



Diversity and biting patterns of *Anopheles* species in a malaria endemic area, Umphang Valley, Tak Province, western Thailand

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ABSTRACT

Malaria is highly endemic in Umphang Valley, a district in the western edge of Tak Province, along the boundary with Kayin State of Myanmar. Although there are high indigenous malaria cases in this area every year, nothing about malaria vectors and their transmission role have been investigated before this study. The objective of this work is to characterize the *Anopheles* species diversity and trophic behavior of malaria vectors in the transmission area of Umphang Valley. Females of *Anopheles* mosquitoes were collected every two months during a two-year period. Mosquito collections were using standard collection technique, indoor and outdoor human landing collections and outdoor cattle bait collection. *Anopheles* mosquitoes were identified using morphological characters and multiplex AS-PCR assay for the identification of sibling species within groups and complexes present. From a total of 16,468 *Anopheles* females, 2723 specimens (16.54%) were collected from humans and 13,745 specimens (83.46%) were captured from cattle. From human landing collections, 2447 specimens (89.86%) of *Anopheles minimus* were obtained, followed by 119 *Anopheles peditaeniatus* (4.37%), 62 *Anopheles maculatus* (2.28%), 17 *Anopheles dirus* (0.6%), 15 *Anopheles aconitus* (0.5%) and 6 *Anopheles sawadwongporni* (0.2%) respectively. Seven putative malaria vectors, including *An. minimus*, *An. dirus*, *An. baimaii*, *An. sawadwongporni*, *An. maculatus*, *An. pseudowillmori* and *An. aconitus* were documented from this study and trophic behavior of each respective species were observed. Such information is definitely crucial for defining the vector capacity of each single species and for designing appropriate vector prevention and control strategies against target vector species.

1. Introduction

Malaria remains a serious vector-borne disease in Southeast (SE) Asia with a burden ranking second after sub-Saharan Africa (WHO, 2017). The disease is the leading cause of death among children under five years of age and pregnant women, especially in sub-Saharan Africa and every year it is responsible for more than 200 million estimated cases worldwide. In SE Asia, approximately 1.35 billion people are still at risk of malaria with an estimated 14.6 million cases and 26,600 deaths in 2016. *Plasmodium falciparum* and *P. vivax* are the most common malaria species (WHO, 2017). Eighty-nine percent of the malaria cases in SE Asian countries were reported from India, followed by Indonesia (9%) and Myanmar (2%). However, malaria continues with high risk in unmanageable foci, especially areas along the

international borders (WHO, 2017). Furthermore, the malaria situation in SE Asian is of high concern due to the emergence of resistance of *P. falciparum* to anti-malarial drugs such as chloroquine (CQ), sulfadoxine-pyrimethamine (SP), mefloquine (MQ), artemisinin (ART), and artemisinin combination therapies (ACT) (Ariey et al., 2014; Guyant et al., 2015; WHO, 2017).

In Thailand, the highest peak of malaria cases was reported in 1988 with around 350,000 cases and the number of cases drastically reduced to < 100,000 cases in 1995 in response to organized malaria control programs and efforts (Chareonviriyaphap et al., 2000; Manguin et al., 2010). Currently, a total of 10,505 Thai and 4186 foreigner cases were officially reported in 2017 (BVBD, 2017b). There is an approximately 5.4 million people at high risk of malaria, especially along the international border areas where transmission occurs in hot-spots (WHO,

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