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Published Since 1957

LOUISIANA Agriculture

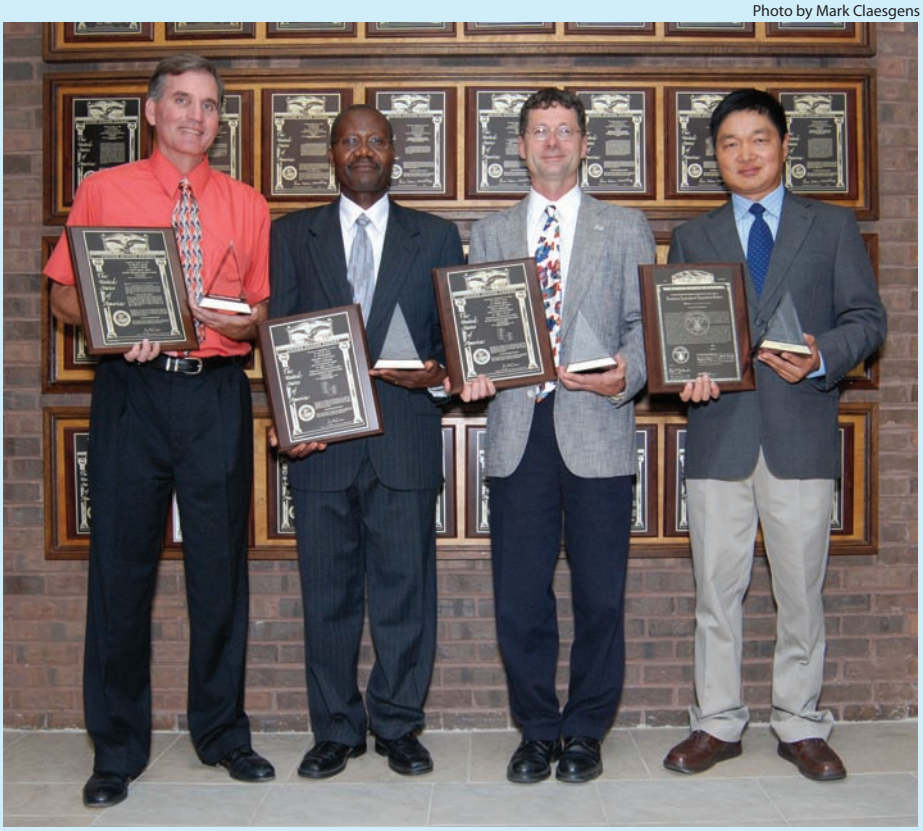
Assuring Our Future Through Scientific Research and Education

ENTOMOLOGY
on the urban front

Terminating termites
Argentine ants ruin resorts
Hold down mosquito numbers

LSU AgCenter
Research & Extension

Photo by Mark Claesgens



These four LSU AgCenter scientists were among the six new inductees into the Patent Club. They are, from left, Kenneth Gravois, Jack Losso, Mark Schexnayder and Xueyan Sha. Not pictured are Keith Bischoff and Peter Rein.

Six More Inducted Into LSU AgCenter Patent Club

Six more scientists have been inducted into the LSU AgCenter's Patent Club, an elite group that now includes 52 researchers who have received patents or plant variety protection certificates.

The new inductees are first-time recipients of patents or plant variety protection (PVP) certificates during the past 12 months.

They include Mark Schexnayder, extension agent based in Metairie, and Jack Losso, associate professor in the Department of Food Sciences, for a patent to extract collagen from calcified tissue; Keith Bischoff, associate professor, and Kenneth Gravois, professor at the Sugar Research Station in St. Gabriel, for a patent for sugarcane variety L98-128; Peter Rein, formerly head of the Audubon Sugar Institute and now retired, for a patented process to produce white sugar from sugarcane and sugar beet juice; and Xueyan Sha, assistant professor at the Rice Research Station in Crowley, for a PVP certificate for a rice variety.

Other patents issued to the AgCenter in the past year include a herbicide-resistant rice to Tim Croughan, former rice researcher and now retired; synthesis of natural insect repellents to Gregg Henderson, professor in the Department of Entomology, and Roger Laine, professor in the Department of Biological Sciences; a new rice variety, Cheniere, to Steve Linscombe, rice breeder and director of the AgCenter's Southwest Region.

In addition, PVP certificates were awarded for oat, wheat and three rice varieties.

In the fiscal year that ended June 30, 2007, the AgCenter received 52 invention disclosures and filed 19 patent applications, according to David Boethel, vice chancellor for research. In addition, the AgCenter executed six license agreements and options.

"We continue to rank among the top research universities in the country as far as our rate of return on dollars invested in research and development," Boethel told a group gathered for a ceremony at the AgCenter to honor club members. "Our royalty income is more than 3 percent of our research expenditures as compared to MIT (Massachusetts Institute of Technology), for example, with 2.5 percent." ■ **Linda Foster Benedict**

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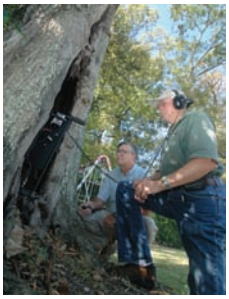


ON THE COVER:
Dennis Ring, left, and Charles McCown, both LSU AgCenter entomologists, inspect a tree in Baton Rouge for Formosan subterranean termites. The instrument in the picture is a termite probe used to listen for termites in trees. (Photo by Bruce Schultz)

The Pest Ants of Louisiana: *A Guide to Their Identification, Biology and Control*
Knowing the species, biology and control can help with ant management. This reference is useful for pest management professionals, extension personnel and homeowners. It includes color photographs, diagrams and a glossary. Spiral bound copies are available for $10 each. To purchase, go to www.lsuagcenter.com. Click on Publications and then Publications for Sale.

What's New?

What's New?

Beware of buying your pet drugs online

Pet owners should be cautious of purchasing animal drugs on the Internet. The products may not be approved by the U.S. Food and Drug Administration and pose a health threat to the pets.

Pet drugs sold by unscrupulous businesses in this country have been a growing concern, according to LSU AgCenter veterinarian Dr. Christine Navarre.

Foreign companies selling pet drugs is also a growing concern because without FDA regulation, they can sidestep the FDA and offer drugs that otherwise require a prescription in the United States.

"Lack of oversight of quality control is a major problem," Navarre said, explaining that the amount of an active ingredient in a product may range from zero all the way to toxic levels. "Pet owners just don't know for sure what they're getting," the veterinarian said.

Some Internet companies may claim to have a veterinarian on staff, but this person never sees the pet and prescribes medication based on an online questionnaire filled out by the pet owner.

Although the drugs most commonly purchased are nonsteroidal anti-inflammatory drugs and heartworm disease prevention products, all types of pet drugs are sold online, Navarre said. ■ **Mark Claesgens**

Louisiana 4-H poultry judging team ranked No. 1 in nation

The Louisiana 4-H Poultry Judging Team achieved the No. 1 national ranking at competition held Nov. 14-15 in Louisville, Ky.

The four-member team, all from Lafourche Parish, included Cody Quebedeaux, Chase Granier, Ashley Rome and Caitlyn Rogers. The coach was David Boldt, an instructor in the LSU AgCenter's 4-H Youth Development Department.

In all, 10 4-H'ers represented Louisiana at the National 4-H Poultry and Egg Conference held in conjunction with the North American International Livestock Exposition, said Theresia Lavergne, associate professor in the School of Animal Sciences. There were 25 states represented at the conference with 19 poultry judging teams.

Quebedeaux was second high individual in the overall contest and first high individual in egg production judging. Granier was third high individual in the overall contest and third high individual in market poultry judging. Rome was 12th high individual in the overall contest. Rogers was eighth high individual in market egg judging.

In addition to poultry judging, Louisiana 4-H'ers earned honors in other competitions during the conference.

Katherine Robillard of Pointe Coupee Parish placed second in the National 4-H egg preparation demonstration contest. She was coached by Layne Langley, an LSU AgCenter extension agent in Pointe Coupee Parish.

Megan Albert of St. Martin Parish placed fourth in the National 4-H chicken barbecue contest. She was coached by Margaret Frey, an LSU AgCenter agent in St. Martin Parish.

Michele Hullum from Ascension Parish placed sixth in the National 4-H turkey barbecue contest. She was coached by Katherine Beier, a volunteer leader in Ascension Parish.

Louisiana 4-H'ers also participated in the National 4-H Avian Bowl contest, Lavergne said. The team members were Nathan Egnew, Jed Hoover and Richard Labranche from Livingston Parish. The team was coached by Bobby Bingham, LSU AgCenter assistant extension agent in Livingston Parish. ■ **Rick Bogren**

Bittersweet news backdrop to dairy field day

Milk prices are up, but feed prices are, too. That was bittersweet news at a recent LSU AgCenter's dairy field day at the Southeast Research Station in Franklinton.

The milk market has improved worldwide with higher prices for farmers, but ethanol production has raised the price of feed, according to Mike McCormick, coordinator of the Southeast Research Station.

Jim Beatty, technical representative for Purina/Land O'Lakes Inc., bore good news for those gathered at the Nov. 13 field day with an optimistic milk price outlook.

"We are at a world-record price for milk right now – 30 percent above where we've ever been," Beatty said.

Explaining why prices are as high as they are, Beatty said, "Australia is in a drought and can't keep up with the demand of the Pacific Rim, and we're picking up that slack.

"Europe has cut their farm subsidies, and when prices were so low in 2006, our production shrunk, and that's helping prices now."

But Beatty doesn't expect the prices to hold past early 2009. He said when Australia is back in the game, and we finally catch up with world demand, prices may start to slip a little.

Dennis French, LSU AgCenter veterinarian, discussed embryo transfer in heat-stressed Holstein cows. His research is examining the benefits of impregnating cows through embryo transfer versus artificial insemination.

French said the results so far look promising, but the final pregnancy rates and a final assessment of this research will not be known until March 2008.

Photo by Johnny Morgan

Participants at the LSU AgCenter's Southeast Research Station Field Day Nov. 13, 2007, learn the proper and environmentally safe ways to operate a waste water lagoon on a dairy farm. The station is near Franklinton, La.

