INTRODUCTION

As mosquitoes play the role of vectors of many diseases, researchers have been prompted to discover newer methods to control them. Mosquito species belonging to genera Anopheles, Culex and Aedes are vectors of pathogens causing malaria, filariasis, Japanese encephalitis, dengue, chikingunya and yellow fever. Controlling mosquitoes at the larval stage is easy as target specificity of the larvicide used can be ensured. But repeated use of synthetic insecticides for mosquito control has been associated with environmental pollution and some mosquito species have developed high levels of resistance to certain insecticides. As an alternative plant products may be used. These plant products can be used as larvicides, adulticides or as repellants depending upon the type of activity they possess. These offer a safer alternative to synthetic chemicals and can be obtained by individuals and other communities at a very low cost.

ABSTRACT

The acetone extract of metal tolerant Oscillatoria was tested under standard laboratory conditions for larvicidal activity against the mosquito Culex quinquefasciatus. Oscillatoria amended with BG11 medium and with zinc, copper, chromium and cadmium (1mg/ml each) were used for this study. Results showed that Oscillatoria challenged with zinc was the most effective having a LC50 of 73.76 mg/L. This study showed that extracts from algae used for bioremediation can be utilized as mosquito larvicides.

Key words: Oscillatoria, Culex quinquefasciatus, Larvicidal activity, algal extract

INTRODUCTION

Oscillatoria is a genus of filamentous blue green algae which is named for the oscillation in its movement. Filaments in the colonies can slide back and forth against each other until the whole mass is reoriented to its light source. Oscillatoria has been used for bioremediation of heavy metal contaminated effluents by earlier workers. In this study, Oscillatoria amended with BG11 medium and with zinc, copper, chromium and cadmium (1mg/L) were used along with untreated algae (control).

MATERIAL AND METHODS

Mosquito larvae

Larvae of Culex quinquefasciatus used in this study were collected from ditches in Chennai. They were acclimatized to laboratory conditions and used for this study. The larvae were maintained at 27°C ± 2°C temperature and 70-85% relative humidity and they were fed with a mixture of dog biscuits and yeast powder in the ratio 3:1.
Preparation of algal extract

Oscillatoria was cultured in BG11 medium under 12:12 hours light, dark regime at 24 ± 1°C for 30 days. Medium supplemented with 1mg/ml of heavy metals such as copper sulphate, cadmium chloride, chromium sulphate and zinc sulphate and without metals (control) were used to grow the algae. After 30 days the algal cultures were centrifuged, the pellets were sonicated, extracted with acetone and dried and the powder was used for further experiments.

Experimental procedure

The larviciding activity against Culex quinquefasciatus was evaluated as per the standard procedure. Late III instar or early IV instar larvae were used for the experiments. The larvae were placed in glass bottles containing 500 ml tap water. Different concentrations of algal extracts were made (50, 100, 150, 200 and 250 mg/L) and placed in the bottles containing the larvae. Untreated larvae were used as control. Four replicates of each concentration were carried out under standard laboratory conditions. The mortality of larvae were monitored after 24 hours and recorded.

Statistical analyses

Values obtained were subjected to log probit regression analysis to obtain LC50 and LC90 values with 95% confidence limits.

RESULTS

Untreated Oscillatoria had a LC50 of 279.61 mg/L (Table 1). Oscillatoria amended with zinc was the most effective with an LC50 value of 73.75 mg/L. Copper Oscillatoria had an LC50 value of 93.49 mg/L. And Oscillatoria with cadmium and chromium had LC50 values of 106.82 mg/L and 142.77 mg/L respectively. The results showed that treated Oscillatoria was more effective than untreated Oscillatoria. The 95% confidence limits of both treated and control Oscillatoria are given in Table 2.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Algal extracts used</th>
<th>LC50 mg/L</th>
<th>LC90 mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Oscillatoria (untreated)</td>
<td>279.61</td>
<td>608.35</td>
</tr>
<tr>
<td>2.</td>
<td>Oscillatoria (Copper)</td>
<td>93.49</td>
<td>190.90</td>
</tr>
<tr>
<td>3.</td>
<td>Oscillatoria (Zinc)</td>
<td>73.75</td>
<td>151.78</td>
</tr>
<tr>
<td>4.</td>
<td>Oscillatoria (Cadmium)</td>
<td>106.82</td>
<td>209.56</td>
</tr>
<tr>
<td>5.</td>
<td>Oscillatoria (Chromium)</td>
<td>142.77</td>
<td>256.61</td>
</tr>
</tbody>
</table>

Table 2: 95% confidence limits for treated and untreated Oscillatoria extracts

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Algal extracts used</th>
<th>LC50 Lower</th>
<th>LC50 Upper</th>
<th>LC90 Lower</th>
<th>LC90 Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Oscillatoria (untreated)</td>
<td>155.28</td>
<td>358.28</td>
<td>518.84</td>
<td>774.60</td>
</tr>
<tr>
<td>2.</td>
<td>Oscillatoria (Copper)</td>
<td>65.51</td>
<td>113.94</td>
<td>165.19</td>
<td>236.41</td>
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<td>3.</td>
<td>Oscillatoria (Zinc)</td>
<td>45.98</td>
<td>92.32</td>
<td>130.10</td>
<td>191.53</td>
</tr>
<tr>
<td>4.</td>
<td>Oscillatoria (Cadmium)</td>
<td>80.49</td>
<td>127.49</td>
<td>181.97</td>
<td>258.50</td>
</tr>
<tr>
<td>5.</td>
<td>Oscillatoria (Chromium)</td>
<td>47.45</td>
<td>230.41</td>
<td>191.66</td>
<td>781.80</td>
</tr>
</tbody>
</table>
DISCUSSION

Several strategies have been adopted to control diseases transmitted by vectors. Larviciding is an important strategy used in vector control programmes around the world. The use of larvicides dates back to as early as 1899, when Ronald Ross applied kerosene on anopheline larval breeding sites in Sierra Leone. Culex mosquitoes are often nuisance biters and are not easily controlled by insecticide treated nets or residual spraying. Therefore controlling this vector is best achieved at the larval stage.

Oscillatoria often inhabits depths of thermally stratified lakes and it is very tolerant to organic pollutants. Oscillatoria amended with metals was used for this study to see if there was any difference between the larviciding potential of both treated and untreated algae. Treated Oscillatoria was definitely more effective than untreated algae as all had lower LC₅₀ values. Among the treated ones, Oscillatoria treated with zinc was the most effective.

Most blue green algae have biotoxins which could be responsible for the larvicidal effect. Some species of Oscillatoria are known to produce toxins. They include toxins such as neurotoxins and hepatotoxins called microcystins. These toxins could have caused the larvicidal effect. Oscillatoria is also reported to produce aplysiatoxins which can cause allergic reactions in people. Oscillatoria is readily found in stagnant water, watering troughs, on damp earth and in other habitats. It is one of the easiest algae to maintain in the laboratory.

Therefore algal extracts can be used as potential larvicides in vector control programmes as high pressure field application of these extracts can be done.

REFERENCES