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Malaria parasite metabolite and mosquito vector dynamics

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Malaria parasite metabolite and mosquito vector dynamics

Erica Erlank

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 in Medicine

Johannesburg, 2021

Declaration

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

EERLANK
_____
(Signature of candidate)

15th day of September 2021

Abstract

Plasmodium falciparum makes its human host more attractive for its vector companion, the *Anopheles* mosquito. Once in the host, the malaria parasite synthesizes isoprenoids via the 2-C-methyl-D-erythritol 4-phosphate pathway. The precursor for isoprenoids in this pathway is known as (E)-4-hydroxy-3-methyl-but-2-enyl pyrophosphate (HMBPP). HMBPP activates red blood cells to release volatile organic compounds that acts as an attractant to the mosquito to stimulate blood feeding. Only a few anopheline mosquito species are known to transmit the human malaria parasite. These mosquitoes can be classified as either major or minor vectors, depending on their impact on malaria transmission. The main African malaria vectors are responsible for 95% of malaria cases while minor vectors contribute to the remaining 5%.

During this study, the aim was to evaluate if HMBPP influences *P. falciparum* susceptibility, feeding rate and attraction in major, minor and non-vector mosquito species. The standard membrane feeding assay was used to artificially infect mosquitoes and evaluate feeding rate, whereas attraction assays was conducted with a dual choice chamber.

Results revealed that both the major vector, *An. gambiae s.s.*, and the minor vector, *An. merus,* had an increase in both prevalence and intensity of parasite oocysts. An increase in feeding rate and attraction was also observed for some vectors, in the presence of HMBPP. These findings could play an important role in understanding the role of parasite volatiles in malaria transmission.

Ethics clearance certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Ms E Erlank

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200692

NAME: (Principal Investigator)	Ms E Erlank
DEPARTMENT:	School of Pathology Department of Virology Wits Research Institute for Malaria Medical School University
PROJECT TITLE:	Malaria parasite metabolite and mosquito vector dynamics
DATE CONSIDERED:	Ad hoc
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor L Koekemoer
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/07/14

This clearance certificate is valid for 5 years from the date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in June and will therefore reports and re-certification will be due early in the month of June each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

EERlank — Principal Investigator Signature

15/07/2020 — Date