"What the preliminary data do show is that fertility of high-producing cows may be improved over artificial insemination during the hot months here in Louisiana," French said. ■ **Johnny Morgan**

Food terrorism addressed at New Orleans meeting

Keeping our food supply safe was the topic at a recent national conference in New Orleans.

Experts spoke on the risks to and readiness of the U.S. food system to acts of bioterrorism, accidental contamination of food-borne pathogens, avian flu and natural disasters at the Food Distribution Research Society Conference Nov. 3-7.

Wes Harrison, LSU AgCenter agricultural economics professor and a conference organizer, said the food system is a vital part of our economy, and it remains vulnerable to a variety of potential threats.

Col. John Hoffman, retired Army and currently the senior research scholar with the National Center for Food Protection and Defense, spoke on food defense and safety of the food supply chain.

"The greatest threat to the food supply right now is actually things that are not intentional, and these threats will continue," he said.

An example that he gave was the recent recalls of contaminated meat and other food products. But he reminded those present that the terrorism threat is definitely still there.

As for intentional food terrorism, Hoffman said there have not been any recent events, but he noted that in 1984 a cult in Oregon tainted salad bars with the toxic salmonella bacteria to try to influence the outcome of a local election.

New Orleans was chosen as the conference site because it is a major port for many food products and is home to many food-related businesses and regional governmental agencies that remain sensitive to the needs of planning and recovery for national emergencies because of Hurricane Katrina two years ago.

"Hurricane Katrina was a wake-up call as to the vulnerability of the system," Harrison said, adding, "I wanted the conference here to address these issues because we've seen how bad things can be when you're not prepared." ■ **Johnny Morgan**

Photo by Mary Ann Van Osdell

The sweet potato digger at the LSU AgCenter Sweet Potato Research Station at Chase, La., uses a blade that digs up the potatoes and walks the potatoes up a conveyer while shaking off the dirt to a place where workers then put the potatoes in bins.

Sweet potato producers pleased with 2007 crop

Sweet potato harvest conditions in Louisiana have been more cooperative in 2007 than in 2006, when late season rains caused several acres to go unharvested.

And though the acreage is down slightly – 15,000 acres compared to 16,000 acres – the yields should compensate, according to Tara Smith, LSU AgCenter sweet potato specialist headquartered at the Sweet Potato Research Station in Chase, La.

"Producers in general are pleased with the 2007 crop," Smith said.

Because of last year's weather problems, several producers increased harvesting capacity with additional harvesters and hand laborers, Smith said.

The production year started off on a positive note. Soil moisture and temperatures were ideal for planting in May and June. As a result, the majority of the crop was planted by June 15.

"We experienced an unusually wet July across the state, with most production areas receiving 10-12 inches of rainfall in July," Smith said. "The excess moisture contributed to delayed maturity, and harvest began a couple of weeks later than expected because early plantings were slower to size than normal."

Myrl Sistrunk, LSU AgCenter county agent in West Carroll Parish, which was the leading sweet potato producing parish in 2006 with 6,500 acres yielding on average 300 bushels per acre, said the weather has cooperated well for the harvest compared to last year's weather problems.

In 2006, sweet potato production contributed more than $100 million to Louisiana's economy, according to figures in the LSU AgCenter's Ag Summary.

Smith said insect pests have been a problem in 2007 – especially cucumber beetles.

"Producers in north Louisiana experienced heavier populations of this insect than they had in recent years, and most were scouting and spraying weekly," Smith said. In addition, several producers in south Louisiana reported significant pockets of white grub damage on a few early-planted acres.

A new variety, Evangeline, released by the LSU AgCenter in early 2007, was planted in small plots on several farms this year. In addition, several acres of Evangeline seed were planted at the Sweet Potato Station in 2007, and many Louisiana producers will have an opportunity to evaluate the variety on a limited commercial scale in 2008. ■ **Mary Ann Van Osdell**

URBAN ENTOMOLOGY

Its Value and Impact in Louisiana

Entomology is one of the LSU AgCenter's most significant areas of research and outreach. Insect pests can cause devastation to crops and livestock. And beneficial insects can ward off a variety of pests, helping to make farming more profitable.

Insects can wreak havoc at home, too, in the house and in the garden – and even as we travel. If you come back from a trip with your car covered in smashed love bugs, you know what I mean.

Insects not only can be a nuisance – like swarming love bugs – but life-threatening. For example, 24 people died of West Nile virus in 2002, a year in which the mosquitoes that spread that disease were particularly numerous in Louisiana.

But insects are life-giving as well. Fruits and vegetables would disappear were it not for bees and other bugs that spread pollen. They also disseminate pollen to the flowers that add visual pleasure to our landscapes.

As the famous entomologist from Harvard University, Edward O. Wilson, has said:

"If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos."

This issue of *Louisiana Agriculture* is about the LSU AgCenter's entomology program aimed at the home. The purpose of this program is to help us learn to control, manage and live with these fellow Earth creatures.

Fighting fire ants

The red imported fire ant – or fire ant, for short – is a major pest around the world. Not native to Louisiana and introduced here without any of its natural predators, this invasive species nests in the yard and garden around structures and along pavement. Once thought to only nest in open, exposed areas, scientists now know these ants can be found in logs and under bark in forested areas and in wall voids in urban areas.

This species forages for insects, including termites, and can be found in the home foraging for sweets and protein materials.

Photo by Michael A. Seymour

A fire ant queen is protected and groomed by her workers.

A goal of the AgCenter's research program is to study the fire ant's enemies. For example, one natural predator is the phorid fly also from South America, which AgCenter scientists have introduced successfully in five areas of Louisiana so far. This fly decapitates the fire ant, and just the sound of its wings causes fire ants to disperse. AgCenter scientists also are investigating another biological control that involves a microbial parasite.

Areawide control

AgCenter scientists have established a communitywide or areawide system of control, which has worked successfully in pastures – where fire ants can hurt livestock production – and in urban areas including neighborhoods and parks.

The system involves blanketing an area with a bait, which fire ants will forage for. The worker ants take this bait back to the colony and to the queen. Once the queen is fed the growth regulator, she becomes sterile. As the adult population of ants in the colony dies, no new larvae or adult ants replace them, and the colony gradually dies off, said Dale Pollet, extension entomologist.

"If everybody in the neighborhood spreads the bait, then you can get rid of the ants," Pollet said. "If an individual does it and his neighbors don't, then the fire ants will move back in."

The whole neighborhood spreads the bait at the same time each spring and fall for about three years. In between, the residents are to use an insecticide to kill any ants missed by the bait. After three years, the neighborhood is to spread the bait – all at the same time – once a year.

So far, 21 LSU AgCenter extension parish offices have spreaders available for loan for the areawide system of fire ant control. For more information about the areawide control system, contact Pollet at (225) 578- 2370 or dpollet@agcenter.lsu.edu.

Formosan subterranean termites

A major urban entomology research program involves control of the extremely destructive Formosan subterranean termite. This insect is an invasive species introduced to this country via shipping from Asia. Ironically, a natural enemy in this country is the red imported fire ant.

The AgCenter's most high-profile termite control program is in the area of New Orleans known as the French Quarter. There, a federally funded program aimed at reducing Formosan subterranean termite numbers has been in process since 1998. Featuring various treatments to combat the termites, the program is a partnership among the LSU AgCenter, the U.S. Department of Agriculture's Agricultural Research Service, the New Orleans Mosquito and Termite Control Board, the Audubon Nature Institute and area pest control applicators.

Photo by Matt D. Voitier

These are Formosan subterranean shelter tubes inside a fiberglass cage in a lab. The hollowed-out object is a two-by-four eaten by termites. The LSU AgCenter was the first to bring baits into citywide field studies in the United States.

Results have been dramatic. Numbers of alates – the winged termites that swarm in the spring to establish new colonies – have been monitored since the beginning of the project. Within areas having the longest history of treatment, the number of alates caught declined by 48 percent from levels measured when the program began. In addition, sampling of 600 in-ground monitoring stations installed throughout the French Quarter has shown the activity of termites has remained reduced compared to the level

Photo by James Gathany, Centers for Disease Control

A female *Aedes aegypti* mosquito in the process of acquiring a blood meal from her human host. This mosquito is responsible for the transmission of dengue fever.

of activity in 1998 and outside the treated area.

An effective urban termite control program involves eliminating these wood-eating pests from trees. Termites in trees in the French Quarter program have been substantially reduced. Infested trees have been treated with baits or liquid termiticides and re-inspected. Only one of these trees was found to be infested in 2007, and it has been retreated. Inspections of trees are continuing in the remaining blocks in the program, according to Dennis Ring, extension entomologist.

Molecular genetics

LSU AgCenter researchers use molecular genetic techniques to help in the development of effective termite control programs. These advanced techniques involve analyzing the DNA of termites before and after treating an area, such as the New Orleans French Quarter, to get a better picture of termite biology including breeding systems, colony affiliation, movement of foraging sites and swarming behavior. Read more about this on pages 16 and 17.

In addition to using molecular methods to describe important aspects of termite biology, AgCenter scientists are developing an alternative to conventional chemical and bait treatments for termite control. The system involves using genetically engineered microbes as "Trojan horses" to produce and spread toxins in termite colonies. The scientists have constructed killer strains of yeast to produce toxins that specifically destroy the gut flora that termite workers need to digest wood. Termites will starve without gut flora. The feeding and grooming habits of these termites spread these toxins naturally throughout the termite colony.

Mosquito threat

Mosquitoes continue to be a threat because they carry diseases that can sicken and kill animals, livestock and humans. More than 60 different species of mosquitoes call Louisiana home. The LSU AgCenter has an active program to help communities develop effective abatement programs. For example, in more urban areas with higher populations of container-breeding mosquitoes, such as the Asian tiger mosquito, officials must invest more time and resources in sanitation and public education programs. In more rural areas, they need to target natural mosquito habitats such as rice fields and poorly drained areas.

AgCenter researchers continue to learn more about the mosquito – its biology, its habits – to help develop more effective control measures. Scientists are studying the oviposition, or egg-laying, behavior of Louisiana mosquitoes. Since a blood meal is required for a female mosquito to lay eggs, being able to attract large numbers of egg-laying mosquitoes allows researchers to sample and test the local mosquito population. All collected mosquitoes are identified and then tested for the presence of West Nile virus, St. Louis encephalitis virus and eastern equine encephalitis virus. Read more on pages 26 and 27.

