bemisia tabaci* Gennadius) is a major threat, affecting okra production. Aphids and leafhoppers are important pests in the early stage of the crop which sucking sap of the plants, makes them weak and reduce the yield reach to 35.4 % to 96 % (Satpathy et al., 2004 and Alak, et al., 2017). In this regard, natural enemies occupy a central position in integrated pest management because of the safety of the cropping ecosystem (Telang et al., 2004 and Sardana et al., 2005). The myco-insecticide based on *Beauveria bassiana* (Balsamo) Vaillemma, *Paecilomyces fumosoroseus* (Wize) Brown and Smith and *Verticillium lecanii* (Zimm.) Viegas has been used to control various insect pests (Babu, et al. 2001, Sharma, 2004, Alter and Vandenberg 2000, Avery, et al. 2004, Butt, et al., 2001)

The entomopathogenic fungi *Beauveria bassiana, Metarhizium anisopliae* and *Isaria fumosorosea Paecilomyces fumosoroseus* designated as *Isaria clade* have been used as myco-insecticides providing biological alternatives to chemical insecticides (Luangsa-Ard et al., 2005). Among their advantages are their reproductive potential and their persistence in the environment and they can play an important role in promoting integrated...
pest management (Castrillo et al., 2004; Faria and Wraight, 2001). The effectiveness of bio-
pesticides against okra pests has been reported by Harischandra and Shekharappa (2009).
Entomopathogenic fungi are natural enemies of various pests and are considered to be
valuable bio-control agents in sustainable crop management (Alak, et al 2017). The present
work targeted to test entomopathogenic *P. lilicanus* fungus toward major okra sucking pests
and their predator.

**MATERIALS AND METHODS**

The experiments were carried out under laboratory and field conditions at National
Research Center, Egypt during the summer season.

**Source of Fungus Culture:**

*Paecilomyces lilicanus* (Thom) was obtained from Mycological Center, Faculty of
Science, Assiutt Univ. The isolate was cultured on Sabouraud dextrose yeast agar (SDYA)
medium g/l, containing 40 g glucose, 20 g peptone, 20 g agar, 2 g Yeast extract and 1000
ml of distilled water in flasks, then autoclaved at 21 °C for 15 min (Sabouraud, 1892)

**Preparation of Tested Bio-Agent:**

Fungal culture was grown on Sabouraud dextrose yeast agar (SDYA) medium
and incubated at 25±2 °C in darkness for 14 days. Conidial suspensions were prepared by
scraping cultures with sterile water containing 0.05% Tween 80 under a laminar flow
chamber. The conidia were harvested by scraping the surface of the culture with an
inoculation needle. The mixture was stirred for 10 minutes the hyphaldebris was removed
by filtering the mixture through a fine-mesh sieve. The conidial concentration of the final
suspension was determined by direct count using Haemocytometer. Serial dilutions were
prepared at 1x10⁶, 1x10⁷ and 1x10⁸ concentrations and preserved at 5C⁰ until used.

**Bioassay Treatments:**

1. **Under Laboratory Condition:**

   Normal fresh okra leaves symptoms (healthy) were collected, cleaned well by using
   wet cotton and placed in Petri-dishes 20cm. diameter provided by wet cotton for keeping
   okra leaves fresh. *Aphis gossypii* was collected from okra plants for artificial infestation (20
   individuals/leave). The adjustable concentrations (1x10⁶, 1x10⁷ and 1x10⁸spore / ml) were
directly sprayed on the infested leaves. Three replicates per treatment were made all
treatments were examined after three, five and seven days to calculate the percentage of
mortality.

2. **Under Field Condition:**

   The present study was carried out during the summer growing season at National
   Research farm, El Nobarya governorate in which cultivated of Okra crop, Baldy cv.
   An area (about 700 m²) was divided into four equal plots. Each plot with ridges (3
   replicates) of 5 meters length and 60 cm apart; all normal cultural practices of land
   preparation, thinning, irrigation, mechanical weed control were followed out and kept free
   from any insecticidal application. One month after plantation before treatment, Samples
   were picked randomly from three levels of the plant (10 leaves of okra plants from each
   replicate making a sum of 30 leaves for each treatment). After that spraying tested fungus
   was carried out by using a handling sprayer using 10L from prepared fungal concentration
to cover one karat. The random samples were picked up at interval times after spraying. Each
one was kept in a tightly closed paper bag and transferred to the laboratory to record the
number of dead adults in both *Aphis gossypii* and leafhopper with the aid of the Stereo-
binocular microscope.
3 - Statistical Analysis:
The percent reduction of infestation was statistically calculated according to the equation of (Henderson and Tilton). Mortality % = 100 (1 - Ta x Cb / Tb x Ca).

Where:
Ta = Post treatment insect counts.
Cb = Untreated insect count before treatment.
Tb = Pretreatment counts.
Ca = Untreated insect count after treatment.

RESULTS
1. Under Laboratory Conditions (in vitro):
Data in Figure (1) show that the mortality percentage of aphids increased with increasing fungus concentration and time of exposure to treatment. The treatment was caused mortality % to Aphids individual ranged between 37.1 to 98.7% at 10^6, 10^7 and 10^8 spore/ml, after post 3, 5 and 7 days respectively. The symptoms of aphids mortality were cleared in Fig (2).

