

**RELATIONSHIP BETWEEN VIRULENCE AND REPELLENCY OF
METARHIZIUM ANISOPLIAE AND *BEAUVERIA BASSIANA*
TOWARDS *MACROTERMES MICHAELSENI* AND CHEMICAL
IDENTIFICATION OF THE MEDIATING SIGNALS**

DAVID MWANGI MBURU

DOCTOR OF PHILOSOPHY

(Zoology)

**JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY**

2009

ABSTRACT

It is not well understood how termites survive in hemiedaphic habitats with diverse array of potentially infective fungi. In the present study, it was initially found that *Macrotermes michaelseni* detected a virulent isolate of *Metarhizium anisopliae* from some distance in a specially designed Y-olfactometer and avoided direct physical contact through olfaction. The overall objective of the study was to evaluate the relationship between virulence and repellency of different isolates of *M. anisopliae* and *Beauveria bassiana* towards the termite and identify possible mediating signals. The results show an interesting co-evolutionary phenomenon in which the termite's response to either *M. anisopliae* or *B. bassiana* is directly related to the potential harm which these fungi can inflict on the insect and that the virulent strains are more likely to be recognized from some distance and be avoided.

Volatile organic compounds emitted by the most and the least repellent isolates of *M. anisopliae* and *B. bassiana* were collected with the use of Super Q as an adsorbent and analysed through GC-MS. Identifications of the compounds were based on the interpretation of the mass spectral fragmentation followed by comparisons with spectral data from authentic samples, which were coupled with computer searches in HP Mass spectral library NIST98 Wiley. Where necessary, reference compounds were also co-chromatographed to confirm GC retention times. Olfactometric bioassays were used to confirm repellency of the selected constituent blends in their respective proportions and amounts present at 50% lethal dose of the respective fungal isolates. There were

qualitative and quantitative differences in the volatile profiles of the most and the least repellent isolates among the fungal species. Six to seven major components of volatiles from *M. anisophliae* and *B. bassiana*, were found to be largely responsible for the repellency action of the blends against termite, *M. michaelseni*. The results with the other components in blends indicated that the repellent action of the different components were due to the combined effects of the different components. The significance of the results and their implications in screening and use of entomopathogens and their ‘entomochemicals’ for control and management of termites are highlighted.

A number of workers have explored possible tactics used by termites to mitigate high risks of fungal transmission within their colony. How healthy individuals of these insects respond to infected conspecifics at different levels of infection at different doses have not been known until the results of this study. Healthy termites may be attracted to conspecifics that are freshly infected with fungal conidia to offer assistance to deal with infections. We compared these for the most and the least virulent (repellent) isolates of the two fungi after 4, 24, 48 and 72 hours post-infection. The results showed a switch from high attraction (freshly infected members) to low attraction (72 hours post-infection by all fungal isolates) towards the termite suggesting mediation of chemical signals produced by infected termites in the communication process. Further research is needed to characterize the underlying mechanisms mediating the “cry for help” phenomena by freshly infected termite *M. michaelseni*.