Irritability and repellency of synthetic pyrethroids on an *Aedes aegypti* population from Thailand

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ABSTRACT: The main objective of this study was to find the optimal dosage of deltamethrin, cyphenothrin, d-tetramethrin, and tetramethrin that would elicit repellency and irritability responses of *Aedes aegypti*. The F1-F3 generations of field mosquitoes collected from Pu Teuy Village, Sai-Yok District, Kanchanaburi Province, Thailand, were tested with four pyrethroids to determine the LC_{25}, LC_{50}, and LC_{99}. These concentrations were 0.010%, 0.020%, and 0.055%, respectively, for deltamethrin; 0.113%, 0.167%, and 0.353%, respectively, for cyphenothrin; 2.091%, 2.770%, and 5.114%, respectively, for d-tetramethrin; and 2.377%, 4.251%, and 10.715%, respectively, for tetramethrin. All dosages were tested in the excito-repellency system. Survival analysis was used to compare each chamber of the test. It was found that cyphenothrin had a stronger repellent effect than the other pyrethroids, while the contact irritant effect was similar among compounds tested. The LC_{50} of each pyrethroid was found to be the optimal dose for repelling *Ae. aegypti*. There was no significant difference in LC_{99} values for either non-contact or contact trials for each pyrethroid. ***Journal of Vector Ecology* 34 (2): 217-224. 2009.**

Keyword Index: Aedes aegypti, deltamethrin, cyphenothrin, d-tetramethrin, tetramethrin, excito-repellency system, Thailand

INTRODUCTION

People in many areas of the world are at risk from a wide variety of vector-borne diseases, including dengue fever and dengue hemorrhagic fever (DF/DHF). It is estimated that 50-100 million people are infected with dengue viruses worldwide (Gubler 1997). This mosquito-borne disease results in considerable morbidity and mortality in humans annually. The virus is vectored primarily by *Aedes aegypti* (L.), a notoriously efficient vector mosquito that often resides in and near human dwellings (Gubler 1997, WHO 1997). Despite progress in vaccine development, no effective and acceptable multi-valent dengue vaccine is currently available. Prevention of this disease remains entirely dependent on vector reduction through the use of insecticides (Roberts et al.1997, Chareonviriyaphap et al. 2004, Grieco et al. 2007).

Previously, studies on how chemicals function have focused primarily on toxicity. Little is known about two types of behavioral avoidance responses elicited by these chemicals: irritability and repellency (Chareonviriyaphap et al. 1997, Grieco et al. 2007). Irritability occurs when an insect is stimulated to move away from an insecticide after making direct physical contact with the chemical residue, whereas repellency occurs when the insect detects chemicals from a distance, and is diverted out of the treated area without making physical contact with the chemical (Roberts et al. 1997). In the last decade, these types of responses have been documented in both field and laboratory mosquito populations. The outcome of either form of behavioral avoidance can be quantified using a specially designed excito-repellency test system (Roberts et al. 1997, Chareonviriyaphap et al. 1997, 2004, Sungvornyothin et al. 2001).

Many chemical compounds, including synthetic pyrethroids, have long been used in national vector control programs (Rieter and Gubler 1997). In Thailand, deltamethrin is frequently and widely used as an indoor residual spray for controlling household nuisance mosquitoes and disease vectors, including *Ae. aegypti* (Chareonviriyaphap et al. 1999, Somboon et al. 2003). Deltamethrin, applied as a space spray, has also been used in attempts to break the mosquito-virus transmission cycle in dengue active areas (Communicable Disease Control (CDC) 2006.). The impact of pyrethroids on disease vectors requires continued investigation and serves as a stimulus for future studies on the mode of action and epidemiological significance of avoidance behavior (Chareonviriyaphap et al. 2001).

Recent studies have reported the spread of deltamethrin resistance in several field *Ae. aegypti* populations from Thailand (Jirakanjanakit et al. 2007). The spread of resistance is raising awareness for the need of alternative insecticides or new methods of controlling mosquito vectors in Thailand. New, effective, and safe synthetic pyrethroids are readily available and are becoming more common for domestic