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Combined Larvicidal and Pupicidal Action of *Coriandrum sativum*, *Piper nigrum* and Synthetic Insecticide Cypermethrin Against the Dengue Fever Mosquito, *Aedes Aegypti* L.

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ABSTRACT
After the adoption of green revolution, India has The combined action of cypermethrin and methanolic extracts of *Coriandrum sativum, Piper nigrum* were observed for their larvicidal and pupicidal activites against *Aedes aegypti*. When analyzed individually, Cypermethrin were found to be most effectual against the first instar larvae of *Aedes aegypti,* followed by methanolic extracts of *Piper nigrum, Coriandrum sativum* being least effective. The LC_{50} values obtained with Cypermethrin and methanolic extracts of *Piper nigrum, Coriandrum sativum* against the first instar larvae were 0.61, 0.71 and 0.86%, respectively and the LC_{90} values were 1.32, 2.73 and 3.71% respectively. The combination of Cypermethrin and *Coriandrum sativum* was studied at mixed with Cypermethrin 0.5% and *Coriandrum sativum* 0.5, 1.0, 1.5, 2.0 and 2.5. Similar mixtures were also used for the combination of Cypermethrin and *Piper nigrum*. The Cypermethrin and *Coriandrum sativum* seed extract combination acted antagonistically. The combination of Cypermethrin and *Piper nigrum* seed extract acted synergistically against the target organisms at a first instar larvae, which showed the best results of: LC_{50} 0.58 and LC_{90} 2.40% at 24 hours, respectively. The present study will be helpful in developing in a commercial formulation for effective vector management.

Keywords: *Cypermethrin, Coriandrum sativum, Piper nigrum, Aedes aegypti, larvicide, pupicide and synergism*

INTRODUCTION
Mosquitoes are major public health pests throughout the World. Among the 3492 species of mosquitoes recorded Worldwide, more than a hundred species are capable of transmitting various diseases to humans and other vertebrates (Rueda, 2008). Many devastating diseases such as malaria, West Nile virus (WN), dengue, filariasis, yellow fever, Japanese encephalitis and chikungunya are transmitted to humans by vector mosquitoes. Also mosquito bite causes considerable pain and leads to loss of sleep. Mosquito attack on frame animals can cause loss of body weight and decreased milk production (Nour *et al*., 2009). The *Aedes aegypti* mosquito is the primary vector of dengue. The *Aedes aegypti* mosquito lives in urban habitats and breeds mostly in man-made containers. Unlike other mosquitoes *Aedes aegypti* is a daytime feeder; its peak biting periods are early in the morning and in the evening before dusk. Female *Aedes aegypti* bites multiple people during each feeding period. As estimated 500 000 people with severe dengue require hospitalization each year, a large proportion of whom are children. About 2.5% of those affected die. Dengue has become the most important mosquito-borne viral disease affecting humans (WHO, 2009). Dengue fever is a severe, flu-like illness that affects infants, young children and adults, but seldom causes death. Dengue should be suspected when a high fever (40c-/104F) is accompanied by two of the following symptoms; severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands or rash.