Irritancy and Repellency Behavioral Responses of Three Strains of *Aedes aegypti* Exposed to DDT and α-Cypermethrin

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ABSTRACT This study quantified both contact irritancy and noncontact repellency behavioral responses of three strains of *Aedes aegypti* (L.) (one long-term colony and two F1-F2 generation field-caught strains) to field application rates of DDT (2 g/m^2) and α-cypermethrin (ACyp) (0.025 g/m^2) by using an excito-repellency test chamber. The colony The colony strain (USDA) was completely susceptible to DDT and ACyp. One field strain was collected from Chiang Mai (CM) Province, northern Thailand, and was characterized as tolerant (reduced susceptibility) to DDT and completely susceptible to ACyp. The second field strain, collected from Kanchanaburi (KAN) Province, western Thailand, was highly resistant to DDT but fully susceptible to ACyp. All three strains exhibited marked irritancy to contact with ACyp, with more pronounced escape responses occurring in the two field strains. With DDT, the KAN strain demonstrated the lowest escape response during both contact and noncontact trials, whereas a greater response was seen in trials conducted with CM and USDA strains. With exposure to ACyp, repellency was less profound than irritancy but still resulted in a significant escape response compared with paired controls without insecticide ($P < 0.05$). DDT elicited both irritancy and repellency responses but comparably greater spatial repellency than ACyp. Findings indicate ACyp functions primarily as a strong contact irritant, whereas DDT functions as a relatively strong noncontact repellent in the strains tested. The higher the degree of physiological resistance to DDT, the greater the apparent suppression of both behavioral avoidance responses. Most importantly, observations using susceptible, tolerant, and resistant *Ae. aegypti* strains show that behavioral responses that can interrupt human–vector contact still occur regardless of degree of physiological susceptibility to compounds tested.

KEY WORDS *Aedes aegypti*, contact irritancy and noncontact repellency, α-cypermethrin, DDT

Dengue is the most significant human mosquito-borne viral pathogen in the world and presents a major public health problem in many tropical and subtropical countries (Gubler 1998, Guzman and Kouri 2002). The disease is transmitted by *Aedes aegypti* (L.), a notoriously efficient vector that invariably resides in close association with humans (WHO 2008). Typically, *Ae. aegypti* breeds in household water storage containers and preferentially feeds indoors during daylight (Christophers 1960, Gubler 1998). *Ae. aegypti* also prefers to rest indoors in darken and undisturbed places, complicating control of this vector (Reiter and Gubler 1997). Generally, *Ae. aegypti* has a flight range of <400 m, although some studies indicate that *Ae. aegypti* is capable of occasionally dispersing over much longer distances in search of oviposition sites or bloodmeals (Scott et al. 2000, Harrington et al. 2001). Despite progress, an effective and commercially available dengue vaccine is not yet available; therefore, the prevention and control of disease transmission rely almost exclusively on vector control strategies.

Mosquito behavior in response to chemical exposure is a critical component in the epidemiology of vector-borne disease transmission. The use of chemical barriers has historically been used to exploit these behavioral responses for the purpose of inhibiting mosquitoes from preferentially feeding on humans, ingesting infectious bloodmeals, or transmitting pathogens to susceptible hosts (Elliott 1972). The natural reaction of mosquitoes to avoid insecticide-treated surfaces is a general phenomenon; yet, behavioral responses, including contact irritancy and noncontact repellency of adult mosquitoes exposed to insecticides, remain poorly studied. This remains true despite

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