Project Title: Behavioral Studies of the Southern and Tawny Mole Cricket

Principal Investigators:
R. L. Brandenburg (North Carolina State University)
M. G. Villani (NYSAES/Cornell University)

Project Description: The goals of this project are to:
1) isolate and determine the activity of sex, aggregation and alarm pheromones of the tawny mole cricket (TMC). 2)improve our understanding of TMC and southern mole cricket (SMC) behavior as affected by environmental conditions. 3) compare the activity of healthy mole crickets to crickets that have been infected with microbial control agents

Project Progress Year 1:

TMC and SMC were collected in North Carolina and transported to the NYSAES, Geneva, New York for laboratory analysis. 'It was noted that when disturbed, both mole cricket species discharged a oily, highly odorous substance from their abdomen. Discharges were collected for biological and chemical assays in our laboratory:

a) preliminary chemical analysis: a small discharge sample from each cricket species was prepared for analysis through the use of gas chromatography. Although there appeared to be basic similarities in the two species discharges as indicated by overlapping peaks in parts of the GC detection strip charts, there were also clear differences in the SMC & TMC discharges (Figure 1a and 1b) indicating unique compound constituents in the discharges for these two species. We are currently working in concert with electroantennogram analysis to determine which peaks are bioactive and therefore should be analyzed further (identification & synthesis).

b) Electroantennogram analysis: The purpose of this procedure was to determine whether the volatiles emitted from the crude discharges of the TMC and SMC elicited a neurological response from the ablated antenna of either mole cricket species. The antenna of either TMC or SMC was attached through a saline-electrode system to an oscilloscope/physiological chart recorder; volatiles were then puffed over the antenna. There was no measurable response from the SMC antenna (a predator of TMC) suggesting that SMC cannot detect discharge volatiles from either species through sensory organs in their antenna. However, TMC antenna reacted positively to volatiles from either species discharges (figure 2). Each time volatiles were puffed over an ablated TMC antenna the antenna discharges (read as a depression on the oscilloscope/physiological chart recorder) indicating the sensory organs on the TMC antenna was sensing compounds from both species. The TMC is prey for the SMC suggesting that these discharges may serve as alarm and warning pheromones for the TMC

c) Behavioral response of TMC nymphs to TMC discharge: TMC discharge was collected on absorbent cotton and placed in soil arenas along with several TMC nymphs. Radiographic analysis (see below) shows a clear avoidance of TMC to areas near the discharge impregnated cotton further suggesting the biological activity of the discharge.

Before detailed studies can be undertaken on the impact of environmental factors and disease status on mole cricket behavior can be undertaken, a clear picture of 'typical' TMC and SMC behavior must be understood. Studies were begun using radiographic technology (x-rays) to visualize the movement and feeding patterns of both TMC and SMC in the soil matrix. Through the placement of a small lead tag on each cricket, tunnel construction and cricket movement in the tunnel could be monitored over time (figure 3 is TMC burrow 20 days after cricket was placed in chamber). These studies indicate: a) TMC produce a characteristic 'Y' shaped tunnel that allows two escape routes to the surface and a long tunnel into the soil profile that most likely aides in thermal and water regulation (figure 3) b) each TMC builds their own tunnel system that they maintain over time. There appears to be little burrow sharing between crickets in the same area c) as TMC grow their burrows widen and extend further into the soil profile suggesting a possible cause for the difficulty in bringing older crickets to the surface through soap flushes and baits. d) SMC appear to create less extensive burrows than do TMC. Instead, SMC appear to burrow predominately at the thatch/soil interface perhaps searching for prey items.

