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Laboratory efficacy of mycoparasitic fungi (*Aspergillus tubingensis* and *Trichoderma harzianum*) against tropical bed bugs (*Cimex hemipterus*) (Hemiptera: Cimicidae)

Zulaikha Zahran¹, Nik Mohd Izham Mohamed Nor², Hamady Dieng³, Tomomitsu Satho⁴, Abdul Hafiz Ab Majid^{1*}

¹Household and Structural Urban Entomology Laboratory, Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia

²Plant Pathology Laboratory, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia

³Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

⁴Department of Microbiology, Faculty of Pharmaceutical Sciences, Fukuoka University, 8-19-1 Nanakuma, Joho-ku, 814-0180 Fukuoka, Japan



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ABSTRACT

Objective: To test the effectiveness of conidial spore formulations [*Aspergillus tubingensis* (*A. tubingensis*) and *Trichoderma harzianum* (*T. harzianum*)] against tropical bed bugs, *Cimex hemipterus*.

Methods: Spore formulations were made from two fungal strains, *T. harzianum* and *A. tubingensis*. The bed bugs were exposed to the conidial spores placed soaked onto a fabric cloth for 1 h and the mortality counts were recorded daily until 14 days.

Results: Mean survival times based on Kaplan–Meier survival analysis showed no significant differences between all the concentrations in both the fungal isolates: *T. harzianum* and *A. tubingensis*. However, the evaluation of both the isolates in terms of virulence resulted in low lethal hours in all the concentrations except for the high concentration of *A. tubingensis* (LT₅₀ = 44.629 h) at the conidial exposure of 1 × 10⁶ spores/mL. Rapid mortality of the bed bugs was observed from Day 6 to Day 12, ranging from 13% to 90% in all three concentrations of *A. tubingensis*. With reference to the *T. harzianum* exposure, the concentration of 1 × 10⁴ spores/mL displayed a gradual increase in the percentage mortality of 90 on Day 14.

Conclusions: Approaches to the bed bugs treatment should be explored in-depth using a natural biological agent like fungus especially *A. tubingensis* to reduce this pest population, in order to replace chemical methods.

1. Introduction

The rise of entomopathogenic fungi studies as pest control has implied that recent studies have shown promising improvements in the fungi's effectiveness as biological control agents. The

potentials of *Metarhizium anisopliae* (*M. anisopliae*) and *Beauveria bassiana* (*B. bassiana*) isolates in reducing the survival of major pests and disease vectors have been proven [1–4]. Despite their wide geographical distributions, both of these fungal strains are also capable of infecting a broad range of insect hosts compared to other fungal isolates that are mostly targeted species [5,6]. The combination of the two fungal species also yielded successful treatment in controlling weevils (*Cylas formicarius*) that tend to attack tuber crops in the field, as shown in the study by Reddy *et al.* [4].

Aside from the above major pathogens against insect, other fungal isolates are also currently developed and studied for their uses as promising biological control agents. These include *Trichoderma* sp. which is known for their pathogenic activities against plant diseases but may act on insect vectors like

*Corresponding author: Dr. Abdul Hafiz Ab Majid, Household and Structural Urban Entomology Laboratory, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.

Tels: +604 653 3847 (Z Zahran); +604 653 3888, ext. 4893 (AH Ab Majid)

E-mails: zahranzulaikha@gmail.com (Z Zahran); abd hafiz@usm.my (AH Ab Majid)

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