Biological Control Sends Scurrying Scourge Scrambling

Like the industrious ant in one of Aesop's fables, the imported fire ant thrives because it's diligent. The fictional ant in the famous story worked hard to prepare for the onset of winter while the grasshopper played. But a modern retelling of the old tale might have ARS scientists working equally as hard to gain the upper hand over troublesome fire ants.

Although the red imported fire ant, *Solenopsis invicta,* is more well-known to most Americans because it infests a larger area, the black imported fire ant, *S. richteri,* actually arrived here first, back in 1918. They are currently found only in Mississippi, Alabama, and Tennessee.

A hybrid fire ant—a cross between a red and a black—was first identified in 1985 by ARS scientists at the Imported Fire Ant and Household Insects Research Unit at Gainesville, Florida. No one is entirely sure why different species of fire ants predominate in certain regions.

The abundance of black imported fire ants in the Mid South provides James "J.T." Vogt, an entomologist at the Biological Control of Pests Research Unit in Stoneville, Mississippi, with the opportunity to evaluate control agents against them as well as the red ones. One agent under study is *Thelohania solenopsae,* a single-celled protozoan parasite first isolated by ARS scientists at Gainesville. (See "Update: Hot on the Trail of Fire Ants," *Agricultural Research,* February 2003, p. 20.) Infected colonies die out in 9 to 18 months. Another biocontrol tool they're investigating is the fire ant-decapitating phorid fly, which uses the ant's head as a protective home for its developing maggot young.

The Stoneville program is relatively new, established in 2000. Vogt and his research leader, entomologist Doug Streett, began a 5-year project in 2001 to assess the impact of biological control agents used along with chemical bait toxicants in keeping imported fire ants at manageable levels.

"The ants are more than a simple annoyance," Vogt says. "If disturbed, they sting. They're called 'fire' ants because their sting causes an intense burning sensation. Some people are hypersensitive and react strongly, and some even die." Fire ants also reduce populations of native ants, other insects, and ground-nesting wildlife.

In cooperation with the Mississippi Agricultural and Forestry Experiment Station, Stoneville researchers established four demonstration sites in the state to explore the feasibility of a biological control program.

Two of the four sites contain *T. solenopsae* and phorid flies in combination with bait toxicants, and two sites contain baits alone as a control group, for comparison. This helps researchers learn whether the biological control agents slow reinfestation by the ants. The baits are highly effective and achieve 90 to 95 percent control with a single application, but baits aren't enough if used alone because ants reinfest areas after treatments. *T. solenopsae* and the flies, on the other hand, are sustainable solutions.

ARS researchers are working with Alabama A&M, Auburn University, and Tennessee State University (TSU) to study phorid fly effectiveness. Cooperators at these institutions released flies in 2002 in an effort to reduce fire ant problems over large, low-value areas such as pastures, where baits are not practical. Cattle producers find it too expensive to treat with baits every year and are interested in self-sustaining alternatives, such as phorid flies. Long-term projects are under way to assess the flies' impact as they're introduced and established.

SCOTT BAUER (K10387-1)

Technician John Davis measures a black imported fire ant mound while entomologist James Vogt records data. Mound area affects visibility in aerial images.

Mass-rearing technology ensures a steady supply of flies for research, release, and establishment in the United States. Vogt established a rearing facility at the Biological Control and Mass Rearing Research Unit in Starkville, Mississippi, for one biotype of a specific species of phorid fly called *Pseudacteon curvatus* that especially favors black imported fire ants and hybrids.

"The facility can produce 3,000 to 5,000 flies a day," Vogt says. "To establish flies in an area, ants are collected from the field, exposed to the flies in large 'attack boxes' in the laboratory and then released back into their source colonies."

High-Tech Solutions

The researchers are using a geographic information system to track phorid fly establishment

SCOTT BAUER (K10391-1)

Ants on a lifter cup: When a cup is in the up position, fire ants travel back to the tray surface using plastic strips that hang down. Every 10 minutes, the cups switch position (moving up or down). This causes the ants to trail back and forth in seeking shelter and increases their exposure to attacking phorid flies. Being frequently on the move, the ants are also unable to group together to defend against the flies.

SCOTT BAUER (K10386-1)

Phorid fly, *Pseudacteon tricuspis*, about 1/32-inch long.

Entomologist James Vogt examines a lifter cup in a phorid fly rearing system.

SCOTT BAUER (K10390-1)

with geographically referenced coordinates. Using the global positioning system to calculate their positions, they can relocate ant mounds where they released flies with an accuracy of less than 1 meter. Otherwise, it can be difficult to navigate rough terrain and return to an exact point. They use hand-held personal computers to display coordinates in a map overlay to monitor their spread and measure the progress of their attempts to establish the flies.

Vogt and cooperators developed techniques to secure imagery of fire ant mounds from airplanes and quantify infestations over large areas. They use passive remote sensing instruments to detect sunlight reflected by mounds and mark areas infested by imported fire ants.

The plane-mounted camera system uses four separate sensors to obtain true-color and false-color infrared, multispectral images of fire ant mounds. Vogt says the mounds typically have a ring of thriving vegetation surrounding them at certain times of the year. The digital images display a dark spot where the mound is located, surrounded by a bright red ring, which indicates healthy vegetation in the false-color infrared images.

SCOTT BAUER (K10389-2)

Technician John Davis uses a GPS unit to record the exact position of a fire ant mound. Mound position data are overlaid onto aerial digital images of the study site to determine mound visibility. Knowing the exact location of a mound also allows researchers to place parasitized ants back into their original colonies.

SCOTT BAUER (K10388-1)

Technician Debbie Smith weighs groups of fire ants for use in the phorid fly rearing system.

Also, because mounds heat up in morning hours more quickly than the surrounding soil does, the researchers are using thermal cameras to measure infrared emission (heat) and locate fire ant mounds, which appear as bright spots in images taken from the air.

The Stoneville researchers will use their remote sensing techniques in the spring of 2003 when they partner with Jason Oliver of TSU to help nurseries in Warren County, Tennessee, hold off quarantine status of the ball and burlap tree and plant industry. Counties to the south of Warren are under partial quarantine to help slow the spread of imported fire ants to other areas of the state. This means they have to treat their stock and soil with the few, costly insecticide treatments approved by USDA's Animal and Plant Health Inspection Service. The Stoneville researchers plan on using remote sensing imagery to help the Tennessee Department of Agriculture identify high-priority areas in those quarantined counties as part of an areawide program to manage imported fire ants.—By **Jim Core,** ARS.

This research is part of Arthropod Pests of Animals and Humans, an ARS National Program (#104) described on the World Wide Web at www.nps.ars.usda.gov.

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