POTENTIAL USE OF *METARHIZIUM ANISOPLIAE* (DUETEROMYCOTINA: HYPOMYCETES) FOR CONTROLLING SUBTERRANEAN TERMITE, *COPTOTERMES CURVIGNATHUS* (ISOPTERA: RHINOTERMITIDAE)

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Key words: Coptotermes curvignathus, subterranean termite, Metarhizium anisopliae

Introduction

The subterranean termite, *Coptotermes curvignathus*, is one of the most serious termite in Malaysia. This termite is known for damage to structural timber and also attacks field and tree crops. It is now known to attack oil palms that are grown on peat soil. *Coptotermes curvignathus* does not build mound and its cryptic habit makes its presence in an area very difficult to detect. Its presence could only be realized when the damage done had been too severe for treatment. Like in most part of the world, soil treatment with chemicals offer the simplest control against subterranean termites in Malaysia. Very often, these chemicals are being excessively applied to the soil and this results in contamination of beneficial soil flora and fauna as well as water resources. Thus alternatives to conventional insecticides for termite control, such as baits and insect pathogens, are very much warranted. Fungal pathogens exhibit characteristics of similar to those bait toxicants, in that they are slow-acting and they can be passed on to members of the colony. Fungal pathogens also offer great promise for control of soil-inhabiting insects because the inocula being in the soil matrix are protected from inactivation by UV radiation temperature extremes. In the tropical region, soil is suitable medium for fungal growth as moisture level seldom limits conidial germination and growth. Thus in this study, effectiveness of an entomopathogenic fungus *Metarhizium anisopliae* in controlling field colony of *C. curvignathus* was evaluated.

Materials and Methods

Fungal preparation: *Metharizium anisopliae* strain, coded as MA-PR, isolated from Pantai Remis, Perak, was selected for this experiment. The fungus was mass-produced by culturing it on cooked rice. The rice, packed in plastic bags, was inoculated with the selected isolate. The bags were incubated for two weeks.The rice bearing conidia were sieved through a mesh. These conidia were packed in sealed plastic bags and kept in a refrigerator. *Determination of termite foraging activity*A newly replanted rubber small holding was selected for the study. Rubber tree stumps were examined for termite infestation. Stumps with termites were marked and pine wood stakes were driven into the ground adjacent to the stumps. Site A with two stations (1 and 2) were chosen for the control and site B with three stations (3, 4 and 5) were chosen for the treatment. Site A and B was separated by a stream running across the land. Stakes were examined biweekly, stakes infested with termites were selected for the monitoring traps. These stakes were replaced with underground monitoring traps. The trap consisted of a hollow plastic in a bundle of oven-dried and weighed pine stakes was placed. The monitoring traps were again examined by weekly. Infested wood bundle were replaced with new pre-weighed wood. Weight loss of the wood was used to assess feeding activity of the colony. Foraging activity was monitored 3 months before the introduction of the conidial preparation. Termite foraging territory and population at sites A and B were estimated using a triple marked-recapture method Worker termites collected from a monitoring trap were placed in petri dishes containing filter papers dyed with 0.1% Nile Blue A. Termites were allowed to feed on dyed papers for 3 to 5 d before being released back to the same trap. Termites were collected from the monitoring traps 7 d after the initial release of the dyed termites. All worker termites, dyed and non-dyed termites, were counted, dyed and released to their respective traps. These procedures were repeated 3 times for the colony at each site. A colony is a group of termites sharing interconnected foraging sites thus a foraging territory was delineated by the presence of marked termites. Population size was estimated using the weighted mean model. The extent of the foraging territory was determined by the presence of dyed termites in the monitoring stations. At the end of the third month, worker termites were collected from one of the traps and dusted with *M. anisopliae* conidia and they were released into the trap. Foraging activities of the termite in the traps were monitored monthly.

Results and Discussion

Five monitoring stations installed were attacked by the termite within one month after installation. During the first three months before treatment the wood consumption ranged from 46 to 215 g and 56 to 300g from site A and B respectively. The colony at site A had foraging population estimated at 150,000 workers and territory linear distance of 10 meter and site B had a foraging population estimated at 312,0000 and territory linear distance of 100 meter. The presence dyed termites in all stations within each site indicated that those termites came from the same colony. Colony at site A was not connected to Site B because there was a stream separating them. After releasing the *M. anisopliae* contaminated workers into one of the trap, the termite continued to actively forage on the wood. The wood consumption remained more than 100 g. However, on the sixth months or three months after treatment, the foraging activity of the termite declined and ceased feeding. The termites completely disappeared from all the traps in site B but they were still active in the traps at site A. The result thus indicates that *M. anisopliae* had initiated an epizootic in a termite colony. Contaminated individuals transferred the conidia to other individuals subsequently killed all individuals in the colony.

Conclusions

In conclusion, colonies of *C. curvignathus* could be monitored, characterized, successfully eliminated with the introduction of *M.anisopliae* conidia into their colony system. The success of controlling the termites, however, depends on the viability in the soil and infectivity of the fungus. All foraging colonies in the target site need to be demarcated and the inoculum must be accessible to all of them. Thus *M. anisopiae* conidia dust formulation has the potential to be used as an alternative to arsenic dust in termite management

Benefits from the study

Metarhizium anisopiae conidia dust formulation has the potential to be used as an alternative to arsenic dust in termite management.

Patent(s), if applicable :

Nil

Stage of Commercialization, if applicable :
Nil

Project Publications in Refereed Journals

1. Sajap, A.S, M.J. Amin and D. Ouimette. 2002. Above -ground baiting for controlling *Coptotermes* termites in Selangor, Malaysia. Sociobiology. 39:345-352.

Project Publications in Conference Proceedings

1. Sajap, A.S, M.J.Amin and D. Ouimette. 2001. Above -ground baiting for controlling *Coptotermes* termites in Malaysia. 2nd International Symposium on *Coptotermes formosanus*. New Orleans. USA. May 2001.

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IRPA Project number01-02-04-0190
UPM Research Cluster:AFF
Project Leader Ahmad Said Sajap