Educational programs

The AgCenter's outreach effort includes many programs that help people learn to live with the insects that inevitably move into their homes and gardens.

Photo by John Wozniak

Honey bees are valued at $400 million plus in Louisiana alone for the services they perform pollinating crops, nuts, berries, flowers and fruits.

Some of these are widely visible such as the media coverage that features AgCenter agents and entomologists. When something unusual happens in the bug world, the media call the local parish extension office or one of the entomologists on the LSU campus – principally Pollet. When termites swarm or yellow jackets get aggressive or there's an infestation of stinging caterpillars, AgCenter people are in the news.

Each of these extension offices is also a wealth of information about entomology in its publication inventory. There's a fact sheet on just about every bug that plagues Louisiana – fleas, forest tent caterpillars, Argentine ants, mole crickets, termites and fire ants. You can also sign up for newsletters with urban entomology information, including "Bugs, Bugs, Bugs" by Pollet. These publications help you identify the offending pest with advice one what to do.

This same information is on the AgCenter's Web site – www.lsuagcenter.com. Type in the insect you want more information about in the search box. You can also read the newsletters online, including "Bugs, Bugs, Bugs."

If you still can't find what you're looking for, you can call your local extension office, and someone there will get you in contact with an expert.

In addition to the media, publications and the Web site, AgCenter experts give presentations to organized groups and at schools, fairs and other special events.

Pesticide applicator schools

Anybody in Louisiana who wants to apply pesticides for a fee must attend pesticide applicator school. They must be certified, says Mary Grodner, LSU AgCenter entomologist who has been teaching the schools since 1980. The Louisiana Department of Agriculture and Forestry does the certifying, regulating and enforcing. But the AgCenter does the education.

Grodner teaches 13 to 15 of these schools for professional applicators per year. Attendance varies from 30 or so for first-time applicators to more than 600. The classes she does for agriculture pesticide applicators usually include about 100 people. They are "static," she says. The growth is in classes for applicators who do right-of-way, industrial and aquatic.

Other classes that have been growing in numbers include ornamental, turf and landscape maintenance people.

"The classes get bigger as this segment of our economy keeps growing," Grodner said.

She also does three classes per year for those involved in mosquito control. Class size is growing in this area, too, she says.

Even though she is nearing the end of three decades of teaching these schools year-round, her mantra has remained the same.

"There are three things," she said. "Read the label. Understand the label. And follow the label."

Homes, lawns, trees, gardens

Insects in the wrong place at the wrong time can ruin our homes, lawns, trees in our yards and our gardens. Many beetle and moth pests can infest our foods and destroy them. Pests such as dermestids, silverfish, firebrats and moths can damage our clothes and household furnishings. Mites from nesting birds and small animals, ticks and bed bugs can find their way into our homes. Yellow jackets, honey bees, bumble bees, carpenter bees and many other wasps and bees can nest in and around dwellings and cause problems. The identification and management of these insects through the urban research and extension programs helps to make life easier for the public. ■ **Linda Foster Benedict**

Bug Fact

Red imported fire ants, Formosan subterranean termites and Asian tiger mosquitoes are just a few of the invasive species that typically appear first in urban areas because of importation of ornamental plants or other raw materials and subsequent transportation of infested materials through the urban environment and into rural areas, says Tim Schowalter, head of the LSU AgCenter Entomology Department. Each person has a responsibility to check plants, luggage and vehicles to prevent spread of unwanted pests. Bring any unusual insects to your local parish extension office. If the agent is unable to identify a specimen, it is sent to the Entomology Department for identification. Any new pests must be reported to the Louisiana Department of Agriculture and Forestry and verified by a taxonomic specialist. Surveys and management programs are then developed to restrict movement and manage the pest. Keeping our plants, homes, businesses and commodities free of invasive pests allows us to produce ornamentals, turf and foods efficiently and economically and to protect our urban as well as rural environment.

Dale Pollet

Bug Man of Louisiana

By 10 a.m. LSU AgCenter entomologist Dale Pollet had already received nine phone calls, including one from Florida.

And even while I interviewed him, the calls and e-mail messages dinged steadily from his cell phone for the next couple of hours.

Yes, Pollet may well be one of the most popular people in Louisiana. That's because he knows every bug in the state and what to do about them. And Louisiana has a lot of bugs.

The call from Florida was from a nursery owner who plans to expand his business to Louisiana and wanted to know how to become certified here. He called Pollet, whom he'd never met but had heard of through nursery associations. Pollet gives about 70 presentations per year, including to nursery groups.

Over the years Pollet's reputation for knowing answers has spread across the South and the nation. LSU AgCenter press releases in which he's the source have been picked up regularly by national media.

He gets requests for interviews from all over the country. But even he was surprised one day several weeks after Hurricane Katrina hit New Orleans in 2005, when the call was from a producer for the "O'Reilly Factor." This is a popular talk show on the Fox network featuring the bombastic Bill O'Reilly.

"He was interested in doing a segment on fire ants. Somehow he'd picked up the press release we'd sent out on the hurricane's effects on fire ants in New Orleans," Pollet said.

So Pollet appeared on prime time television before an audience estimated at nearly 2.5 million. He was live from a studio in Baton Rouge.

"He did a great job," said Tim Schowalter, head of the Department of Entomology and Pollet's boss. "He answered each question eloquently and represented LSU and the AgCenter well."

"I heard from people who saw the show," Pollet said modestly.

Although his title is entomologist, his mission is a harmonious environment. The insects of the world are not so much

the enemy as they are fellow occupants that must be accommodated.

As far is Pollet is concerned, the No. 1 issue in entomology is identification. If you can just figure out what the insect is, then you can determine what to do about it.

"The environmental concerns about pesticide misuse and the effectiveness of any kind of control or management program hinge on correctly identifying the insect," Pollet said.

Identification is also the most difficult part of this science. But that was the hook that got Pollet started on his life's quest.

"My aunt gave me an insect book, and she wrote in it, 'To a future entomologist.' I was 5 at the time," Pollet, 63, remembered fondly.

He found the book fascinating and continued a career of collecting bugs, which he still maintains. He went on to compete in school science fairs and win ribbons and statewide competition in 4-H with entomology projects.

A native Louisianian from the Lutcher and Napoleonville area, he attended LSU for his bachelor's and then master's degree. But he crossed a few state borders to matriculate at Virginia Polytechnic Institute for his Ph.D., which he earned in 1972. All three degrees are in entomology.

After a five-year stint as an extension entomologist for Clemson University in South Carolina, Pollet was lured back to Louisiana to fill the post of a retiring extension entomologist. He's been here ever since.

Although he can understand the impatience, disgust and even abhorrence people have for bugs, his chief concern is the single-minded solution to kill, kill, kill.

Bug Fact

If you do a Google search of the Formosan subterranean termite or the red imported fire ant, you will find that the LSU AgCenter is consistently among the top 20 sites worldwide. Go to www.lsuagcenter.com and search for information about any insect pest you find in your home or yard, and you will find a wealth of information.

"Insecticides are like guns. They have to be used properly," Pollet said. "A lot of times people kill the beneficials along with the pests or instead of the pests. Whenever making recommendations, it is important to realize there may be more than one way to address the problem. I ask a lot of questions to make sure the client gets the right information to manage the situation and the pest safely and effectively."

People tend to spray way more than is needed. Not only is this harmful to the environment but it can lead to an insect's resistance to that particular chemistry. Over time, the effectiveness of that pesticide will be lost.

One way to use less insecticide is to make sure the water used to carry it is more acidic so as not to neutralize the solution.

"Louisiana water has an average pH of 8.3. The ideal pH for use with pesticides is between 5.5 and 6.5," Pollet said.

Adding a little vinegar to your mixture of water and insecticide before you spray will correct this. Pollet includes step-by-step directions in his newsletters and publications available through LSU AgCenter parish offices and on the LSU AgCenter Web site at www.lsuagcenter.com.

"The insecticides will be more effective. You won't have to use as much," Pollet said.

In addition to judicious use of insecticides, he advocates using environmentally friendly insecticides, if possible. For example, for an infestation of caterpillars, Pollet recommends an insecticide containing bacteria called *bacillus thuringiensis*, or Bt for short, at your local nursery. Bt is a natural enemy of many nuisance bugs.

After spraying the caterpillars, collect the dead caterpillars with a tweezers and place them in a jar. Cover them with milk and place the jar in the refrigerator.

Next time you have an outbreak, if you do, get your jar and add some water to it. Liquefy the mixture in a blender. Then spray the caterpillars with your homemade brew.

"It's not toxic," Pollet said. "You can safely clean the blender in your dishwasher."

Here's another homemade treatment for aphids, mites, small caterpillars and scales that can wreak havoc in your gardens. Collect Asian or other lady beetles, which are beneficial insects, when they are plentiful and place them in a cleaned ice cream carton along with some moist straw. Put the carton in your refrigerator. Then next spring, release the beetles in your garden when pest problems begin.

"They'll overwinter," Pollet said assuringly.

Some bugs can be just out-and-out dangerous, though, such as bees and wasps. But they're critical for environmental balance as pollinators and predators and should not be destroyed.

"Honey bees are valued at $400 million plus in Louisiana alone for the services they perform pollinating crops, nuts, berries, flowers and fruits. They even help many self-pollinating plants by enhancing the fertilization to produce better quality fruits and vegetables," Pollet wrote in his popular monthly newsletter called "Bugs, Bugs, Bugs."

Pollet says call your local county agent – or Pollet himself – to find out what to do. Pollet keeps a list of professionals who can get rid of the bees for you – whether they're outside or inside your house.

"This is especially important if the bees are inside your house," Pollet said. "A professional will make sure the bees are relocated, get the honey out of the walls and fix the walls."

Then there are love bugs, which every few years can be so thick they'll plug the radiator of your car as you drive down the road. And there is no effective way to get rid of them.

"Although a pest and a big nuisance while driving, they do assist in the decomposition of grass and other debris along the roadways, levees and fields where grass clippings are left. The immature or larvae feed and develop on this material," Pollet also wrote in his "Bugs" newsletter, trying to help people understand that all Earth's creatures have a purpose.

Taking good care of your lawn and garden will help hold down insect problems, Pollet advises. With proper watering and fertilization, plants aren't so vulnerable to pests.

