Efficacy of Cladosporium cladosporioides, as a Biocontrol Agent for Controlling Tetranynchus urticae Koch (Acari: Tetranychidae) under Laboratory Conditions

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ABSTRACT

The two spotted spider mite Tetranynchus urticae (Acari, Tetranychidae) is a serious polyphagous plant pest. Laboratory experiments were conducted to evaluate the efficacy of Cladosporium cladosporioides as microbial control agent against T. urticae adults and larvae. The current data showed that C. cladosporioides revealed very satisfactory efficacy when compared with B. bassiana. The results indicated that LC50 of: 1.37x10^4 and 4.45x10^3 conidia/ml against adults and new hatched larvae, respectively.

Keywords: Cladosporium cladosporioides, biocontrol, Tetranynchus urticae

INTRODUCTION

The two spotted spider mite Tetranynchus urticae (Acari, Tetranychidae) is an important polyphagous pest worldwide (Walter & Proctor, 1999). T. urticae (Koch.) usually feeds on leaves leading to yellow, brown blotch and accompanied by dry and leaf fall. Severe mite infestation causes significant economic reduction in crop production quality and quantity (Abd El- Rahamn et al. 2005). Chemical control has been confounded by many environmental and health problems. Moreover, development of resistance in spider mite populations against acaricides. So, searching for more safe alternatives became very necessary.

Entomopathogenic fungi were among the first organisms used for the biological control of pests. Many species of Cladosporium were used as a safe alternative of traditional chemical insecticides for controlling many plant-insect pests like aphids and whiteflies. The target of the current study is to investigate the efficacy of C. cladosporioides as biocontrol agent for controlling both of larvae and adults of T. urticae under laboratory conditions.

MATERIALS AND METHODS

The tested pest:

Laboratory strain of T. urticae was obtained from the Faculty of Agriculture, Mansoura University. The culture of the spider mite was maintained on castor leaves placed upside down in Petri-dishes (20 cm in diameter) filled with cotton-wool, saturated with water and kept under laboratory conditions of 25±2°C, and 75 ±5 RH and 14:10 hours L: D. Infested leaves and tap-water were changed as necessary.

Entomopathogenic Fungi:

Cladosporium cladosporioides:

The culture of C. cladosporioides was obtained from Dr. Heba Youssif El-Sayed Ibrahim as pure strain. This strain was previously isolated from A. craccivora and was identified by Assiut Univ. Mycological Center (AUMC), Egypt. (Ibrahim, 2012)

The fungal strain of C. cladosporioides was cultivated on autoclaved Sabouraud Dextrose yeast extract Agar (10 g/L peptone, 40 g/L dextrose, 10 g/L yeast extract and 20 g/L agar) and incubated at 25± 2°C and 80±5% RH until further growth. C. cladosporioides spores were harvested and counted using a haemocytometer Neubauer. Different concentrations of spore suspensions were prepared.

Biosect (Organic Bio technology): a commercial product of Beauveria bassiana 32x10^6 conidia/ml to serve as a positive control.

Bioassay:

Petri-dishes (20 cm in diameter) were filled with cotton wool, saturated with water. Three discs (2.5 cm in diameter) of washed and sterilized castor leaves were placed upside down on cotton wool in each dish. A thin film of water was left around the edge of the leaf discs to prevent escaping of the spider mite and the cotton pad was moistened daily. Ten individuals (adult females or ten newly hatched larvae in case of treatment of larvae) were transferred on each disc. Then, they were sprayed with different concentrations of tested fungus, C. cladosporioides. Another three discs were sprayed with B. bassiana different concentrations to serve as positive control. Untreated three discs (negative control) for each experiment were sprayed only with water and 0.05 % aqueous Tween 80. The Petri-dishes were incubated at 25±2°C, 75 ±5 %RH., and photoperiod 14: 10 hs (L: D). Data

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was recorded daily and the experiment continued for seven days.

**Statistical analysis:**

The average of mortality percentages of both larvae and adults of spider mite were determined and corrected using Abbott’s formula (1925). The corrected mortality percentages were calculated according to Finney (1971). LC₅₀, LC₉₀, slope values and toxicity index were estimated by using Sun’s equation (1950).

**RESULTS AND DISCUSSION**

Data illustrated in Table 1 & 2 showed that the cumulative mortality percentages of both *T. urticae* adults and larvae was increased with increasing concentrations and time intervals after treatment. This agreed with Yankovskaya (1999) who tested the pathogenicity of *Paecilomyces fumosoroseus* and *M. anisopliae* against the two- spotted spider mite, *T. urticae* and found that mortality percentage increased with increasing the time elapsed after treatment. *T. urticae* cadavers were turned to a brown or dark green color, then the color turned black. This agreed with Gámmez-Guzmán et al. (2019).

Also, it is clear from the obtained data that the mite larvae were more susceptible to both entomopathogenic fungi. Results indicated that *C. cladosporioides* revealed more potentiality than *B. bassiana* on adults of *T. urticae* with LC₅₀: 1.37×10⁴ conidia/ml, LC₉₀ 60.79×10⁴ conidia/ml and toxicity index at LC₅₀ of 100%, while, *B. bassiana* showed LC₅₀ of 1.76×10⁴ conidia/ml, LC₉₀: 10.59×10⁴ conidia/ml and toxicity index: 77.61%.

