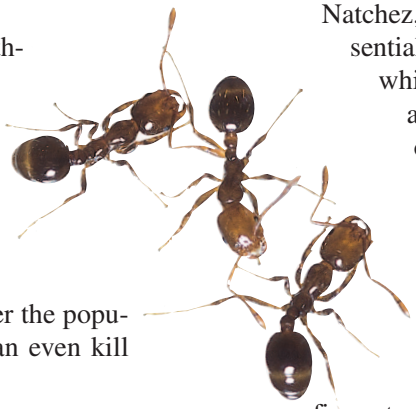
Putting Out the Fire

ARS sets up regional programs to combat imported fire ants

Fire ants have been pests in the southern United States since their arrival in 1918 aboard merchant ships coming to Alabama from South America. They found their way onto land and have been multiplying and migrating ever since.

Now fire ants can be found throughout the southeastern United States. It's estimated that up to 40 percent of all people living in urban areas infested with these insects are stung by fire ants each year, and the percentage is even greater in rural communities.

Imported fire ants pose a potentially deadly hazard to people, damage electrical equipment and farm equipment, create unsightly mounds, and alter the population mix of native insects and wildlife. They can even kill young cattle and other livestock.



Forming a United Front

To combat this ongoing problem, the Agricultural Research Service's Biological Control of Pests Research Unit in Stoneville, Mississippi, is conducting regional integrated management programs in that state as well as Alabama and Tennessee. The programs are designed to implement and test biological control agents against red and black imported fire ants *(Solenopsis invicta* and *S. richteri)* and their hybrid. Researchers are also examining ways to preserve native ants, which are thought to slow reinfestation of areas by imported fire ants. Universities, federal and state agencies, and landowners are all cooperating with ARS researchers to combat fire ants in two specific areas: the Natchez Trace Parkway (National Park Service) and south-central Tennessee's vital nursery crop production region.

The Natchez Trace Parkway, extending from Natchez, Mississippi, to Nashville, Tennessee, essentially represents a north-south transect along which red, black, and hybrid imported fire ants all occur. Thus it offers an ideal opportunity to try out the latest control technologies—and to develop new ones. Central Tennessee's nursery industry is a vital part of the economy in that region. Imported fire ants mean increased production costs, because growers must treat their nursery stock with chemical insecticides to comply with imported fire ant quarantine regulations. One grower in the region has estimated his increased cost to average as much as $1 per plant sold—which doesn't seem like much until you consider that a large nursery operation may ship thousands of plants at a time.

Comparative studies of various biological control measures being used against the different fire ants will result in new information on their effectiveness. Establishment of biological control agents in central Tennessee may slow the spread of the ants into nursery areas. A pathogen and several species of parasitoid flies are the most effective biological control agents currently known. Researchers hope these organisms will become established and spread throughout fire ant populations, giving native ants an opportunity to compete with and perhaps suppress imported fire ants.

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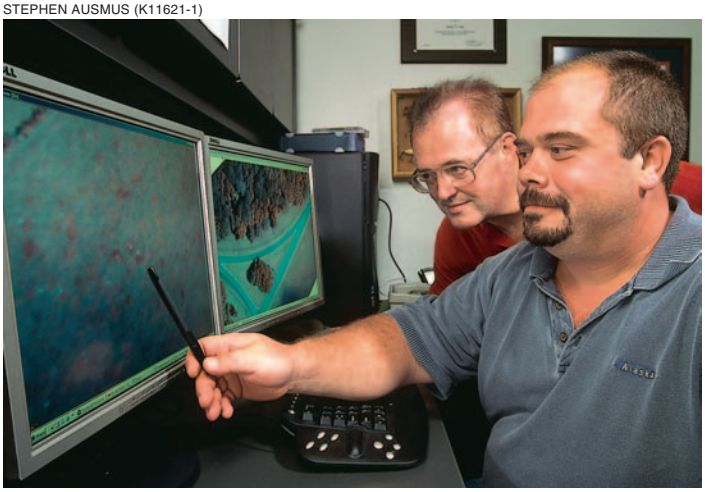

Entomologists J.T. Vogt (foreground) and Douglas Streett examine fire ant mounds in an airborne digital image from Natchez Trace Parkway. In this false-color infrared image, mounds appear as light spots of bare soil surrounded by reddish halos of healthy vegetation.

The Horrid Phorid

Fire ants face a nasty natural enemy in the phorid flies from the genus *Pseudacteon*. The tiny flies, some species less than 1 mm across, attack and parasitize fire ants, eventually decapitating them. How?

A female fly injects a single egg into a worker fire ant. When the egg hatches, the immature maggot migrates to the ant's head, where it continues to develop and eventually eats the brain and muscles. This decapitates the ant, but the developing fly remains in the head capsule as a pupa. After a couple of weeks, a new adult fly emerges and begins the cycle again.

