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Prevalence of *Plasmodium* spp. in *Anopheles* mosquitoes in Thailand: a systematic review and meta-analysis

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Abstract

Background: The entomological inoculation rate (EIR) is one of the key indices used to evaluate malaria transmission and vector control interventions. One of the components of the EIR is the sporozoite rate in *Anopheles* vectors. A systematic review and meta-analysis was performed to identify the prevalence of *Plasmodium* spp. in field-collected *Anopheles* species across Thailand.

Methods: This systematic review was registered under the PROSPERO number CRD42021297255. Studies that focused on the identification of *Plasmodium* spp. in *Anopheles* mosquitoes were identified from the electronic databases PubMed, Web of Science, and Scopus. The quality of the identified studies was determined using the Strengthening the Reporting of Observational Studies in Epidemiology approach. The proportion of *Anopheles* mosquitoes collected, *Anopheles* vectors for *Plasmodium* species, and specificity of *Anopheles* vectors for *Plasmodium* species were analyzed. The pooled prevalence of *Plasmodium* species among the primary vectors (*Anopheles dirus*, *Anopheles minimus*, and *Anopheles maculatus*) was estimated using the random-effects model.

Results: Of the 1113 studies identified, 31 were included in the syntheses. Of the 100,910 *Anopheles* mosquitoes identified for species and sibling species, *An. minimus* (40.16%), *An. maculatus* (16.59%), and *Anopheles epiroticus* (9.18%) were the most prevalent *Anopheles* species. Of the 123,286 *Anopheles* mosquitoes identified, 566 (0.46%) were positive for *Plasmodium* species. The highest proportions of *Plasmodium* species were identified in *Anopheles hodgkini* (2/6, 33.3%), *Anopheles nigerrimus* (2/24, 8.33%), *Anopheles balabacensis* (4/84, 4.76%), *An. dirus* (114/4956, 2.3%), *Anopheles annularis* (16/852, 1.88%), *Anopheles kochi* (8/519, 1.54%), *Anopheles vagus* (3/215, 1.4%), and *Anopheles baimaii* (1/86, 1.16%). The pooled prevalence of *Plasmodium* species identified in the main *Anopheles* vectors was 0.4% of that of *Plasmodium* species identified in *An. dirus* was 2.1%, that of *Plasmodium* species identified in *An. minimus* was 0.4%, and that of *Plasmodium* species identified in *An. maculatus* was 0.4%.

Conclusions: We found a low prevalence of *Plasmodium* infection in *Anopheles* mosquitoes across Thailand. Therefore, the use of EIR to determine the impact of vector control intervention on malaria parasite transmission and elimination in Thailand must be undertaken with caution, as a large number of *Anopheles* specimens may be required.

Keywords: *Plasmodium*, *Anopheles*, Thailand, Meta-analysis

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Background

Malaria is one of the major causes of morbidity and mortality in the Greater Mekong Subregion countries, including Thailand [1, 2]. Thailand is located at the center of