The same goes for inside your house. A clean house without clutter is less attractive to bugs. Most of the bugs that cause problems inside your house come from the outside. So keep your landscaping as pest-free as possible.

Pollet's advice is practical, valuable and endless. He fires off answers to bug questions from day's beginning to end. His depth of knowledge is helping to save our planet – not from bugs but in harmony with bugs. ■ **Linda Foster Benedict**

Formosan Subterranean Termite Management in the French Quarter

Dennis R. Ring, Alan Morgan, Frank S. Guillot, Alan R. Lax and Charles McCown

A federally funded Formosan subterranean termite pilot test in New Orleans' French Quarter, known as the French Quarter Program, began in 1998. Featuring various treatments to combat the termites, the program is a partnership among the LSU AgCenter, the U.S. Department of Agriculture's Agricultural Research Service, the New Orleans Mosquito and Termite Control Board, the Audubon Nature Institute and area pest control applicators.

Photo by Scott Bauer, U.S. Department of Agriculture

Formosan subterranean termites inside a tree.

Two types of treatments are used to try to decrease the Formosan subterranean termite numbers in the test area. One is baits that the pest management professionals monitor monthly. The other is a liquid treatment, and these treatments are inspected yearly. The treatments are applied by local pest management professionals using commercially available baits or nonrepellent termiticides. The program pays the pest control applicators, so homeowners have no out-of-pocket expense for the treatments.

Pest management professionals have treated almost every structure within 56 square blocks in the French Quarter using baits or nonrepellent termiticides according to label and state requirements. An additional 22 square blocks were added in the fall of 2006 and 2007, bringing the total area under study in the French Quarter to 76 square blocks plus the riverfront area between Decatur Street and the Mississippi River bordering the French Quarter. Approximately 16 square blocks along Canal Street are not currently or yet enrolled in the program.

Structures enrolled in the program are inspected visually, with infrared cameras and microwave devices. When termites are detected, the buildings are treated by installing aboveground bait stations or are spot-treated with liquid insecticides. In the initial area, inspections in 2003 found 22 percent of the structures were infested with Formosan subterranean termites, but re-inspections in 2005 found only 6 percent of the structures infested. These results strongly indicate that the program is decreasing the number of Formosan subterranean termites.

Numbers of alates – the winged termites that swarm in the spring to establish new colonies – have been monitored since the beginning of the project. Traps were used at selected locations for the first two years. Since then, they have been installed at all street corners with available lights. Within areas having the longest history of treatment, the number of alates caught declined by 48 percent from levels measured when the program began. In addition, sampling of 600 in-ground monitoring stations installed throughout the French Quarter has shown the activity of termites has remained reduced compared to the level of activity in 1998.

The levee along the Mississippi River is an open area without structures and contains trees, planter boxes and railroad tracks. More than 35 percent of the in-ground stations in that area had active termites during 2003. A rigorous bait program to control these termites was initiated in 2005. As a result, termite activity during 2006 in the in-ground stations on the levee was reduced 95 percent, and the number of alates caught on traps on the levee decreased about 65 percent from 2003 to 2006.

More than 1,000 properties with structures and 1,870 trees on these properties have been inspected for the presence of termites. Less than 2 percent of the properties with trees and about 2 percent of the trees were infested with Formosan subterranean termites. This percentage of infested trees is lower than the percentage of infested trees found in many areas outside of the French Quarter. Infested trees have been treated with baits or liquid termiticides and re-inspected. Only one of these trees was found to be infested in 2007, and it has been retreated. Inspections of trees are continuing in the remaining blocks in the program.

Structures in the additional area included in the program in 2006 and 2007 are being inspected for termites before treatment to determine effectiveness of treatments.

Areawide integrated pest management (IPM) has reduced the number of Formosan subterranean termites in program areas, although termite activity has remained high in isolated areas. Intensive inspection of structures and trees has led to identification of hidden colonies that heretofore had escaped treatment. The reduction in the number of infested structures and activity on the levee is particularly encouraging. Continued treatment, inspections and sampling are expected to further reduce the numbers of Formosan subterranean termites in the French Quarter. Results from this program may be used to develop areawide IPM programs to reduce the number of Formosan subterranean termites in other areas. ■

Dennis R. Ring, Professor, and Alan Morgan, Professor, Department of Entomology, LSU AgCenter; Frank S. Guillot, Formosan Subterranean Termite National Program Coordinator, and Alan R. Lax, Research Leader, Southern Regional Research Center, U.S. Department of Agriculture, Agricultural Research Service, New Orleans, La.; and Charles McCown, Extension Associate, Department of Entomology, LSU AgCenter, Baton Rouge, La.

This is an exit port of a Formosan termite colony in a tree in the French Quarter. From this perch winged termites will swarm. The "carton" at the area of a branch scar is characteristic of Formosan subterranean termites.

Photo by Christopher Dunaway

A Successful Louisiana Program for Managing Formosan Subterranean Termites

Dennis R. Ring, Gregg Henderson and Charles R. McCown

The invasive Formosan subterranean termite eats the centers of living trees and builds carton nests inside them. Additionally, it is considered the most destructive insect in Louisiana, attacking the wood and paper in structures. Thus, infested trees may serve as reservoirs for termites to attack structures. The state of Louisiana has taken steps to reduce the numbers of termites in trees on public lands. This program consists of drilling into trees in the Greater Lake Charles and Greater New Orleans areas and treating them with insecticide foam. LSUAgCenter personnel selected the trees, examined them after treatment and evaluated the results.

Trees to be evaluated were selected in 2000 using visual inspection for evidence of termites in at least three locations on the outside of the tree. The species of termite attacking a tree and tree species were determined. Selected trees were drilled and treated by licensed pest management professionals. AgCenter personnel treated other infested trees with water as experimental controls.

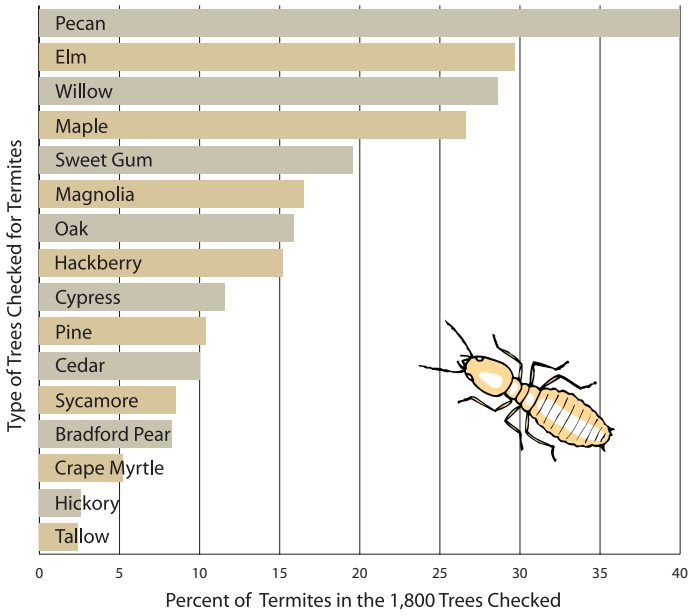
The selected trees were inspected after treatment every year for six years for evidence of termites to evaluate the effectiveness of the treatments. Formosan subterranean termite

Dennis R. Ring, Professor; Gregg Henderson, Paul K. Adams Professor; and Charles R. McCown, Extension Associate, Department of Entomology, LSU AgCenter, Baton Rouge, La.

infestations were not found in 70 percent of the trees treated with Termidor 12 months after treatment and in 58 percent of the trees six years after Termidor treatment. Formosan subterranean termite infestations were not found in 65 percent of the trees treated with Premise 12 months after treatment; however, termite infestations were absent in less than 50 percent of these trees after three years. Formosan subterranean termite infestations were not found in 13 percent of water-treated control trees 12 months after treatment, and 13 percent to 20 percent of the water-treated trees remained without infestation for the duration of the study.

Because the tree treatment program was developed to control termites already in trees, it was considered a remedial program. The success of most integrated pest management programs, however, depends on preventative measures, when possible. Preventing termite invasion into trees is unfortunately a very difficult task. Termites can travel along the tree roots, which provide a natural pathway, or invade at points far from where any chemical treatment was applied. If the plants are young enough, we can employ a treatment in the soil where the plant ball will set. This treatment measure should be considered when dealing with new plantings in termite-infested areas.

Another preventative measure is to use plants less preferred by termites. Through this program we checked more than 1,800 trees for infestations by termites. These data show



Formosan subterranean termites showed a preference for pecan trees. Moreover, trees that produce nuts or fruits for human consumption cannot be chemically treated as described. The products used in this study are not labeled for use on nut and fruit trees. It would be wise to choose plants less preferred and to keep a vigilant eye for infestations as trees grow.

In addition to the success in reducing Formosan subterranean termite infestations in trees, considerable success has also been achieved in educating home owners in the Greater Lake Charles and Greater New Orleans areas. Another benefit of the program was the training and experience pest management professionals gained in treating trees for Formosan subterranean termites. This program may also serve as a basis for other programs to treat termites in trees. ■

Photo by Christopher Dunaway

A shelter tube leads from a hole in the tree to the ground. The shelter tube is made of a clay material that termites use to fill the void of eaten and hollowed trees.

Bug Fact

Beneficial insects are an important link in pest management. Lady beetles, rove beetles, assassin bugs, spiders, lace wings, wasps, parasitic wasps, tiger beetles, some thrips and mites, dragonflies, robber flies, syrphid flies and praying mantis are just some of the good insects that assist us in our gardens. They feed on a wide variety of pests that potentially could damage our ornamental plants. Identification is important. If you do not know the insect found, ask your county agent. If he or she cannot identify it, he or she will ask the specialist. Many people see insects and just spray. Many times this removes the beneficial population and allows the pest population to increase.

Unique termite school helps with Louisiana pest control

Since 2000, nearly 450 pest control operators and technicians have completed two days of either basic or master training programs on treating for termites and other wood-destroying insects at the Lois Caffey Termite Training Center at the LSU AgCenter in Baton Rouge.

The operators, who come from across Louisiana, learn pest control procedures according to the state minimum termite treating standards as one of the steps required to test for state certification or re-certification.

"Knowledge is the most powerful thing you get here," said Ashley Quirk, who operates Quirk's Pest Control in Slidell.