Figure 1a

Gas Chromatography Detector Strip Chart
3µl Southern Mole Cricket Discharge

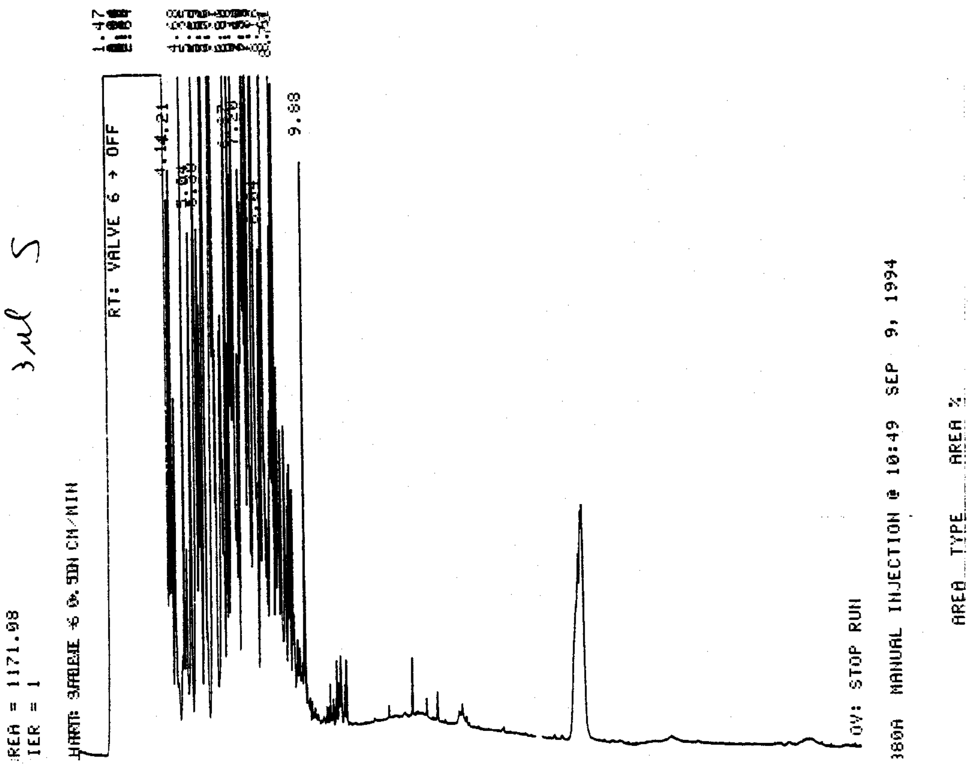

Figure 1b

Gas Chromatography Detector Strip Chart
3µl Tawny Mole Cricket Discharge

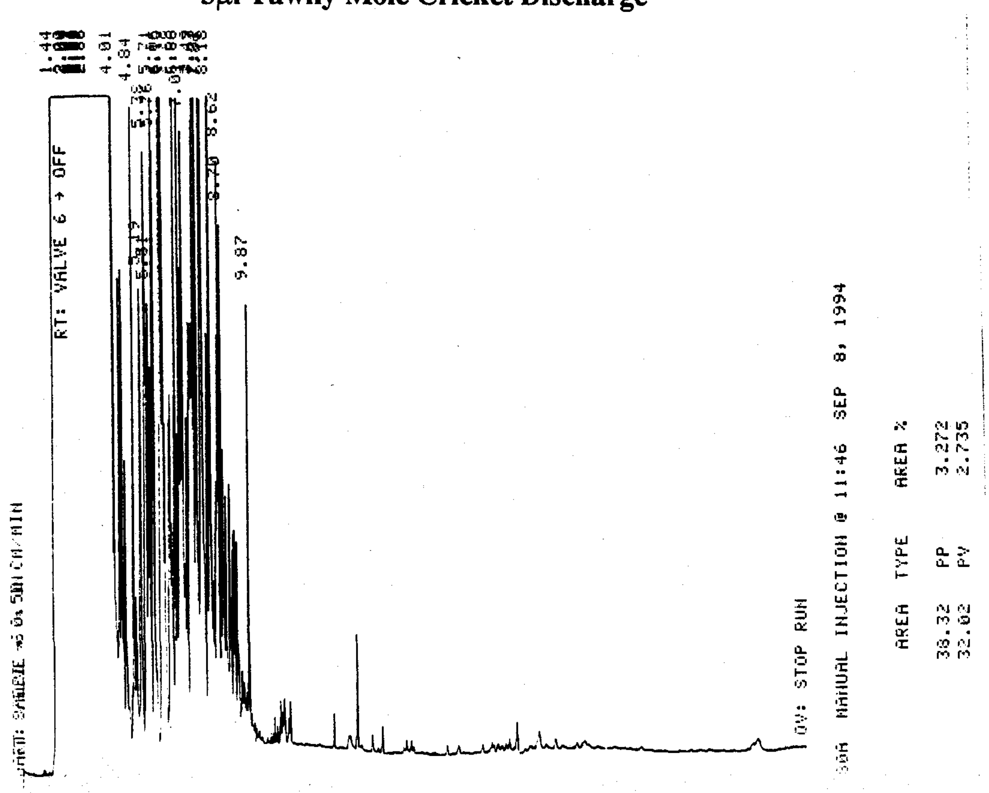

Figure 2

Electroantennogram obtained when crude volatiles from TMC and SMC discharges were puffed over antenna of TMC that was wired to a strip chart recorder. The TMC antenna responded each time individual applications of the volatiles from each species (depression from baseline: 3 TMC volatile puffs (T); 3 SMC volatile puffs (S). Similar experiment with SMC showed no antenna response.