Postdoctoral researcher Larry G. Thead reared thousands of phorid flies for research and field releases. One tiny species, *P. curvatus,* has been successfully established on black and hybrid fire ants in a multistate release program that began in 2002. Flies released in two pastures in Clay County, Mississippi, now occupy some 560,000 acres up to more than 28 miles from the release sites. Collaborators Kenneth and Rufina Ward, with Alabama A&M University, and Jason Oliver, with Tennessee

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Before an experiment to evaluate potential treatments for killing fire ant queens and preventing shipment contamination, Jason Oliver, entomologist with Tennessee State University, labels root balls. Oliver's research is aimed at developing APHIS-approved treatments for certifying nursery stock as fire ant free.

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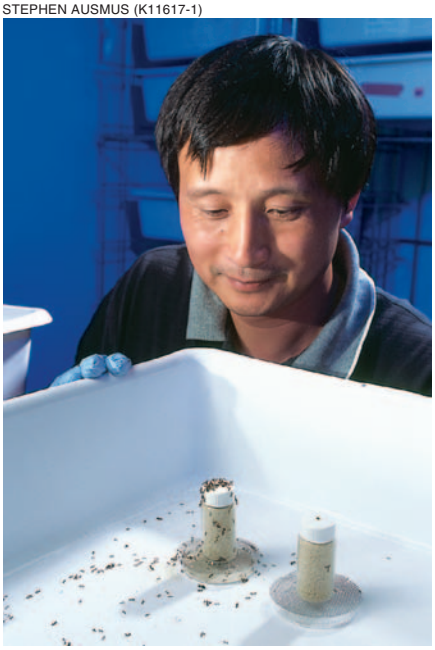


Entomologist Jian Chen checks the repellency of specific compounds using a new bioassay he developed based on digging behavior of fire ants.

State University, have reported successful establishment and overwintering at Natchez Trace and nursery production sites. "We're very excited about the dispersal rate," says Thead. "Not only are the phorid flies attacking and parasitizing the ants, they are harassing them. This affects the ants' ability to search for food, weakening colonies and allowing native ants a better chance to compete and reestablish."

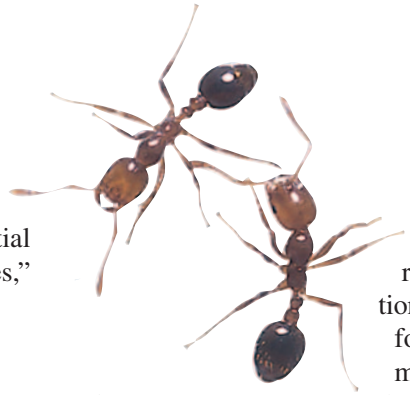
Douglas A. Streett, who leads the Stoneville unit, believes that "the research unit's proactive IPM approach to regional fire ant programs will be successful at controlling the insect's populations." Entomologist James "J.T." Vogt is developing remote sensing techniques to gather information from airplanes about the abundance and distribution of fire ant mounds at targeted locations. A geographic information system, a computer system that collects and displays geographically referenced data, is being used to track fire ant populations and associated landscape characteristics. This reveals information that researchers need to map fire ant populations, track success of their control efforts, and guide research efforts in regional management programs.

Having developed methods for detecting 70 percent or more of mounds in some landscapes using airborne multispectral imagery, Vogt is investigating thermal characteristics of mounds to optimize timing of airborne thermal infrared data collection. "Adding another layer of information to multispectral images,

O Fire Ant, Where Is Thy Sting?

Fire ant colonies can be spotted by mounds of aboveground soil—the result of a network of underground tunnels that serve as living quarters and branch out into the ants' hunting territory. The ants are very aggressive and will readily attack anything that disturbs their mound, including humans. After firmly grasping the victim's skin with its jaws, an ant arches its back and inserts its rear-end stinger into the flesh, injecting venom from a poison sac, inflicting seven or eight stings. Fire ant venom is unique because of the high concentration of toxins, which are responsible for a firelike burning pain. Stings can also cause swelling and tiny blisters and, in severe allergic reactions, hives, nausea, vomiting, breathing difficulty, and even death.

specifically surface temperature, has the potential to improve detection and decrease false positives," says Vogt.



Integrating Pest-Management Techniques

Regional programs involve what is known as integrated pest management—combining tactics such as insecticidal baits with natural organisms. Chemical bait treatments alone are not sustainable, because fire ants will reinfest previously treated areas. But they can be very effective, consistently killing about 90 percent of colonies in an area when applied correctly. In the nursery industry, chemical control measures are sometimes necessary to protect workers and adhere to quarantine regulations.

