EFFECT OF DIFFERENT PLANT EXTRACTS AGAINST TWO-SPOTTED SPIDER MITE, Tetranychus urticae Koch and Predatory Mite, Phytoseius persimilis A.-H

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Abstract
Pink flowers, Black seed and garlic water extracts tested on adult females on the two-spotted spider mite, Tetranychus urticae Koch (Acar/Hemiptera) and on the predatory mite, Phytoseius persimilis A.-H. Percentages of mortality on T. urticae were increased gradually with increasing concentration of Pink flowers, Garlic and Black seeds extracts. When compared between the effects of Pink flowers Garlic and Black seeds extracts on the adult females of T. urticae after 1, 3 and 7 days from treatment, Garlic extract, came in the first, then Black seeds extract and in the end came Pink flowers extract. It can be concluded that by LC50, LC90 values and slopes. The same results, were found against P. persimilis. In general, T. urticae gave more tolerance against the three extracts than P. persimilis.

INTRODUCTION

The two-spotted spider mite, Tetranychus urticae Koch (AcarIi: Tetranychidae) is a major economic pest attacking several kinds of fruit trees, field crops and vegetables especially strawberry, cucumber and cantaloupe.

T. urticae is considered a serious economic pest; all stages of this mite are pests as plant feeders, except eggs. They have ability to produce webs on the host plants that coating them with a shiny dust which reduces the plant photosynthetic abilities. Its damage results from the sucking of plant juices with its piercing-sucking mouth parts, causing bronzed and off-coloured foliage. Under heavy infestations, defoliations and undersized poorly coloured fruit are produced. It affects the quantity and the size of fruits and also reduces their quality. In Egypt, many problems have been appeared as a result of the extensive use of synthetic acaricides, including acaricide resistance, residual contamination of human foods, mammalian toxicity and pollution of the environment. For that, entire world are going to reduce chemicals use and trying to introduce natural enemies and botanical extracts such as natural products.

The present work aims to test some plant extracts for controlling the two-
spotted spider mite, *Tetranychus urticae* Koch and its side effects on the predatory
mite, *Phytoseiulus persimilis* A.-H.

**MATERIALS AND METHODS**

1. **Preparing the two-spotted spider mite, *Tetranychus urticae* Koch**
   
   (Acarina : Tetranychidae) and the predatory mite, *Phytoseiulus persimilis* A.-H. (Acar : Phytosellidae) culture:
   
   The initial inoculations of the prey and the predator populations were obtained
   from stock cultures maintained in two separated greenhouses belonging to Plant
   Protection Research Institute at Dokki district (Giza Governorate) and were reared
   under laboratory conditions at 25±2°C and 65±5% RH on kidney bean seeds,
   *Phaseolus vulgaris* (L.).
   
   Individuals of the predatory mite, *Phytoseiulus persimilis* (Athias-Henriot) were
   obtained from its mass rearing on spider mites *T. urticae* Koch on bean plants in a
   greenhouse 60×9m² about 540 m² (EL-Halawany et al.,2000 & Heikal and Ibrahim
   2002).
   
   Garlic, Pink flowers and Black seeds were extracting with water. Extracts with
different concentrations (0.25, 0.5 and 1.0 ml/ml) were tested. Mortality was recorded
after 1, 3 and 7 days post treatment.
   
   The toxic effect for the tested materials was evaluated by leaf disc dip technique
   according to Siegler (1947). Four discs of castor bean leaves were dipped in each
   concentration for 5 seconds and left to dry. Each treatment was replicated four times.
   
   To measure the toxic effect of tested plant extracts on predatory mite, *P.
   persimilis*, all treatments were evaluated by leaf discs dip technique. A series of
   concentrations for each tested plant extract were prepared. Then, four discs of bean
   leaves were dipped in each concentration for 5 seconds and left to dry.
   
   A number of the prey, *T. urticae* were added as a food for *P. persimilis*. Then, 5
   adult female predatory mites were transferred to each disc using a brush (No 0.0).
   The discs were placed on a moist filter paper, which rested on a moist cotton wool
   pads in Petri dishes.

