

Short Communication

Larvicidal activities of ethanol extract of *Allium sativum* (garlic bulb) against the filarial vector, *Culex quinquefasciatus*

I. G. Kalu^{1*}, U. Ofoegbu¹, J. Eroegbusi², C. U. Nwachukwu³ and B. Ibeh⁴

¹Department of Biotechnology, Federal University of Technology, Owerri, Imo State, Nigeria.

²Department of Medical Biochemistry, Abia State University, Uturu, Nigeria.

³Department of Biology, Alvan Ikoku Federal College of Education, Owerri, Imo State, Nigeria.

⁴Department of Biochemistry, Federal University of Agriculture, Umudike, Abia State, Nigeria.

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Vector control is facing a threat due to the emergence of resistance to synthetic insecticides. Insecticides of botanical origin may serve as suitable alternative biocontrol techniques in the future. Garlic bulbs are common and widely distributed in many parts of Nigeria with medicinal properties, but the larvicidal activity of this plant has not been reported so far. Ethanol extract of *Allium sativum* (garlic bulb) was evaluated for larvicidal activities against the filarial mosquito *Culex quinquefasciatus*. The larval mortality was observed after 24 h treatment. The LC₅₀ values calculated for the second, third and fourth larval instars were 144.54 ± 2.3, 165.70 ± 1.2 and 184.18 ± 0.8 ppm respectively. The results obtained show that this plant material exhibited significant activity and could be considered as potent natural larvicidal agent.

Key words: *Culex quinquefasciatus* larvae, garlic bulb extract, larvicidal activity.

INTRODUCTION

Mosquitoes are the vectors for the dreadful diseases of mankind. Of all the insects that transmit diseases, mosquitoes represent the greatest menace. WHO has declared the mosquito "public enemy number one" because mosquitoes are responsible for the transmission of various dreadful diseases causing pathogens (WHO, 1996). The mosquito *Culex quinquefasciatus* acts as a vector for *Wuchereria bancrofti* responsible for filariasis in Nigeria. One of the methods available for the control of mosquitoes is the use of insecticides. Chemical control using synthetic insecticides had been favourable so far, because of their speedy action and easy application. The relative toxicity of insecticides to various mosquito species has been studied by entomologists in detail (Rajavel et al., 1987; Saxena and Kaushik, 1988). Synthetic insecticides are toxic and adversely affect the environment by contaminating soil, water and air. There is a need to find alternatives to these synthetic pesticides.

The study of biologically active materials derived from plant sources can act as larvicides, insect growth regulators, repellents and oviposition attractants and have deterrent activities as observed by many researchers (Babu and Murugan, 1988; Venkatachalam and Jebanesan, 2001a, b).

Botanical pesticides are promising in that they are effective, environment – friendly, easily biodegradable and also inexpensive. Botanical pesticides have been used traditionally by human communities in many parts of the world against pest species of insects (Jacobson, 1958). The present study was an attempt to find new larvicidal products from the extracts of garlic plants to control the filarial vector *Culex quinquefasciatus*.

MATERIALS AND METHODS

Sample collection

Fully matured already harvested bulb was bought in the market. The wet garlic bulb samples were carefully washed in a basin to remove all dirt while for the dry samples, the garlic bulbs were air dried on top of a platform inside a shed.

*Corresponding author. E-mail: olaedo_k@yahoo.com. Tel: +2348033459499.

Table 1. Larvicidal activity of ethanol extract of garlic bulb against *C. quinquefasciatus*.

Instars	LC50 (ppm)	Regression equation	95% confidential limit (ppm)		Chi-square (X2)
			LCL	UCL	
II	144.54 ± 2.3	Y = 4.424 + 4.363X	118.72 ± 0.6	175.96 ± 1.6	7.865*
III	165.70 ± 1.2	Y = -5.028 + 4.518X	139.43 ± 2.1	196.93 ± 1.0	8.025*
IV	184.18 ± 0.8	Y = -5.017 + 4.422X	152.65 ± 1.9	222.65 ± 2.3	10.267*

*Significant at $p < 0.05$ level. Each value represents mean of nine values ± SD Values were based of three concentrations and three replicates with 10 larvae in each.

