ASSESSMENT OF IMPACTS OF INDOOR RESIDUAL HOUSE SPRAYING (IRHS) ON THE DIVERSITY, ABUNDANCE AND DISTRIBUTION OF HUMAN MALARIA VECTORS IN CHONGWE DISTRICT, ZAMBIA

By

Osbert Namafente (BSc, UNZA)

AUGUST, 2012

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Osbert Namafente (BSc, UNZA)

A dissertation submitted to the University of Zambia in Partial Fulfillment of the requirements of the degree of Master of Science in Entomology.

University of Zambia
Lusaka, Zambia
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DECLARATION

I, **Osbert Namafente**, hereby declare that this dissertation represents my own work and that it has not been previously submitted for a degree, at this or any other University.

Signature

Date

APPROVAL

This dissertation of **Osbert Namafente** is approved as fulfilling part of the requirements for the award of the degree of Master of Science in Entomology by the University of Zambia.

Signature: **Date:**

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Prof. E.T. Mwase
Internal Examiner

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Dr. P.O.Y Nkunika
Internal Examiner

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Dr. C.J. Shinondo
Internal Examiner

DEDICATION

I dedicate this dissertation to my parents, my wife Mutinta, and my son Busongo

ABSTRACT

Dominant human malaria vectors in Chongwe district, Zambia, were identified and impacts of indoor Residual House Spraying (IRHS) on their diversity, abundance and distribution assessed. A case-control type of study design was used in which Chishiko village in the district was the case in point, where houses had been sprayed with DDT insecticide during the 2008-2009 malaria transmission period through a government of Zambia sponsored IRHS programme and Chiota village was the control, where houses had not been sprayed with any insecticide during the period. Specific objectives of the study were to: Identify and classify endophilic mosquito species of Chongwe district, using morphological methods and molecular methods and to assess effects of IRHS on the diversity, abundance and distribution of human malaria vectors in the district. Three hypotheses were tested in the study namely that: Endophilic mosquito species of Chongwe District did not include malaria vector species; The major vector of human malaria in the district was not an *Anopheles gambiae* complex sibling species; and that the IRHS malaria vector control programme being implemented in the district had no effect on the diversity, abundance and distribution of human malaria vectors in the district. Indoor-resting mosquitoes of the study area were collected for identification and classification through spray-catch sampling of 72 randomly selected houses in two villages of the study area. Mosquito identification was both morphological using taxonomic dichotomous identification keys for all indoor-resting mosquitoes collected from the houses and molecular, using polymerase chain reaction (PCR) assays sibling species belonging to the *Anopheles* species complexes among them. Vector abundance in the villages was determined through computations of mosquito mean densities and comparison of these using ANOVA, while the variance: Mean ratio ($S^2/\overline{x}$) was used to determine vector distribution patterns in the study areas. Two endophilic mosquito species were identified in the study area by the morphological

method used namely: *Culex quinquefasciatus* Say 1823, *Anopheles squamosus* Theobald, 1901. Additionally, there were 11 mosquito specimens collected from the study areas that keyed out as sibling species of the *Anopheles gambiae* complex using morphological method. Molecular characterization of the *Anopheles gambiae* complex sibling species specimens using PCR revealed that all 11 specimens were *Anopheles arabiensis* Patton, 1905, indicating that this was probably the dominant human malaria vector species in Chongwe district. The alpha (α) index of diversity used to estimate the mosquito species diversity of the study area put the number of endophilic mosquitoes in the district at three. The most abundant mosquito species collected from the study area was *C. quinquefasciatus* (78.6%), followed by *A. arabiensis* (13.1%) while *A. squamosus* accounted for 8.3% of the mosquito samples collected. The difference in abundance of *C. quinquefasciatus* between the two study areas was not significant ($p = 0.1127$), while that of *Anopheles* species, was significant ($p < 0.05$). Mosquito distribution in the study area was aggregated ($S^2 >$ x-bar). There was some indication of positive impact of the IRHS programme on the abundance and distribution of human malaria mosquito vectors. But a longitudinal study would be needed to make the results more conclusive about the effects of the IRHS programme in Chongwe district.

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LIST OF ABBREVIATIONS AND ACRONYMS

bp: base pair.

BSA: Bovine Serum Albumin.

ddH_2O: Double Distilled Water.

DDT: dichlorodiphenyltrichloroethane.

DNA: Deoxyribonucleic acid.

dNTPs: Deoxyribonucleotidetriphospates

EDTA: Ethylenediamineteraacetic Acid

ITNs: Insecticide Treated Nets.

MoH: Ministry of Health.

NMCC: National Malaria Control Center.

PBS: Phosphate Buffered Saline.

PCR : Polymerase Chain Reaction.

TBE: Tris-Borate-EDTA.

TDR: Tropical Diseases Research.

UNDP: United Nations Development Plan.

UNICEF: United Nations Children Emergency Fund.

W/V: Weight per Volume.

WHO: World Health Organization.

µl: Microlitre.

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