

Improved Mole Cricket Management Through the Application of an Enhanced Ecological and Behavioral Data Base

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Number of Years: 3

Total Funding: \$75,069

Objectives:

1. *Develop an effective integrated pest management program for mole crickets that ultimately reduces total pesticide use through improved implementation of chemical strategies and effective integration of biological and cultural options*
2. *Apply the extensive research findings and validation of biological control strategies based upon our new knowledge of mole cricket ecology and behavior*

Laboratory and field studies were initiated to evaluate mole cricket behavior toward entomopathogenic soil fungi and to evaluate the efficacy of subsurface and surface fungal applications. The effect of the entomopathogenic fungi, *Beauveria bassiana* and *Metarhizium anisopliae*, on the behavior of tawny mole crickets (TMC) was tested using two experimental methods. In the first set of experiments, TMC had no choice but to tunnel through a layer of fungal treated sand in order to reach a sod food source. TMC in untreated boxes tended to tunnel to the surface more quickly and in greater numbers than TMC in boxes treated with fungal pathogens. Some TMC started to tunnel into fungal treated sand and then changed direction and tunneled below or away from the treated layer. In similar laboratory investigations, white grubs also avoided soil treated with a fungal pathogen.

In the second set of experiments TMC were given a choice to establish tunnels in clean or *B. bassiana* treated sand. TMCs in buckets of sand half treated with *B. bassiana* and half untreated tunneled exclusively in the untreated sand. In buckets of untreated sand, TMC tunneled regardless of side, and tunnels were somewhat larger than those in the choice treatment. In buckets of *B. bassiana* treated sand, tunnels were extremely small or nonexistent. In two of the four buckets of treated sand, the TMC were at the interface between the sand and sod.

In 1997 and 1998, Naturalis-T (Troy Biosciences Corp., Phoenix, AZ) and BotaniGard ES (MycoTech Corp., Butte, MT), containing *B. bassiana*, were field tested for control of mixed nymph populations of the southern mole cricket and the tawny mole cricket. Mole cricket damage ratings from surface applied *B. bassiana* treated plots were not significantly different from the untreated control. In 1999, three commercial products containing *B. bassiana*, Naturalis-T (Troy Biosciences Corp., Phoenix, AZ), BotaniGard ES (MycoTech Corp., Butte, MT, and 7695 SCK (JABB, Carolina Inc, Pine Level, NC), were applied to field plots using subsurface injection as well as surface sprays. The change in mole cricket damage ratings between pre and post treatment was compared. Damage ratings were significantly reduced in plots treated with subsurface injections of 7695 SCK (JABB, Carolina Inc, Pine Level, NC) and surface sprays of the insecticide

control deltamethrin. In contrast, mole cricket damage ratings increased or did not change in plots treated with surface applications of *B. bassiana* and in the untreated control. These findings suggest that placement of fungal pathogens in the soil profile may influence the effectiveness of a product to control mole cricket damage to turf. The avoidance response seen in laboratory experiments may be evidence of an evolutionary adaptation to avoid infected insects and areas of soil with high concentrations of fungal spores. Avoidance behavior may explain the inconsistent results found in the field with high doses and surface applications of fungal pathogens. Subsurface applications of fungal pathogens may lengthen the time a pathogen remains viable compared to pathogen survival after surface application.

Future studies will include: tests of mole cricket behavior toward the carriers contained in fungal formulations, in depth analysis of mole cricket movement in the radiographs (such as calculation of the area of the tunnels to see if the amount of tunneling was different in treated and untreated areas), and a comparison of fungal viability in the soil overtime after surface and subsurface applications.