Also, *C. cladosporioides* revealed less potential activity against *T. urticae* larvae than *B. bassiana* where it showed LC₅₀: 1.37×10⁴ conidia/ml, LC₉₀ 60.79×10⁴ conidia/ml and toxicity index at LC₅₀ of 100%, while, *B. bassiana* showed LC₅₀ of 4.45×10⁴ conidia/ml, LC₉₀: 35.82×10⁴ conidia/ml and toxicity index: 45.41%. It was noticeable that there were pronounced difference of *B. bassiana* virulence against different stages of the same host. It may be due to difference of the chemistry topography of the cuticle of adults and larvae (Sosa-Gomez et al., 1997).

Table 1. Efficiency of the tested entomopathogenic fungi against adults of two spotted spider mite, *T. urticae* under laboratory conditions of 25 ± 2 °C, 75 ± 5% RH

<table>
<thead>
<tr>
<th>Entomopathogenic fungi</th>
<th>Conc. (conidia/ml)</th>
<th>Cumulative mortality % at indicated day after treatment.</th>
<th>LC₅₀ (ppm) and confidence limits at 95%</th>
<th>LC₉₀ (ppm) and confidence limits at 95%</th>
<th>Slope ± SE</th>
<th>X²</th>
<th>Toxicity index*</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ch. cladosporioides</em></td>
<td>1x10⁴</td>
<td>0</td>
<td>46.67</td>
<td>1.37×10⁴</td>
<td>0.78</td>
<td>0.07</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>1x10⁴</td>
<td>43.33</td>
<td>66.67</td>
<td>60.79×10⁴</td>
<td>± 0.20</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1x10⁴</td>
<td>0</td>
<td>46.67</td>
<td>1.76×10⁴</td>
<td>0.72</td>
<td>0.01</td>
<td>77.61</td>
</tr>
<tr>
<td></td>
<td>1x10⁴</td>
<td>66.67</td>
<td>93.33</td>
<td>10.59×10⁴</td>
<td>± 0.19</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td><em>Bassiana</em></td>
<td>1x10⁴</td>
<td>0</td>
<td>36.67</td>
<td>2.63×10⁴</td>
<td>0.58</td>
<td>0.28</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>1x10⁴</td>
<td>36.67</td>
<td>70.00</td>
<td>4.45×10⁴</td>
<td>± 0.12</td>
<td>45.41</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Efficiency of the tested entomopathogenic fungi against larvae of two spotted spider mite, *T. urticae* under laboratory conditions of 25 ± 2 °C, 75 ± 5% RH.

<table>
<thead>
<tr>
<th>Entomopathogenic fungi</th>
<th>Conc. (conidia/ml)</th>
<th>Cumulative mortality % at indicated day after treatment.</th>
<th>LC₅₀ (ppm) and confidence limits at 95%</th>
<th>LC₉₀ (ppm) and confidence limits at 95%</th>
<th>Slope ± SE</th>
<th>X²</th>
<th>Toxicity index*</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ch. cladosporioides</em></td>
<td>1x10⁴</td>
<td>0</td>
<td>30.00</td>
<td>4.45×10⁴</td>
<td>0.67</td>
<td>0.67</td>
<td>45.41</td>
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<tr>
<td></td>
<td>1x10⁴</td>
<td>36.67</td>
<td>53.33</td>
<td>12.5×10⁴</td>
<td>± 0.12</td>
<td>45.41</td>
<td></td>
</tr>
<tr>
<td><em>Bassiana</em></td>
<td>1x10⁴</td>
<td>0</td>
<td>43.33</td>
<td>2.02×10⁴</td>
<td>0.56</td>
<td>0.28</td>
<td>100.00</td>
</tr>
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<td></td>
<td>1x10⁴</td>
<td>36.67</td>
<td>66.67</td>
<td>4.08×10⁴</td>
<td>± 0.11</td>
<td>100.00</td>
<td></td>
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</tbody>
</table>

**REFERENCES**


**Tetranychus** كفاءة فطر Cladosporium cladosporioides كعامل حيوي لمكافحة الحلم العنكبوتی ذو البقعتين تحت الظروف المعملیة urticae

مرفت قاسم جبر الشربينی
معهد بحوث وقاية النباتات - مركز البحوث الزراعیة. الدقی. الجیزة. مصر

يعتبر الحلم العنكبوتی ذو البقعتین Tetranychus urticae آفة خطیرة متعددة العوائل النباتیة. لذلك فقد تم تصمیم تجربة معملیة لتقيیم كفاءة

كلامل من عوامل المكافحة المیکروبیة لمکافحة کلا من الأطراف البالغة ويرقات الحلم العنكبوتی ذو البقعتین. فأظهرت النتائج أن فطر Cladosporium cladosporioides اظهیر كفاءة مشهورة جدا مقارةً نفط B. bassiana حيث سجل تركیزا نصف مميت: 10^1.37 4.45×10^0 و 10^4×10^1.45 كونیدة/مللي على كل من الأطراف البالغة واليرقات حديثة للنفس على التوالي.