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Research article

Comparative study on larvicidal activity of green synthesized silver nanoparticles and *Annona glabra* (Annonaceae) aqueous extract to control *Aedes aegypti* and *Aedes albopictus* (Diptera: Culicidae)

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ABSTRACT

The present study reports mosquito larvicidal potential of green synthesized silver nanoparticles by using *Annona glabra* leaves (An-AgNPs). Synthesized An-AgNPs were characterized by Ultraviolet-Visible spectroscopy (UV-VIS), Scanning Electron Microscopy (SEM), Dynamic Light Scattering (DLS) technique and Fourier transform infrared spectroscopy (FTIR). Colur change from pale yellow to brick red of the plant extract and $AgNO_3$ solution indicated the formation of An-AgNPs initially. Surface Plasmon Resonance (SPR) band at 435 nm in the UV-Vis confirmed the formation of An-AgNPs. SEM images showed that An-AgNPs were spherical in shape. FTIR proved that An-AgNPs were functionalized with biomolecules in *A. glabra* leaves. Based on DLS analysis the average size range of synthesized An-AgNPs was determine to be 10–100 nm and 100–1000 nm.

Third instar larvae of dengue vector mosquitoes, *Aedes aegypti* and *Aedes albopictus* were subjected to larvicidal bioassays in a range of concentrations of An-AgNPs and *A. glabra* crude aqueous leaf extract (2–10 mg/L). An-AgNPs exhibited very high larvicidal activity against dengue vector mosquito larvae; LC_{50} value for *Ae. aegypti* at 24 h exposure to An-AgNPs (Plant extract: $AgNO_3$ 1 : 10) 5.29 mg/L; An-AgNPs (Plant extract: $AgNO_3$ 2 : 10) 2.43 mg/L while LC_{50} value for *Ae. albopictus* at 24 h exposure to An-AgNPs (Plant extract: $AgNO_3$1:10) 3.02 mg/L; An-AgNPs (Plant extract: $AgNO_3$ 2:10) 2.51 mg/L. LC_{50} values obtained for *A. glabra* leaf extract tested against *Ae. aegypti* and *Ae. albopictus* are 5.94 mg/L and 5.00 mg/L respectively at 24-hour exposure. This study further revealed that *Ae. albopictus* is more susceptible than to *Ae. aegypti* to a given concentration of An-AgNPs and to crude aqueous leaf extract of *A. glabra*. Larvicidal effect of An-AgNPs is superior to the crude aqueous leaf extract of *A. glabra*. An-AgNPs is a potent larvicide for dengue vector control.

1. Introduction

Aedes aegypti and *Aedes albopictus* are the two mosquito vectors of important arboviruses of the two genera of Flavivirus and Togavirus globally. *Ae. aegypti* is the main competent vector of flaviviruses such as ZIKA, dengue, chikungunya and yellow fever virus. *Ae. albopictus* is a vector for Flaviviruses such as yellow fever virus, Zika virus, dengue virus, Japanese encephalitis virus, and West Nile virus and Togaviruses such as Eastern equine virus and ross river virus (Paupy et al., 2009).

With the exception of yellow fever, for which an efficient vaccine has been available since the 1940s (Frierson, 2010), no vaccine is currently commercially available against the viral diseases transmitted by *Ae. aegypti* and *Ae. albopictus*. Therefore, the prevention of these diseases is mainly achieved through mosquito population control (Bisset et al., 2006; WHO, 2009).

Larvicides are among the main tools in mosquito control programmes. The most widely used larvicides are organophosphates such as temephos, methoprene, growth inhibitors, and bacterial insecticides such as *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bisset et al., 2006; De Silva and Mendes, 2007; Poopathi and Abidha, 2010; Anupam et al., 2012). Larvicides are applied to either natural or artificial bodies of water, as a result their effect to beneficial and other nontarget organisms,

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