

## Review Articles

# Role of gut inhabitants on vectorial capacity of mosquitoes

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### ABSTRACT

Mosquito-borne diseases are spreading at an alarming rate. Globally millions of deaths occur due to the diseases transmitted by mosquitoes, next to AIDS and tuberculosis. Several methods have been used to control these vectors and the diseases caused by them. Earlier studies have shown the potential role of mosquito gut inhabitants on disease transmission. Their findings can be used as an innovative approach for devising strategies to modify the survival of mosquitoes by reducing their lifespan, reproduction and disease transmission abilities. In this study, microbiome of the three genera of mosquitoes, namely *Aedes*, *Anopheles*, and *Culex* along with their vectorial capacity have been reviewed for assessing their role in mosquito control and transmission. Relevant articles were accessed using different databases, including LILACS, Embase, Science Direct and PubMed from inception to June 2017. The search keywords included "*Aedes*", "*Anopheles*", "*Culex*", "gut inhabitants", "vectors", and "mosquito". The titles, abstract, and keywords of the retrieved articles were screened, and eligible research articles were sorted. The review indicates that paratransgenesis may be considered as a versatile and effective strategy to eradicate the spurt of mosquito transmitting diseases. *Enterobacter* species is the most common type of gram-negative bacteria associated with the gut of all the three genera of mosquitoes. It was found to have a beneficial effect on humans as it helps in destroying dreadful disease-transmitting vectors. These symbiotic qualities of the microbes need to be thoroughly investigated further to reveal their antipathogenic effect on the vector.

**Key words** *Aedes*; *Anopheles*; *Culex*; gut inhabitants; microbes; mosquito; vectorial capacity

### INTRODUCTION

Mosquitoes, the hexapod invertebrates belonging to the Culicidae family of Insecta class, have profound influence on human beings. More than 3555 recognized mosquito species divided into two subfamilies (Anophelinae and Culicinae) and 112 genera have been recorded in different parts of the world<sup>1</sup>. India, belonging to the oriental region is regarded as one of the richest biogeographic zones for different mosquitoes. A record indicates that Indian mosquito fauna includes 393 species divided among 49 genera and 41 subgenera<sup>2</sup>. Most species of this holometabolous insect remains as nonpathogenic, while some are vectors of certain dreaded diseases like malaria, chikungunya, Zika, yellow fever *etc.* More than one million people die every year throughout the world due to mosquito-borne diseases<sup>3-6</sup>.

The vector competences of mosquitoes are highly dependent on the microenvironment of their gut which normally undergoes radical structural remodeling during each stage of the life cycle<sup>7</sup>. Hence, studies on gut content analysis of mosquito in terms of feeding (which includes

diverse form of microbial flora composed of commensal or symbiotic bacteria, algae, protozoans, organic debris *etc.*) are essential, as their feeding behaviour changes during metamorphosis from an aqueous larval stage to an aerial adult<sup>8</sup>. Studying the interaction between the gut microenvironment and vector competency might be helpful in controlling vector-borne diseases without disturbing the ecological balance. Accordingly, a systematic review was made, intended to reveal the characteristic features of microbial consortia residing in the mosquito gut. For this different published research articles and reviews were assessed using the online databases, *viz.* LILACS, Excerpta Medica data BASE (Embase<sup>®</sup>), Science Direct and PubMed<sup>®</sup> from inception to June 2017. Other sources consulted were the CDC, WHO, and NIH websites. The search keywords included "*Aedes*", "*Anopheles*", "*Culex*", "gut inhabitants", "vectors", and "mosquito". Articles retrieved for the study were absolutely in English. The titles, abstract, and keywords of the retrieved articles were screened, and eligible research articles were sorted. The selected articles were considered reliable, if they revealed one or more perspectives about the research