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ABSTRACTS

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BOOK I

[2004] MICROBIAL CONTROL OF TERMITES IN BRAZIL #3510

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In Brazil, termites are considered important agricultural and urban pests. Several crops, such as sugarcane, pastures, forests and citrus are frequently attacked by termites. In urban areas, these insects attack trees, buildings, furniture and even phone cables. To replace chemical control, studies were developed on microbial control (MC) of *Heterotermes tenuis* in sugarcane using baits ("Termitrap"), in which individuals are contaminated with control agents. These agents are later transmitted to other insects by contact or trophallaxis. The baits contained entomopathogenic fungi in association with chemical insecticides. Strains of *Beauveria bassiana* and *Metarhizium anisopliae* were selected for the control of *H. tenuis* in the laboratory and a higher than 90% mortality rate was observed. Also, *B. bassiana* associated with several insecticides caused similar mortality levels. The baits were also used for bioecological studies of *H. tenuis* in sugarcane to evaluate population level and foraging area. These studies showed that cultural practices in the sugarcane crop influence the termite populations, and that the use of 30 to 35 baits/ha is sufficient to monitor these populations. In field tests, the insecticide trifiumuron, mixed or not with the entomopathogenic fungi, caused reduction of the termite population at 0.1, 0.15 and 0.2% concentrations. Similar results were obtained when the entomopathogenic fungi were used alone. Preliminary studies showed efficacious control of small and medium mound termite nests. *Cornitermes cumulans* with *B. bassiana* and *M. anisopliae* applied in an inundate strategy. However, this strategy was not very effective for the control of large nests. Further studies associating entomopathogenic fungi with im

[2005] MICROBIAL CONTROL OF TERMITES IN THE USA IN THE UNITED STATES

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The potential for biological control using predators, parasites and pathogens has not been thoroughly investigated for termite control. Vertebrate and invertebrate predators have not been seriously considered because of a variety of biological constraints and the zero tolerance action thresholds used in termite control (Grace 1997. Agri. Entomol. 14:281-189). Insect parasitic nematodes have been investigated but were found to repel termites from the point of application rather than effect serious termite population reductions (Mix 1986. Pest Control 53:48-54; Epsky & Capinera 1988. J. Econ. Entomol. 81:21-30). Bacterial pathogens have been screened but effects on termites in laboratory bioassay were not promising (Grace and Ewart 1996. L. Appl. Microbiol. 23:183-186). No viral pathogens have been examined. Biological control of subterranean termites in the United States has been directed toward survey and laboratory bioassay of entomopathogenic fungi (Lai et al. 1982. J. Invertebr. Path. 39:1-5; Zoberi and Grace 1990. Mycologia 82:289; Jones et al. 1996. Environ. Entomol. 25:481-487). Intuitively, Rhinotermitidid termites have co-evolved with and therefore should have defenses against fungal epizootics. Experimentally it has been shown that termites have physical and social barriers to fungal infection (Boucias et al. 1996. Pflanzenschutz-Nachr. Bayer 49:103-145; Rosengaus et al. 1998. J. Chem. Ecol. 24:1697-1706). Our research has indicated that several isolates of three species of fungi are repellent in the spore or conidial stage while they are non-repellent in the blastospore or mycelial stages and they were ineffective in reducing reproductive potential (Forschler & Jelks 1998. Proc. Nat. Conf. Urban Entomol. pp. 102) It would appear that fungi are best suited for application to infested structural lumber as a repellent (Forschler 1998. Proc. 6[th] Siconbiol. pp. 100-105) rather than a subterranean termite population management tool. The greatest potential for a biological control agent probably lies with the little studied entomopathogenic viruses. Theoretically, a latent virus could be disseminated in a termite population via social contact before it expresses its lethal effects. Therefore, large-scale population impacts are possible and by knowing the stress factor that would 'turn on' a latent virus one could plan or predict the timing of termite population reductions. Screening termite populations for viral pathogens should yield candidates for intensive bioassay.

Index terms: biological control, subterranean termites, Rhinotermitidae, fungi, viridacloprid at low concentrations resulted in a 4X reduction of the amount of conidia used, and in control levels greater than 80% for large *C. cumulans* nests. Microbial control of *Nasutitermes sp.* using *B. bassiana* was also effective when the fungus was applied inside the nests. Despite the advances of MC in Brazil, studies are needed to evaluate its effectiveness and define strategies for its use in wide scale. It is important to continue studies with new insecticides in association with entomopathogens and the investigation of possible factors that affect the MC in the field, especially the action of antagonistic microorganisms in the soil.