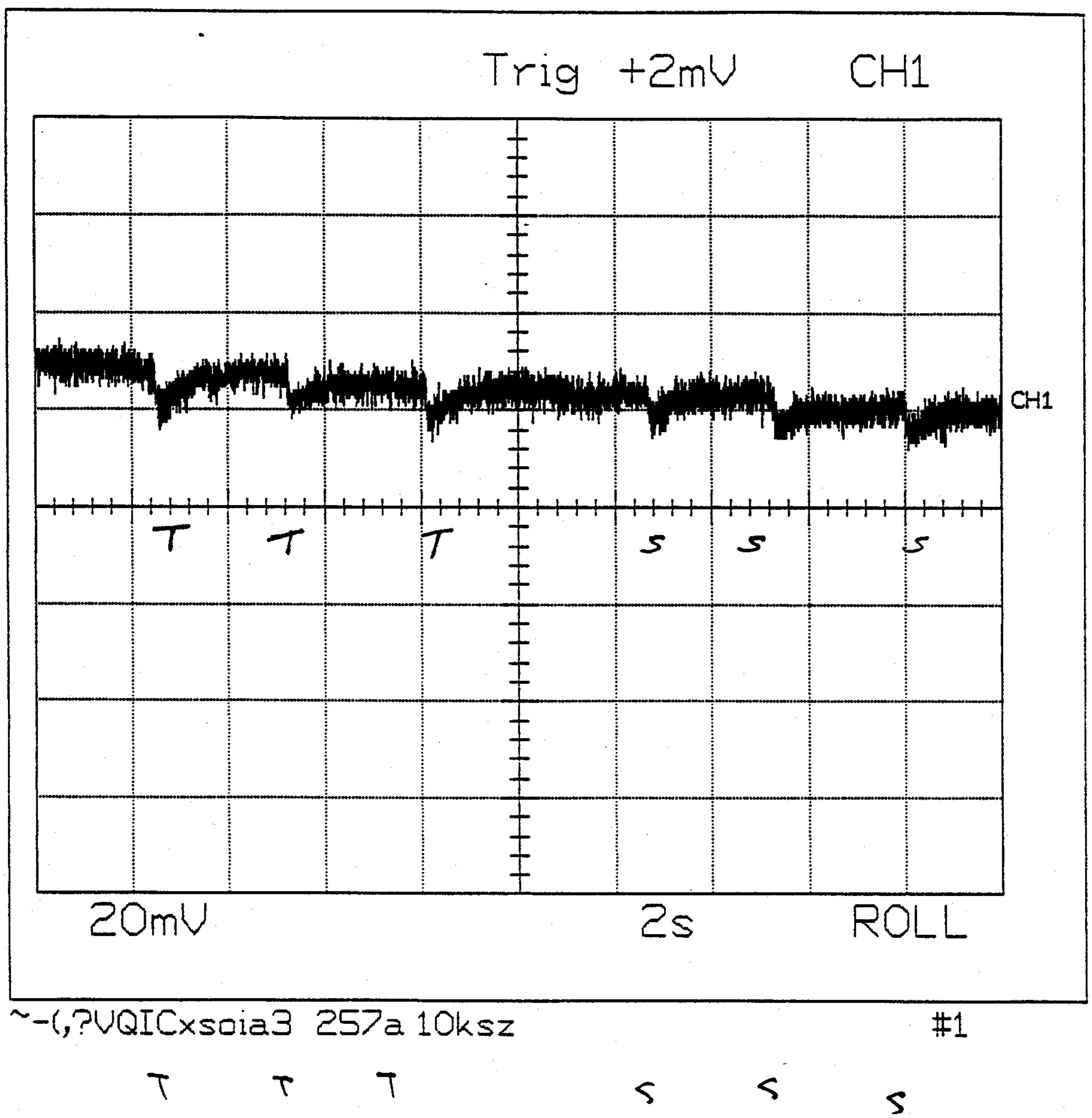

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