**Statistical analysis**

In laboratory tests, mortality percentages were calculated and corrected for
natural mortalities by Abbott's formula 1925. The corrected percent mortalities were
statistically compounded according Finney (1971) and plotted on probit analysis paper.
The tested compounds were compared for their efficiency on the mites and its
predator according to their LC₅₀, LC₉₀ and slopes of the toxicity lines.
RESULTS AND DISCUSSION

1. Relative toxicity of different tested compounds on adult females of *Tetranychus urticae* and their side effect on adult of predatory mite *Phytoseiulus persimilis*

Pink flowers, Black seed and garlic extracts are the natural products used in these experiments against adult females of *T. urticae* and also their side effect against the predatory mite *P. persimilis*.

1.1. Relative toxicity of Pink flowers extract on adult females of *T. urticae*.

Data in Table (1) and Fig. (1) show the effect of Pink flowers extract on mortality percentages of adult females of *T. urticae*. Percentages mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Pink flowers extract. After 1 day from treatment the mortality percentage were 31, 18 and 11% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 22, 16 and 9% mortality, respectively after 3 days. While, after 7 days from treatment the mortality reached 19, 13 and 7% for the previous concentrations, respectively.

When compare between the effects of Pink flowers extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC_{50} values of Pink flowers extract were 2.696, 6.49 and 7.67 for 1, 3 and 7 days, respectively (Table 1).

On base of the LC_{50} values, Pink flowers extract show the same trend, whereas these LC_{50} values were 28.91, 155.98 and 157.69 with 1, 3 and 7 days, respectively (Table 1).

On base of the slop values, Pink flowers extract gave 1.23, 0.93 and 0.98, respectively.

1.2. Relative toxicity of Pink flowers extract on adult of *P. persimilis*.

Data in Table (2) and Fig. (2) show the effect of Pink flowers extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Pink flowers extract. After 1 day from treatment the mortality were 33, 21 and 13% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous
Fig. 1. Relative toxicity of Pink flowers extracts on adult females of *Tetranychus urticae* after feeding on bean leaves under laboratory conditions.

Table 1. LC$_{50}$ values and slopes of Pink flowers extracts on adult females of *Tetranychus urticae* after feeding on treated bean leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pink flowers extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 days</td>
</tr>
<tr>
<td>LC$_{50}$</td>
<td>2.61</td>
</tr>
<tr>
<td>LC$_{90}$</td>
<td>28.91</td>
</tr>
<tr>
<td>Slope</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Concentrations gave 22, 15 and 10% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 20, 13 and 8% for the previous concentrations, respectively.

When compare between the effects of Pink flowers extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC$_{50}$ values of Pink flowers extract were 2.45, 8.18 and 7.89 for 1, 3 and 7 days, respectively (Table 2).

On base of the LC$_{50}$ values, Pink flowers extract show the same trend, whereas these LC$_{50}$ values were 32.34, 265.45 and 183.59 with 1, 3 and 7 days, respectively (Table 2).

On base of the slope values, Pink flowers extract gave 1.14, 0.85 and 0.94, respectively.
1.3. Relative toxicity of Garlic extract on adult females of *T. urticae* and on adults of *P. persimilis*.

Data in Table (3) and Fig. (3) show the effect of Garlic extract on mortality percentages of adult females of *T. urticae*. Percentages mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Garlic extract. After 1 day from treatment the mortality were 45, 38 and 29% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 41, 32 and 21% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 37, 28 and 20% for the previous concentrations, respectively.

When compare between the effects of Garlic extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC50 values of Garlic extract were 1.45, 1.67 and 2.46 for 1, 3 and 7 days, respectively (Table 3).

![Graph showing relative toxicity of Garlic extract](image)

**Fig. 2.** Relative toxicity of Pink flowers extracts on adult of *phytoseiulus persimilis* after feeding on bean oil leaves under laboratory conditions:

**Table 2.** LC50 values and slopes of Pink flowers extracts on adult of *phytoseiulus persimilis* after feeding on treated bean oil leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>1 days</th>
<th>3 days</th>
<th>7 days</th>
</tr>
</thead>
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<tr>
<td>LC50</td>
<td>2.45</td>
<td>8.18</td>
<td>7.89</td>
</tr>
<tr>
<td>LC50</td>
<td>32.34</td>
<td>265.45</td>
<td>183.59</td>
</tr>
<tr>
<td>Slope</td>
<td>1.24</td>
<td>0.85</td>
<td>0.94</td>
</tr>
</tbody>
</table>
On base of the LC$_{50}$ values, Garlic extract show the same trend, whereas these LC$_{50}$ values were 94.10, 36.66 and 80.77 with 1, 3 and 7 days, respectively (Table 3).

