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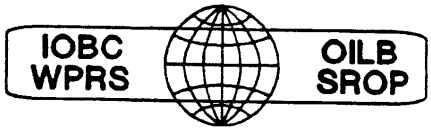

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PROCEEDINGS OF THE MEETING AT AVIGNON (FRANCE)
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THE USE OF PHEROMONES AND OTHER ATTRACTANTS IN MONITORING POPULATIONS OF S. invicta, A PEST ANT IN THE UNITED STATES

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United States Department of Agriculture
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Summary

Solenopsis invicta was accidentally imported into the United States about 50 years ago and quickly attained pest status. The ants' potent sting, large numbers, and aggressive behavior have created public health problems, and significant damage to several crops. The fire ant currently infests 11 southern states and Puerto Rico, but has the potential for survival in irrigated areas of New Mexico, Arizona, and California. Quarantine measures are in place; however, early warning detection methods are needed. We have initiated research to devise a species-specific trap that will catch foraging fire ant workers. The trap design is a limited access pitfall-like trap that excludes large non-ant insects. We are in the preliminary stages of formulating a fire ant selective food attractant and/or two attractant pheromone systems (worker produced recruitment and queen produced worker attractant pheromones).

Introduction

Solenopsis invicta is a pest ant in the United States that was accidentally imported from South America. Over the 50 years since its introduction it has developed an impressive reputation. Its dominant features are its aggressive behavior, potent sting, and large mounds (nests). Each mound can have up to 250,000 workers and there can be over 100 mounds per hectare.

The major components of fire ant venom are piperidine alkaloids that have a wide range of physiological activities (histidine release, hemolysis, and antibiotic activity). The number of people exhibiting hypersensitivity is about 1% of the population (as in honeybees); however, because many more people are stung by fire ants, the number of reports of deaths and hyper-sensitivity is much greater than for bees. Fire ants are also an agricultural pest and have been shown to affect the yields of numerous crops from potatoes and okra to soy beans.

Currently, the ant infests 11 southern states, as well as Puerto Rico.. S. invicta has found its adopted home very attractive and is present in most areas in high densities. The fire ant effectively colonizes new territory because of its high production of sexuals and numerous mating flights; however, transportation of ant colonies in sod and nursery stock accounts for its rapid distribution throughout the Southern United States. The potential range includes parts of New Mexico, Arizona, California, Oregon and Washington that have adequate rainfall or are irrigated. Quarantine treatments with chlordane were used until the late 1970's. Since its demise there have been numerous discoveries of the fire ant in Tennessee and Oklahoma, and west Texas. Two isolated infestations were discovered and eradicated in New Mexico and Arizona. This highlights the need for fire ant-specific detection methods.

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Reference

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Colony Stages of Interest

There are 4 basic colony stages to deal with 1) insemination of a female sexual, which takes place 100-200 meters in the air; 2) claustral colony founding, where the first worker brood is reared by the queen in isolation; 3) incipient colony development, where worker numbers increase along with colony energy flow; and 4) the mature colony, which can contain up to 250,000 workers and produce 5000 sexuals each year. All three of the last stages can be transported by man to other parts of the country, such as california. Isolated colony founding queens are extremely difficult to detect. The most logical target for detection are worker fire ants foraging for food.

Trapping Methods and Specificity

Pitfall traps are currently used in California at potential incipient fire ant population sites. These traps are non-insect discriminant and are labor intensive. Our laboratory has concluded that limited access pitfall traps baited with a fire ant specific attractant would provide the best initial approach to the problem. Small-access holes effectively exclude non-ant insects. What remains is to incorporate a fire ant-specific attractant to further exclude non-target ant species.

Research on the feeding preference of a major non-target ant, P. morrisi, indicates a strong preference for soybean oil over pumpkin seed oil. These results are promising; however, further tests are necessary to determine if pumpkin seed oil is selectively attractive to fire ants.

Two fire ant pheromone systems have behavioral properties that may prove useful in developing species-specific traps. Three components from the trail pheromone have been isolated from the Dufour's gland that attracts worker ants. Two of these compounds have not yet been synthesized. Their lack of availability has inhibited our evaluation of this pheromone complex. A second pheromone system is a queen produced worker attractant. Three components are responsible for this activity and have been synthesized but are not readily available. To alleviate the problem of pheromone availability, we recently hired a postdoctoral research associate to synthesize the necessary compounds. Future reports will elaborate on our progress in making fire ant trap detection a reality.

Reference

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