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Full Length Article

A comparative study on larvicidal potential of selected medicinal plants over green synthesized silver nano particles

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ABSTRACT

Larvicidal activity was assessed for alcoholic extracts of *Phyllanthus amarus*, *Annona squamosa*, *Coccinia grandis* and *Eclipta prostrata* extracted using solvents of various polarity. Third instar stage larvae of *Dengue-vector, Aedes aegypti* and Japanese encephalitis (JE) causing mosquito *Culex tritaeniorhynchus* were subjected to larvicidal bioassay at various concentrations (1000, 500, 250 ppm). The results explored that the phytoconstituents and secondary metabolites present in all the plants elucidated potent larvicidal activity. Among the tested extract ethyl acetate, petroleum ether and hexane extract expressed significant larvicidal activity. Similarly, these plants were subjected to green synthesis of silver nanoparticles, characterized and subjected for its larvicidal activity against *Anopheles stephensi* causing malaria. The synthesized silver nanoparticles were characterized by UV–VIS spectroscopy, Fourier Transform Infra-Red spectroscopy, Scanning Electron Microscopy respectively. The FTIR analysis strongly supported the capping behaviour of bio-reduced synthesized silver nanoparticles which in turn imparted the high stability of the synthesized silver nanoparticles. The average size of synthesized nanoparticles was less than 1 μm, most spherical in shape with SEM analysis. The findings revealed that *Eclipta prostrata* and *Annona squamosa* has effective larvicidal activity, whereas all the synthesised nanoparticles demonstrated dose dependent activity even at very low concentration and the findings reveals that these extracts and nanoparticles can be a better remedy against these mosquitoes.

1. Introduction

Mosquito borne diseases is a major universal health problem causing malaria, dengue fever, Japanese encephalitis, chikungunya fever and lymphatic filariasis which are more prevalent in India. It has been reported that 2.5 million cases have been reported with malaria and India alone contributed 76% of the cases [1]. *Anopheles stephensi* is the malaria causing mosquito of plasmodium genus. About 400 known *Anopheles* species are normally found everywhere except cold temperate regions. *Anopheles stephensi* is a major insect vector in the world has been shown directly responsible for about 40–50% of the annual malarial incidence [2]. Similarly, *Aedes aegypti* a vector of Dengue fever has created a serious public health problem globally. Among the arbovirus in India, spreading all the dengue virus types is constantly increasing [3]. It has been reported that around 50–200 million cases of Dengue fever infection worldwide every year [4]. It is difficult task to control breeding of *Aedes aegypti* as it is a fresh water breeding mosquito.

Whereas JE (Japanese encephalitis) is caused by mosquito vector *Culex tritaeniorhynchus* distributed mostly in south Asia and southeast Asia [5] and has reported a mortality of about 30,000–50,000 annually. These vectors breeds especially in irrigation waters of rice field and uses pigs as their amplification host. The symptoms of Japanese Encephalitis infections are mild, with or without apparent symptoms, but many reports suggest that certain patients results in severe disease characterized by raise in body temperature, headache, neck stiffness, disorientation, coma, seizures, spastic paralysis and death. Control of mosquito is something important in the present day with rise in number of illness caused by mosquito and it is a major sources for death in developing countries.

Bioactive compounds from plant origin plays a major role as a defence agent against various insects. A diversity of plants have been reported with insecticidal compounds and the use of products of plants origin to control mosquito larvae has been shown to be an exciting alternative to traditional methods of larval

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controlling, as they are not associated with the problems [6]. Several research has been carried out to make eco-friendly repellents and larvicidal activity using plants [7,8]. Medicinal plants are found to be the alternative medicine used since ancient times to cure many diseases due to their therapeutic values. Medicinal plants have many characteristics which make them useful for treatments, they are synergic medicine, supportive medicine and preventive medicine [9].

Nanotechnology finds application in different areas like health care, cosmetics, drug-gene delivery, energy science, optoelectronics, photo-catalyst property [10,11] etc. Nanoparticles provides solutions to technological and environmental problems and also provides high surface area to volume ratio. Green synthesis of nanoparticles helps to develop a clean, nontoxic, and eco-friendly methods. They also find place in the insecticides like nanomaterials-based insecticides. They provide green and efficient alternatives for pest management without harming the nature. The atom by atom arrangement of nanoparticle influences their size, shape and orientation to act specifically on the targeted site. The nanoparticle possess more strength, chemical reactivity and a high electrical conductivity, along with their physical, biological and chemical properties.

