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Dose–Response Assay for Synthetic Mosquito (Diptera: Culicidae) Attractant Using a High-Throughput Screening System

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Simple Summary: Entomological surveillance is important to evaluate vector management interventions. However, collecting adult mosquitoes using direct human bait is controversial and often discouraged because of potential infection risk. Alternatively, active and passive trapping methods are available. Female mosquitoes detect human host cues such as body heat, carbon dioxide, and other volatile body emanations using olfactory sensilla to direct movement to a host. Attractive chemical lures have been identified and evaluated using a variety of olfactometric methods to increase trap production and efficiency. In this study, we evaluated a simple olfactometer without need of airflow. To 'optimize' a commercial mosquito attractant, 10 different doses of product, the Biogents-lure (BG-lure^{TM}), were compared. Results showed dose-dependent responses with 0.005 g with the highest attraction for *Aedes aegypti*, while doses of 0.2 g and above produced a repellent response. There was no significantly different response behavior between permethrin-susceptible and -resistant *Ae. aegypti*. *Culex quinquefasciatus* showed significantly different responses compared to *Ae. aegypti* by producing attraction over four times a wider range of amounts. These results demonstrate a simple olfactometer device to screen potential chemical attractants without use of an air-plume, thus expanding testing capabilities beyond more sophisticated laboratory settings.

Abstract: Natural volatile host cues play a critical role for mosquito orientation and locating a blood source for egg production. Similar olfactory activation responses have allowed the use and development of artificial chemical attractants to lure mosquitoes to trapping devices. Using a pre-formulated commercial product mixture of different attractant chemicals, a high-throughput screening system (HITSS) is used to screen varying doses of chemical required to activate behavioral responses. Two strains of *Aedes aegypti* (L.): permethrin-susceptible (USDA) and -resistant (Pu Teuy) phenotypes and one *Culex quinquefasciatus* Say. (NIH) laboratory strain were tested. Overall, mosquitoes showed repellency between 1.0 g and to 10.0 g dose of each compound. However, by progressively reducing the dose, *Cx. quinquefasciatus* showed a greater positive percent attraction (88.9%) at 0.025 g, whereas the USDA and Pu Teuy *Ae. aegypti* produced optimum attractant activation at 0.005 g (72.6% and 58.9%, respectively) without significant difference within species ($p > 0.05$). In parallel control assays, *Cx. quinquefasciatus* was significantly attracted to 1 g of dry ice (carbon dioxide) (76%) more than *Ae. aegypti* (USDA) (12.2%). The HITSS was originally designed to measure three chemical actions to sublethal concentrations of chemicals by mosquitoes: toxicity and the two primary behavior avoidance responses (contact excitation and spatial repellency). These findings demonstrate that the HITSS assay, with only minor modifications, allows comparison screening of candidate compounds as potential attractants for anemotactic responses under laboratory-controlled conditions. Further investigations will be required to equate measurements obtained from controlled laboratory assays to more varied field conditions for attracting natural mosquito populations.

Keywords: yellow fever mosquito; *Aedes aegypti*; southern house mosquito; *Culex quinquefasciatus*; BG-lure^{TM}; high-throughput screening system; olfactometer; attractant; lure; dose response

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