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 LC₅₀ 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