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Research

Repellency and Contact Irritancy Responses of *Aedes aegypti* (Diptera: Culicidae) Against Deltamethrin and Permethrin: A Cross-Regional Comparison

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Abstract

Control strategies exploiting the innate response of mosquitoes to chemicals are urgently required to complement existing traditional approaches. We therefore examined the behavioral responses of 16 field strains of *Aedes aegypti* (L.) from two countries, to deltamethrin and permethrin by using an excito-repellency (ER) test system. The result demonstrated that the escape percentage of *Ae. aegypti* exposed to pyrethroids did not vary significantly between the two countries in both contact and noncontact treatment despite the differing epidemiological patterns. Deltamethrin (contact: 3.57 ± 2.06% to 31.20 ± 10.71%; noncontact: 1.67 ± 1.67% to 17.31 ± 14.85%) elicited relatively lower responses to field mosquitoes when compared with permethrin (contact: 16.15 ± 4.07% to 74.19 ± 4.69%; noncontact: 3.45 ± 2.00% to 41.59 ± 6.98%) in contact and noncontact treatments. Compared with field strains, the mean percentage of escaping laboratory susceptible strain individuals were significantly high after treatments (deltamethrin contact: 72.26 ± 6.95%, noncontact: 61.10 ± 12.31%; permethrin contact: 78.67 ± 9.67%, noncontact: 67.07 ± 7.02%) and the escaped individuals spent significantly shorter time escaping from the contact and noncontact chamber. The results indicated a significant effect of resistance ratio on mean escape percentage, but some strains varied idiosyncratically compared to the increase in insecticide resistance. The results also illustrated that the resistance ratio had a significant effect on the mortality in treatments. However, the mortality in field mosquitoes that prematurely escaped from the treated contact chamber or in mosquitoes that stayed up to the 30-min experimental period showed no significant difference.

Key words: avoidance behavior, resistance ratio, indoor residual spraying, field strain mosquito, *kdr* resistance

Dengue fever is a rapidly emerging arboviral disease primarily transmitted to humans by two container-dwelling mosquitoes: *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse) (Kyle and Harris 2008, Vasilakis et al. 2009). An effective dengue vaccine is not yet commercially available. The current dengue fever prevention measures are thus primarily environmental management and various chemical and biological approaches (Ooi et al. 2006, Morrison et al. 2008, Simmons et al. 2012).

Chemical approaches—based on toxicity, repellency, and contact irritancy to *Aedes* species—remain the most effective method of rapidly suppressing disease-transmitted vectors in densely populated and impoverished regions worldwide (Grieco et al. 2007). Insecticide toxicity is a crucial element of mosquito control, and little attention has been paid to the behavioral variation and innate response of mosquitoes to chemical intervention. Moreover, insecticide resistance in mosquitoes has become a global concern because of the intensive and regular use of a single insecticide (Cui et al. 2006, Ahmad et al. 2007, Lima et al. 2011, Ocampo et al. 2011, Faucon et al. 2015). Control strategies exploiting the behavioral responses of mosquitoes to chemicals, such as repellent and irritant responses, are urgently required to complement the existing approaches and increase the effectiveness of global public health interventions. Such interventions, including indoor residual spraying (IRS) and the use of insecticide-treated materials (ITMs), have obtained promising