LABORATORY EVALUATIONS OF LEAF OF ANNONA SQUAMOSA TO SUPPRESS THE POPULATION OF MALARIA VECTOR ANOPHELES STEPHENSI (DIPTERA CULICIDAE)

*Amrita Singh, Ashok Kumar and Veena P. Swami
Department of Zoology, BSNV PG, College (University of Lucknow), Lucknow, U.P. India
*Author for Correspondence

ABSTRACT
Mosquitoes transmit a number of diseases and are important in terms of public health killing millions of people per year worldwide. Phytochemicals of plants in the control of these vectors has gained momentum due to hazardous effects of synthetic pesticides. In the present study leaf powder of Annona squamosa was investigated for their larvicidal and growth regulating activities against Anopheles stephensi at different concentrations. Mortality in the larvae, pupae and adults produced about 60 to 89% fall in population with respect to control. A decrease in total developmental period was also found.

Key Words: Annona Squamosa, Mosquito Vectors, Anopheles, Larvicides

INTRODUCTION
Mosquitoes, a flying insect of family Culicidae, belonging to genera Anopheles, Culex and Aedes are the vectors for the arthropod-borne viruses or pathogens of various diseases like malaria, filariasis, Japanese encephalitis, dengue, yellow fever etc (Hubalek and Haluzka, 1999; Halstead, 2000). Vector control is one of the most successful methods for reducing the incidence of diseases. It may be done by either killing, preventing mosquitoes to bite human beings or by causing larval mortality in a large scale at the breeding places of the vectors. Conventional pesticides such as Malathion, DDT and pyrethroids are generally used for mosquito control are known to cause the problem of environmental pollution, residual effects and resistance by their indiscriminate use. Development of resistance to Malathion (Guneady et al., 1989) and to deltamethrin (Chen, 1990) in adult C. pipiens has been reported in C. quinquefasciatus (Chandre et al., 1998).

Pytochemicals derived from plant sources with proven mosquito control potential can be used as an alternative to synthetic insecticides or along with other insecticides under the integrated vector control. Herbal pesticides have gained importance as they are ecofriendly and considerably safer for pest control. Several plant products have been screened to identify the insecticidal and other biological activity against the mosquito larvae (Banerji et al., 1985; Saxena et al., 1992; Kalyansundram and Das, 1985; Velu et al., 2000; Jaswanth et al., 2002; Amer and Mehlorn, 2006; Govindrajan et al., 2008). Annona squamosa (Annonaceae), a large evergreen shrub is commonly found in India. Commonly known as custard apple is used as antitumour, wound healing, diuretic and antihelmintic. Unripe and dried fruits are used for diarrhea and dysentery (Kumar et al., 2010).

The objective of the present study is to evaluate the larvicidal and growth regulating activities of A. squamosa leaf against A. stephensi under the laboratory conditions.

MATERIALS AND METHODS
The leaves of Annona squamosa were collected locally in and around Lucknow. The leaves were washed with water, dried in shade at room temperature and powdered with the help of mechanical device. The powdered leaves of A. squamosa were used in the evaluation of the potential as the mosquitocide.

Colonies of A. stephensi were reared in the laboratory in clean water and yeast tablets were given as food. Females were allowed to feed blood feed by placing a rat inside the cages 3days after emergence. 100 second instar larvae of A. stephensi were released in 250ml beaker containing different test concentrations of A. sauamosa leaf (100,150,200,250mg) dissolved in 100ml of distilled water followed by vigorous
stirring. The treatments were replicated three times. Each replicate set contained an untreated control. The effect of the above treatments on development, moulting and metamorphosis of larvae and pupae of *A. stephensi* was studied.

**RESULTS AND DISCUSSION**

Larvicidal activity was shown by the leaf powder of *A. squamosa* against second instar larvae of *A. stephensi*. The mosquito larvae exposed under plant product showed significant behavioural changes. The changes were observed within 1h of exposure. The most obvious sign of behavioral changes observed in *A. stephensi* was restlessness whereas in control (untreated) zig zag movement was observed. This effect may be due to the presence of neurotoxic compounds in the plants. It was clear from the observations (Table-1) that there was a significant difference (P<0.005) in average, larval, pupal and developmental periods of treated and control groups. During the experiment there was a 60 to 89 % fall in population of larvae due to mortality of larvae and pupae in different concentrations with respect to control. The growth index of the treated mosquitoes was observed shorter than the control groups. Larval and pupal mortality may occur either due to the imbalance of growth stimulating and growth inhibiting hormones.

Recently, the malarial control programme focused more on elimination of mosquitoes in the larval stage with plant extract.

**Table 1: Effect of *A. squamosa* leaf powder on *Anopheles stephensi***

<table>
<thead>
<tr>
<th>Conc of <em>A. squamosa</em> leaf powder (mg)*</th>
<th>Av. larval pd ± S.E (days)</th>
<th>%larval mortality</th>
<th>Av. Pupal pd.</th>
<th>% pupal mortality</th>
<th>% adult emergence (a)</th>
<th>Av. Dev Pd ±S.E (days) (b)</th>
<th>Growth Index (a/b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>16.69±0.0 3</td>
<td>0</td>
<td>4.89±0.01</td>
<td>0</td>
<td>100</td>
<td>19.0±0.06</td>
<td>5.26</td>
</tr>
<tr>
<td>100</td>
<td>20.54±0.0 3</td>
<td>52</td>
<td>6.12±0.01</td>
<td>8</td>
<td>40</td>
<td>20.83±0.03</td>
<td>1.92</td>
</tr>
<tr>
<td>150</td>
<td>24.39±0.0 3</td>
<td>56</td>
<td>10.49±0.01</td>
<td>10</td>
<td>34</td>
<td>24.54±0.01</td>
<td>1.38</td>
</tr>
<tr>
<td>200</td>
<td>29.14±0.0 1</td>
<td>63</td>
<td>13.32±0.01</td>
<td>17</td>
<td>20</td>
<td>26.14±0.04</td>
<td>0.76</td>
</tr>
<tr>
<td>250</td>
<td>32.53±0.0 1</td>
<td>69</td>
<td>15.34±0.03</td>
<td>20</td>
<td>11</td>
<td>27.84±0.11</td>
<td>0.39</td>
</tr>
</tbody>
</table>

100 second instar larvae were treated at each concentration

The advantage to target the larvae of mosquito is to restrict their movement from their breeding places until they become adult. It will also reduce the overall Ariel use of chemicals to control adult mosquitoes by Ariel application (Glesier and Zyгадlo, 2007). In the present study, the larvicidal activity of *A. squamosa* leaf exhibited lethal effect against larvae of *A. stephensi*.

With the increase in concentration of leaf powder in treated groups, the average larval, pupal and developmental period increases.

It has already been reported that in addition to acute toxicity, compounds from different plants significantly lengthened the larval period in mosquito (Supavarn *et al.*, 1974). The mode of action of the crude leaf powder of *A. squamosa* on *A. stephensi* are not known but previous studies demonstrated that phytochemicals interfered with the proper functioning of mitochondria more specifically at the proton transferring sites (Rey *et al.*, 1999; Usta *et al.*, 2002).
Research Article

The pytochemicals primarily affect the midgut caeca and the malpigian tubules in mosquito. Furthermore, the crude extracts may be more effective compared to the individual active compounds, due to natural synergism that discourages the development of resistance in the vectors (Maurya et al., 2007). In conclusion, it can be said that leaf of Annona squamosa can be used selectively in places where mosquito breed to control the larvae and to reduce the egg laying capacity of adult female Aedes stephensi.

REFERENCES


Research Article