Quirk said the school is important for a one-man operation like his because "it puts you on an even level" with competitors.

"You need to know how to do this," Quirk said. "Whether it's a $100,000 house or a $1 million house, each is treated the same way."

The LSU AgCenter school is one of three programs approved by the Louisiana Structural Pest Control Commission. The other two are operated by private companies.

"This is the only one for independent pest control operators," said Allen Fugler, who helps administer the training programs. Fugler is vice president of marketing with LIPCA Insurance, a company owned by more than 250 pest control operators in Louisiana and specializing in insuring pest control companies.

Bug Fact

The best cure for bug problems is prevention, say Dale Pollet and Alan Morgan, LSU AgCenter entomologists. You don't want insects destroying the beauty of your home's landscape. First, select the right plants for your area and the correct location to plant. Then, keep them healthy and growing with appropriate watering and use of fertilizer. A well-maintained landscape will attract the birds and butterflies that enhance your yard.

The training includes hands-on demonstrations on a variety of sample foundations, insect and damage identification, treatment calculations, equipment calibrations and demonstrations, thorough review of state rules and regulations, pesticide safety and environmental concerns.

The LSU AgCenter termite training program had its genesis in 1991 when Lois Caffey of Alexandria began promoting and raising funds for the project.

The LSU AgCenter termite training program had its genesis in 1991 when Lois Caffey of Alexandria began promoting and raising funds for the project.

Working with industry supporters, Caffey raised funds from a variety of sources to build the AgCenter's training facilities. Construction began in 1992. In recognition of her dedication, the LSU Board of Supervisors in 2001 approved naming the facility the Lois Caffey Termite Training Center.

Caffey has been in the pest control business since 1961, when she went to work for Adams Pest Control in Alexandria, where she still works as corporate secretary and treasurer. A licensed pest control operator in Louisiana, she has served on the board of the National Pest Management Association and is past president of the Louisiana Pest Control Association and the Cenla Pest Control Association.

Termite school classes are taught by LSU AgCenter faculty and representatives from the Louisiana Department of Agriculture and Forestry, which administers pest control regulations and operator registrations in Louisiana.

The termite school adds professionalism to a job that generally does not get the respect it should, said Gregg Henderson, an LSU AgCenter entomologist who teaches the students how to track termites.

"At the termite school we teach pest control operators how to make the best decision possible when employing a control strategy based on knowledge of construction, treatment methodologies and, above all, termite biology," Henderson said.

Termite control in Louisiana is regulated by state statue through the Structural Pest Control Commission and enforced by the Louisiana Department of Agriculture and Forestry. The school is set up to follow and teach the regulations.

"We're partners in providing education for pest management professionals," said Dennis Ring, an LSU AgCenter entomologist and one of the members of the training faculty.

Students learn to locate sources of infestations and how to treat and prevent reinfestations, said Milton Schleismann, New Orleans district manager for agricultural and environmental sciences in the Louisiana Department of Agriculture and Forestry.

Schleismann, whose responsibilities include overseeing pest control practices and citizen complaints in seven parishes, has been on the school faculty since the program began. He teaches how to read and follow the label and to be familiar with and know the minimum specifications for pesticide applications as well as how to identify the different types of structures in Louisiana and how to treat them.

"Our role is to make sure they're following labels," Schleismann said. "The label is the law."

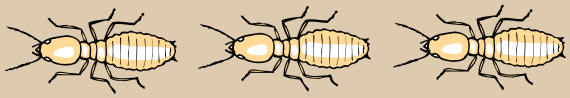
Most problems with termites arise from excessive moisture or construction defects. Pest control companies treat and inspect annually, looking for active infestations, Schleismann said.

Homeowner responsibility includes eliminating moisture in, on or under the structure; assuring no wood-to-ground contact; and letting the pest control operator know of any alterations or additions to the structure.

Caffey said her motivation for starting the school was because pest control operators had no place to go to learn about wood-destroying insects – primarily termites but also powder post beetles and carpenter bees.

"I started the school for the benefit of the Louisiana Pest Control Association," Caffey said. "I do this because it helps the pest control operator learn to do professional work. Then they can better serve the public as well as the pest control industry. The students appreciate everything they're taught. ■ **Rick Bogren**

Natural Plant Extracts



in Formosan Subterranean Termite Control

Gregg Henderson, Lixin Mao and Roger A. Laine

In many ways plants and insects are intimately related. Possibly the most widely appreciated is the 150 million-year-old mutual dependence of flowering plants and honey bees. Without honey bees, many of our crops would not be pollinated.

Plants also have developed strategies to discourage the multitude of insects that want to eat them. Plants keep insects at bay by using physical obstructions, such as tough leaves, spines and hairs, and chemical warfare. Chemicals called essential oils are believed to have evolved in plants mainly as a defense against insects. Touch the leaves of plants like rosemary or mint, and you will smell the essential oils designed by nature. Humans have taken advantage of these fragrant oils and used them in many products, including laundry and dish detergents, toothpastes, perfumes, air fresheners, drinks, cooking oils and even mosquito repellents.

In the development of insecticides, natural products have a big advantage over synthetic chemicals because they often are generally regarded as safe (GRAS) for humans by the Environmental Protection Agency. Chemical companies can spend more than $100 million in the development and registration of an insecticide, while a chemical on the GRAS list can cost less to produce and be put on a fast track to registration.

Vetiver grass and termites

Vetiver grass contains a natural repellent to the Formosan subterranean termite. Vetiver grass is a type of bunch grass related to sugarcane and lemon grass. Because of its massive and fast-growing root system, it is known around the world for its ability to reduce erosion. It is native to India and has been grown in Louisiana for about 200 years. The fast-growing roots contain essential oils used in citrus sodas, soaps and perfumes. Early Louisianians place the dried roots in closets and armoires for its pleasing fragrance and to repel moths.

In the late 1990s, a Louisiana entrepreneur, Don Heumann, and his wife, Judy, brought vetiver plants to the attention of LSU AgCenter researchers, who found that a major substance – vetivone – was well-known to be the major insect-repelling chemical in vetiver grass extracts. This initiated an investigation into similar chemicals that might affect termites. One such chemical was found – nootkatone – which became a lead compound in termite control research. Scientists tested the roots and found them to contain other repellent and toxic compounds effective against Formosan termites in the laboratory.

The AgCenter scientists also were able to extract and identify from the roots several other components especially active in the repelling and killing of termites. Tests are under way to determine if the plant can be used as a natural repellent against termite invasions into homes by planting them as a hedge. Additionally, the U.S. Army Corps of Engineers is now considering the use of vetiver grass along levee systems in New Orleans to reduce erosion during hurricanes. This may also affect the termite infestations known to be at high levels on some of the levees.

Several AgCenter patents from this work have been licensed for development into commercial insecticides.

Sesame seeds and ants

Sesame seeds have long been used as an ant repellent in kitchens in Egypt. Sesame oil is reported to control chinch bugs, spider mites, aphids, leaf rollers, leaf miners, white flies, fungus gnats and scale insects. AgCenter investigations of the components of unroasted sesame seed oil against Formosan termites showed that sesamol – a natural compound in the seeds – is an effective repellent at low concentrations and remains active for several months. Sesamol is relatively inexpensive and shows promise as a natural alternative pesticide.

Patchouli oil

Patchouli oil has a nice woody smell detectable if you rub the leaves between your fingers. Its heyday in the United States marketplace was as a natural deodorant in the 1970s. The oil remains an important natural material in the perfumery and food industries and has been used in Asia historically to repel clothes moths and as a cold remedy. Using gas chromatography, AgCenter scientists determined that the oil consists mainly of patchouli alcohol (40 percent) and alpha-patchoulene (15 percent). Treatments of food sources with the oil or alcohol could dramatically stop termite feeding. The alcohol is about twice as effective as the oil itself.

Naphthalene and 2-acetonaphthone

LSU AgCenter researchers discovered that high levels of naphthalene occur in Formosan subterranean termite nests. This led to the testing of a related compound – 2-acetonaphthone – a natural oil of corn. The performance of 2-acetonaphthone on the Formosan termite was evaluated via topical application, no-choice and choice treated filter paper assays, and in sand barrier assays. It proved highly effective in the topical application assays and in a sand barrier at concentrations as low as 8 parts per million. The strong repellency observed at concentrations much lower than some other naturally occurring chemicals has led to a patent submission by the AgCenter.

Ku Shen and termites

A member of the legume family known as sophora root or ku shen contains alkaloids that possess broad biological activity. This ancient Chinese herb used in traditional medicines grows wild throughout China in sandy areas, sunny meadows and hillsides. About two dozen alkaloids have been identified in ku shen, with matrine and oxymatrine being the major components of the dried root. Tests with wood treated with matrine and oxymatrine against Formosan termites showed antifeedent, a chemical agent that causes an insect to stop eating, and toxic properties that remain effective for at least a year. ■

Acknowledgments

Research associated with these studies would not have been completed without the assistance of the following individuals: Sanaa A. Ibrahim, Huxin Fei, Savi Kambham, Poornima Jayasimha, Karen Nix, Betty Zhu, Feng Chen and Lara Maistrello.

Gregg Henderson, Paul K. Adams Professor, and Lixin Mao, Postdoctoral Researcher, Department of Entomology, LSU AgCenter, Baton Rouge, La., and Roger A. Laine, Professor, Department of Biological Sciences, LSU, Baton Rouge, La.

Molecular genetic methods help unravel termite mysteries

Claudia Husseneder

The Formosan subterranean termite has global economic impact as an urban pest. The nesting and feeding habits of this invasive pest leave many factors of its biology literally hidden in the dark. This lack of knowledge has limited scientists' ability to evaluate the success of termite management practices and develop novel strategies for termite control. Recently, however, molecular genetic techniques are providing powerful methods to unravel many aspects of termite biology.

LSU AgCenter researchers employ microsatellite genotyping to obtain information about the organization of termite colonies, such as breeding systems, colony affiliation, movement of foraging sites and swarming behavior. Microsatellite genotyping uses polymerase chain reactions to make copies of non-coding genomic regions containing repetitive sequences with high mutation rates. This procedure results in specific banding patterns, or genotypic profiles. Genotypes are inherited according to Mendelian rules, which mean that half of each termite's bands are inherited from each of its parents. Therefore, genotypes contain information about genetic diversity and relationships of individual termites and colonies.

