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Larvicidal Activity of Tolerant Oscillatoria against *Culex quinquefasciatus* (Say)

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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 BG_{11} 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 LC_{50} 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

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[1]. 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[2]. 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.

Oscillatoria is a genus of filamentatous 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[3]. *Oscillatoria* has been used for bioremediation of heavy metal contaminated effluents by earlier workers[4]. In this study, *Oscillatoria* amended with BG_{11} 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 BG_{11} medium under 12:12 hours light, dark regime at 24 ± 1°C for 30 days[5]. 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 quinquefasiatus* was evaluated as per the standard procedure[6]. 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 LC_{50} and LC_{90} values with 95% confidence limits[7].

RESULTS

Untreated *Oscillatoria* had a LC_{50} of 279.61 mg/L (Table 1). *Oscillatoria* amended with zinc was the most effective with an LC_{50} value of 73.75 mg/L. Copper *Oscillatoria* had an LC_{50} value of 93.49 mg/L. And Ocillatoria with cadmium and chromium had LC_{50} values of 106.82 mg/L and 142.77mg/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 1: LC_{50} and LC_{90} Values for treated and untreated *Oscillatoria* extracts

S. No.	Algal extracts used	LC_{50} mg/L	LC_{90} mg/L
1.	*Oscillatoria* (untreated)	279.61	608.35
2.	*Oscillatoria* (Copper)	93.49	190.90
3.	*Oscillatoria* (Zinc)	73.75	151.78
4.	*Oscillatoria* (Cadmium)	106.82	209.56
5.	*Oscillatoria* (Chromium)	142.77	256.61

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

S. No.	Algal extracts used	LC_{50}		LC_{90}	
		Lower	Upper	Lower	Upper
1.	*Oscillatoria* (untreated)	155.28	358.28	518.84	774.60
2.	*Oscillatoria* (Copper)	65.51	113.94	165.19	236.41
3.	*Oscillatoria* (Zinc)	45.98	92.32	130.10	191.53
4.	*Oscillatoria* (Cadmium)	80.49	127.49	181.97	258.50
5.	*Oscillatoria* (Chromium)	47.45	230.41	191.66	781.80

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[8]. *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[9].

Oscillatoria often inhabits depths of thermally stratified lakes and it is very tolerant to organic pollutnts. *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 LC_{50} 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[10]. These toxins could have caused the larvicidal effect. *Oscillatoria* is also reported to produce aplysiatoxins which can cause allergic reactions in people[11]. *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

1. McHugh C.P., *Laboratory Medicine*, **25**: 429-437 (1994).
2. Severini C., Rom R., Mari Nucci M, and Rajmond M., *J. am. Mosq. Control Assoc.*, **9**: 164-170 (1993).
3. Fritsch F.E., *Proc. Roy. Soc. LondonB*, **79**: 197-254 (1907).
4. Kirkwood A.E., Nalewajko C. and Fulthope R. R., *J. Appl. Phycol*. **15**: 325-335 (2003).
5. Rippka R.J., Derulles J.B., Waterbury W., Herd,man M. and Staine R. Y., *J. Cyan. Microbiol*. **111**: 1-61 (1979).
6. WHO, CTD/WHOPES/IC/96. **1**: 69 (1996).
7. Finney D.J., Probit Analysis, Cambridge University Press, United Kingdom, 68-72 (1971).
8. Bockarie M.J., Gbakema A.A. and Barnish G., *Ann. Trop. Med. Parasitol*. 93: 213-224 (1999).
9. Chavasse D.C. and Yap H.H., WHO/CTO/ WHOPES/97. **2**: 35 (1997).
10. Carmichael W.W., *J. Appl. Bacteriology*, **72**: 445-459 (1992).
11. Carmichael W.W., *Scientific American*, **270**(1): 78-86 (1994).