Preparation of stock solution of plant extract

The garlic bulbs were divided into two groups, dry and wet. The crude wet extracts were prepared by grinding the garlic bulb in a mortar with pestle. Required concentrations of aqueous extracts were prepared by mixing the crude wet extract with a suitable amount of ethanol for one hour and using Soxhlet apparatus containing ethanol. The dry leaves were finely ground. The ground bulb was extracted with ethanol by soaking in ethanol for one hour and by using Soxhlet apparatus containing ethanol. The extract was collected and the column of the Soxhlet apparatus was washed with 100 ml of ethanol as an eluent after bulb was extracted. The extract was obtained by filtering the mixture into conical flasks through a Whatman No 1 filter paper. The extract was concentrated at 40°C by evaporation in a regulated oven.

Test organism

The larvae used to test for the larvicidal activity were obtained from colonies of *C. quinquefasciatus* mosquitoes cultured and maintained in the laboratory at a temperature of 28°C ± 2°C and 80 – 90% relative humidity. The larvae were fed with mice feed and yeast powder in the ratio of 3:1. They were transferred to another clean bowl each day for three (3) days and the water was aerated with the aid of an air pump.

Bioassay

Larvicidal activity of the mosquito *C. quinquefasciatus* was assessed by using the standard WHO method (WHO, 1996). Testing of the garlic bulb extract for larvicidal activity was carried out at different concentrations ranging from 100 to 300 ppm in distilled water. Ten second, third and fourth instar larvae of *C. quinquefasciatus* were collected separately and transferred gently to the test medium and simultaneously a control was maintained with ethanol-fresh tap water mixture. The larval mortality in both treated and control were recorded after 24 h. Dead larvae were identified when they failed to move after probing with a needle in the siphon or cervical region. The experiments were replicated three times and conducted under laboratory conditions at 25 - 30°C and 80 - 90% relative humidity. The LC₅₀ value was calculated after 24 h by Probit analysis (Finney, 1971).

RESULTS

The toxicity of garlic bulb extracts to the second, third and fourth instar larvae of *C. quinquefasciatus* mosquito was noted and the statistical data are presented in Table 1. The LC₅₀ values were 114.54 ± 2.3, 165.70 ± 1.2 and

184.18 ± 0.8 ppm for second, third and fourth instar respectively. Chi-square values were significant at $p < 0.05$ level. From the LC₅₀ it was evident that higher concentration was required for 3rd and 4th instars.

DISCUSSION

Vector control is facing a threat due to the emergency of resistance in vector mosquitoes to conventional synthetic insecticides, warranting either countermeasures or development of newer insecticides (Chendre et al., 1998). Therefore, it is necessary to look for and find a better insecticide or larvicide, which could provide a safer and long-lasting control against *C. quinquefasciatus* mosquito. The results of this study showed that ethanol garlic bulb extract was very effective against *C. quinquefasciatus* mosquito larvae. Rajkumar and Jebanesan (2004) studied ovicidal activity of *Moschosma polystachyum* leaf extract against *C. quinquefasciatus* and observed 100% egg mortality at 100 ml/l. Mullai and Jebanesan (2006) reported the larvicidal efficacy of the leaf extract of *C. pubescens* with four different solvents against late third instar larvae of *Anopheles stephensi*, *C. Quinquefasciatus* and *Aedes aegypti*. Similarly, Claire and Amanda (1999), studied the use of garlic and lemon peel extracts as *Culex pipens* larvicides in which the interaction and persistence of the extracts with the organophosphate resistance mechanism was observed.

The chemical composition and broad spectrum of biological activity for the plant extract can vary with plant age, the plant tissues, geographical origin of plant and the species and age of a targeted pest organism (Chiasson et al., 2001). In the present study it was concluded that the ethanol extract from garlic bulb exhibited effective larvicidal properties.

Crude extracts or isolated bioactive phytochemicals from the plant could be used in stagnant water bodies which are known to be the breeding grounds for mosquitoes. However, further studies on the identification of the active principals involved and their mode of action and field trials are usually needed to recommend any of these plant materials as an anti-mosquito product used to combat and protect from mosquitoes in a control program.

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