Fig.1: Effect of different concentrations of Paecilomyces lilicanus fungus on aphid mortality under laboratory condition.

Fig.2: Morality symptom of aphids after treatment with pathogenic fungus showing fungus growth on the outer surface of aphids
2- Under Field Conditions *(in vivo)*:

2.a on an aphids population: Data in Table (1) described that *P. lilicanus* had a myco-insecticide effect which reduces significantly the population dynamic of aphids and extends their effect to 10 days recorded reduction reaches to 72.7 and 63.0% after 5 and 10 days of treatment, respectively.

**Table (1):** Effect of *P. lilicanus* fungus against *A. gossypii* on okra under field condition

<table>
<thead>
<tr>
<th>Tested materials</th>
<th>Before Treatment</th>
<th>After 5 days</th>
<th>Reduction %</th>
<th>After 10 days</th>
<th>Reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. lilicanus</em></td>
<td>73.6±32.188</td>
<td>18.6±4.970</td>
<td>72.7%</td>
<td>31.6±2.3</td>
<td>63.0%</td>
</tr>
<tr>
<td>Control</td>
<td>74±7.234</td>
<td>68.6±19.18</td>
<td>--</td>
<td>86±9.53</td>
<td>--</td>
</tr>
</tbody>
</table>

Statistical analysis

L.S.D 0.05=91.48
L.S.D 0.01=126.05

2.b- On Leafhopper Population: Data in Table (2) cleared that *P. lilicanus* had a bio-pesticide effect. It reduces significantly the population dynamic of leafhopper and their effect was extended to 10 days so, the reduction was reached to 88.7 and 86.7% after 5 and 10 days of treatment, respectively.

**Table (2):** Effect of *P. lilicanus* fungus against leafhopper on okra under field condition.

<table>
<thead>
<tr>
<th>Tested materials</th>
<th>Before Treatment</th>
<th>After 5 days</th>
<th>Reduction %</th>
<th>After 10 days</th>
<th>Reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. lilicanus</em></td>
<td>15±4.1633</td>
<td>2.33±1.20</td>
<td>88.7%</td>
<td>3.0±2.08</td>
<td>86.7%</td>
</tr>
<tr>
<td>Control</td>
<td>20±5.13</td>
<td>27.6±1.3</td>
<td>-</td>
<td>30.3±4.4</td>
<td>-</td>
</tr>
</tbody>
</table>

Statistical analysis

L.S.D 0.05=22.85
L.S.D 0.01=31.48

3. On Predator: The results in Table (3) indicated that *P. lilicanus* caused a reduction in the population dynamics of a predator to reach 76.4% and 43.3% after 5 and 10 days of treatment, respectively. From investigation wasn't observed mortality among individuals of the predator by fungus so their effects were attributed to the reduction in the population of their prey.

**Table (3):** Effect of *P. lilicanus* fungus against Predator (F/Coccinellidae) on Okra under field condition

<table>
<thead>
<tr>
<th>Tested materials</th>
<th>Before Treatment</th>
<th>After 5 days</th>
<th>Reduction %</th>
<th>After 10 days</th>
<th>Reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. lilicanus</em></td>
<td>14.3±2.926</td>
<td>1.33±1.33</td>
<td>76.4%</td>
<td>5.33±1.201</td>
<td>43.3%</td>
</tr>
<tr>
<td>Control</td>
<td>7.6±3.92</td>
<td>3±0.577</td>
<td>-----</td>
<td>5±2.30</td>
<td>-----</td>
</tr>
</tbody>
</table>

Statistical analysis

L.S.D 0.05=16.717
L.S.D 0.01=23.03
DISCUSSION

Our results showed that the high concentration 1x 10^8 of entom-pathogenic fungus was elicited effects toward aphids under laboratory test. While it showed the best effect toward reduction population of aphids for 10 days under field test. On the other side, leafhopper, *E. decipiens* were affected by tested materials. *P. lilicanus* the best effect toward reduction population of aphids for 10 days under field test. These results agree with (Ibrahim, *et al.*, 2020) who showed that *M. anisopliae* (S1) caused the best impact on the population of aphids to extend to 10 days.

CONCLUSION

The obtained results in this study explore the pathogenicity of the entomopathogenic fungus, *P. lilicanus* as promising biological control agent alternative to chemical control against sucking pests.

REFERENCES


القدرة الإمراضية لفطر Paecilomyces lilicanus

تتجاوز الحشرات الثاقبة الماصة ومفترستها على نبات البامية.

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الدراسة الحالية، تقييم دور فطر Paecilomyces lilicanus الممرض للحشرات في التغلب على آفات البامية الماصة بالإضافة إلى التأثيرات الجانبية للمفترس. تم زرع الفطر المستهدف الممرض للحشرات على Sabouraud dextrose واللوضوع ثلاث تركيزات متعددة اختبار فعاليتها تجار حشرات البامية تحت الظروف المعملية. تم توضيح النتائج التي تم الحصول عليها بأن التركيز العالي 10^8 spore/ml تسبب في أفضل نسبة وفيات تحت الظروف الحقلية. تم تقليل عدد حشرات البامية (A. gossypii) بنسبة 72.7% 73.8% في الأوراق و 86.7% في الأوراق التالي، تأثرت أعداد المفترسات (F / coccinellidae) أيضاً بسبب تقليل عدد فراشها.