Index terms: *Heterotermes tenuis*, *Cornitermes cumulans*, entomopathogens

[2006] INTRODUCTION OF A PROTOZOAN FOR CONTROL IMPORTED FIRE ANTS IN THE USA #3510

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Protozoan infections in fire ants have been reported infrequently since the 1970's. *Thelohania solenopsae* was the first protozoan (microsporidia) to be observed in fire ants, specifically the red imported fire ant, *Solenopsis invicta*, by Buren in 1973. Extensive studies in the mid-1990's by Briano et al., of *T. solenopsae* infections in the black imported fire ant, *S. richteri*, have established the potential of this protozoan as a biological control agent for fire ants. In 1996, *T. solenopsae* was discovered in Florida, USA from *S. invicta* by Williams et al. Imported fire ant 1colonies have been infected with *T. solenopsae* collected from Florida via the introduction of infected brood. Artificial inoculations of laboratory colonies have resulted in infected queens with reduced queen weights and oviposition rates. This has resulted in significantly less brood (88%) and lower queen survivorship than in uninfected colonies. To examine the potential host range of the Florida collected *T. solenopsae*, infected fire ant brood was introduced into laboratory colonies of seven species of ants. Infections were detected only in *S. richteri* colonies obtained from Argentina. Examinations of field collected colonies of 7 non-*S. invicta* ant species were also negative for *T. solenopsae* infection. Field inoculations were initiated in Florida in 1997, and 4 of 5 inoculated colonies became infected. Infections were detected in non-inoculated fire ant nests on subsequent sample dates suggesting that infections had spread. By 1999, infections have been detected in over 85% of the colonies sampled at this study site, and reductions in fire ant populations of over 60% also have been observed. Additional introductions were made in ten states to document the potential impact of *T. solenopsae* on imported fire ants in different geographic areas of the southern USA. Infections have been detected in seven of these states. Field infections in the USA have been predominately found in polygynous fire ant populations. The first field infections in the monogynous form of *S. invicta* have been detected among these introductions. *T. solenopsae* has been detected in 93% of the males and 75% of the females alates initiating nuptial flights. It is possible that infected reproductives will fail to establish new colonies, thus impeding the spread and continual reinfestations by fire ants.

Index terms: *Solenopsis invicta*, Formicidae, Microsporidia, biological control

[2007] MICROBIAL CONTROL OF ANTS WITH FUNGI

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Entomopathogenic fungi can infect and kill a wide variety of arthropod species but their role in the dynamics of social insect populations and communities is not well defined. The discovery in 1985 of a naturally occurring strain of the white muscardine fungus, *Beauveria bassiana*, in populations of *Solenopsis invicta* in Mato Grosso, Brazil spawned interest in the possibilities of using fungi as biological control agents for ants. Field studies in Brazil confirmed that *B. bassiana* has natural epizootics in fire ant populations in Mato Grosso and suggested that this microbial agent is an important factor in the regulation of abundance and distribution of fire ants in South America. Isolate 447 of *Beauveria bassiana* was selected as a candidate for evaluation as a microbial pesticide against ant species. Studies were conducted to evaluate the efficacy of the fungal strain for a variety of ant species including: (1) Red Imported Fire Ant, *Solenopsis invicta*; (2) Carpenter Ant, *Camponotus floridanus*; (3) Pharaoh Ant, *Monomorium pharaonis*; (4) Crazy Ant, *Paratrechina longicornis* and (5) Ghost Ant, *Tapinoma melanocephalum*. A bait formulation of the fungus was tested in comparison with three chemical pesticide products. Results showed that the fungal bait was significantly efficacious for all ant species tested and that performance of fungal bait was equal to or superior to chemical bait products for most of the ant species. These results indicate that a non-toxic biological control for social insects is not only possible but also feasible. The fungal strain was tested for eight other ant species and was found to be very pathogenic. However, the efficacy of fungal formulations appears to be dependent upon ant foraging and recruitment behaviors as is also the case with chemical bait products. The 447 strain is being developed as commercial products for ant control by SafeScience, Inc. and this strain also has potential for control of termites.

Index terms: *Beauveria bassiana*, fungal infection, ants, microbial control