

# Human-Landing Patterns of *Anopheles dirus* sensu lato (Diptera: Culicidae) in Experimental Huts Treated With DDT or Deltamethrin

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**ABSTRACT** *Anopheles dirus* females landing on humans inside experimental huts treated with residual applications of DDT or deltamethrin were observed during the wet season in Pu Teuy Village, Kanchanaburi Province, western Thailand. Two identical experimental huts were constructed in the fashion of typical local rural Thai homes. Pretreatment (baseline) human-landing collections (HLC) in both huts showed an early evening peak of activity between 1900 and 2000 h with no significant difference in numbers of mosquitoes captured between huts over a period of 30 collection nights. During posttreatment HLC, female mosquitoes continued to show greater landing activity inside huts fitted with insecticide-treated panels during the first half of the evening compared with the second half. A greater number (proportion) of *An. dirus* females landed on humans in the hut treated with deltamethrin compared with DDT. Comparing pre- and posttreatment HLC, the DDT-treated hut showed a 79.4% decline in attempted blood feeding, whereas exposure to deltamethrin resulted in a 56.3% human-landing reduction. An odds ratio was performed to demonstrate the relative probability (risk) of mosquitoes entering and attempting to blood feed in the two treated huts compared with untreated control huts. Mosquitoes were  $\approx 0.47$  times less likely to land on humans inside a DDT-treated hut compared with the deltamethrin-treated hut. Although both chemicals exerted strong excitatory responses, DDT appears to have a more pronounced and significant ( $P = 0.002$ ) effect on behavior than deltamethrin, resulting in greater movement away from the insecticide source and thus potential reduction of blood-feeding activity.

**KEY WORDS** *Anopheles dirus*, behavioral response, experimental hut, deltamethrin, DDT

In Thailand, malaria remains a major and re-emerging health problem despite vector control programs that have been successful in reducing morbidity and mortality throughout much of the country (MPH 2006). Approximately 70% of the malaria cases are documented from the less developed border areas with eastern Myanmar, where efficient malaria vectors such as *Anopheles dirus* Peyton & Harrison are common (Scanlon and Sandhinand 1965, Kitthawee et al. 1990, MPH 2006). *An. dirus* s.l. is a well-known species

complex of the *Anopheles leucosphyrus* group and closely associated with forest and forest-fringe habitats in Thailand (Baimai 1988). Unlike most species in the group that have infrequent contact with humans, a few members of *An. dirus* are regarded as excellent malaria vectors because of its highly endophagic and anthropophilic behavior. Natural high malarial infectivity rates (up to 13%) are not uncommon (Rosenburg and Maheswary 1982, Baimai et al. 1984). The most favored breeding habitats are shaded animal footprints, wheel-tracks, and temporary ground pools, making environmental control of this species particularly difficult. *An. dirus* larvae are occasionally found in water jars, cut tree stumps, and rot holes, adding to the problem of detection and control (Rattanarithikul et al. 2006).

*An. dirus* s.l. has shown varying behavioral responses to indoor use of insecticides (Ismail et al. 1974, 1975; Suwonkerd et al. 1990). In Thailand, indoor residual spraying (IRS) is routinely applied for interruption of human-vector contact and malaria transmission (Chareonviriyaphap et al. 1999, 2001). For many decades, DDT was the chemical of choice and

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