

Biological Control of Imported Fire Ants

Since 1998, the Alabama Fire Ant Management Program has been releasing natural enemies of imported fire ants. It is hoped that these organisms will provide a natural, biological control of fire ants. These natural enemies are being studied on an experimental basis to determine their impact on fire ants (Figure 1). It is hoped that eventually the overall number of fire ants in Alabama can be reduced through biological control methods. While we will never be able to eradicate imported fire ants, we can make them easier to live with.

This publication provides information about a group of decapitating flies, called phorid flies (*Pseudacteon* spp.), that parasitize imported fire ants. It also provides information about other biological control agents that are being studied.

Background

Imported fire ants were accidentally brought to the United States by ships coming into the port of Mobile. The black imported fire ant, *Solenopsis richteri*, arrived in 1918, and the red imported fire ant, *Solenopsis invicta*, arrived between 1933 and 1941. Both species are from South America. Several native fire ant species were already in the South, so little attention was paid



Figure 1. Regional Extension Agent Henry Dorrough (left) receives training from Sanford Porter (USDA Agricultural Research Service) on how to release and sample for decapitating flies in Talladega County.

to these new ones. However, by 1949, it was obvious that the imported fire ants occurred in much higher densities than the native fire ants and that the area infested with imported fire ants was increasing at an alarming rate. The imported fire ants, particularly the red ones, were more competitive than other ant species and quickly displaced them. Today, imported fire ants are present throughout Alabama. Most of these ants are the red imported fire ant or a hybrid between the red and the black species.

In South America, the density of red and black imported fire ants is about 20 percent of what it is in the United States. This population difference is attributed primarily to natural enemies that are in South America but not in the United States. When the imported fire ants arrived in the United States, they left their natural enemies behind. The absence of biological control allowed the imported fire ants to be very successful competitors. We hope that the natural enemies discussed here will help make the imported fire ants less competitive in the United States so that their overall population will decrease.

The Decapitating Flies

At least twenty-one species of decapitating flies, also called phorid flies, attack fire ants in South America. The flies are small—barely visible with the naked eye (Figure 2). Flies attack worker ants during the day as the ants go about their daily activities. The female decapitating fly attacks an ant and lays one egg at a time in the body of the ant (Figure 3). When the parasite egg hatches, the tiny larva burrows into the head of the fire ant, where it feeds on the ant's internal tissues (Figure 4).



Figure 2. Adult *P. tricuspis* with penny



Figure 3. Decapitating fly attacking a fire ant worker

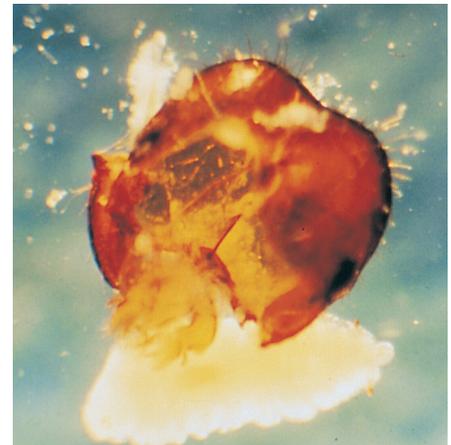


Figure 4. A full-grown decapitating fly larva dissected from a fire ant head

When the larva is ready to begin turning into a fly, it releases a chemical that causes the fire ant's head to fall off (Figure 5). The new fly emerges from the ant's head, and the cycle begins again (Figure 6).



Figure 5. A decapitated fire ant



Figure 6. Decapitating fly emerging from a fire ant head

In South America, decapitating flies directly parasitize approximately 1 percent of fire ant workers. However, the flies have their greatest effect by terrorizing the fire ant workers and preventing them from conducting their normal routine. The interference by the flies makes the imported fire ant less competitive and makes more food available for other predators and scavengers.

Different species of decapitating flies specialize in different sizes of fire ant workers. Entomologists envision that a number of different species of decapitating flies can be introduced, maximizing their effectiveness against all sizes of fire ants.

Thus far, three species of decapitating flies have been released in Alabama: *Pseudacteon tricuspis*, *Pseudacteon curvatus*, and *Pseudacteon litoralis*. These flies, originally from Brazil and Argentina, were imported by the USDA Agricultural Research Service. Extensive testing in South America and in quarantine facilities at the

