Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage:www.elsevier.com/locate/apjtb

Document heading

Insecticide susceptibility of the dengue vector *Aedes aegypti* (Diptera: culicidae) in Makkah City, Saudi Arabia

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ARTICLE INFO

Article history:
Received 5 April 2011
Received in revised form 21 April 2011
Accepted 20 May 2011
Available online 1 June 2011

Keywords:
Aedes aegypti
Insecticide
Makkah
Saudi Arabia
Susceptibility

ABSTRACT

Objective: To examine the insecticide susceptibility of *Aedes aegypti* (*Ae. aegypti*) from various sites in Makkah City, Saudi Arabia. **Methods:** This was examined based on WHO standard procedures. **Results:** The larvae of *Ae. aegypti* were susceptible to all larvicides examined, but this susceptibility was more pronounced in wild populations, which tended to show tolerance to icon. Icon was the most effective larvicide with LC_{50} values of 0.007 ppm and 0.012 ppm for the laboratory and field strains, respectively. *Ae. aegypti* adults exposed to lambda-cyhalothrin showed a low mortality rate in comparison with those exposed to deltamethrin and cyfluthrin. **Conclusions:** The results of the present study indicate differential susceptibility between field and laboratory larval populations. Wild larvae are less susceptible to insecticide treatments than their laboratory-bred counterparts. Taken together, these results suggest that tolerance and the tendency toward resistance to commonly used insecticides are present in *Ae. aegypti* populations throughout Makkah City, Saudi Arabia.

1. Introduction

With the increased development of transportation, there is a concern among epidemiologists regarding the eventual effects of the movements of humans on the evolution of arboviral infections[1]. Diseases most likely to become a public health threat include dengue, outbreaks of which are now possible anywhere and at any time[2,3]. Reasons for these outbreaks include unplanned urban growth, which has resulted into the proliferation of breeding sites. There has also been an increase in diversity of serotypes, *i.e.*, DEN-1, DEN-2, DEN-3, and DEN-4[4], being introduced into new regions[5].

In Saudi Arabia, *Aedes* mosquitoes have been implicated in many arboviral infection epidemics including outbreaks of dengue[6,7]. Three serotypes of dengue (DEN-1, DEN-2, DEN-3) were first detected in Jeddah in 1994[8]. Concomitant with these disease occurrences, there has been an increase in the distribution of *Aedes aegypti* (*Ae. aegypti*) throughout the country. El-Badry *et al* reported the recent establishment of viable populations in Al-Madinah Al-Munawwarah where the mosquito was previously unknown[9]. This mosquito has recently been incriminated in dengue epidemics in some areas, including Makkah, a city in Western Saudi Arabia. Fifty-five cases of dengue were reported in this city in 2008[10], with a marked increase in the incidence of the disease thereafter[11]. As the city holds the Kaaba, the most sacred site in Islam, it is a pilgrimage point for Muslims worldwide. Millions of Muslim pilgrims visit Makkah annually[12]. Thus, the huge influx of visitors from dengue-endemic areas and the presence of ecological features conducive to the spread of *Ae. aegypti* (*i.e.*, uncovered domestic water storage, warm climate, well-developed transport network) have crucial public health significance, and there is a concern with respect to the possibility of large-scale dengue outbreaks.

Current efforts to control mosquito-borne diseases rely heavily on insecticides, the mainstream vector control strategy in many countries, including the Kingdom of Saudi Arabia. In this country, the application of larvicides

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