Laboratory and Field Evaluation of Bacillus thuringiensis Israelensis (WDG) against Dengue Vector Aedes albopictus Larvae in Lahore Pakistan

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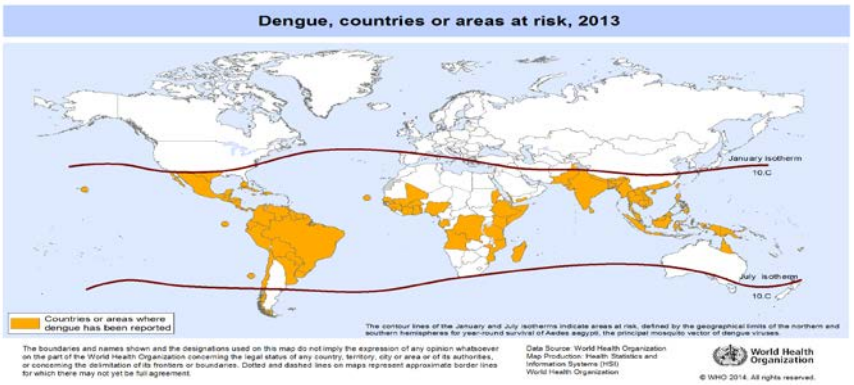
***Abstract*-** Dengue fever is making headlines all over the world. It is a mosquito-borne disease. The huge leap in dengue cases is causing many scientist and medical experts to worry. There is no cure for dengue fever. In fact, one of the biggest challenges the medical community faces is how to control dengue and how to stop the disease from spreading. Right now, one of the most effective way is the vector control. The current study is the laboratory and field evaluation of Bacillus thuringiensis var israelensis Vectobac® WDG (Water dispersible granules) 3000 ITU / mg was carried out against Aedes albopictus (early 4th instar) larvae from Lahore Pakistan. The primary objective was to control Aedes mosquitoes (Mainly vector of Dengue fever) by determing the minimum effective dosage of Bti WDG for larval mortality and pupae reduction of Aedes albopictus in laboratory as well as in the field assay.

I. Introduction and Background

Dengue is an acute mosquito-borne viral infection that places a significant socioeconomic and disease burden on many tropical and subtropical regions of the world. It is currently regarded as the most important arboviral disease internationally as over 50% of the world's population live in areas where they are at risk of the disease, and approximately 50% live in dengue endemic countries. The main arthropod vector for transmission of the dengue viruses is Aedes aegypti (A. aegypti). The second, less effective vector, Aedes albopictus (A. albopictus), feeds on multiple species of vertebrates, but has still been shown to be responsible for some dengue transmission.

In Pakistan, the two most striking species are; Aedes aegypti and Ae. albopticus. Their distribution and relative abundance need to be studied. Aedes aegypti, commonly known as the yellow fever mosquito and is the most important vector for Yellow fever, Dengue fever and Chikungunya. While Ae. albopictus commonly known as Asian tiger mosquito is also a competent vector of many viruses including dengue and Eastern equine encephalitis.

Dengue is the growing public health disease. There is no vaccine for preventing dengue. Prevention and control of dengue and DHF currently depends on controlling the mosquito vector. The most effective way is the larval source reduction, i.e., elimination of water-holding containers that serve as the larval habitats for Aedes mosquitoes. The microbial larvicides used for mosquito control are Bacillus thuringiensis var israelensis (Bti) and Bacillus sphaericus (Bsph). Bacillus thuringiensis israelensis (Bti) was shown to be effective in reducing the number of immature Aedes in treated containers. However, further studies of Bti in combination with other insect viruses and other strategies to control dengue vectors are warranted. The sterile insect technique is an environmentally friendly, species-specific population control method. These two biological insecticides due to their environmental safety and specificity to mosquitoes have become mosquito control agents of choice almost throughout the world. Humans are the principle source of blood and utensils that can hold water are the primary sites for oviposition and larval development. Aedes breeds primarily in man-made containers like earthen jars, metal drums, used automobile tires and other items that collect rain water. In Southeast Asia, both of Ae. aegypti and Ae. albopictus are important vectors of Dengue fever (DF) and dengue hemorrhagic fever (DHF). Nearly about 87% population is at risk.