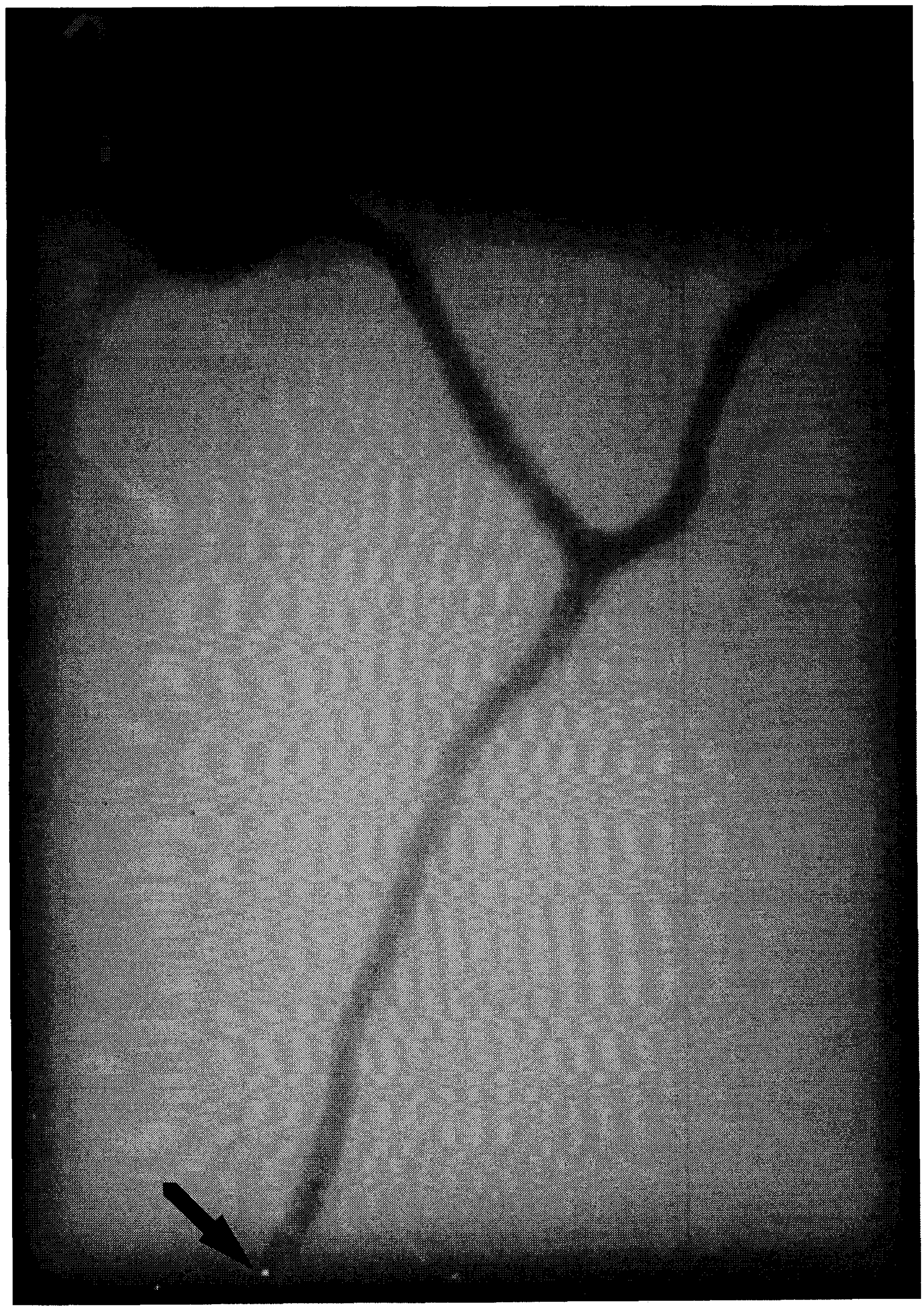
FIGURE 3

14 inches



17 inches