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Behavioral responses to transfluthrin by *Aedes aegypti*, *Anopheles minimus*, *Anopheles harrisoni*, and *Anopheles dirus* (Diptera: Culicidae)

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Abstract

Airborne spatial repellency (SR) is characterized and distinguished from other chemical actions including contact locomotor excitation and toxicity. The use of volatile spatial repellents is a potential new intervention class for combatting mosquito-borne pathogen transmission; therefore, continuing investigations on the actions of these chemicals that modify mosquito host-seeking behavior (i.e., bite prevention) is needed. The objective of this study is to characterize the key behavioral avoidance actions of transfluthrin (TFT) to advance spatial repellent development into practical products. Behavioral avoidance responses were observed for adult laboratory strains of *Aedes aegypti*, *Anopheles minimus* and *An. dirus*, and two field populations of *An. harrisoni* and *Ae. aegypti*, respectively. Established TFT sublethal (LC_{50} and LC_{75}), lethal concentrations (LC_{99}) and discriminating concentrations (DCs) were selected corresponding to each mosquito test species. Spatial repellency and contact excitation ('irritancy') responses on adult mosquitoes to TFT were assessed using an excito-repellency assay system. At LC_{50}, TFT exhibited strong avoidance with *An. minimus* (60.1% escape) and *An. dirus* (80% escape) laboratory strains, showing between 12 and 16x greater escape response than *Ae. aegypti* (5% escape). Repellency responses for field collected *Ae. aegypti* and *An. harrisoni* were 54.9 and 47.1% escape, respectively. After adjusting the initial contact escape response (a measure of combined irritancy and repellency) to estimate only escape due to contact, the LC_{50} and LC_{99} showed moderate escape irritancy with laboratory *Ae. aegypti* (41.4% escape) and no contact activity against the field population. Adjustment showed only weak contact activity (16.1% escape) in laboratory *An. minimus* at LC_{50}. Spatial repellency is the predominant mode of action of TFT among colonized and field mosquitoes used in this study. Established baseline (susceptible) dose-response curves assist in optimizing SR products for mosquito control and pathogen transmission prevention.