In the Eastern Mediterranean region, dengue is classified as an 'emerging disease'. Cases have only been officially reported to WHO for the last 2 decades, during which time three countries – Saudi Arabia, Pakistan, and Yemen – have had multiple outbreaks. For example, In Pakistan, first outbreak of Dengue hemorrhagic fever was reported in 1994 from Karachi with no confirmed deaths but in 2011, the city of Lahore in Pakistan experienced a major dengue outbreak associated with 21,685 confirmed cases and 350 deaths, mainly due to DENV-2. Observed climatic changes, including increased average global temperature and increased humidity, theoretically increase the epidemic potential of dengue. Based on long-term average vapor pressure prediction, climate change and population projections, approximately 50%–60% of the global population would be living in areas at risk of dengue transmission by 2085.

The current study was designed for laboratory and semi field evaluation of Bti WDG Vectobac 3000 ITU / mg as biological larvicides against field collected 4th instars of Aedes albopictus from Lahore. To date, this study is the first report of its kind against Asian dengue vector from Lahore Pakistan.

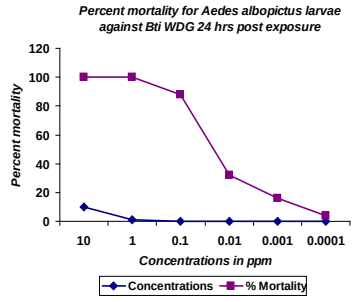
Symptoms and Treatment for dengue

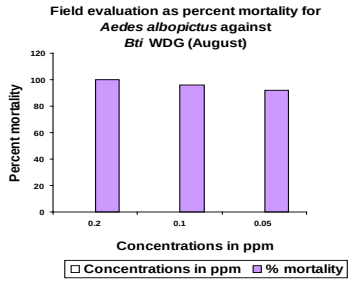
The principal symptoms are high fever, severe headache, backache, joint pains, nausea and vomiting, eye pain, and rash. Generally, younger children have a milder illness than older children and adults. Dengue hemorrhagic fever is characterized by a fever that lasts from 2 to 7 days, with general signs and symptoms. This stage is followed by hemorrhagic manifestations tendency to bruise easily or other types of skin hemorrhages, bleeding nose or gums, and internal bleeding. There is no specific medication for treatment of a dengue infection. Persons who with dengue should use analgesics (pain relievers) with acetaminophen and avoid those containing aspirin. They should also rest, drink plenty of fluids, and consult a physician.

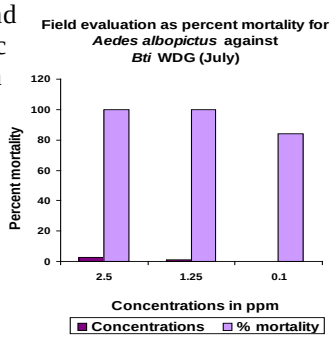
Mosquito Rearing and Maintenance:

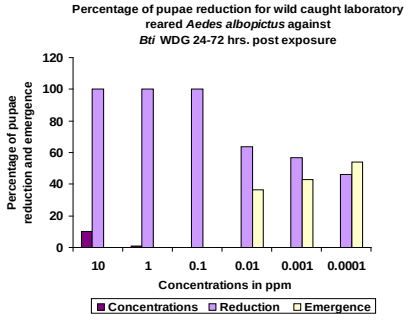
Aedes larvae were reared in the laboratory under standardized conditions at 27ºC±3ºC and 80%±3% Relative Humidity (R H). Larvae for colony and experiments were maintained in batches of 200, each in 1200 ml of deionized water.

FEEDING: Each batch was mixed with 0.02% yeast solution then for larval growth finely coursed fish food was applied on the surface of water up to pupae formation (9-12 days of post hatching). Adults emerging within 24 hours were maintained in cages 30 cm^3 and fed on 10% glucose solution and water. Females (4-6 days post emergence) were fed periodically on restricted albino mice to maintain the colony.









II. CONCLUSION AND FUTURE PRESPECTIVE

There has been no promising solution for sustainable control of Dengue vectors. The only effective way is: The trend for dengue vector control has shifted from insecticides to biological control such as use of biological agents (Bti) carried out in this study. In conclusion, Aedes albopictus (Asian dengue vector) found highly susceptible to Bti WDG microbial control agent, more effective for field studies. Furthermore, the minimum effective dosages to kill 100% of the larval population in a habitat have shown to be extremely low and product may have great potencies for inclusion in integrated vector management operations. Further studies for integrated control are recommended for Aedes mosquitoes to control dengue disease.

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