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UPDATE ON USDA-ARS BIOLOGICAL CONTROL STUDIES ON FIRE ANTS

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The Red Imported Fire Ant, *Solenopsis invicta*, is a major urban and agricultural pest throughout the entire southeastern United States. This species is one of the most abundant insect pests in North America with average densities of 20-30 mounds/acre and 100-200 ants/ft². High densities of this pest in the United States appear to be at least partially the result of biological release from natural enemies in South America where fire ant populations are usually 1/5 of what they are in the United States. Natural biological control agents are almost entirely absent in the United States. We feel that the introduction of natural enemies from South America could sufficiently shift the biological balance in the United States so that our native ants could compete with this imported pest which could reduce populations here to levels similar to those found in South America.

Over three dozen species of natural fire ant enemies have been identified in South America. We propose to focus our efforts on the following three potential natural agents: (1) the microsporidium *Thelohania solenopsae*, (2) a parasitic ant *Solenopsis [Labauchena] daguerrei*, and (3) phorid flies (Diptera).

Results to date with *T. solenopsae* have been promising and indicate that this pathogenic protozoan may offer potential for reducing the size of fire ant populations in the U.S. Laboratory studies in Argentina showed that healthy colonies lived longer than infected ones. Individual workers separated from healthy colonies and kept in complete starvation lived an average of 26% longer than infected workers under the same conditions (4.1 vs. 3.3 days). In field studies, the size of infected colonies was smaller than noninfected ones and the overall density of the infected populations declined by more than 80%.

While surveying for pathogens in the U.S. for use as biological control agents for imported fire ants, *Solenopsis invicta*, we recently discovered fire ant workers infected with spores from a microsporidium. Seventy-five percent of the colonies were infected. We believe that this microsporidium may be the same *Thelohania solenopsae* found in fire ant colonies in Brazil and Argentina. Studies using rRNA sequencing procedures (Polymerase chain reaction - PCR products of the 16SrRNA gene) to determine this are underway and will be completed within two months. This is the first time that a microbial pathogen has been discovered in imported fire ants in the United States. Its potential for use as a biological control agent against the imported fire ants in the U.S. is unknown at the present time.

The parasitic ant, *Solenopsis daguerrei*, is especially intriguing because it lacks a worker caste; only queens and males are ever produced. *S. daguerrei* queens enter fire ant colonies and attach themselves to the mother queen. Previous studies have demonstrated that this parasite inhibits the fire ant mother queen and her egg production, thus causing the ant colony to collapse and eventually die out. Since *S. daguerrei* queens attach themselves to fire ant queens, this species could be especially useful in controlling the multiple-queen form of the fire ant.

Present laboratory studies underway in Gainesville, Florida as follows: (1) mating under laboratory conditions, (2) yoking studies on newly introduced *S. invicta* queens and introduction into IFA colonies, and (3) species-specificity of *S. daguerrei*. Field studies being conducted in Argentina are: (1) mound size of parasitized and non-parasitized colonies, (2) caste composition of parasitized and non-parasitized colonies, and (3) polygyny of the parasite and host.

More than a dozen species of phorid flies (Diptera) attack fire ants in South America. Up to seven species have been found at a single site. Phorid flies appear to be common and active throughout most of the year in South America. The presence of phorid flies can substantially reduce fire ant foraging activity in daylight hours. Reduced foraging activity should greatly facilitate competition from ants that would otherwise be excluded from food sources in fire ant territories. The available evidence suggests that individual phorid species are very specific and would attack only ants in the genus *Solenopsis*. Recent research has solved 3 major rearing problems:

1) We have developed techniques for handling and feeding adult flies that has increased their longevity from 2-3 days up to a week or more. This has made it easier to ship the flies to the US and hold them for testing.

2) We have discovered how to increase the pupation rate of mature maggots from less than 10% to between 70-80%.

3) We have been able to increase successful emergence of the adults from about 10% to 80%. This means that more than half of the maggots in the lab colonies now develop into adults.

4) We are currently working on the 4th major problem and that is to have newly emerged flies vigorously attack fire ants in the laboratory. Solving this last problem will hopefully close the loop in our efforts to rear these flies in the laboratory. This accomplishment would greatly facilitate further studies of these flies and our efforts towards field releases.

Recent tests of phorid specificity conducted in the laboratory indicated that at least 5 species of South American phorid flies will attack IFA in North America. Results of specificity tests indicate that these flies have a strong preference for the red imported fire ant over the native fire ant, *Solenopsis geminata*. Attacks were observed on both monogyne and polygyne fire ant colonies. All sizes of workers were attacked although different phorid species do appear to have different size preferences.