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Perspective

# Midgut Bacteria Fauna in Aedes Mosquito

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## DESCRIPTION

Genus *Aedes* is the most important vectors of arboviral disease like dengue and chikungunya, zika and yellow fever. In some cases, they are also vectors of filariasis and viral diseases. Genus *Aedes* comprises more than 950 species among them only species *Ae. aegypti*, *Ae. albopictus*, *Ae. vittatus*, *Ae. polynesiensis* and *Ae. scutellaris* are the most important one and have been attributed to dengue and chikungunya outbreaks. Each of these species has a particular ecology, behaviour and geographical distribution. *Ae. aegypti* generally dwells in urban and suburban areas.

For completion of their life cycle they preferred mainly human-made containers, tree-holes and bamboo internodes holding stagnant water, within or in close proximity to households. Its high preference for taking human blood meals and to a lesser extent from domestic mammals makes it a very potent vector of dengue viruses. Due to the asian origin and the conspicuous stripes, *Ae. albopictus* known as the Asian tiger mosquito. Unlike *Ae. aegypti*, *Ae. albopictus* is an aggressive biter and primarily a forest species associated with arboreal vegetation, but it has adapted to rural, suburban and urban human environments also. For egg laying, *Ae. albopictus*, mainly prefer natural water holding containers around or further away from households like tree-holes and bamboo internodes, and man-made artificial containers for its immature development. *Ae. albopictus* bites humans, but also a variety of available domestic and wild vertebrates, for taking their blood meals.

Dengue fever is caused by four distinct, but closely related, serotypes of dengue virus, DEN-1, DEN-2, DEN-3, and DEN-4. It is a *Flavivirus* (positive single-stranded RNA virus) of family Flaviviridae and transmitted by *Ae. aegypti* and *Ae. albopictus* mosquitoes. Recovery from one serotype infection provides lifelong immunity against that particular serotype. Dengue occurs in two severe clinical manifestations- Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS). Dengue fever is a severe, flu-like illness and affects infants, young children, and adults. Dengue fever is responsible for 390 million dengue infections annually, of which 96 million manifests clinically with varying disease severity. Prior to 1970, severe dengue epidemics were reported only from 9 countries of the world, but now days about 128 countries are affected. Another most important viral disease transmitted by *Ae. aegypti* and *Ae. albopictus* is the chikungunya. The fever of chikungunya is caused by the infection of CHIKV virus (single stranded RNA virus), an Alphavirus of family Togaviridae. The disease was reported to be very similar to a dengue-like fever and it included a sudden onset of fever; a severe headache; chills; nausea; vomiting, and joint pain. Sometimes it is constant for a long time but generally not fatal. Some chikungunya patients become disable with their severe joint pain and this may last for weeks or months. Outbreaks of chikungunya are mainly in the Sub-Saharan Africa, India and the Indian subcontinent. Chikungunya was first time reported in India in 1963, but the largest outbreak was recorded in 2006 and 2007. Fortunately yellow fever is not occurring in India.

The mosquito's midgut is the second largest organ and is the site where the disease causing parasite, harmful bacteria, viruses and toxins as well as food and water comes the first time in contact with mosquito environment. Each disease causing pathogen has its distinct life cycle, but they face the same and common events after being ingested and exposed to the mosquito's midgut environment. Shortly after ingestion of blood meal in midgut, the temperature and pH change abruptly and digestion process starts with proteolytic enzymes. These digestive enzymes can have a negative or positive impact on the pathogens and therefore can influence 4 vector competences. Pathogens must be passed over the peritrophic matrix during migration to their developmental site for their development (in the case of filarial worm), multiplication (in the case of malaria and viral agents). Although, the role of mosquitoes in the transmission of dengue and chikungunya was known to medical community for over long times still, these diseases continuously influenced the human population from tropical and subtropical countries. All the existing control strategies for these diseases are insufficient and unable to contain the populations of vectors and parasites and leading to insurgence and emergence of new diseases; and also the increased mosquito population has caused great trouble to the man and animals. This may be attributed to the presence

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of multidrug resistant strains of pathogen; failure to develop novel vaccines, development of insecticide resistance in mosquitoes. Environmental and health concerns about chemical control have made controlling of disease difficult. Vector control is the main strategy in the control of insect borne diseases mainly through insecticides. Since several decades, various chemical insecticides such as Organophosphate, Malathion, Fenthion, Pirimiphos-methyl, and Temephos, Chlorpyrifos and Organochlorine, DDT, Hexachlorocyclohexane (HCH) Benzene Hexachloride (BHC), Dieldrin compounds have been using to reduce the mosquito's adult populations. But the insecticides provide the relief only for a short period. Heavy and prolong use of insecticides lead to the development of resistance in vectors and environment degradation. This has compelled to look for eco-friendly alternative control methods so that the use of insecticides can be minimized.

## CONCLUSION

Several environment friendly methods involving use of insectivorous fishes, biopesticides, pheromones, sterilized males, refractory mosquitoes, endosymbiont, midgut symbionts, etc. are being developed with various degree of success. Some promise has also been shown by 'Lure & Kill' Technology (LKT) and 'Genetic Control of Vectors' (GCV). In the Lure & Kill technology various types of attractants are used to pull out the mosquito population to a trap where they are subsequently killed by pesticides. But this technology is slow and highly specific in nature and moreover, different populations of the same species may respond differently to that particular semio-chemicals in different geographical regions. While in Genetic modification (GM) of vector mosquito is one of such technologies which can be mainly used either to suppress or replace the wild populations of a vector so as to decrease vector populations or reduce vector ability to transmit. These applications include release of reared male mosquitoes in the environment to introduce modified genetic traits in wild populations. GM encompasses multiple approaches which are broadly categorized into two types. The first category includes Sterilized Insect Technique (SIT) for population suppression and the second category is Gene drive systems for population replacement or manipulation. The Sterilized Insect Technique (SIT) includes the Dominant Lethal Gene systems (RIDL), Wolbachia mediated Cytoplasmic Incompatibility (CI) and Classical radiation induced male sterility.