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Effect of delayed mating on reproductive performance and life-history parameters of dengue vector *Aedes aegypti*

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Abstract

Dengue is a fast-spreading mosquito-borne viral disease in the world. The primary vector of the disease is *Aedes aegypti* of the family Culicidae. It is a container breeder. Since a vaccine or a drug has not been developed against dengue, vector control appears to be the best method so far to control dengue. The current study was conducted to determine the effect of delayed mating on fecundity, fertility, life-history parameters, and longevity of *Ae. aegypti*, because such information can help formulate integrated vector control strategies involving the release of sub-fertile males into the environment. During this study, mating was delayed by 0, 2, 5, and 8 days after emergence. Males and females were separated by hand at the pupal stage using the apparent size difference of the sexes. The separated pupae were kept in separate cages until emergence. When mating was delayed for 8 days, the number of eggs laid by the female declined by 38%, and the percentage number of eggs that hatched reduced by 24%. However, the percentage of larval mortality, duration of the larval and pupal periods, and adult longevity were not significantly affected. The current results indicate that delayed mating has a negative effect on the reproductive performance of vector mosquitoes.

Introduction

There are medically important mosquitoes that transmit diseases to humans. Their capability for disease transmission determines the medical importance of mosquitoes. Most mosquitoes are vectors of infections caused by viruses, protists, and nematodes (Agudelo *et al.*, 2021). *Aedes* mosquitoes transmit dengue, chikungunya, yellow fever, and Zika viruses to humans. Currently, dengue is the most important vector-borne disease caused by the DEN virus. Depending on the geographic area, several *Aedes* species, *Aedes aegypti*, *Aedes albopictus*, *Aedes polynesiensis*, and other members of the *Aedes scutellaris* group act as vectors for dengue virus transmission (Gubler, 1998). Vitarana *et al.* (1997) stated that, in Sri Lanka, *Ae. aegypti* serves as the primary vector while *Ae. albopictus* serves as the secondary vector.

Female *Ae. aegypti* is monogamous (Craig, 1967; Spielman *et al.*, 1967), and they accept the sperms from only one male, although they copulate with many males (Hausermann and Nijhout, 1975). They start to copulate soon after the emergence from the pupae (Gwadz and Craig, 1968). Even if they copulate soon after emergence, females may not be inseminated as they become receptive to insemination only after 48–72 h of emergence (Gwadz and Craig, 1968). Furthermore, it takes about 15–24 h for the male genitalia to rotate 180°, which is necessary for successful insemination (Hartberg, 1971). The time lag after emergence for females to become receptive to insemination and males to undergo rotation of genitalia to effect successful sperm transfer allows the newly emerged females to disperse from the site of emergence and mix with the population before being inseminated. Ultimately, this prevents inbreeding and facilitates evolution through genetic mixing (Hartberg, 1971). Thus, it ensures that mating does not occur in the breeding sites.

The global incidence of dengue has increased from 8.3 million in 1990 to 58.4 million in 2013 (Stanaway *et al.*, 2016). Annually, 390 million new dengue cases are reported from 128 dengue-endemic countries (Bhatt *et al.*, 2013). Dengue control measures used by most countries rely heavily on insecticides, but the trend towards an integrated approach is evident in many countries, including Sri Lanka. Thus, an understanding of the life history, habitats, and other aspects of the ecology of the vector is vital towards this end.

Since an operative vaccine or a drug has not yet been developed to treat dengue, vector control is the only effective way to regulate the dengue (De Valdez *et al.*, 2011). The conventional approaches used to control the vector embrace source reduction, spraying larvicides, fumigation, and the use of *Bacillus thuringiensis israelensis* bacteria. Chemical controlling methods are delimited as they are toxic to humans, affect non-targeted species, and progress insecticide resistance (Dorta *et al.*, 1993; Denholm *et al.*, 2002; Teixeira *et al.*, 2003).

Various pheromones act as mating disruptors; besides, they delay the mating or prevent the mating of insects (Vickers, 1992). The upshot of delayed mating diverges among different