On base of the slop values, Garlic extract gave 0.71, 0.99 and 0.85, respectively (Table 3).

1.4. Relative toxicity of Garlic extract on adult of *P. persimilis*.

Data in Table (4) and Fig. (4) show the effect of Garlic extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Garlic extract. After 1 day from treatment the mortality were 47, 39 and 31% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 42, 33 and 24% mortality, respectively after 3 days.

While, after 7 days from treatment the mortality were 38, 29 and 21% for the previous concentrations, respectively.

When compare between the effects of Garlic extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC$_{50}$ values of Pink flowers extract were 1.27, 1.72 and 2.32 for 1, 3 and 7 days, respectively (Table 4). On base of the LC$_{50}$ values, Garlic extract show the same trend, whereas these LC$_{50}$ values were 87.23, 58.6 and 80.79 with 1, 3 and 7 days, respectively (Table 4).

On base of the slop values, Pink flowers extract gave 0.69, 0.84 and 0.83, respectively.

![Graph showing the relative toxicity of Pink flowers extract on adult of *Phytoseiulus persimilis* after feeding on bean oil leaves under laboratory conditions.](image)

Fig. 3. Relative toxicity of Pink flowers extract on adult of *Phytoseiulus persimilis* after feeding on bean oil leaves under laboratory conditions.
Table 3. LC50 values and slopes of Garlic extracts on adult females of *T. urticae* after feeding on treated bean leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
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<tr>
<td></td>
<td>1 days</td>
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<tr>
<td>LC50</td>
<td>1.45</td>
</tr>
<tr>
<td>LC90</td>
<td>94.10</td>
</tr>
<tr>
<td>Slope</td>
<td>0.71</td>
</tr>
</tbody>
</table>

1.5. Relative toxicity of Black seeds extract on adult females of *T. urticae* and on adult of *P. persimilis*:

Data in Table (5) and Fig. (5) show the effect of Black seeds extract on mortality percentages of adult females of *T. urticae*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Black seeds extract. After 1 day from treatment the mortality were 43, 35 and 22% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively. While the previous concentrations gave 38, 27 and 18% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 29, 21 and 14% for the previous concentrations, respectively.

When compare between the effects of Black seeds extract on the adult females of *T. urticae* after 1, 3 and 7 days from treatment it can be concluded that the LC50 values of Black seeds extract were 1.42, 2.01 and 4.26 for 1, 3 and 7 days, respectively (Table 5).

On base of the LC50 values, Black seeds extract show the same trend, whereas these LC50 values were 28.97, 36.99 and 125.33 after 1, 3 and 7 days from treatment respectively (Table 5).

On base of the slop values, Black seeds extract gave 0.98, 1.01 and 0.87, respectively (Table 5).

1.6. Relative toxicity of Black seeds extract on adult of *P. persimilis*:

Data in Table (6) and Fig. (6) show the effect of Black seeds extract on mortality percentages of adult of *P. persimilis*. Percentages of mortality were increased gradually (after 1 day of treatment till 7 days) with increasing concentration of Black seeds extract. After 1 day from treatment the mortality were 46, 36 and 24% for the successive concentrations 1, 0.5 and 0.25 ml/ml, respectively.
Fig. 4. Relative toxicity of Garlic extracts on adult of *phytoseiulus persimilis* after feeding on bean leaves under laboratory conditions.

Table 4. *LC*₉₀ values and slopes of Garlic extracts on adult of *phytoseiulus persimilis* after feeding on treated bean leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Garlic extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 days</td>
</tr>
<tr>
<td><em>LC</em>₉₀</td>
<td>1.27</td>
</tr>
<tr>
<td><em>LC</em>₉₀</td>
<td>87.23</td>
</tr>
<tr>
<td>Slope</td>
<td>0.69</td>
</tr>
</tbody>
</table>
Fig. 5. Relative toxicity of Black seeds extracts on adult females of *Tetranychus urticae* after feeding on bean leaves under laboratory conditions.

