Biochemical Systematics and Isozyme Expression in Insectiside Susceptible and Resistant *Anopheles albimanus* Wiedemann Populations

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ABSTRACT Isozymes of 6 test populations of *Anopheles albimanus* Wiedemann were compared using starch gel electrophoresis. Tests were performed on laboratory colonies from El Salvador, Guatemala, and Mexico, and 3 wild caught populations from Belize. From a total of 31 enzyme systems, 24 were consistently detected and 35 putative loci were scorable. Higher genetic variability was found in the 3 wild caught populations from Belize and the young colonies (2 years in the laboratory) from Guatemala and Mexico. Mean heterozygosity values of populations from Belize and the young colonies from Guatemala and Mexico ranged from 0.093 to 0.200, compared with 0.057 of the old colony (20 years in laboratory) from El Salvador. Detailed analyses showed all 6 populations of *An. albimanus* to be conspecific with minor instraspecific variations. Zymograms were compared among 6 test populations of *An. albimanus*, including a pyrethroid resistant colony from Guatemala (El Salvador). One locus of esterase, *Est-3*, was found to be diagnostic for separating susceptible and resistant populations. Since esterase was consistently elevated in the resistant population, we conclude that esterase may be specifically involved in the metabolic detoxification pathway in a pyrethroid resistant population. Due to regular agricultural use of organophosphate and carbamate insecticides in Guatemala, the elevated esterase activity in El Semillero colony also may be associated with these 2 compounds. Therefore, the elevated esterases in wild *An. albimanus* populations may be related to the exposure to organophosphate, carbamate, pyrethroids, or all 3 compounds, and may limit insecticide use against *An. albimanus* populations in parts of Central America.

KEYWORDS: isozyme, malaria vector, insecticide, resistance.

INTRODUCTION

Anopheles albimanus Wiedemann (Diptera: Culicidae) is widely distributed throughout the neotropics of the Americas.[1] This species has been incriminated as an important malaria vector in Southern Mexico, Central America and Northern South America.[2] *Anopheles albimanus* is resistant to most known insecticides used in public health along the coastal areas of Central America.[3,4] Many insecticide resistance mechanisms have been progressively reported in arthropods of medical importance.[5] Enzyme detoxification, by modifying or increasing endogenous enzymes within the insect, is major mechanism of resistance.[6] O-demethylase was reported to be the primary detoxification enzyme of methoprene in the house fly, *Musca domestica*.[7] Carboxylesterases, phosphotriesterases, acetylcholinesterases and glutathion-dependent-transferases are important in organophosphate resistance.[6] Detoxification of pyrethroids by elevated esterases in numerous populations of *An. albimanus* may limit the usefulness of pyrethroids for malaria control in the Americas.[8] Elevated esterase levels correlated well with the survival rate of *An. albimanus* after exposure to synthetic pyrethroids.

Biochemical differences exist within the same detoxification enzymes between susceptible and resistant insects. Therefore, several studies on insecticide resistance have focused on electrophoretic analyses, and this technique can serve as a means of identifying resistant genotypes in mosquito populations.[6]

Electrophoretic methods have been used since 1960[9] for the study of genetics and evolutionary