



Physical influence on larvicidal and pupicidal activity of the silicone-based monomolecular film

Warunee Ngrenngarmert^{a,*}, Chutipong Sukkanon^a, Rapeeporn Yaicharoen^a, Theeraphap Chareonviriyaphap^b

^a Department of Community Medical Technology, Faculty of Medical Technology, Mahidol University, Nakhon Pathom 73170, Thailand

^b Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok 10900, Thailand

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ABSTRACT

Although silicone-based monomolecular film (MMF) has been accepted as larvicide in several countries, its mosquito control potential has never been investigated in Thailand. Laboratory assessment in this study was conducted to determine the MMF efficacy against *Aedes aegypti*. At the recommended dosage (1 mL/m² of water surface), mortality of pupae (99.17 ± 0.83%) was significantly greater than mortality of old and young larvae (73.33 ± 9.13, 11.67 ± 3.47%; respectively). Pupicidal activity was rapidly exhibited within hours while larvicidal activity took at least one day. Interestingly, among the survived mosquitoes after MMF exposure, larval length (3.6 ± 0.18 mm), pupation (0%) and adult emergence (0%) were significantly less than the control group. Gravid females also avoided laying eggs in MMF-treated oviposition cups. There was no influence of physical factors on MMF efficacy and no toxic effects on fish and plants. These results indicated the MMF is promising to provide not only larvicidal and pupicidal activity but also inhibition of larval development as indicated by both larval length and stage transformation.

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1. Introduction

Mosquitoes play a significant role as vectors of infectious pathogens, especially dengue virus. More than billion people in tropical and subtropical countries are at risk of infection with dengue (Bhatt et al., 2013). Although therapy schemes are available for mosquito borne diseases, integrated mosquito management is critically required for interruption of disease transmission (World Health Organization, 2004). Insufficient and ineffective mosquito control measures have been proven by increasing incidence and the outbreak of diseases in many countries (Corbel et al., 2013; Zeller et al., 2013). Moreover, increasing resistance to common larvicides and insecticides in mosquito populations has challenged in searching new approaches of mosquito control (Chareonviriyaphap et al., 2013; Chuaycharoensuk et al., 2011; Nauen, 2007).

An organophosphate-based larvicide (temephos) has been routinely used in Thailand since 1950, but there is no perfect larvicide for every situation (Chareonviriyaphap et al., 2013). To strengthen mosquito control operation, the main direction of the plan focuses

on larviciding, the method of controlling juvenile mosquitoes while in larvae and pupae stages (Bureau of Vector Borne Disease, 2015). The combination of larvicides with different modes of action should be considered for controlling breeding sites. The monomolecular film (MMF) is a silicone-based liquid which rapidly spreads on water surface, forming a one molecule thick layer film which reduces water surface tension and restricts mosquito breathing. With physical action, the MMF holds great potential for being used in combination with other larvicides to provide better control than a single larvicide (Nayar and Ali, 2003; Nelder et al., 2010; Unlu et al., 2015).

The MMF has recently been introduced in Thailand as an additional control agent for larviciding. The objective of this study was to assess the efficacy of the MMF against all developmental stages of *Aedes aegypti* and also evaluated the residual larvicidal and pupicidal activity after the MMF was exposed to high temperature, ultraviolet light and acid or base pH. Both guppy fish and plants (African violet and Golden pothos) were used to determine potential non-target impacts of the MMF.

* Corresponding author.

E-mail addresses: warunee.ngr@mahidol.ac.th (W. Ngrenngarmert), c.sukkanon@gmail.com (C. Sukkanon), rapeeporn.yai@mahidol.ac.th (R. Yaicharoen), faasthc@ku.ac.th (T. Chareonviriyaphap).