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Citation: Egypt. Acad. J. Biolog. Sci. (F. Toxicology & Pest control) Vol. 9(1)pp.1-7(2017)
Efficacy of Some Plant Extracts on *Lucilia Sericata* (Meigen) (Diptera: Calliphoridae)

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**ABSTRACT**

The insecticidal effectiveness of three acetone extracts from Tree of Heaven (*Ailanthus altissima*), Dill (*Anethum graveolens*) and Coriander (*Coriandrum sativum*) against third larval instar of *Lucilia sericata* was investigated. The extracts were highly toxic, with median lethal concentrations (LC$_{50}$) of 1.37%, 0.31% and 0.87% for tree of heaven, dill and Coriander, respectively. The effects of median lethal concentration of these extracts on pupation and adult emergence percentage were also determined. The pupation and adult emergence percentage were markedly decreased after treatments. Treatments with LC$_{50}$ disturb activity of acid and alkaline phosphatases, and protease enzymes.

**INTRODUCTION**

Myiasis is an important medical and veterinary problem. Larvae of *Lucilia sericata* are obligatory ectoparasites. *Lucilia sericata* is commonly referred to as sheep blowfly, since sheep are its primary host in places like Australia. The fly lay eggs in the sheep wool. The larvae feed on the skin surface causing massive cutaneous lesions and secondary bacterial infections. This causes a huge economic impact, not only does it cost money to treat infected wounds, but also, measures must be taken to control *L. sericata*.

According to Tellam and Bowles (1997) the blowflies control is accompanied by organophosphate or by insect growth regulators (IGR$_S$), (Levot and Sales, 2004). These methods of control are becoming ineffective because of resistance to insecticides (Whyard *et al*., 1994) and residues left in the environment. To solve the economic and environmental problems, the search for new materials from plants as an alternative source for controlling of insects is being conducted all over the world (Hasheminia *et al*., 2011).

*Ailanthus altissima* (Tree of Heaven), is a plant in the family Simaroubaceae. Methanol extract of *A. altissima* leaves has insecticidal activities against *Aedes aegypti* (Tsao *et al*., 2002).

*Anethum graveolens* L. (Dill), is a plant in the family Apiaceae. Previous studies revealed the insecticidal activity of *A. graveolens*. Mohamed and Ali (2013) stated that methanol extract of *A. graveolens* has toxic effect against *Tribolium confusum*. 
Coriandrum sativum (Coriander) is an important member of the family Apiaceae. It has insecticidal activity against different insect pests. The \textit{C. sativum} petroleum ether extract showed a larvicidal effect against larvae of \textit{Aedes aegypti} (Harve and Kamath, 2004).

The present study is aimed to evaluate the effect of acetone extracts from Ailanthus altissima, Anethum graveolens, and Coriandrum sativum plants on some biological and biochemical aspects of third larval instar of \textit{Lucilia sericata}.

**MATERIALS AND METHODS**

**Insects**

Colonies of \textit{Lucilia sericata} (\textit{L. sericata}) adult were collected from Zagazig Sharkia Governorate, Egypt, using fly netting. According to El-Khateeb \textit{et al.} (2003), flies were reared in the laboratory.

**Plant extracts**

\textit{Ailanthus altissima} (\textit{A. altissima}) leaves and seeds of both \textit{Anethum graveolens} (\textit{A. graveolens}) and \textit{Coriandrum sativum} (\textit{C. sativum}) were purchased from the market. Leaves and seeds powders of the three selected plants were pulverized and exhaustively extracted acetone under reflux. The acetone extracts were filtered and evaporated under reduced pressure. The extracts were kept in the refrigerator (4°C) until use.

**Testing technique**

Third instar larvae of \textit{L. sericata} were exposed to acetone extracts of plants under investigation at five different concentrations, 0.25%, 0.5%, 1.0%, 3.0%, and 5.0%. The experiments were replicated four times for each concentration. Twenty-five larvae were used for each replicate. Two milliliters of the tested materials were added to 25 gm of meat in glass jars (6 cm x 9 cm). In the control experiments, acetone only added to the meat. Larvae were transferred to jars containing treated meat after complete evaporation of acetone. Larval mortality was recorded 24h after treatment.

**Biochemical analysis**

**Determination of activity of acid and alkaline phosphatases**

Acid and alkaline phosphatases activities were determined according to the method of Laufer and Schin (1971).

**Determination of protease activity**

The activity of protease was estimated according to the method of Ishaaya, \textit{et al.} (1971).

**Statistical analysis**

The larval mortality average data were subjected to Probit analysis (Finney, 1971) to estimate the median lethal concentrations (LC$_{50}$) with their 95% fiducial limits. A one way–ANOVA using (Statistica, 1997) performed to determine differences between larval mortality, pupal stage, adult emergence, acid phosphatases, alkaline phosphatases and protease activity of each treatment and control.

