Environmental Science and Pollution Research (2018) 25:13833–13843
https://doi.org/10.1007/s11356-017-1078-8

RESEARCH ARTICLE

Occurrence of sweet refuse at disposal sites: rainwater retention capacity and potential breeding opportunities for *Aedes aegypti*

Hamady Dieng[1] · Tomomitsu Satho[2] · Nur Khairatun Khadijah Binti Meli[3] · Fatimah Abang[3] · Cirilo Nolasco-Hipolito[3] · Hafijah Hakim[1] · Fumio Miake[2] · Wan Fatma Zuharah[4] · Nur Faeza A Kassim[4] · Abdul Hafiz Ab Majid[4] · Ronald E. Morales Vargas[5] · Noppawan P. Morales[6] · Gabriel Tonga Noweg[1]

Received: 27 July 2017 / Accepted: 18 December 2017 / Published online: 6 March 2018

Abstract

Nectar is the staple diet of adult mosquitoes in the wild, but its availability is inconsistent and can be affected by rainfall. In urban centers, *Aedes* vectors commonly use man-made containers as their major habitat; however, they can colonize any items replenished by rainfall. Garbage output has increased significantly in recent years, at a time when collection frequency is reducing. Such garbage usually includes organic components, some of which are sweet and can be fed upon by other animals or become can containers for rainwater. Despite evidence that *Aedes* larvae can thrive in containers comprised of organic waste material, which can be produced by rodents gnawing on fruits or vegetables, and that adults can survive on sweet waste fluids, the capacity of organic waste materials to accumulate rainwater and act as egg deposition sites has not been examined. It is also unknown for how long sweet extracts can sustain the life of adult vectors. Here, we investigated the abundance of sweet leftovers at garbage sites and the rainwater retention capacity of some organic materials through a field survey and laboratory bioassays. We also examined whether sweet waste fluids impact egg hatching success and longevity of *Aedes aegypti*. The results of this study indicated that sweet products with leftovers are highly prevalent in garbage. When exposed to rain, food items (BAFrc, banana fruit resembling container; and BSPrc, boiled sweet potato resembling container) and the packaging of sweet foods (SMIc, sweetened condensed milk can) retained water. When provided an opportunity to oviposit in cups containing BAF extract (BAFex), BSP extract (BSPex), and SMI extract (SMIex), eggs were deposited in all media. Egg maturation in the BAFex environment resulted in similar larval eclosion success to that resulting from embryo development in a water milieu. Adults maintained on sweet waste extracts had long lifespans, although shorter than that of their sugar solution (SUS)-fed counterparts. Taken together, these results indicated that sweet waste materials are useful to dengue mosquitoes, acting both as oviposition sites and energy sources.

Responsible editor: Philippe Garrigues

✉ Hamady Dieng
hamachan1@yahoo.com

[1] Institute of Biodiversity and Environmental Conservation (IBEC), Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Kuching, Kota Samarahan, Malaysia

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

[3] Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Kota Samarahan, Malaysia

[4] School of Biological Sciences, Universiti Sains Malaysia, Penang, Malaysia

[5] Department of Medical Entomology, Faculty of Tropical Medicine, Mahidol University, Ratchathewi, Bangkok, Thailand

[6] Department of Pharmacology, Faculty of Science, Mahidol University, Ratchathewi, Bangkok, Thailand

Keywords *Aedes aegypti* · Garbage · Sweet waste · Rain · Oviposition · Larval eclosion · Lifespan

Introduction

The mosquito, *Aedes aegypti*, is present in many parts of the world and is still a public health problem in developing countries where it is endemic (Weaver and Reisen 2010; WHO/PAHO 2016). This mosquito is a vector of many viral diseases that adversely affect human health worldwide, including Zika virus, which hinders reproductive health, pregnancy, and the developing fetus (Hennessey et al. 2016; CDC 2016), and dengue viruses, which place 2.5 billion people at risk and are responsible for about 24,000 deaths annually (WHO 2013; International Society for Infectious Diseases/ProMED-mail 2017). The ability of this mosquito to persist in these