Table 5. LC50 values and slopes of Black seeds extracts on adult females of *Tetranychus urticae* after feeding on treated bean leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Black seeds extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 days</td>
</tr>
<tr>
<td>LC50</td>
<td>1.42</td>
</tr>
<tr>
<td>LC90</td>
<td>28.97</td>
</tr>
<tr>
<td>Slope</td>
<td>0.98</td>
</tr>
</tbody>
</table>
Fig. 6. Relative toxicity of Black seeds extracts on adult of *Phytoseiulus persimilis* after feeding on bean leaves under laboratory conditions.

Table 6. LC<sub>50</sub> values and slopes of Black seeds extracts on adult of *Phytoseiulus persimilis* after feeding on treated bean leaves.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Black seeds extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 days</td>
</tr>
<tr>
<td>LC&lt;sub&gt;50&lt;/sub&gt;</td>
<td>1.22</td>
</tr>
<tr>
<td>LC&lt;sub&gt;90&lt;/sub&gt;</td>
<td>23.24</td>
</tr>
<tr>
<td>Slope</td>
<td>1.00</td>
</tr>
</tbody>
</table>

While the previous concentrations gave 39, 29 and 20% mortality, respectively after 3 days. While, after 7 days from treatment the mortality were 30, 22 and 16% for the previous concentrations, respectively.

When compare between the effects of Black seeds extract on the females of *P. persimilis* after 1, 3 and 7 days from treatment it can be concluded that the LC<sub>50</sub> values of Pink flowers extract were 1.22, 1.98 and 4.71 after 1, 3 and 7 days, of treatmates, respectively (Table 6).

On base of the LC<sub>50</sub> values, Black seeds extract show the same trend, whereas these LC<sub>50</sub> values were 23.24, 47.06 and 203.71 after 1, 3 and 7 days, of treatmate, respectively (Table 6).

On base of the slop values, Black seeds extract gave 1.00, 0.93 and 0.78, respectively.
The results are agreement with those obtained by David and David (1997) they found that garlic, onions, and chives and its extracts have been popular press as a repellent for many arthropods. Also, 100% garlic juice gave reduction to *T. urticae*.

Abd El-Wahhab (2003) found that the high concentration of the different plant extracts had a significant effect and resulted in a high percentage of mortality. All tested extracts were more toxic to the prey than to the predator, these results similar to those founded by Souliotis et al. (2000).

REFERENCES


تأثير سمية بعض المستخلصات النباتية ضد العكبوت الأحمر

TETRANYCHUS URTICAE KOCH

PHYSALIS PERSIMILIS A.-H.

أنвар عبد السلام هلدي منجد، علاء محمد حكارة

ميد تجربة وقاية النباتات - مركز البحوث الزراعية - الدقي - البيضاء

تم دراسة فاعلية بعض المستخلصات النباتية (مستخلص بذور النعناع ومستخلص القرنفل

ومستخلص حبة الزيتون) على أثاث العكبوت الأحمر ذو البقعين ومترس وعَدَّلّت النتائج بعد 1 يوم

وقال 7 أيام من المعاملة.

أوصت النتائج أن: بصفة عامة أن فاعلية هذه المستخلصات زادت زيادةً للتركيز وكان أعلى

تأثير اثاثي لمستخلص النعناع ضد أثاث العكبوت الحمر يليه مستخلص حبة الزيتون وكان الأقل

مستخلص القرنفل. بعد يوم 7 أيام بعد المعاملة بعد حساب قيم IC 50 وميل

الخط المستقيم.

كما أوصت النتائج نفس الفاعلية لهذه المستخلصات ضد المفترس الأكراوري. ولكن كل

المفترس الأكراوري أكثر استجابة (أثاث حساسية) لهذه المستخلصات مقارنة بإثاث العكبوت

الأحمر.

وإذن يمكن استخدام هذه المستخلصات في برامج المكافحة المتكاملة لهذه الأثاث اثاث النباتات.