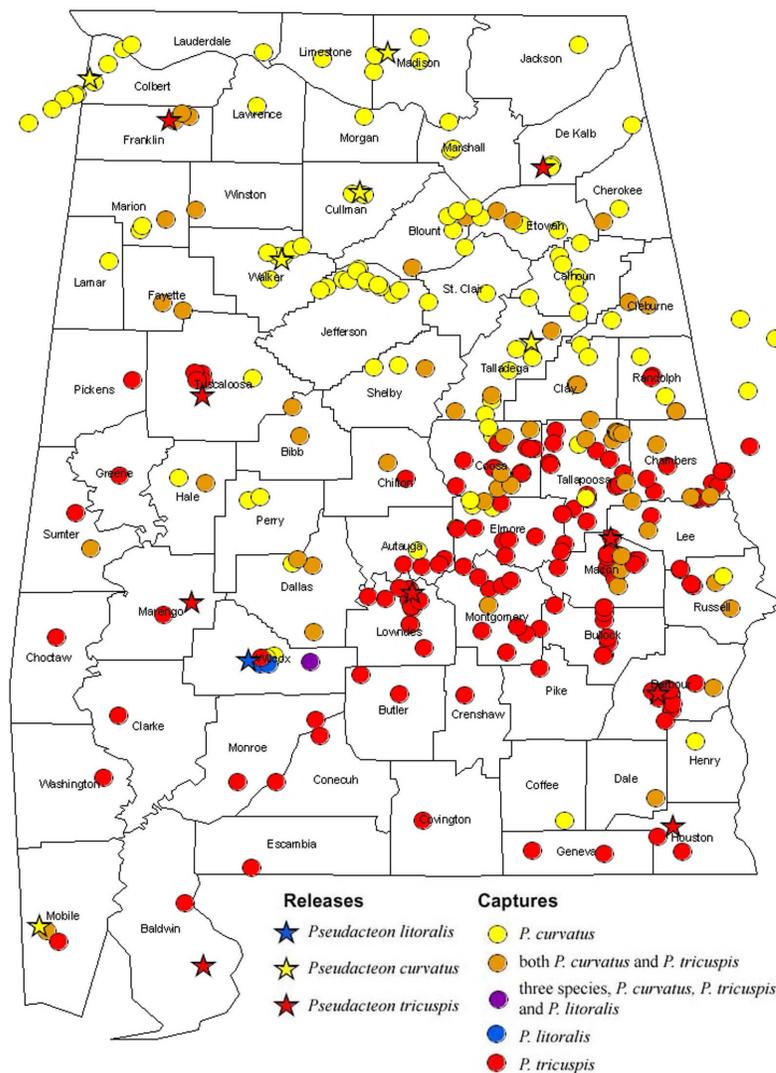


Figure 7. Locations where decapitating flies have been released or found in Alabama

USDA-ARS, CMAVE lab in Florida has shown that the decapitating flies are not harmful to humans, mammals, or other groups of insects.

Decapitating flies have now been released in sixteen Alabama counties (Figure 7) through the cooperative work of the Alabama Fire Ant Management Program at Auburn University, Alabama Cooperative Extension System, USDA APHIS, USDA ARS, Alabama A&M University, Tuskegee University, the U.S. Fish and Wildlife Service, and the Alabama Department of Agriculture and Industries. The flies have spread from these release sites. Two species, *Pseudacteon curvatus* and *Pseudacteon tricuspis*, have established populations that are spreading throughout the state at

a rate of 10 to 12 miles per year. Currently, at least one species is found in each county of Alabama. The area around Sylacauga is the second area in the United States where two species of decapitating flies co-exist. *Pseudacteon litoralis* was released in Wilcox county in 2005. Wilcox is the first location in the United States where three species of decapitating flies co-exist.

These fire ant natural enemies have the potential to reduce, but not to eradicate, imported fire ants. Extension agents and researchers in Alabama will continue to monitor the decapitating flies. The goal will be to determine if the flies are effective in reducing fire ant populations and to determine how far and how fast the flies can spread.

The Microsporidian Pathogen

The microsporidian *Kneallhazia solenopsae* is a microbial pathogen (disease-causing agent). It infects all growth stages of the fire ant (Figure 8) but has its most debilitating effect on the fire ant queen. Infected queens slowly stop laying eggs and eventually die prematurely. Depending on the number of infected queens, colonies can succumb to this pathogen in 6 to 12 months.



Figure 8. Cysts of the microsporidian *Kneallhazia solenopsae* inside an imported fire ant

Kneallhazia solenopsae was released in Macon County with the cooperation of USDA-ARS, CMAVE, and in Madison County, with the cooperation of USDA-ARS, CMAVE, and Alabama A&M University. We have had little success with this pathogen, probably because it is most effective in populations of fire ants that have multiple queens in each colony. Colonies that have multiple queens are not territorial, thus infected colony members can move among other colonies, which facilitates the spread of *K. solenopsae*. Most of Alabama is infested with single-queen-colony fire ants.

The Future

Researchers across the country are continuing to look for more natural enemies of imported fire ants. Recently, viruses and nematodes have been found infecting these ants (Figures 9–10). As these and other potential biological control agents are discovered, they will be evaluated for their potential to control fire ants.

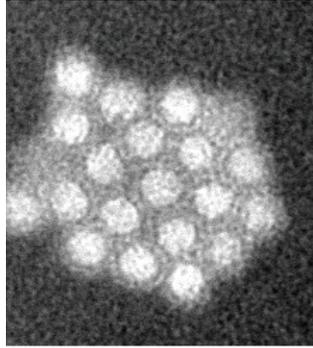


Figure 9. Electron micrograph of *Solenopsis invicta* virus (SINV-I) purified from infected fire ants



Figure 10. *Allomermis* sp., a new species of nematode in fire ants from Argentina