The object of termite control treatments is to eliminate the termite colony, which consists of kings, queens and their offspring. To evaluate a treatment, colonies first have to be clearly identified and key factors of their organization described. Genetic analyses have revealed two different breeding systems in subterranean termite colonies. One is the simple family headed by a single pair of reproductives, one king and one queen. The other is the extended family headed by multiple reproductives.

Colonies of the Formosan subterranean termite are always founded by a pair of winged adults, called alates, formed each year during the swarming season between late April and June. AgCenter scientists have found that partner selection during colony foundation favors large body size in males and females and high genetic diversity in females. How related two potential partners are does not play a role in partner selection.

Once the partners begin to reproduce, the king with the queen and their offspring become a simple family. When this original founder pair dies, it is replaced by multiple reproductives developed from their own offspring. This colony then forms an extended family. In most investigated populations of the Formosan subterranean termite, extended families are headed by fewer than 10 reproductives. Colonies are distinct genetic units because foragers from different colonies rarely mix.

Colonies of the Formosan subterranean termite are always founded by a pair of winged adults, called alates.

To evaluate treatment success, researchers must first determine the number, spatial extent and movement of colonies in an area before and after treatment. Colonies of the Formosan subterranean termite can have millions of workers and can occupy large foraging areas that span 100 yards and more. Thus, termites found at different infestation sites have to be assigned to foraging areas of colonies to identify the number and extent of colonies. Molecular methods make this possible by way of diagnostic genotypes (certain bands in the genetic profile), which distinguish the genetic profile of each colony from the profiles of other colonies. Termites that possess these bands can be assigned to a particular colony. Genetic profiles can be used to tag colonies before treatment. In cases where termites appear in the same location after treatment, comparisons of genetic profiles aid in determining if these termites are remnants from the same colony, invaders from neighboring colonies or – should their profiles not match known colonies – entirely new infestations.

Assigning termites found at different foraging sites to colonies via their genetic profile provides vital information about colony number, spatial extent and movement. High colony numbers were found in every investigated area in New Orleans. AgCenter scientists identified 14 colonies in the 31.5 acres Louis Armstrong Park. Along a one mile stretch of the Riverfront Railroad, 33 different colonies were found. Sixteen colonies surrounded the Supreme Court Building over the course of four years. While the colonies in relatively undisturbed, park-like locations typically had large foraging areas that were stable over time, the colonies located in areas disturbed by landscaping, construction or termite treatment moved frequently. The high colony density and frequent movement of termite colonies in disturbed urban landscapes may explain why areawide colony elimination in a city like New Orleans is difficult to achieve.

In a recently completed study to evaluate treatment success, AgCenter scientists compared colony numbers and breeding systems of Formosan termites infesting in-ground stations along the Riverfront Railroad in New Orleans before and after treatment. Both breeding systems, simple and extended families, were present.

Four simple family and 11 extended families were found before treatment. A year after treatment began, all treated colonies had vanished and did not reappear. The breeding system of the colonies had no effect on the treatment success because both simple and extended families were successfully eliminated.

Despite the successful elimination of baited colonies, the termite pressure in the area led to rapid reinfestation in a considerable proportion of in-ground stations. This underscores the importance of continued and long-term monitoring and treatment programs. After treatment 12 simple families and six extended families

Claudia Husseneder, Assistant Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.

were found. The prevalent breeding system became simple family colonies. It is likely that elimination of the extended family colonies through treatment opened up large tracts of underground tunnels and prompted the expansion of young simple family colonies. Most of these young colonies were still headed by the original founder pair as shown by the unrelated parental genotypes and low degrees of inbreeding within the colony. Understanding these patterns and processes of reinfestation of a previously treated area by termite colonies will help to measure the impact of population-wide treatment and devise future areawide management strategies.

The AgCenter researchers also used genotypic profiles of swarming alates to attempt to find their colonies of origin in the French Quarter. The vast majority of the alates, however, could not be assigned to colonies infesting nearby in-ground stations. Some of the alates that could be assigned had flown from colonies occupying in-ground stations as much as 370 yards and even 670 yards away. Apparently, alates can fly farther than commonly assumed. The dispersal distance of alates was sufficient to guarantee mixing of an average of 13 colonies within swarm aggregations that were collected around light sources. Genotypic frequencies differed significantly between male and female alates, suggesting that males and females originated from different colonies. Both of these mechanisms decrease the likelihood of pairing with a nest mate and limit inbreeding in newly founded colonies, even though termites do not actively avoid pairing with related partners. These observations confirm previous studies demonstrating that the majority of simple family colonies in Louisiana populations are headed by unrelated pairs of reproductives.

In addition to using molecular methods to describe important aspects of termite biology, LSU AgCenter scientists are developing an alternative to conventional chemical and bait treatments for termite control. The system involves using genetically engineered microbes as "Trojan horses" to produce and spread toxins in termite colonies. The scientists have constructed killer strains of yeast to produce toxins that specifically destroy the gut flora that termite workers need to digest wood. Termites will starve without gut flora. Termite feeding and grooming habits spread these microorganisms naturally throughout the termite colony. This system is a promising approach to eliminate termite colonies in a cost-effective way. ■

Scientist studies Formosan termites in China

Collecting and studying Formosan subterranean termites from their native China may help entomologists find new ways of combating these invasive pests in the United States.

Claudia Husseneder of the LSU AgCenter and Ed Vargo, an entomologist at North Carolina State University, went to China in May 2007 to learn about Formosan subterranean termites in their native habitat.

"Most termites are not invasive. That is, they don't move far and establish themselves in new places," Husseneder said.

But that's not true of the Formosan variety, she said. They can be found all around the Pacific Rim and in the southeastern United States.

One difference between the two geographic areas, Husseneder said, is that Formosan subterranean termites display more aggression in their Chinese "homeland."

Photo by Edward Vargo

Claudia Husseneder, right, and Mr. Pan, a student from Zhejiang University who served as her guide and translator, collect termites from pine wood stumps in China.

"We tested colonies against each other, and some of them fight to the death," Husseneder said.

"Aggression between colonies is fairly low in Louisiana and other places where the termite has been introduced," she added. "In their new territory, they hardly fight and are more cooperative. This may be a clue to why they are such successful invaders."

Husseneder said the termites that found their way to the United States lost some of their genetic diversity, which may explain why they are less aggressive.

"The objective of the China trip is to use genetic markers and aggression tests to compare the levels of genetic diversity, colony breeding structure and aggression between colonies with those of introduced populations," Husseneder said.

The scientists will also examine the genetic relationship among native populations and those in the United States to determine whether any of the native populations may have been a source of the termites in this country.

Husseneder and Vargo traveled more than 2,500 miles by air, train, bus, taxi and rickshaw and on foot to collect 86 samples from four termite populations in Zhejiang Province, Fujian Province, Guangdong Province and Hunan Province.

They found termite colonies in live trees along city streets as well as in private homes, schools and temples. Husseneder said they even collected termites from the surgical ward of the Affiliated Hospital of Nanhua University in Hengyang.

"In natural habitats, colonies were frequently discovered in old pine stumps along logging paths," she said.

With funding from National Geographic, she and Vargo were able to fund last spring's trip. And they have enough funds from the grant to pay for at least two more trips, she said. She and Vargo are planning to visit Hong Kong, Macau, Hainan and the southern and western provinces of the People's Republic of China.

"The work will provide valuable new information on the major features of the breeding system of native Formosan subterranean termite populations and how these features vary over geographic regions in the native and introduced range," she said. "We finally may figure out what makes this termite such an exceptionally successful invader." ■ **Rick Bogren**

Leaf-cutting Ants

Miniature 'Town' Builders

Linda M. Hooper-Bùi and Michael A. Seymour

In western Louisiana from Lake Charles all the way north of Lucky in Bienville Parish, a common site near roads and open areas are "towns" of small crater-shaped soil piles with large red ants busily moving particles of soil. These clusters of craters are nests of Texas leaf-cutting ants, which give them their nickname "town ants." Sometimes these ants are called "parasol ants" because the pieces of leaves they carry look like little umbrellas (parasols). These ants are native to Louisiana but used to be more widespread.

Though fascinating to watch, this activity can cause extensive damage, especially when the ants cut the leaves of prize lilies, roses, citrus trees and other plants, rendering them unsightly. The ants use the cut leaves as a soil on which they plant a special fungus, which provides food for the hundreds of thousands of ants in mature colonies.

Leaf-cutting ants often excavate soil near roads. In two recent incidences in Kisatchie National Forest and on private property near Rosepine, La., the ants excavated enough soil to cause sinkholes that swallowed vehicles.

Damage caused by these leaf-cutting ants make them not only a nuisance to landowners and the forestry industry but also costly. The forestry industry in particular loses money when these ants strip new pine saplings of their needles, which can happen in a single night by a leaf-cutter colony. These saplings almost never recover and, if they do, their growth is stunted both vertically and horizontally. This creates patchiness and trees of different sizes in carefully planted pine plantations. There are no effective methods to suppress these ants.

In the past three years, LSU AgCenter scientists have excavated six nests of town ants and found extensive excavation of the soil by the ants. The ants remove the soil from tunnels and larger areas called galleries and place the excavated soil on the surface. The ants even dig a hole in which the members of the

Photo by Michael A. Seymour

This is a view of the excavation in Kisatchie District of Kisatchie National Forest, southwest of Natchitoches, La.

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colony spend the winter called a central chamber. The discovered chamber was at least the size of a 50-gallon drum.

Members of a leaf-cutter ant colony include reproductives, workers and brood. Brood is another name for eggs, larvae and pupae of ants. The winged reproductives will go on a mating flight on a moonless night in April, May or early June. Females will mate with a male, who will quickly die. The female will lose her wings and then build a new nest in deep, well-drained sandy soil. Once inside her nest, she lays eggs. She nourishes the developing larvae with nutrients obtained by regurgitating her digested wing muscles. These larvae eventually become pupae that mature into workers, who dig the nest to enlarge it, cultivate the fungus garden, feed the developing larvae and clean the queen and the nest. The queen carries the "stock" for the fungus garden in a special pouch in her mouth when she leaves her maternal nest on her mating flight. She plants this garden when she digs her new nest. When the new workers emerge, they will tend this fungus garden.