STEPHEN AUSMUS (K11620-1)

At Natchez Trace Parkway, Bill Whitworth, natural resource director for the parkway, and ARS entomologist Jian Chen prepare to offer fire ants experimental bait.

Entomologist Jian Chen joined the Stoneville team in 2003 and hit the ground running. He has already developed a new bait formulation.

"Tests have shown that the bait is more water resistant, which means it will last longer in the field," says Chen. "And it attracts fire ants better than previous formulas."

In addition to attractants, repellents are being developed to keep fire ants away from areas where they are a nuisance and where it's not practical to use insecticides because of health or environmental concerns.

Chen developed a fast, easy-to-perform fire ant repellent bioassay by taking advantage of fire ant digging and tunneling behavior. The bioassay identified dimethyl and diethyl phthalates—common ingredients found in cosmetics, personal care products, and plastics—as strong repellent candidates in possible formulations. Repellents could prove to be useful tools for keeping fire ants out of electrical equipment or out of nursery plants that are being held for shipment. Chen hopes the bioassay can be used to help find even more repellents.

The scientific team has also invented a red imported fire ant bait. The bait is licensed to and distributed by Waterbury Companies, Inc., of Waterbury, Connecticut.—By **Alfredo Flores** and **Jim Core,** ARS.

This research is part of Veterinary, Medical, and Urban Entomology, an ARS National Program (#104) described on the World Wide Web at www.nps.ars.usda.gov.

Douglas A. Streett, James T. Vogt, Jian Chen, and Larry G. Thead are in the USDA-ARS Biological Control of Pests Research Unit, 141 Experiment Station Rd., Stoneville, MS 38776; phone (662) 686-5487, fax (662) 686-5281, e-mail dstreett@msa-stoneville.ars.usda.gov, jvogt@ars.usda.gov, jianchen@ars.usda.gov, lthead@msa-msstate.ars.usda.gov. ★

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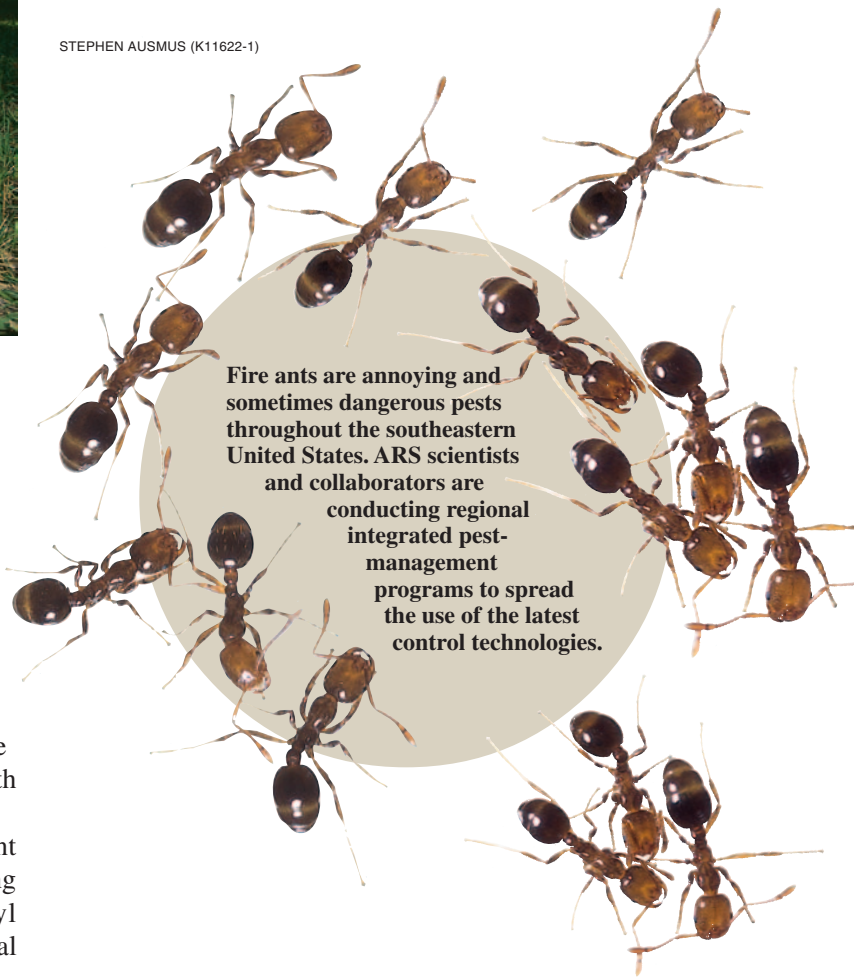

Fire ants are annoying and sometimes dangerous pests throughout the southeastern United States. ARS scientists and collaborators are conducting regional integrated pest-management programs to spread the use of the latest control technologies.