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Full Length Research Paper

Microbial control of caged population of *Zonocerus variegatus* using *Beauveria bassiana* and *Metarhizium* sp.

O.E. FAGADE[1], S.A. BALOGUN[2] and C.J. LOMER[3]

[1]Environmental and Biotechnology Unit, Department of Botany and Microbiology, University of Ibadan, Ibadan, Nigeria.
[2]Environmental Microbiology Unit, Department of Microbiology, Adekunle Ajasin University, Akungba-Akoko, Nigeria.
[3]International Institute for Tropical Agriculture, Biological Control and Functional Biodiversity Centre, BP 08-0932 Cotonou, Benin Republic.

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Microbial control of caged populations of *Zonocerus variegatus* was carried out using indigenous fungal entomopathogens isolated from the grasshopper's cadaver. Bioassay response indicated a dose-dependent mortality coupled with drastic reduction in food consumption among spores infected grasshoppers. Lethal time (LT_{50}) of 4.6 days for 10^3 spores/ml and 3.8 days for 10^7 spores/ml of oil formulation of *Beauveria bassiana* were observed. While *Metarhizium sp* recorded LT_{50} of 9.0 days and 2.8 days for 10^3 and 10^7 spores/ml, respectively. The results obtained were discussed in relation to use of the isolates in the control *Z. variegatus* infestation in forest agro-ecosystem of south west, Nigeria.

Key words: Microbial control, entomopathogenic fungi*, Beauveria bassiana, Zonoccrus variegatus, Metarhizium sp.*

INTRODUCTION

Beauveria bassiana and *Metarhizium sp* are known entomopathogens of locusts and grasshoppers which include *Zonocerus variegatus* (Order: Orthoptera). They are have been implicated in natural epizootics of these insects globally. The presence of these fungi in grasshoppers' population has been reported in North America and South East Asia (Bidochka and Khachatourians, 1991), Europe (Hernandez – Crespo and Santiago – Alvarez, 1997) Sahel Africa (Balfour-Browne, 1960) and Benin Republic, West Africa (Shah et al., 1994).

In Nigeria, extensive work has not been done on entomopathogens of grasshoppers. Also, the need to use indigenous pathogens to control grasshoppers other than imported ones has been emphasized by several workers (Mason and Erlandson, 1994; Thomas et al., 1995).

This study reports on the assessment of indigenous fungi *B. bassiana* and *Metarhizium sp.* in the control of the variegated grasshopper in Ibadan, South west, Nigeria.

MATERIALS AND METHODS

Grasshopppers were collected with sweeping net from the fringes of the forest reserve of the International Institute of Tropicla Agriculture, Ibadan and on the campus of the University of Ibadan. They were kept in clean cages of 25 grasshoppers per cage. The experiments were completely randomized.

The grasshoppers were allow to acclimatize in the cages for one week, after which they were fed with 20 g of surface sterilized cassava leaves and twigs as described by Dourou-Kpindou et al. (1995) and Thomas et al. (1997).

*Corresponding author. E-Mail: balogunsa33@hotmail.com.

Table 1. Comparison of bioassay regimes.

Treatments	F. value	Pr>f
Group. 1 vs group 2	37.58	0.0001
Group 3 vs group 4	7.13	0.0091
Group 2 vs group 3	112.11	0.0001
Group 1 vs group 4	14.95	0.0002
Group 1 vs group 3	88.18	0.0001
Group 2 vs group 4	1.43	0.2344
All vs control	45.17	0.0001

Key:
Group 1 – 10^3 spores/ml of *B. bassiana*.
Group 2 – 10^7 spores/ml *B. bassiana*.
Group 3 - 10^3 spores/ml of *Metarhizium sp.*
Group 4 – 10^7 spores/ml of *Metarhizium sp.*

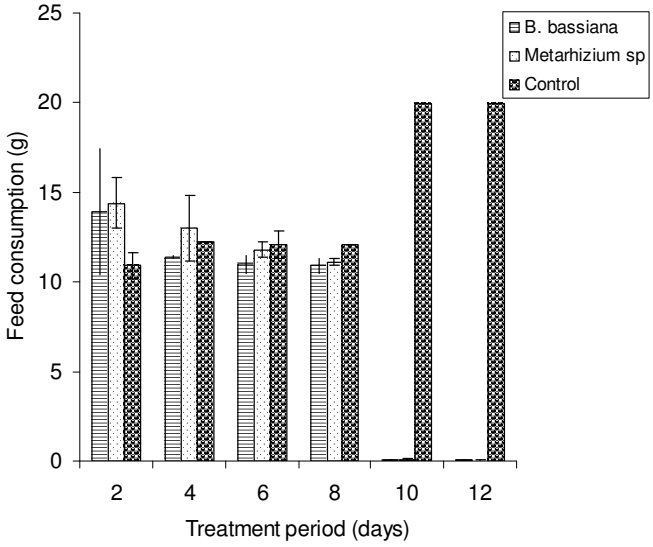

Figure 1a. Feed consumption level of grasshopper infected with 10^3 spores/ml of *B. bassiana* and *Metarhizium sp*

