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Cananga odorata (Magnoliales: Annonaceae) Essential Oil Produces Significant Avoidance Behavior in Mosquitoes

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Abstract

Essential oil of *Cananga odorata* Hook. F. & Tomson is a source of insect repellent, but contact irritancy and noncontact repellency actions that stimulate insect's avoidance behavior (escape away from chemical source after direct physical contact or without making physical contact, respectively) have not been investigated. Therefore, an excito-repellency test chamber was used for measuring avoidance behavior of four insectary-reared mosquito species (Diptera: Culicidae) that escape from esposure to four concentrations (0.5, 1.0, 2.5, and 5.0% v/v) of *C. odorata* oil. The oil strongly repelled both *Culex quinquefasciatus* Say (85–97% escape) and *Anopheles minimus* Theobald (97–99%) at high concentrations (2.5–5.0%). For *Anopheles dirus* Peyton & Harrison and *Aedes aegypti* (L.), highest repellency (64 and 39% escape, respectively) was demonstrated at 2.5% concentration. For contact irritancy, the oil produced relatively high percent escape found in *Cx. quinquefasciatus* (90–100% escape) and *An. minimus* (83–100%). Whereas moderate contact irritancy was observed against *An. dirus* (40–50% escape) and *Ae. aegypti* (51–59%). The percent escape was then adjusted with repellency to estimate the effect of contact irritancy alone. We found that highest contact irritancy was presented at 0.5% concentration against *An. minimus* (67% escape). Knockdown and toxic actions were only found in *Anopheles* mosquitoes at 5.0% concentration. The results revealed that *An. minimus* and *Cx. quinquefasciatus* were more prone to be repelled by *C. odorata* oil. Detailed analysis of oil identified primary compounds as methyl benzoate (14.6%), α-gurjunene (12.8%), *p*-methyl-anisole (11.3%), and benzyl acetate (9.9%). Further investigations are needed to assess excito-repellency actions of these compounds alone or in combination.

Key words: *Aedes*, *Anopheles*, *Culex*, excito-repellency, repellent

In view of increasing chemical resistance, studies of botanical-based repellents for personal bite protection against insect pests and vectors of disease pathogens have been expanding, particularly for mosquitoes (Chareonviriyaphap et al. 2013, Benelli and Pavela 2018). Various plants have traditionally been used as insect repellents by hanging plants inside houses, burning dried plants to produce smoke, or applying substances from crushed plant parts on the body (de Boer et al. 2010, Pavela and Benelli 2016). Most of the reported plant species are rich in essential oils, secondary metabolites produced by plants consisting of various volatile organic compounds (Nerio et al. 2010). Due to their promising efficacy and eco-friendly, essential oils have received attention for developing new green repellents (Nerio et al. 2010, Tisgratog et al. 2016). Although natural, botanical-based repellents appear, in general, to have a lesser degree of protective efficacy and provide a shorter duration of effect when compared with commercial synthetic products, this is not regarded as major limitation for use as bite prevention (Moore et al. 2002). In malaria endemic areas of Southeast Asia where early evening outdoor biting mosquito vectors are common (Tananchai et al. 2019), providing just a few critical hours of protection during this high-risk exposure

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