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INSECTICIDE RESISTANCE IN MALARIA VECTORS IN CENTRAL SUDAN

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A dissertation submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science.

Johannesburg, January 2007.

DECLARATION

I,……declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

……..

January 2007

ABSTRACT

Malaria is the leading cause of mortality and morbidity in Sudan. The annual malaria cases and deaths are estimated at 7.5 million and 35, 000 respectively. One of the possible factors that have led to this situation is the development of insecticide resistance in the main malaria vector in Sudan, *Anopheles arabiensis*.

This study therefore, was initiated to identify the malaria vectors in Gezira and Sennar states of central Sudan, determine their susceptibility levels to the different classes of insecticides used for malaria vector control, identify mechanisms of resistance, and determine the sporozoite infection rate and the blood meal sources in these populations.

The polymerase chain reaction (PCR) for species identification revealed that *An. arabiensis* was the only member of the *An. gambiae* complex present in the study area. The blood meal analysis using ELISA showed high anthropophily with 89.2% feeding on humans. The overall sporozoite infection rate was 2.3 %. WHO susceptibility tests showed complete susceptibility of *An. arabiensis* to bendiocarb (100% mortality) and multiple resistance to permethrin (54-78%), DDT (55-66%) and malathion (76-78%).

The *kdr* mutation analysis revealed the presence of the West African *kdr* allele with the majority of specimens being heterozygous (RS). The *kdr* in DDT/permethrin susceptible specimens were: 15% homozygous for the *kdr* mutation (RR), 64.2% heterozygous (RS) and 20.8% homozygous for the susceptible allele (SS). Amongst the DDT/permethrin resistant specimens, 13% were SS, 48.7% RS and 38.3% RR. The apparent lack of

correlation between *kdr* and resistant phenotype strongly suggests that other resistance mechanisms are playing a role.

DEDICATION

To the memory of my grandfathers.

To my grandmother, my parents, my sisters and my brothers. Without you, my life would fall apart. I might not know where the life's road will take me, but walking with you through this journey has given me strength.

Publications and Presentations Arising from this Study

Publication

Matambo, T.S., Abdalla, H., Brooke, B.D., Koekemoer, L.L., Mnzava, A., Hunt, R.H., and Coetzee, M. (2007). Insecticide resistance in the malarial mosquito *Anopheles arabiensis* and association with the *kdr* mutation. *Journal of Medical and Veterinary Entomology*, 21, 97–102. (See Appendix III).

Presentation

Abdalla, H. M., Koekemoer, L. L., Mnzava, A. P., Hunt R. H and Coetzee, M. (2006). *Anopheles arabiensis* from Sudan: insecticide resistance and the West African *kdr* mutation. *Poster presentation at the NICD Academic Day,* 28-29 November, 2006. (See Appendix IV).

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