Pure culures of *B. bassiana* and *Metarhizium sp.* isolated from grasshoppers cadaver. They were cultivated on Sabouraud Dextrose Agar (SDA) for 15 days at 30°C for 12 h light and darkness photoperiod. Fungal spores were harvested using sterile spatula. Harvested spores were transferred into sterile McCartney bottles containing groundnut oil. Glass beads were added to the spores suspension and shaken for 5 min so as to separate the spores from the mycelia. The oil suspension was allowed to pass through a 0.75 um sieve, twice and the spores concentration was determined using Neubauer haemocytometer as described by Lomer and Lomer (1996). Fungal spores concentration of 10^3 and 10^7 spores/ml of *B. bassiana* and *Metarhizium sp.* were used for the bioassay respectively. Then 2 µl of the spore suspension were applied to the pronotal shield of each grasshopper (Dourou-Kpindou et al., 1995; Thomas et al., 1997). Mortality in caged grasshoppers was recorded. In addition, the voraciousness (i.e. the level of feed consumption) of the grasshoppers was determined from the initial 20 g cassava stem fed to the grasshoppers periodically (Thomas et al., 1997).

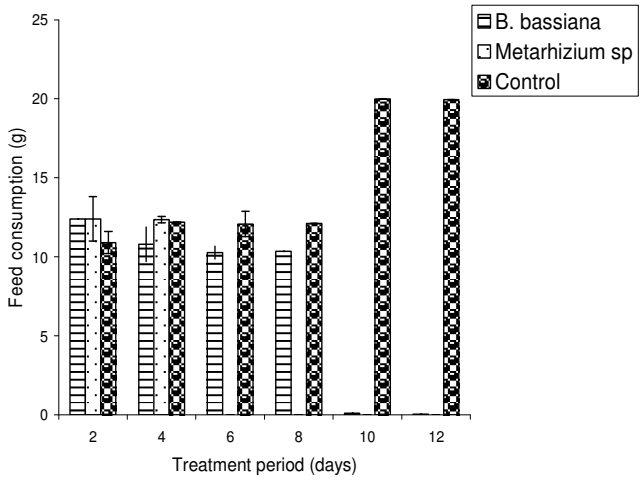

Figure 1b. Feed consumption of grasshopper infected with 10^3 spores/ml of B.bassiana and Metarhizium sp.

RESULTS AND DISCUSSION

Table 1 shows the comparison and correlation of mortality in grasshoppers with the treatment regimes. A strong relationship between treatments and bioassay was established. This suggests that mortality in grasshoppers is dependent on the cavative entomopathogen and the inoculums load or dosage (Prior and Geathend, 1985).

The feeding experiment/bioassay involving spore infected *Z. variegatus* (Figures 1a and b) shows that reduction in feeding started from day 6. Also, it was observed that the reduction in feeding is dependent on spore concentration. This suggests that the voraciousness of *Z. variegatus* fell considerably even though morality has not set in. The pest status of grasshoppers is mainly associated with their voraciousness (Alomenu, 1985); hence *B. bassiana* and *Metarhizium sp* may be suitable agents for the control of *Z. variegatus* infestation. However, spore concentrations of at least 107 spores/ml are desirable for the control to be effective. Dosage dependent reduction in feeding (Thomas, et al., 1997) and mortality (Lomer, et al., 1993) had been reported.

Bioassay of 10^3 spores/ml shows LT_{50} of 4.6 days and 68% of kill at the end of the bioassay for *B. bassiana* while *Metarhizium sp.* recorded LT_{50} of 9 days and 58% of kill at the end of the bioassay (Figure 2). This suggests that *B. bassiana* spores are more virulent at low doses than *Metarhizium sp.*, since it caused comparatively higher mortality in *Z. variegatus* (Johnson, et al., 1992). This further suggests that low doses of *B. bassiana* could be used in inoculative augmentative biocontrol approach to modulate the population of *Z. variegatus* over a period of time (Hermandez-Crespo and Santiago – Alvarez, 1997).

