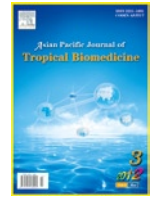




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Unusual developing sites of dengue vectors and potential epidemiological implications

Hamady Dieng^{1*}, Rahman GM Saifur¹, Abu Hassan Ahmad¹, MR Che Salmah¹, Al Thbiani Aziz¹, Tomomitsu Satho², Fumio Miake², Zairi Jaal¹, Sazaly Abubakar³, Ronald Enrique Morales⁴

¹School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia

²Faculty of Pharmaceutical Sciences, Fukuoka University, Fukuoka, Japan

³Department of Medical Microbiology, University of Malaya, Kuala Lumpur, Malaysia

⁴Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand

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ABSTRACT

Objective: To identify the unusual breeding sites of two dengue vectors, *i.e.* *Aedes albopictus* (*Ae. albopictus*) and *Aedes aegypti* (*Ae. aegypti*). **Methods:** During the second half of 2010, we performed an occasional survey in rural (Teluk Tempoyak) and urban (Gelugor) areas of Penang Island, Malaysia, to identify cryptic breeding sites. **Results:** In the rural area, we found heterogeneous immature stages of *Ae. albopictus* in the water bowl of an engaged bird. We also observed *Ae. aegypti* eggs deposited in the flush tank of a toilet in the urban area. **Conclusions:** It can be concluded that both breeding patterns can increase contact with hosts (humans and birds) and presumably population densities of *Ae. albopictus* and *Ae. aegypti*, thereby potentially boosting the risks for spread and transmission of arboviral diseases.

1. Introduction

Originating in Africa^[1], *Aedes aegypti* (*Ae. aegypti*) can now be found in many urbanized areas around the world^[2,3], due to its ability to breed in habitats close to humans^[4]. This characteristic is shared with another particularly invasive mosquito species, *Aedes albopictus* (*Ae. albopictus*)^[5,6]. Previously believed to be restricted to South–East Asia forests^[7], *Ae. albopictus* has become well established in the western hemisphere^[8]. These two *Aedes* mosquito species act as vectors of dengue^[9], a human disease caused by one of four closely related but antigenically distinct virus serotypes belonging to the genus *Flavivirus*^[10]. About 50%–60% of the projected global population in 2085 is expected to be at risk for dengue transmission^[11]. To date, an estimated 2.5 billion people are at risk of dengue globally, more than 70% of whom reside in countries in the Asia Pacific region^[12].

In Malaysia, a total of 33 684 people were infected with dengue viruses in 2009^[12]. As of October 2010, there have been 40 152 cases and 118 deaths in Malaysia^[12]. In this country, *Ae. aegypti* was first found during the 20th century in coastal towns^[13]. By 1920, it had already moved inland^[14] and has been considered to be main vector of dengue since the early 1950s^[7]. Suspected dengue transmission by *Ae. albopictus* was first reported in 1958 by Smith, who also reported that this mosquito was breeding in forest canopies. *Ae. albopictus* is now known to breed inside homes on Penang Island, where *Ae. aegypti* is also present^[15].

Measures to control the spread of dengue and related diseases are dependent on how well vector management programs can target the areas where the vectors breed and develop. The main vector, *Ae. aegypti*, is highly anthropophilic^[16] and prefers to feed during the day and to rest inside houses. Female *Ae. aegypti* shows a preference for laying their eggs in domestic containers^[17], but may also use rainwater–accumulating containers present in peridomestic environments^[18,19]. This ability to utilize many containers near human dwelling areas combined with its

*Corresponding author: Dr. Hamady Dieng, School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia.

Tel: +6010-3887158

E-mail: hamachan1@yahoo.com

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