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Research article

Laboratory evaluation of novel long-lasting insecticidal nets on *Aedes aegypti* L., using a high-throughput screening system

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Abstract

Vector-borne diseases, causing more than one million human deaths annually, account for more than 17% of all infectious diseases, especially malaria and dengue. Long-lasting insecticidal nets (LLINs) remain the mainstay of malaria vector control; however, the impact of LLINs on vector populations is unclear. In this study, the efficacy of LLINs was assessed under laboratory conditions against *Aedes aegypti*, using a high-throughput screening system (HITSS). Two different types of LLINs—LN A (candidate net) and LN B (reference net)—with unwashed and washed conditions were evaluated for three assays—contact irritancy assay, spatial repellency assay and toxicity response assay. The results showed that *Ae. aegypti* populations elicited a significant (p = 0.0022) escape response (contact irritancy) across all LLIN tests. Weak spatial repellency for all tests was observed. *Aedes aegypti* exposed to LN B (reference net) displayed a higher number of mosquito-escapees compared to LN A (candidate net). Washed LN B had a higher number escape (4.16±1.09 – 5.83±1.32) than unwashed LN B (4.17±0.79 – 5.33±1.38). Toxicity response was documented for all tested LLINs. The highest mortality was showed in washed LN B (100%). The results showed that two actions of LLINs were contact irritancy and toxicity.

Introduction

Dengue is one of the serious mosquito-borne diseases that remain public health issues in urban and suburban areas in the Americas, Asia, the Eastern Mediterranean, Africa and the Western Pacific (Messina et al., 2014). Dengue virus belongs to the Genus *Flavivirus* which comprises at least four serotypes namely Den-1, Den-2, Den-3, and Den-4 (Kumaria, 2010). It is transmitted by the bite of infective female *Aedes aegypti* L. and *Aedes albopictus* (Skuse) (Ferreira-de-Lima & Lima-Camara, 2018). Primary infection usually results in milder illness, while more severe symptoms occur in cases of repeated infection with different serotypes (Supradish et al., 2011). Almost 4 billion people in 128 countries are at risk of dengue infection spreads throughout more than one-half of the world's population (Brady et al., 2012; World Health Organization, 2017).

As no effective or commercial multi-valent dengue vaccine is readily available, prevention of this disease remains almost entirely dependent on various methods of vector control with control measures of mosquito-vectors remaining the most effective means of reducing virus transmission potential (Gubler, 1998; World Health Organization, 2012). Unfortunately, *Ae. aegypti* has proven very difficult to control because of its close association with humans and its exploitation of domestic and peridomestic environments. The standard control techniques are based on mechanical, chemical, and biological methods, including larval habitat control or elimination, and using more expensive approaches with chemical or biological means (Beier et al., 2008).

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