Scientific Note

An improved experimental hut design for the study of *Aedes aegypti* (Diptera: Culicidae) movement patterns in Thailand

Theeraphap Chareonviriyaphap[1], John P Grieco[2], Wannapa Suwonkerd[3], Atchariya Prabaripai[4], Suppaluck Polsomboon[1], Krajana Thainchum[1], Sungsit Sungvornyothin[5], and Nicole L. Achee[2]✉

[1]*Department of Entomology, Kasetsart University, Bangkok 10900, Thailand*
[2]*Department of Preventive Medicine and Biometrics, Uniformed Services University of the Health Sciences, Bethesda, MD 20814, U.S.A.*
[3]*Office of Disease Prevention and Control No 10, 18 Boonrungrit Rd., Chiangmai 50200, Thailand*
[4]*Division of Biostatistics and Computer, Faculty of Liberal Arts and Science, Kasetsart University, Kamphaengsean Campus, Nakhon Pathom 73140, Thailand*
[5]*Department of Medical Entomology, Faculty of Tropical Medicine, Mahidol University, Bangkok 10400, Thailand*

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Knowledge of the behavioral responses of mosquito vectors to chemical insecticides is of paramount importance to understanding the epidemiology of disease transmission and optimum strategies for vector control. Several studies have employed the use of experimental huts to evaluate changes in mosquito behavioral responses that are relevant to disease transmission (i.e., disruption of human-vector contact) when they are exposed to insecticides, as compared to chemical-free conditions, including measurement of time and density of house entry, exit, and indoor resting, with attention concentrated mainly on *Anopheles* species (Smith 1965, Roberts et al. 1984, Grieco et al. 2000, Pates and Curtis 2005). Relatively few attempts have been made, however, to describe the responses incited by insecticides on other mosquito species using experimental huts (Symes et al. 1942, Kennedy 1947, Brown 1964, Lal et al. 1965, Moore 1977, Suwannachote et al. 2009).

Our previous research describing the movement patterns of *Ae. aegpyti* to identify chemical modes of action demonstrated that a portable hut based on the design of Achee et al. (2005) served as a successful tool for such studies (Suwonkerd et al. 2006, Chareonviriyaphap et al. 2005, Grieco et al. 2007). Although these huts mimicked indigenous Thai homes and produced consistent and reliable results, structural adjustments were identified that could increase hut longevity and improve mosquito sampling efficiency. These modifications included: 1) a raised platform to prevent structural damage from termites and soil moisture; 2) cement ant traps placed underneath the raised platform to prevent predation on knock-down mosquitoes during chemical trials; 3) a walkway around the perimeter of the hut to facilitate mosquito removal from window and door traps and; 4) increased airflow between the ceiling and exterior roof to aide in indoor heat dissipation.

As part of a larger proof-of-concept research program evaluating a Push-Pull vector control strategy to reduce host-seeking *Ae. aegypti* from inside homes and the peridomestic environment using minimal chemical dose and treatment coverage of standard vector control compounds, additional experimental huts have been constructed based on these design modifications (Figure 1). This report describes these huts, interception traps, and baseline studies, that were generated without chemical intervention to determine if changes in hut design would negatively affect mosquito movement patterns as compared to previous findings.

The dimensions of the modified huts are 4 m wide x 5 m long x 2.5 m high with three windows (0.9 m wide × 0.6 m high) and one door (1 m wide × 2.4 m high) onto which can be affixed removable window and door traps, respectively (Figure 2). Hut frames are made of iron pipe, untreated wood planks are used for walls and flooring, with the roof constructed of zinc panels. The dimensions of the window traps are 0.60 m long x 0.90 m wide x 0.60 m high (Figure 3A). Louvers made of 1.6 cm non-treated hard wood were placed over the front opening of each trap with a hinged mesh flap used to cover the bevel opening during removal of trapped mosquitoes. The door trap is separated into two equal portions with each measuring 0.73 m wide × 0.56 m high × 0.93 m long (Figure 3B). Louvers and mesh flaps are integrated into each portion as described for window traps. The frames of both upper and lower traps are fixed to the hut door but the lower door trap can be opened independently and easily disassembled during experimental trials to allow collectors to exit and enter the huts during host rotation periods. Both window and door traps have three collection portals through which collectors insert manual aspirators for removal of trapped mosquitoes (depicted in Figure 3B).

To validate the modified experimental huts, entry and exit movement patterns of *Ae. aegypti* populations from Kanchanaburi Province, Thailand, were evaluated under chemical-free conditions on four consecutive days for entrance trials and four consecutive days for exit trials following previously described methodologies (Grieco et al. 2007). Briefly, each test population consisted of 100 five-to-seven-day-old, female mosquitoes marked