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FIRE ANT SPECIES-SPECIFIC BAITS AND REPELLENTS

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There are at least two methods to utilize pheromones - A) as a behavior disruptant and B) incorporated into a bait to enhance that baits species-specificity and efficacy. The USDA has opted to pursue bait enhancement. This means that we must incorporate a species-specific pheromone into the currently used bait.

A fire ant bait is composed of: A) soybean oil - a solvent for the insecticide and very importantly an excellent phagostimulant that induces the worker ants to ingest both it and the dissolved insecticide; B) an inert carrier - pregeled defatted corn grit; and C) the insecticide - of which there are three commercially available and registered for limited fire ant use.

Our working hypothesis is that the use of an attractant pheromone will decrease the time it takes for *S. invicta* workers to discover a bait particle. If this can be achieved, then the bait will be more species-specific and more efficient. In addition, if fire ants can be removed from an area while leaving native ant species, then the re-infestation rate will decrease through native ant predation on the vulnerable newly mated fire ant queens.

WHAT PHEROMONE SYSTEMS ARE AVAILABLE?

The glands associated with the sting apparatus are the source of the queen and recruitment pheromones. In the queen the poison gland produces chemicals that elicit a wide variety of behaviors and likewise the Dufour's gland elicits several worker behaviors. In both cases our interests lie with the worker attraction elicited by each of these systems.

QUEEN PHEROMONE. Three components (A, B, C) were isolated and identified from whole queen extracts. The bioassays used in the isolation measured several different behaviors. Consequently an olfactometer was used to investigate the relationship between the three compounds and the specific behavior - attraction. Components B and C are optically active, thus the possible test materials are A, +B, -B, ±B, +C, -C, and ±C. Of the nine possible three component mixtures, several had significant attraction (>65%) and one of these, A, ±B, ±C, did not require optically pure isomers. This is desirable in terms of potential commercialization because optically pure compounds cost significantly more to synthesize. On the negative side incorporation of three synthetic compounds into a bait system still represents cost problems.

Of the 15 two component possibilities there only 3 mixtures gave

nurseries. There are several fire ant sources for contamination of nursery stock, e.g. colony founding queens from mating flights dropping onto nursery grounds, and movement of incipient and/or mature colonies into nursery stock.

INCIPIENT/MATURE COLONIES. In the laboratory small queenright colonies were set up in petri dish cells, in which they are content as long as they do not have soil as an alternative. Within 30 minutes after introduction of a peat pot and soil worker fire ants discover the pot and move the entire colony into the soil.

In the course of screening for attractants using the olfactometer we discovered a very good fire ant repellent. Application of this repellent to peat pots at increasing concentrations gave the expected increase in repellent longevity. Such that at the highest concentration used the colonies were kept at bay for almost 2 months.

Peat pots treated at high repellent concentrations were aged outside for up to 56 days, and periodically brought into the laboratory to measure the time of fire ant invasion. The highest concentration maintained 100% repellent activity through 4 weeks of aging outdoors.

Another experiment used plastic pots filled with soil. There were two treatments repellent painted on the outside; and repellent mixed with lacquer and painted on the outside of the pot. Ants moved into the controls within 30 minutes. The repellent treated pots kept the ants out for over 24 hours; but significantly the lacquer/repellent combination enhanced the length of activity by a factor of five! This is important because it illustrates that altering the release rate of the repellent extends its active life. Controlled release technology may be able to significantly improve the results shown here.

NEWLY MATED QUEENS. A newly mated queen - colony foundation choice test consisted of a large colony tray into which 4 smaller trays were countersunk so that when the small trays were filled with soil, a flat surface was formed across the bottom of the large tray. Two soil controls and two repellent treatments of different concentrations were used. Newly mated queens collected the afternoon of their mating flight were brought back to the laboratory and immediately distributed equally on the surface of the controls and treatments. The soil was excavated and searched for queens 2 to 3 days later.

The results show that there was no significant difference between the two controls and that only one out of 48 queens chose repellent treated soil at the lowest repellent concentration and no queens choose the higher concentration. The repellent successfully discouraged newly mated queens from founding colonies in treated soil.

This particular repellent is highly suitable for controlled release formulation, which should increase its efficacy for excluding fire ants from areas where they are not wanted. Preparation of a patent application is in progress.