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Evaluation of mosquito larvicidal activity of *Azolla pinnata* leaf extracts against the filarial vector *Culex quinquefasciatus*

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Vector control is a major challenge now-a-days when they became resistance against commonly available insecticides. As an alternative, preliminary laboratory evaluation of *Azolla pinnata* crude and chloroform: methanol solvent extract was carried out under laboratory trials for control of *Culex quinquefasciatus*. Crude and solvent extract (chloroform: methanol) extracts of *A. pinnata* leaves were examined for the larvicidal activity against all the larval instars (1^{st} to 4^{th}) of *C. quinquefasciatus.* Dose-dependent mortality assays were performed using the extracts. Further, determinations of LC_{50} and LC_{95} values were accomplished through log-probit analyses and regression analyses. The larvicidal activity was statistically justified through ANOVA analyses. Effects of the extracts were examined on non-target water fauna. Exposure to *A. pinnata* crude and chloroform: methanol extract increased the mortality of first to fourth-instar *C. quinquefasciatus*. All the graded concentrations showed significant (P <0.05) larval mortality and the results of the regression equation revealed that the mortality rates were positively correlated with the concentrations of the extracts (R^2 close to 1). LC_{50} values of all instars after 24 h of exposure were between 86.99-294.06 ppm for crude and 48.87-111.44 ppm for chloroform: methanol extract. Chloroform: methanol extract is better than crude because the nature of biological components can be enhanced in presence of solvent and secondly the stronger extraction capacity could have produced a greater number of active constituents. The residual effect is noted even at the end of 72 h. A negligible toxicity to the larvae of *Chironomus circumdatus* was noticed as non-target organisms.

Keywords: *Azolla pinnata*, *Culex quinquefasciatus*, Larvicide, Leaf extract, Non-target organisms.

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Introduction

Mosquitoes are environmentally and economically significant insects because they transmit a variety of diseases that can be fatal. Filariasis is a disease transmitted by the vector *Culex quinquefasciatus* in tropical regions. The vectors of these diseases have long been a focus of disease eradication efforts[1]. Mosquito embryonic and larval stages have been a key target for researchers looking for medications to decrease mosquito populations due to their prevalence in confined spaces (small pools and puddles)[2-4]. For mosquito control, pyrethroids, carbamates, and organophosphates are among the synthetic insecticides available.

Random use of organophosphates such as temephos and fenthion and insect growth regulators such as diflubenzuron and methoprene leads to mosquito resistance against these chemicals[5]. The use of random synthetic pesticides leads to various types of cancer and birth defects in human beings[6]. Some 344 species have been reported to have a variety of activities against mosquitoes[7-14].

However, majority of them are contaminants that impair the ecosystem and non-target creatures[2,15,16]. When *Cx. quinquefasciatus* larvae were treated to the mosquito-control chemicals permethrin and temephos, respectively, they developed resistance[17,18]. As a result, novel medications or drug combinations must be tested in order to manage mosquito populations.

Other biological pest management strategies, such as the use of fungal pathogens, predators, traps, and plant-based medications, are used in addition to synthetic pesticides[2,16]. Plant-based pesticides are popular among biological mosquito control strategies because of their low cost, ease of availability, and environmental friendliness.

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