The workers provide leaves on which the fungus grows. Leaves are cut by workers and brought back to the nest. Workers lick the leaves to remove the waxes and clip them into pieces about the size of the letter "a" on this page and plant them at 90-degree angles to each other in the fungus garden. The workers also labor to remove any "weeds" or varieties of fungus that do not belong in the garden. When the fungus "fruits," workers will pick the fungus and feed it to members of the colony. Because of these specific habits, leaf-cutting ants do not respond well to most baits.

So next time you happen upon a "town" of ants, look at the vegetation (or the lack thereof) around the nest. Leaves of trees will be missing or look like they have bites taken out of them. Much of the grass and surrounding forbs and shrubs will be trimmed. What you can't see is an entire city beneath the soil. Research on leaf-cutting ants and the effect of their activities on soils, particularly soil nutrients continues. ■

Photos by Michael A. Seymour

A fungus garden with roots that provide structure.

Note that this fungus garden is about 6 inches in diameter.

This winged reproductive has two cockroaches on her – one on her body and one on her wings. These cockroaches are only found with this species of ant. These cockroaches live symbiotically with the ants and cannot live without the ants. The exact nature of the relationship between the two is unclear, such as what the cockroaches are eating or whether the ants get any benefit from the cockroaches being in the nest. What scientists do know is the ant nests are the only place where these unique cockroaches are found.

Communitywide Control of Argentine Ants in Louisiana

Argentine ant queen.

Photo by Michael A. Seymour

Linda M. Hooper-Bùi

The Argentine ant is an exotic species brought to New Orleans from South America in the late 1800s. Historically, populations have been high in many areas of Louisiana, and for unknown reasons the populations have been expanding in the past 10 years.

Argentine ants form mega-colonies with millions of workers and hundreds of queens that can extend for miles. Argentine ants forage in trees to "tend" plant-feeding insects such as aphids and scales. This means they protect them from natural enemies and actually herd them similarly to farmers herding cows. The ants eat the honeydew excreted by these insects. The ants also forage on the ground for food items. They make their nests under rocks, fallen branches, mulch and at the base of trees.

Argentine ant populations can reach huge numbers. One of many areas under siege is Toledo Bend Reservoir in northwest Louisiana. In some areas, homes and cabins have several trails or lines of ants 2-3 inches wide. Once inside, these ants infest kitchens, bathrooms and other areas of the house. Tourists to the area have been horrified to find Argentine ants infesting their boats, cars, RVs and even tents within minutes after arrival. Sometimes, tourists take these unwanted guests home with them.

Resort owners and homeowners are using massive amounts of insecticides to combat the Argentine ants. Some fishing camp and resort owners have reported that they no longer allow tent camping because Argentine ants will crawl into people's tents and join them in their sleeping bags. They also report using contact insecticides, often daily, to keep the ants out. This overuse of pesticides may suppress populations of beneficial insects or may runoff into the reservoir during rains. Scientists from the LSU AgCenter designed a treatment protocol to suppress the Argentine ants and reduce the amount of pesticides used in areas of infestations.

The Argentine ant is considered a nuisance but does not sting. This ant is extremely difficult to control because it is so nomadic. The only way to manage it is on an area-wide or community-wide basis.

Areawide or communitywide management of fire ants has been successful

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in Louisiana for the past eight years. LSU AgCenter researchers have modified the techniques they developed for fire ant management and have applied them to the Argentine ant problem. The protocol, however, is more complex than the fire ant program. The Argentine ant protocol must be done with all residents in the area at the same time to be successful. They MUST treat twice. They have to treat again six weeks later. If they don't, the population will be up and running again in less than two months. They also must eliminate harborage, which is not an issue with fire ants. They also must reduce the number of ants foraging into trees and homes to get them to take the bait. Early April (1-15) is the best time because it is important to disrupt populations before they get too large.

Clean up the area and eliminate harborage

Look around the yard for areas harboring Argentine ant colonies. If harborage is eliminated, one can reduce the amount of insecticides used to suppress ant colonies. Harborage can protect the ants from winter freezes and insecticidal treatments. Examples of ant harborage include boat seats, overturned canoes or kayaks, dead stumps, dead or felled trees, children's toys, free-standing basketball nets, woodpiles and lawn tools. These items also provide extra heat for rapid development of colonies, which can quickly overwhelm the property.

Trim plants and trees so they do not touch structures

Ants can gain entry into structures from tree branches close to the roof. Argentine ants are attracted to moist wood and rotting wood. To prevent infestation, consider replacing rotting siding, window sills and door frames on homes and outbuildings. Look for ground-to-wood contact around structures and find a way to eliminate this problem. This may also prevent new termite infestations. The next time it rains, walk around the property and look for water that may pool or contact the wood on the structures. Eliminating water-soaked wood will help prevent ant infestation of homes and siding.

Disrupt the foraging into trees and houses

Using a contact insecticide such as a pyrethroid or an organophosphate in a handheld pump or backpack sprayer, apply a liquid barrier around trees approximately two feet up and one foot out from the base of the tree or house on which the ants are trailing. Make sure to treat all surfaces of the bark of the trees and try to treat all the trees on your property at the same time. Drench with pesticides any nests of ants you see. If possible, adjust the pH of the water to 5.5-6.6 for maximum efficacy of sprays and drenches. Toxicology research has shown that the pH of the water affects the efficacy of insecticides. Treating in this manner will disrupt the nesting and foraging and allow the bait treatment to be successful. The drenching of the visible nests will reduce the number of ants that require bait. Be sure to trim your trees so that they do not touch your house or shed.

Let them eat bait

Many of the nests are hard to detect, so baiting lets the foraging ants do the work of gathering the bait and bringing it to the nest. Broadcast granular bait such as Max Force (the active ingredient is hydramethylnon) (1.5 pounds per acre) in the early spring. Corn and soybean-based bait products such as Amdro, which also has hydramethylnon as the active ingredient, are not readily taken by Argentine ants, even though they are on the label. The ants are attracted to the fish oil and protein in a bait such as Max Force, which acts as a stomach poison in the ants and robs them of energy. The bait must be fresh and applied when the ground is dry, and no rain is expected for 24 hours. Broadcast bait over the entire property. Liquid baits, such as those with boric acid, can also be offered in bait stations. Ants will usually visit these stations when they need sugars or carbohydrates and may come to them intermittently. Be sure to place the bait stations out of direct sunlight. Ants will not enter a hot bait station.

Repeat

To be effective this process must be repeated four to six weeks after the first treatment. The first treatment will kill large numbers of workers and some queens. However, not all the queens are fed all the time, and some of the larvae may survive the initial treatment. Repeating the whole process will help suppress more of the population of these persistent ants. ■

Tips for success

- *Reduce the cost of bait by sharing a large batch of bait with neighbors.*
- *Schedule a weekend for everyone to treat at the same time.*
- *Be sure to use fresh bait that has not been stored with other insecticides or chemicals such as gasoline.*
- *Avoid cigarette smoking while applying the bait because the ants do not like the smell.*
- *Try to apply the bait as evenly as possible with a hand-held spreader.*
- *Follow label instructions and keep bait and contact insecticides out of water systems.*
- *Repeat the treatment within six weeks.*

Bug Fact

The LSU AgCenter cooperates with other agencies to help solve Louisiana's bug problems. An example is a recent incident in Jefferson and Orleans parishes with the pink hibiscus mealybug. This pest is a danger to both nursery and agricultural crops. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) provided tiny parasitic wasps – a natural enemy of the mealybug – which officials from the AgCenter and the Louisiana Department of Agriculture and Forestry (LDAF) released and monitored. The mealybugs were controlled before they became a problem.

FAST
Fire Ant
Surge
Threat

PREVENTION

FIRE ANTS
in New Orleans Post-Katrina

Linda M. Hooper-Bùi, Beverly A. Wiltz, Michael A. Seymour and Lee A. Womack

Linda M. Hooper-Bùi, Associate Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.; Beverly A. Wiltz, former post-doctoral researcher and now Research Entomologist, USDA-ARS Formosan Subterranean Termite Research Unit, Poplarville, Miss.; Michael A. Seymour, former research associate and graduate student and now with the Louisiana Department of Wildlife and Fisheries, Baton Rouge, La.; and Lee A. Womack, former graduate student and now with Shaw Environmental & Infrastructure, Inc. Natural Resources-Coastal Division, Baton Rouge, La.

On Aug. 29, 2005, when Hurricane Katrina hit the Gulf Coast, floodwaters from storm surge and breached levees inundated New Orleans and surrounding areas with salt water. The red imported fire ant, a flood-adapted species originally from the Paraguay River flood plain in South America, was suppressed and in some cases eradicated. Many native ant species also were eradicated or their populations suppressed.

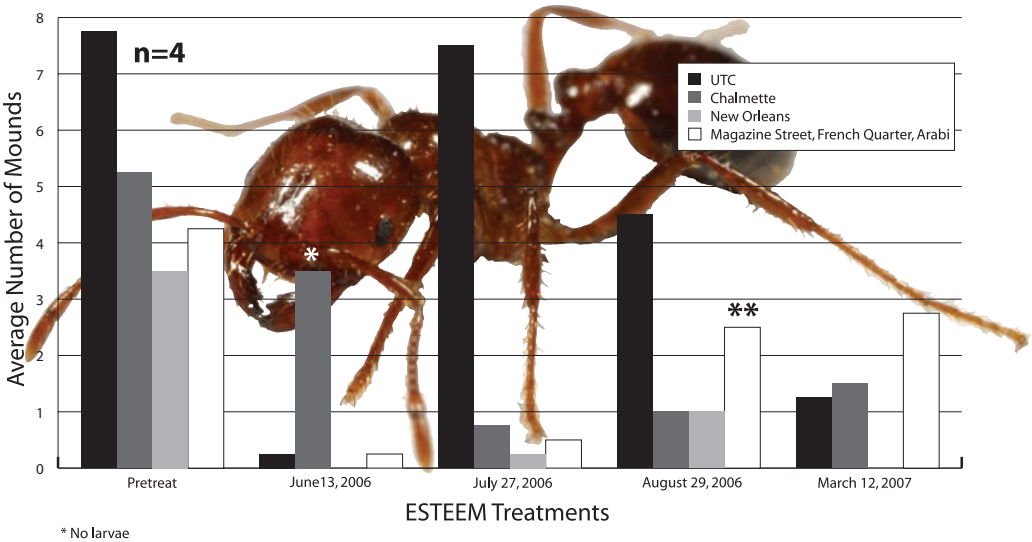
Photo by Johnny Morgan

This absence of ants posed a situation in which the fire ant, which is much more aggressive in recolonizing, could become "the only ant in town." Additionally, areas with little or no flooding were a source of large populations of fire ants that could easily recolonize once-flooded neighborhoods.

