Improvement of Citrus Peelminer Pheromone Lures

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Several years ago, we identified what appeared to be the main component of the pheromone of the citrus peelminer (i.e., the only compound that was attractive to male moths as a single component), along with several related compounds that were also produced by virgin female peelminer moths. However, in numerous trials conducted over several years in a variety of crops in the Coachella Valley, Riverside, and the Central Valley, the pheromone has not worked well enough and/or consistently enough to be incorporated into routine IPM programs. We suspect that the problem is due to subtle-ties in the chemistry of the pheromone.

The goal of this project was to find the root cause of the continuing problems with the pheromone, and if possible, fix it. We have approached this from two directions. First, we repeated some of our earlier analytical work in much greater detail, conducting multiply replicated coupled gas chromatography-electroantennogram (GC-EAD) analyses of extracts of the pheromone prepared by extracting the gland tissues with solvent, or by collecting the volatile pheromone as it is released by live female moths.

These analyses by both methods reaffirmed that females produce a number of compounds in addition to the main component of the pheromone, some of them in relatively large amounts. Furthermore, most of these compounds elicited significant responses from the antennae of the male moths (Figure 1), suggesting that these compounds might indeed have some role in the pheromone.

We have identified these compounds, and field tested them as individual components and in various blends with the major component of the pheromone. Although we have not yet been able to increase the attractiveness of the main component, there were two important results. First, during field trials of the possible minor components, we found that one of the isomers of a minor component was highly inhibitory; when present in only trace quantities, it completely shut down attraction to traps. Second, in an effort to produce the main component with a higher degree of purity, we synthesized it by a different route than we had used before. Very significantly, the new material was not attractive, clearly indicating that either the presence or absence of trace components in the blend is critical to the activity of the blend.

We are proceeding with further tests, using coupled GC-EAD to compare the old and the new batches of pheromone, looking specifically for minor components in one or the other of the two batches that might be the cause of the difference in activity between the two batches. Identifying these highly active trace compounds may finally provide the key to developing reliable and effective pheromone lures for citrus peelminer.

Figure 1. Gas chromatogram (top) and corresponding male peelminer antennal responses to compounds in a pheromone extract from female peelminer moths. Arrowed peaks indicate the disproportionately strong responses seen to specific minor components in the extracts.