It has been reported that Silver nanoparticles possess antibacterial activity [12] similarly, antiviral [13], anti-fungal activity [14]. Nano particles synthesized from microorganism or plants sources acts can potentially to eliminate the problem by making the nanoparticles more bio-compatible, hence many researchers are working on plants, algae, fungi, bacteria, and viruses to produce

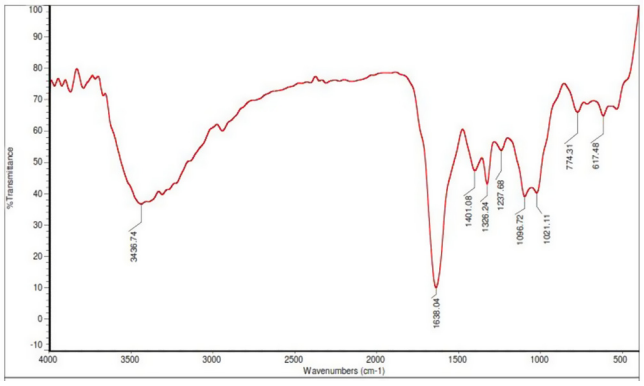

Fig. 1. FTIR spectrum of synthesized silver nanoparticles using extracts of *Phyllanthus amarus.*

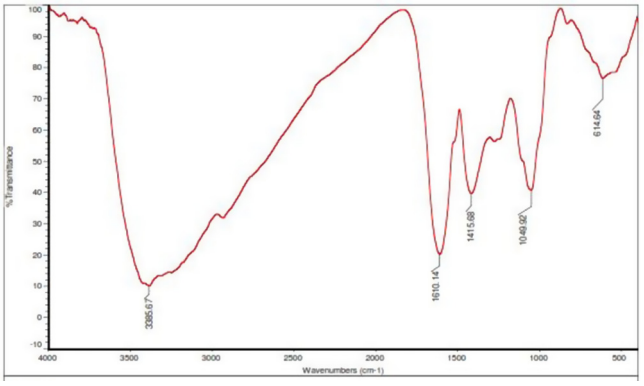

Fig. 3. FTIR spectrum of synthesized silver nanoparticles using extracts of *Eclipta prostrata.*

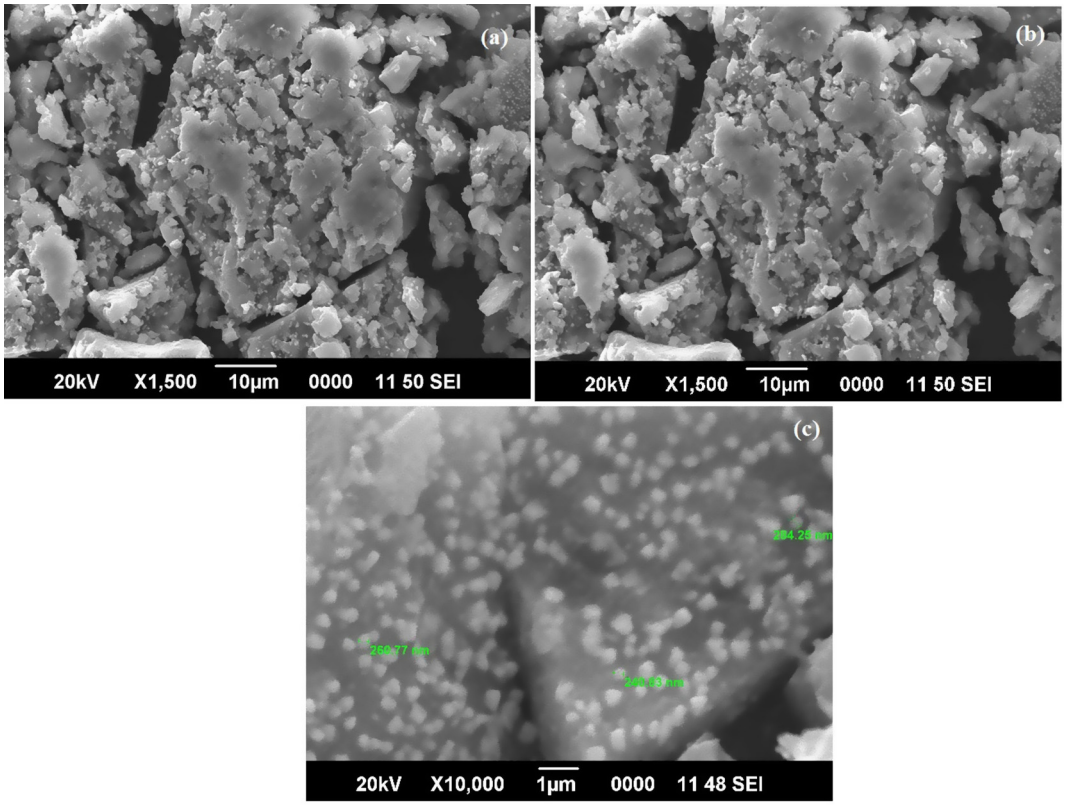

Fig. 2. (a-c) SEM micrograph a) ×1 500 10 μm; B) ×5000 5 μm; C) ×10,000 1 μm showing the silver nanoparticles synthesized using extract of *Phyllanthus amarus.*

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