Behavioral Studies of the Southern and Tawny Mole Cricket

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Goals:

- *Improve our understanding of tawny mole cricket and southern mole cricket behavior especially as affected by environmental conditions through radiographic studies.*
- *Isolate and determine the activity of sex, aggregation and alarm pheromones of the tawny and Southern mole crickets.*
- *Determine the behavior of tawny mole crickets in the presence of microbial and chemical insecticides.*
- *Initiate field studies to better understand tawny and southern mole cricket behavior as suggested by laboratory studies.*

Studies were begun using radiographic technology to visualize the movement and feeding patterns of both tawny and southern mole crickets in soil. Tawny mole crickets produce a characteristic 'Y' shaped tunnel that allows two escape routes to the surface and down into the soil, and a long tunnel into the soil profile that most likely aids in thermal and water regulation.

Environmental conditions can alter, but do not destroy, the stereotypical movement patterns of tawny mole cricket behavior. Predatory southern mole crickets appear to burrow at the thatch/soil interface, perhaps searching for food. Studies conducted in this project indicate that prey size is a major determinant in the acceptability of tawny mole crickets as southern mole cricket food.

When disturbed, both mole cricket species discharged an oily, highly odorous substance from their abdomen. Discharges were collected for biological and chemical assays in our laboratory. Radiographic analysis shows a clear avoidance of tawny mole cricket to areas near the discharge. Live tawny mole crickets do not seem to affect the tunnel patterns of their neighbors, suggesting that they do not discharge their compounds around other tawny mole crickets.

By comparison, live southern mole crickets move away as far from each other as possible when placed together in a chamber. This suggests, but does not conclusively confirm, the presence and activity of a chemically-mediated avoidance behavior in this species.

Adult southern and tawny mole crickets were dissected in order to remove anal and protodeal glands. Gas chromatography and mass spectraphotometry of all samples indicated a range of hydrocarbon compounds. Electro-antennogram and electro-palpograms gave no differential response among the 13 extracts tested. We see no indication of the presence of a long-range male or female sex or aggregation pheromone in tawny or southern mole cricket adults.

Radiographic assays with a synthetic insecticide and the fungal pathogen *Beauveria* suggests that tawny mole crickets can sense and avoid high concentrations of the product in soil, thereby reducing overall insecticide activity. It should also be noted that this behavior did not occur in every insecticide-treated, chamber suggesting that the effect may be transient or be in response to only the parent or one or more breakdown products. Radiographic experiments designed so crickets could not escape insecticide suggested a decline in burrow construction and maintenance.

Field studies in North Carolina have provided significant new information on mole cricket development, dispersal, field behavior, interspecies relationships, and the influence of the soil environment on damage and control. The consistently earlier egg hatch and development of tawny mole cricket nymphs is a key to survival in areas also inhabited by southern mole crickets.

Since behavior is influenced by nymph size and since the initiation of control strategies is affected by egg hatch, the relationship that has been established with soil temperatures and degree day accumulation and the occurrence of these events is important new information. This will help target management strategies to those most susceptible stages as well as provide insight into the best timing to diminish the likelihood of mole cricket behavior minimizing the control strategies effectiveness and improved follow-up scouting and management efforts.

Additional research on the effect of soil moisture on egg hatch and surface damage helps us determine when visible surface damage is most likely and when environmental conditions favor significant egg survival in non-irrigated areas. This information has also helped us determine preferred areas of egg laying for both species and is providing significant insight into the identification of "high-risk" areas to help reduce scouting time and develop guidelines for targeting the use of new insecticides which are most effective when used in a preventive mode (Table 6).

Table 7. Effects of irrigation on the efficacy of Lambda-cyhalothrin applied for the control of mole cricket nymphs, Brierwood Golf Club, Brunswick County, NC, in August 1996.

Treatment	Rate (oz./A)	Irrigation Schedule	Average Damage Ratings[1]
Simitar GC	10	Pre/No Post	0.55
Simitar GC	10	No Pre/Post at 2 hr	2.05
Simitar GC	10	No irrigation	1.65
Simitar GC	10	Pre/Post immediately	1.55
Untreated	---	Pre/Post	2.40

[1]Damage ratings, where 0 = no damage, 9 = severe damage.