**RESULTS**

**Toxicological studies**

The larval mortality after treatment increased as the extract concentration increased (Fig. 1). There is no mortality detected in the control experiments. The sensitivity of larvae of \textit{L. sericata} to plant extracts was expressed by LC$_{50}$ values of 1.37%, 0.31% and 0.87% for \textit{A. altissima}, \textit{A. graveolens} and \textit{C. sativum}, respectively. The LC$_{50}$ values demonstrate the efficacy of the plant extracts. The acetone extract of \textit{A. graveolens} was 2.80 and 4.41 times more effective than \textit{C. sativum} and \textit{A. altissima}, respectively (Table 1).
Efficacy of some plant extracts on *Lucilia Sericata* Meigen Diptera: Calliphoridae

Fig. 1: Mortality percentage of *Lucilia sericata* larvae after feeding on diet treated with *Ailanthus altissima*, *Anethum graveolens* and *Coriandrum sativum* acetone extracts at different concentrations.

Table 1: LC$_{50}$, slope function and relative efficacy values of *Ailanthus altissima*, *Anethum graveolens* and *Coriandrum sativum* acetone extract against third larval instar of *Lucilia sericata*.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>LC$_{50}$ (L.F.L.-U.F. L)</th>
<th>Slope</th>
<th>X$^2$ (df =4)</th>
<th>Relative efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ailanthus altissima</em></td>
<td>1.37 (0.73 – 2.81)</td>
<td>1.75±0.14</td>
<td>24.71</td>
<td>4.41</td>
</tr>
<tr>
<td><em>Anethum graveolens</em></td>
<td>0.31 (0.13 -0.55)</td>
<td>0.65±0.12</td>
<td>5.91</td>
<td>1.00</td>
</tr>
<tr>
<td><em>Coriandrum sativum</em></td>
<td>0.87 (0.40- 1.64)</td>
<td>1.33±0.13</td>
<td>16.98</td>
<td>2.80</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Larval treatments altered the biological aspects as pupation and percentage of adult emergence relative to control (Table 2). The pupation percentage reduced to -18.48%, -60% and -25.5% as a result of treatments with *A. altissima*, *A. graveolens* and *C. sativum*, respectively. The adult emergence also affected after treatments with *A. altissima* (-24.5%), *A. graveolens* (-84.6%) and *C. sativum* (-51.0%) as compared with control (Table 2).

Table 2: Effect of *Ailanthus altissima*, *Anethum graveolens* and *Coriandrum sativum* acetone extracts on pupal stage and adult emergence of *Lucilia sericata*.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Pupal Stage</th>
<th>Adult Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean± SE</td>
<td>Change %</td>
</tr>
<tr>
<td><em>Ailanthus altissima</em></td>
<td>20±0.46$^a$</td>
<td>-18.4%</td>
</tr>
<tr>
<td><em>Anethum graveolens</em></td>
<td>9.5±0.95$^a$</td>
<td>-60%</td>
</tr>
<tr>
<td><em>Coriandrum sativum</em></td>
<td>18.2±2.78$^a$</td>
<td>-25.5%</td>
</tr>
<tr>
<td>Control</td>
<td>24.5±0.50</td>
<td>-</td>
</tr>
</tbody>
</table>

Effect of extracts on acid and alkaline phosphatase activities

According to table (3) acid phosphatase (ACP) activity in body homogenate affected depending on the extract. Treatments with median lethal concentrations of *A. altissima*, *A. graveolens* and *C. sativum* extracts lead to clear reduction in the enzyme activity in larvae by -37.29%, -48.16% and -8.10%, respectively.

The present work also carried out to detect the effect of selected plant
extracts on alkaline phosphatase (ALP) of third larval instar of *L. sericata*.

Results in the table (3), ALP activity increased after treatment with all extracts. The most promoting action was recorded by *A. altissima* extract (39.50± 0.37) µgm phenol/min/gm body weight followed by *C. sativum* extract (26.11± 0.15) µgm phenol/min/gm body weight, and *A. graveolens* extract (9.49±0.19) compared to 7.77± 0.08 µgm phenol/min/gm body weight in control.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Acid phosphatase (µg phenol/min./g body weight)</th>
<th>Alkaline phosphatase (µg phenol/min./g body weight)</th>
<th>Protease (mg tyrosine/min./g body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean± SE</td>
<td>Change %</td>
<td>Mean± SE</td>
</tr>
<tr>
<td>Ailanthus altissima</td>
<td>23.60± 0.21</td>
<td>-37.29</td>
<td>39.50± 0.37</td>
</tr>
<tr>
<td>Anethum graveolens</td>
<td>19.51± 0.37</td>
<td>-48.16</td>
<td>9.49±0.19</td>
</tr>
<tr>
<td>Coriandrum sativum</td>
<td>23.29± 0.28</td>
<td>-38.10</td>
<td>26.11±0.15</td>
</tr>
<tr>
<td>Control</td>
<td>37.64± 0.60</td>
<td>-</td>
<td>7.70±0.08</td>
</tr>
</tbody>
</table>

