Parasites & Vectors

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Review of insecticide resistance and behavioral avoidance of vectors of human diseases in Thailand

Theeraphap Chareonviriyaphap[1*], Michael J Bangs[2], Wannapa Suwonkerd[3], Monthathip Kongmee[4], Vincent Corbel[1,5] and Ratchadawan Ngoen-Klan[1]

Abstract

Physiological resistance and behavioral responses of mosquito vectors to insecticides are critical aspects of the chemical-based disease control equation. The complex interaction between lethal, sub-lethal and excitation/repellent ('excito-repellent') properties of chemicals is typically overlooked in vector management and control programs. The development of "physiological" resistance, metabolic and/or target site modifications, to insecticides has been well documented in many insect groups and disease vectors around the world. In Thailand, resistance in many mosquito populations has developed to all three classes of insecticidal active ingredients currently used for vector control with a majority being synthetic-derived pyrethroids. Evidence of low-grade insecticide resistance requires immediate countermeasures to mitigate further intensification and spread of the genetic mechanisms responsible for resistance. This can take the form of rotation of a different class of chemical, addition of a synergist, mixtures of chemicals or concurrent mosaic application of different classes of chemicals. From the gathered evidence, the distribution and degree of physiological resistance has been restricted in specific areas of Thailand in spite of long-term use of chemicals to control insect pests and disease vectors throughout the country. Most surprisingly, there have been no reported cases of pyrethroid resistance in anopheline populations in the country from 2000 to 2011. The precise reasons for this are unclear but we assume that behavioral avoidance to insecticides may play a significant role in reducing the selection pressure and thus occurrence and spread of insecticide resistance. The review herein provides information regarding the status of physiological resistance and behavioral avoidance of the primary mosquito vectors of human diseases to insecticides in Thailand from 2000 to 2011.

Keywords: *Anopheles*, *Culex*, *Aedes*, Control, Insecticide, Susceptibility, Behavior, Thailand

Introduction

A number of insect species can transmit pathogens to humans resulting in significant morbidity and mortality as well as placing a profound burden on human productivity and development. Transmission of these vector-borne diseases is related to the complex interplay of three primary components; pathogenicity/virulence of the infectious agent, vector competence (infectivity) and host (human) susceptibility. This transmission cycle is directly and indirectly driven by a diverse number of inter-related environmental factors. Successful control of human diseases requires an understanding of the interaction among these three components and the various other biological, environmental, and socio-economic factors that influence transmission. Such a task often requires or benefits from the full participation of both governmental and private sectors, sufficient numbers of trained personnel, adequate and sustained financial support, and a well-designed, evidence-based vector control program. Despite decades of organized vector control efforts, malaria, dengue, lymphatic filariasis and Japanese encephalitis, remain real threats in various areas of Thailand. One of the most effective means of prevention of these diseases involves vector control to reduce the risk of transmission. In some instances, this requires the use of various chemical compounds as larvicides applied to aquatic habitats and adulticides as outdoor space

* Correspondence: faasthc@ku.ac.th
[1]Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok 10900, Thailand
Full list of author information is available at the end of the article