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ORIGINAL ARTICLE

Carica papaya (Papaya) latex: a new paradigm to combat against dengue and filariasis vectors *Aedes aegypti* and *Culex quinquefasciatus* (Diptera: Culicidae)

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Abstract
This study manifests the larvicidal efficacy of *Carica papaya* latex extract and silver nanoparticles (CPAgNPs) synthesized using latex, against developing immature juveniles of *Aedes aegypti* and *Culex quinquefasciatus*. Briefly, the latex was collected and fractioned with different solvents such as chloroform, methanol and aqueously. The obtained crude extracts were subjected to larvicidal activity in the dose-dependent method. After 24 h, the mortality rate was calculated and statistically analyzed. From the results, it was demonstrated that the chloroform extract displayed prominent activity in IInd and IIIrd instar larvae of *A. aegypti* and *C. quinquefasciatus* with better LC_{50} values followed by methanol and aqueous extract. Subsequently, we profiled the qualitative analysis of a chloroform extract through biochemical tests; Fourier transform infrared spectroscopy and gas chromatography-mass spectrometry. Moreover, we authenticated the major secondary metabolites and activated larvicidal compound present in the extract. Further, we synthesized CPAgNPs using aqueous latex extract and challenged with IInd and IIIrd instar larvae of *A. aegypti* and *C. quinquefasciatus.* Noticeably, the synthesized nanoproducts were showed 100% mortality in a 24-h treatment with significant LC_{50} values. Hence, this study has opened up new vistas in the field of parasitological research to develop *Carica papaya* latex as a new stratagem in the insect vector management program.

Keywords *Aedes aegypti* · *Culex quinquefasciatus* · Latex · *Carica papaya* · Silver nanoparticles

Introduction

Plants and its extracts were practiced in traditional and ethnic medicine for the treatment of many diseases such as malaria, dengue fever, wound healing, viral and bacterial diseases, cancer, arthritis, diabetes, menstrual disorders and as supplementary food for normal metabolism and growth of humans (Shaalan et al. 2005). India has a rich floral diversity and bioprospecting of plants in the view of pharmaceutical perspective was still going on. Until now, numerous plants have been identified as a starting material as lead compounds for the development of next-generation drugs (Ghosh et al. 2012).

Tropical country like India was highly prone to infectious disease due to climate change and anthropogenic activities. Such tropical areas were the hot spots of mosquito (*Anopheles stephensi, Aedes aegypti, Culex quinquefasciatus*) prevalence (Mohankumar et al. 2016). Mosquitoes act as vectors for parasites, pathogens causing malaria, dengue fever, and lymphatic filariasis. These dreadful diseases cost huge sum of people's death worldwide. Moreover, it also affects the government and individual economy every year (Benelli and Mehlhorn 2016; Benelli et al. 2016a). In Indian scenario, the incidence of these dreadful diseases were high in all parts of states, causing high mortality and morbidity rate (Chitra et al. 2014; Ravindran et al. 2015).

Conventionally, synthetic insecticides organochlorines, carbamates, organophosphates, and pyrethroids temephos, fenthion, malathion, and dichlorodiphenyltrichloroethane (DDT) were expensive, leaving a residual effect, adapting

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