(+) increase or decrease from control
\(^{\circ}\) High significant difference (p< 0.01) and \(^{\circ}\) very high significant difference (p< 0.001)

**Effect of extracts on protease activity**

The data in table (3), a general enhancing action on activity of protease in larvae treated with *A. graveolens* and *C. sativum* extracts (189.70± 3.92 and 248.90± 4.84) mg tyrosine/ min/gm body weight compared to control (184.04± 4.05) mg tyrosine/ min/gm body weight. On contrary, *A. altissima* extract show clear reduction in enzyme activity (163.53± 3.00) mg tyrosine/ min/gm body weight.

**DISCUSSION**

The three applied extracts were effective against larvae of *L. sericata*, similar results have been recorded following treatment of *L. sericata* with certain commercial neem extracts, (El-Khateeb et al., 2003). Extracts of *Chenopodium ambrosiodes and Thymus vulgaris* have insecticidal effect on *L. sericata* (Morsy et al., 1998b).

In the present study, treatments with median lethal concentrations of plant extracts under investigation affect number of pupae, pupation percentage, number of adults and adult emergence percentage. Such results have been observed against *L. sericata* exposed to some plant oils (Khater and Khater, 2009) as well as with neem extracts and pomegranate (*Punica granatum*), (El-Khateeb et al., 2003).

The activity of acid phosphatase is usually correlated to histolysis (Spates and Wright, 1975). The activity of ACP after treatment with extracts of the selected plants showed a drastic reduction, especially with *A. graveolens* extract. These results are similar to results recorded the inhibitory effects of Jojoba oil on *Musca domestica* (Ghoneim et al., 2008). Senthil-Nathan et al. (2005) investigated, a reduction in ACP activity lead to reduction in liberation of phosphorus for energy metabolism and decrease metabolism.

Alkaline phosphatase is located in cells that are most active in the synthesis of fibrous proteins that develop with histolysis of larval tissues (Bassal and Ismail, 1985). So many similar results recorded increase in ALP activity by several botanicals on different insects, Hasheminia et al. (2011) and Khater (2009). Increasing ALP activity in *L. sericata* larvae treated with plant extracts under investigation may indicate the contribution of this enzyme in process of detoxification against the toxins present.
in the extracts as reported by Shekari et al. (2008).

Proteases cleave the peptide bonds in the insect food to release amino acids. The decrease in protease activity with A. altissima treatment may be due to the presence of protease inhibitors in this extract. This result similar to the finding of Remya et al. (2013). These protease inhibitors may bind with in the alimentary canal proteases of insects, interfering their digestion and reducing development in some insect species (Josephrajkumar et al., 2006). On the contrary, the increase in enzyme activity with A. graveolens and C. sativum extracts treatment is in accordance with similar effects on other insects (Devanand and Usha Rani, 2011). Many insects adapted to protease inhibitor in their food, by either increasing effected proteases or by expressing novel proteases insensitive to the ingested protein inhibitors (Brousseau et al., 1999).

In this research, neither isolated nor identified constituents was applied on L. sericata, but crude extract has been applied. Thus, the active ingredient(s) needs to be explored by the future investigation.

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and malathioncarboxyl esterase in the sheep blowfly, *Lucilia cuprina*.  

ARABIC SUMMERY

كفاءة بعض المستخلصات النباتية ضد ذبابة لوسيليا سيريكاتا (ميجن) (رتبة ثنائية الأجنحة: كاليفوردي)

كريمة شكري خاطر  
جامعة الزقازيق. كلية العلوم. قسم ع علم الحيوان (شعبة الحشرات) الزقازيق الشرقية. مصر

تمت دراسة فاعلية الإبادة الحشرية لثلاثة مستخلصات استخراج من نباتات شجرة السماء والشبت والكزبرة ضد العمر اليرقي الثالث لذبابة لوسيليا سيريكاتا وظهر ان هذه المستخلصات شديدة السمية وكان التركيز نصف المميت لنباتات شجرة السماء والشبت والكزبرة هو 73.1% و 13.7% و 13.1% على التوالي.

وقد تم تحديد تأثير التركيز نصف المميت على كل من نسبة التغذر ونسبة خروج العورة البالغ. واظهرت النتائج ان هناك تأثير مثبط للتغذر ولخروج العورة البالغ.

وبعامة العمر الثالث لليرق بالتركيز النصف المميت ظهر اختلال في نشاط كل من إنزيم الفوسفاتاز الحامضي والفوسفاتاز القاعدي والبروتاز.