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TRANSMITTED LIGHT AS ATTRACTANT WITH MECHANICAL TRAPS FOR COLLECTING NOCTURNAL MOSQUITOES IN URBAN BANGKOK, THAILAND

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ABSTRACT. Mosquito surveillance is the cornerstone for determining abundance, species diversity, pathogen infection rates, and temporal and spatial distribution of different life stages in an area. Various methods are available for assessing adult mosquito populations, including mechanical trap devices using different forms of attractant cues (chemical and visual) to lure mosquitoes to the trap. So-called "light traps" use various electromagnetic wavelengths to produce a variety of visible spectral colors to attract adult mosquitoes. However, this type of trapping technology has not been widely used in Thailand. This study compared the efficacy of 4 light-emitting diodes (LEDs) (blue, green, yellow, and red) and 2 fluorescent (ultraviolet [UV] and white) lights for collecting mosquitoes in urban Bangkok. Using a Latin square experimental design, 6 light traps equipped with different lights were rotated between 6 trap site locations within the Kasetsart University (KU) campus. Each location received 6 replicate collections (6 consecutive trap-nights represented 1 replicate) over 36 collection nights for a total of 216 trap-nights. Traps were operated simultaneously (1800 to 0600 h), with captured mosquitoes removed at 3-h intervals. In total, 2,387 mosquitoes consisting of 11 species across 5 genera (*Aedes*, *Anopheles*, *Armigeres*, *Culex*, and *Mansonia*) were captured. Collectively, *Culex* species represented the predominant group sampled (2,252; 94.4%). The UV light source captured 1,544 (64.7%) of the total mosquitoes collected, followed by white 389 (16.3%), with the 4 LED sources collecting between 6.8% (blue) and 1.9% (yellow). Traps equipped with UV light were clearly the most effective for capturing nocturnally active mosquito species on the KU campus.

KEY WORDS Adult mosquitoes, fluorescent, light-emitting diode, mechanical light trap, Thailand

INTRODUCTION

The mosquito genera considered of primary medical and veterinary importance are confined to *Aedes*, *Anopheles*, *Culex*, and *Mansonia*, and of these, only a relatively few species are regarded as a vectors of pathogens, primarily viruses, protozoa, and nematodes (Hay et al. 2004, Bhatt et al. 2013, Kollars et al. 2016). With a few exceptions (e.g., effective vaccines), primary prevention to reduce transmission risk remains dependent on various vector control tools supported by well-organized mosquito surveillance and control programs (Roberts et al. 1997, Chareonviriyaphap et al. 2004, Grieco et al. 2007). Routine monitoring of mosquito populations serves as a crucial indicator for estimating disease risk, directing timely control measures, and assessing program performance.

For female mosquitoes with obligatory blood-feeding, the human landing collection (HLC) method is considered the "gold" standard for obtaining indoor and outdoor measurements of anopheline and culicine mosquitoes attracted to humans, thus providing an estimate of biting activity for a variety of purposes (Muirhead-Thomson 1968, Kweka and Mahande 2009, Dusfour et al. 2010, Duo-Quan et al. 2012). However, HLC is very labor intensive, requiring trained and motivated collectors, extensive supervision, and resources generally absent or unsustainable for routine sampling in operational settings. Moreover, using unprotected humans and animals as attractants for host-seeking mosquitoes has safety and ethical concerns for the welfare of the host. Alternatively, animal (e.g., cow or buffalo)–baited collections using single- or double-net trap designs have limitations due to strong host specificity (i.e., selection bias) by some mosquitoes, thereby diminishing representative sampling of species diversity (Suwonkerd et al. 2002, 2004). Many types of trapping devices and sampling methods for adult female mosquitoes have been developed, in particular mechanical traps using some form of olfactory (e.g., carbon dioxide) or visually stimulating illumination (light source) as potential attractant (i.e., positive phototaxis) (Silver 2008). Mechanisms and environmental interactions governing mosquito visual responses and flight paths (e.g., orientation towards a target for long- and short-range attraction flights) are controlled primarily by visual or olfactory cues (Bidlingmayer 1994). Visual orientation alone to targets of interest is appetitive flight (endogenous-driven need), whereas attraction flights are "goal-oriented," involving an appropriate stimulus, either visual or olfactory or both.

The use of light traps to capture nocturnally active mosquitoes has a long history and continues to be one of the main methods for monitoring populations of mosquito vectors devoid of live bait cues (Mulhern 1934, Headlee 1937, Sudia and Chamberlain 1962, Muirhead-Thomson 1991, Silver 2008). Subsequent to those early developments, various light sources have been used in traps to enhance mosquito

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