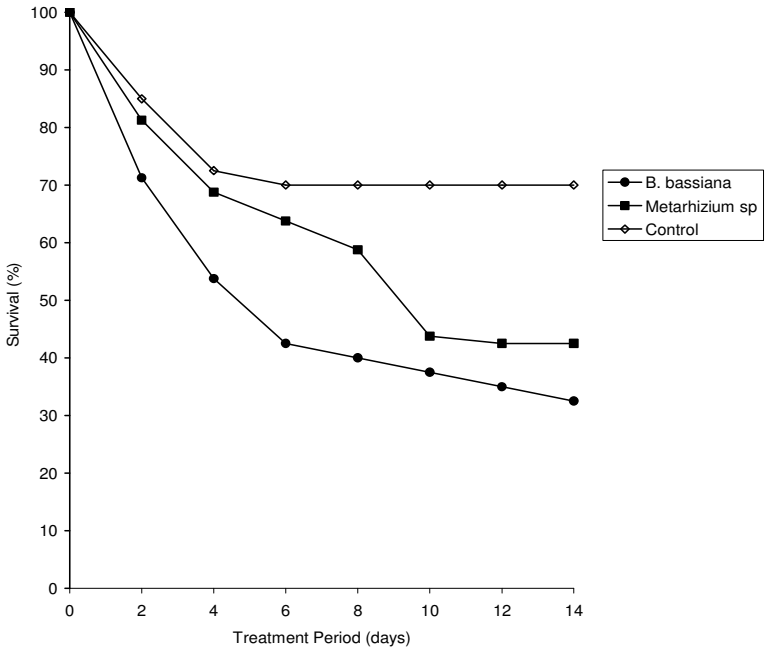

Figure 2. Survival of *Z. variegatus* in fungal bioassay using oil formulation of 10^3 spores/ml of *B. Bassiania* and *Meterhizium* sp.

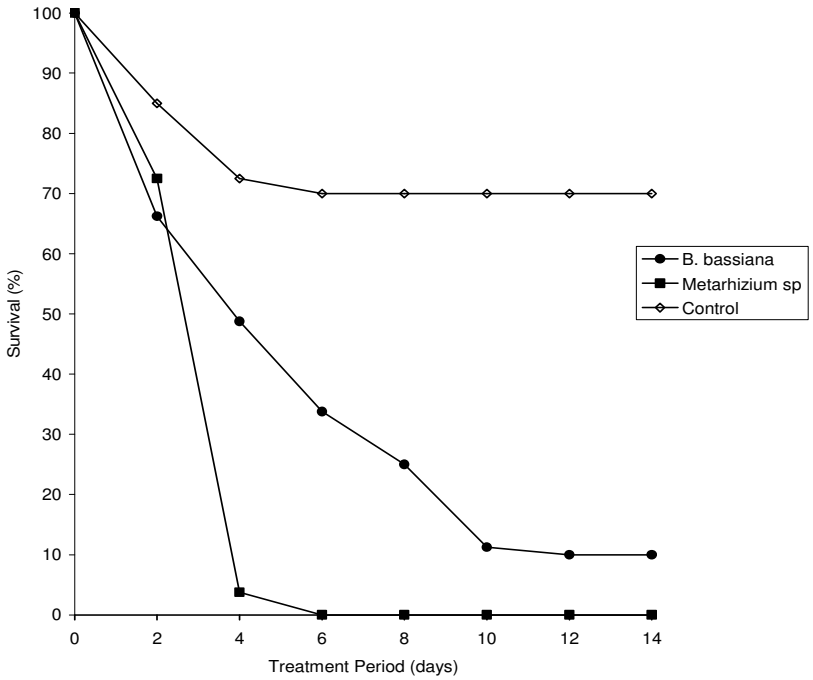

Figure 3. Survival of *Z. variegatus* in fungal bioassay using oil formulation of 10^7 spores/ml of *B. Bassiania* and *Meterhizium* sp.

Lethal time of 3.8 days and 2.8 days were recorded for *B. bassiana* and *Metarhizium* sp., respectively. Also, a maximum mortality of 90% was recorded for *B. bassiana* at the end of the bioassay while *Metarhizium* sp. recorded 100% (Figure 3). This suggests the lethal potency of *Metarhizium* sp. over *B. bassiana* at higher

doses. The study shows that the indigenous fungal entomopathogens of *Z. variegatus* (*Beauveria bassiana* and *Metarhizium* sp.) have great potentials for the control of the variegated grasshopper in south west Nigeria.

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