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COMPARATIVE EXCITO-REPELLENCY OF THREE CAMBODIAN PLANT-DERIVED EXTRACTS AGAINST TWO MOSQUITO VECTOR SPECIES, *AEDES AEGYPTI* AND *ANOPHELES MINIMUS*

CAMILLE DESGROUAS,[1,2] JIROD NARARAK,[1] RUNGARUN TISGRATOG,[1] VALERIE MAHIOU-LEDDET,[2] SOTHAVIREAK BORY,[3] EVELYNE OLLIVIER,[2] SYLVIE MANGUIN[4] AND THEERAPHAP CHAREONVIRIYAPHAP[1,5]

ABSTRACT. A study of the behavioral responses of *Aedes aegypti* and *Anopheles minimus* to 3 Cambodian plant extracts at 3 different concentrations (1%, 2.5%, and 5%) was performed using an excito-repellency test system. These 3 plants were *Strophanthus scandens, Capparis micracantha,* and *Dioscorea hispida,* selected according to traditional healer's knowledge, bibliographic studies and market surveys. Results showed that *S. scandens* leaves' hexane extract was the only one to exert repellency against *Ae. aegypti* with 23.3% of escaped mosquitoes at a concentration of 5%. *Capparis micracantha* was responsible for an irritant activity against *An. minimus* with 20.2% of escaped mosquitoes at a concentration of 2.5% and 22.8% escaping at a concentration of 5%. *Dioscorea hispida* showed an irritant activity on both mosquito species with 23.2% of escaped *Ae. aegypti* at a concentration of 5% and about 20% of escaped *An. minimus* at 2.5% and 5%. This is the first report on the irritant and repellent activities of *S. scandens, D. hispida,* and *C. micracantha* against mosquito species.

KEY WORDS *Aedes aegypti*, *Anopheles minimus*, behavior, Cambodian plant extracts, excito-repellency

INTRODUCTION

Aedes aegypti (L.) is a common mosquito species found in tropical and subtropical areas of Southeast Asia such as Thailand (WHO 2011). It is the primary vector of dengue viruses, and it also transmits yellow fever, chikungunya, and Zika viruses (Marchette et al. 1969, Morrison et al. 2008). This species is a domestic and day-biting mosquito and preferentially feeds on humans (WHO 2014). In contrast, *Anopheles minimus* (Theobald) is considered one of the most important malaria vectors in Southeast Asia (Manguin et al. 2008, Sinka et al. 2011). In Thailand, *An. minimus* is commonly found in rural forested areas that border Malaysia, Cambodia, and most importantly Myanmar (Manguin et al. 2010, Suwonkerd et al. 2013).

The prevention and control of dengue and malaria remain dependent on various vector control strategies to decrease transmission risk. Most of them are based on the use of chemical adulticides such as in indoor residual spraying (IRS) and insecticide-treated materials with various pyrethroids (Chareonviriyaphap et al. 2000, 2013). Recent review has reported the spread of pyrethroid resistance in several *Aedes* and *Anopheles* mosquitoes, although in Thailand the main malaria vectors still do not show resistance (Chareonviriyaphap et al. 2013), unlike Vietnam (Van Bortel et al. 2008). Thus, insect repellent properties of specific plant extracts or bio-insecticides represent interesting alternative methods for vector control programs. To date, no resistance of mosquitoes to natural insecticides has been reported. The use of natural molecules in vector control programs is recent, and research on bio-insecticides less toxic to humans and the environment could reduce health risk and help preserve biodiversity.

Chemicals protect humans from the bite of mosquitoes by at least 3 different actions: irritating, repelling, or killing the insects (Roberts et al. 2000, Grieco et al. 2007). Most studies have focused on the killing function of chemicals whereas few studies have been done on the nontoxic actions (Boonyuan et al. 2014; Noosidum et al. 2014; Sathantriphop et al. 2014a, 2014b). In this context, the use of the excito-repellency test system is well adapted for the study of the nontoxic properties of natural compounds on the main malaria and dengue mosquito vectors (Chareonviriyaphap et al. 2002). Two different nontoxic properties are observed when mosquitoes are exposed to chemicals. Irritancy is determined by the escape of mosquitoes from the chamber after physical contact with the residual chemical. Repellency corresponds to the avoidance of a treated surface by mosquitoes without physical contact (Roberts et al. 1997).

Actually, traditional plants are used to repel insects and provide a popular protection measure. Plant-based compounds could also decrease problems of toxicity to nontarget organisms and resistance of mosquitoes to synthetic insecticides. In recent years, commercial repellent products contain-

[1] Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok, Thailand.
[2] Laboratoire de Pharmacognosie et d'Ethnopharmacologie, UMR-MD3, Faculté de Pharmacie, Aix-Marseille Université, France.
[3] Faculty of Pharmacy, University of Health Sciences, Phnom Penh, Cambodia.
[4] Institut de Recherche pour le Développement (IRD), Laboratoire d'Immuno-Physiopathologie (LIPMC), UMR-MD3, Faculté de Pharmacie, Montpellier, France.
[5] To whom correspondence should be addressed.