In May 2006, the LSU AgCenter launched the Fire Ant Surge Threat Prevention (FAST) program to encourage fire ant suppression and allow the native or good ants to reestablish. Fortunately, the fire ants' mating season (usually in late May or June) was delayed because of lack of food and drought in the affected area. This allowed time to apply an insect growth regulator bait for foragers to bring into the colonies before mating flights began.

The goals of the program were (1) spread bait over public green space in May and June, (2) educate people in nonflooded communities about communitywide fire ant management and (3) educate "pioneers" or individual residents who were able to move into previously flooded areas about fire ant prevention. The last objective is extremely difficult because people have been slow to repopulate and those who do are often isolated.

Each bar represents the average of four areas sampled including four areas used as untreated controls (UTC). Before treatment, treated areas averaged between 3 and 5 mounds per 200 square meters (or 1,800 square feet) or 0.02 hectares (0.04 acres). By July, treated fire ant populations had been radically suppressed. In August, we began seeing fire ant resurgence in treated areas that were surrounded by private property that was presumably untreated.



* No larvae
** Contains two plots surrounded by private property that did not flood.

The program launch began with a press conference. Local and national television, radio, newspapers and news Web sites carried the story.

Several companies donated ant control products, and several partnerships were developed. Valent USA donated 5,000 pounds of ESTEEM (active ingredient 0.5% pyriproxifen) Fire Ant Bait, an insect growth regulator. LSU AgCenter scientists worked with the Louisiana Department of Agriculture and Forestry (LDAF) to obtain the proper permits to apply this bait to public areas in Orleans and St. Bernard parishes. Although this bait has a broad label that includes more than 200 fruits and vegetables, urban use had not been added to the label at the time. The active ingredient in ESTEEM works to interrupt reproduction in ant colonies. The queen stops laying eggs, and the larvae stop developing and never turn into workers or reproductives. Any reproductives in the colony that receive a dose of the active ingredient, even if they go on a mating flight, would be rendered sterile and unable to reproduce. Workers and queens, however, are not directly killed by this product.

Garden Tech donated 2,500 pounds of Over N' Out Fire Ant Granules (active ingredient 0.01% fipronil) for use by individual residents in flooded neighborhoods. These residents were also given a brochure with information on how to choose plants and other landscaping materials to keep their property fire ant free. Over N' Out is a contact insecticide that affects ants that move soil and is ideal for prevention of fire ant infestation. When Over N' Out is applied, native ants such as carpenter ants, acrobat ants and other ants are not affected because they do not extensively excavate the soil.

Ambrands donated three semis of Amdro for use in community-wide fire ant management and by individual residents. The New Orleans Mosquito and Termite Control Board (NOMTCB) – the LSU AgCenter's main partner in the project – received matching dollars from the federal government equal to the value of the donated goods. The New Orleans board partnered with the LSU AgCenter to conduct education campaigns and distribute bait in flooded and nonflooded neighborhoods. For example, AgCenter personnel distributed 2,500 pounds of ESTEEM using ATVs equipped with broadcast bait spreaders to treat 2,500 acres of infested public land in Orleans and St. Bernard parishes. A pickup truck with a bait blower was used to apply bait to levees.

The results of this project will not be known for many years. LSU AgCenter personnel are monitoring the populations of invasive and native ants. Figure 1 shows the ant populations before LSU AgCenter personnel treated the public areas and after. The sampling in 2007 has been conducted when there was little rain or when it was very hot so very few mounds visible. However, it appears that the fire ants are reestablishing in most areas of the city.

LSU AgCenter personnel continue to work with the New Orleans board to monitor the ants and distribute bait. The NOMTCB is still treating abandoned properties where they find fire ants in their daily efforts to suppress mosquitoes, flies and rodents. LSU AgCenter personnel are monitoring the invasive and native ant populations and providing education to communities on community-wide fire ant management. ■

The LSU AgCenter held a press conference the day the FAST Prevention program was initiated in New Orleans, which was May 11, 2006. Linda Hooper-Bùi, LSU AgCenter entomologist, at far right, explained to reporters how to control fire ant spread.

RAPID RESPONSE
Arthropod Diagnostic Services

Christopher Carlton, Victoria Bayless and Dale Pollet

The first step in successfully dealing with insect-related problems, whether in urban or agricultural settings, is identifying the organisms. In this context, "insect" refers to all arthropod groups, with insects being the most diverse of several classes of arthropods, which include spiders, mites, scorpions and their relatives.

With about 95,000 species of insects in North America alone, identification requires a high level of expertise in taxonomy – the practice of classifying plants and animals according to their natural relationships. In addition, maintaining a collection requires specialized techniques in curating. Diagnosticians rely on well-curated collections of reference specimens and taxonomic literature to provide timely identification and evaluation of samples, photographs or descriptions submitted by citizens and first responders.

Historically, taxonomy services in Louisiana have been handled through the Louisiana State Arthropod Museum (LSAM) in the LSU AgCenter's Department of Entomology, while diagnostic and control questions have been handled through AgCenter extension faculty. The merger of extension and research faculties within the Department of Entomology has facilitated coordination between these two overlapping responsibilities and has improved the speed of delivering information to end users.

In addition, the dramatic increase in public access to information technology during recent years has revolutionized the speed of delivery of insect diagnostic information.

During 2004-2006, the staff of the LSAM processed more than 150 requests for insect diagnostic information per year. They use electronic data sources, digital photographs and Internet resources in combination with the insect collection to serve Louisiana's needs for rapid, accurate information about current and potential pests.

Diagnostic services for urban pest management

Requests to identify and evaluate potential pests in urban settings mainly involve known or suspected structural, stored-product, lawn-and-garden or household nuisance pests. Major pests – subterranean termites for example – are handled by research specialists or trained

Red imported fire ants.

Christopher Carlton, Professor and Director, and Victoria Bayless, Research Associate and Curator, Louisiana State Arthropod Museum, Department of Entomology, LSU AgCenter, Baton Rouge, La., and Dale Pollet, Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.

pest control operators. Structural pests that require a higher level of taxonomic expertise include the numerous species of powder post beetles. Infestations of these pests often have legal ramifications for contractors and lumber suppliers. Correct species identification is critical because liability issues may depend on details of life history or geographic origins that differ among species.

Likewise, correct identification of stored-product pests is critical to tracking sources of infestations in homes, factories and warehouses. Suspected household pests include mole crickets, cicada killer wasps, convict caterpillars, lace bugs, long horned beetles emerging from firewood, cigarette and drugstore beetles, ants of all kinds, lady beetles and their larvae, assassin bugs, solitary bees, fire brats and various scale insects.

One of the challenges involving inquiries about suspected pests in urban settings is correctly evaluating whether the species involved represents an incidental, non-threatening occurrence or whether it signifies a persistent population that presents a nuisance or more serious kind of threat. Identifying the species involved helps to determine if control measures need to be taken.

Photo by Michael A. Seymour.

Medical/veterinary concerns

Medical and veterinary diagnostic work overlaps broadly with urban issues because many of the insects that may be simple nuisances or curiosities in some contexts have implications to human health in others. Assessing the context of the inquiry and advising homeowners accordingly is an important part of diagnostic work. For example, while assassin bug inquiries are often from gardeners curious about what the insects are doing in the garden, these same species are also capable of delivering a painful bite. A limited number of rarely encountered assassin bugs may also serve as vectors of Chagas disease – a serious, debilitating tropical disease. Again, knowing the species involved is essential to understanding the level of action warranted.

Inquiries from veterinary and health care workers generally involve unusual and infrequent situations. Examples include identification of the organism that causes paederine dermatosis, a skin inflammation from a particular kind of staphylinid beetle, and identifying suspected blister beetles following livestock toxicity from contaminated hay.

Private citizens usually request identification about stinging or biting insects and spiders. Their concerns most frequently involve suspected brown recluse or brown widow spiders and buckmoth caterpillars. In addition, there are each year several cases of delusory parasitosis, a mental health condition characterized by imaginary infestations by biting or otherwise-tormenting organisms. These sufferers often provide samples containing household dust and skin debris, but they almost never contain organisms. These difficult cases often require referral to mental health providers. In other cases, simply reassuring individuals that, in fact, their suffering is not caused by any organism is sufficient to put them on a path to recovery.

Public Education

One of the most rewarding aspects of insect diagnostic work is providing information that educates the public about the importance of insects and related arthropods to ecosystem function and their relevance to daily life. This is also the most rapidly expanding area of insect diagnostics due in large part to growing public access to digital technology and home-based Internet communication.

Many of these inquiries are predictable based on the seasonal cycles of species. For examples, inquiries about the identity of the large, subtropical golden silk orb-weaver spiders and the beautiful scarlet-bodied wasp moth come in late summer and early fall. Spring brings questions about forest tent and white-marked tussock moth caterpillars, and summer brings inquiries about a diversity of entomological curiosities and oddities. Most of these questions are motivated by curiosity and a desire to learn rather than by concern, fear or a perceived need to eliminate the creatures.

Entomology museums in the information age

Electronic information transmission, storage and retrieval and the availability of vast amounts of entomological information on the Internet have revolutionized the process of inquiry evaluation and delivery of information in insect diagnostics. But nothing can replace the entomology museum as a central library of information about the identification, life histories and distributions of the vast diversity of insects and related arthropods.

Faculty in the LSU AgCenter museum are in the process of creating a database of more than 750,000 specimens in the collection. This will provide immediate access to detailed data about all collection species, including the estimated 15,000 species of insects found in Louisiana. This project will help facilitate delivery of fast, accurate taxonomic information to citizens of Louisiana. ■

Bug Fact

Insect injury to plants can often be confused with other types of damage. Insects can cause a stippling of the foliage that begins as a zigzag line of discoloration. Over time the entire leaf has a grayish bleached-out color. Thrips, mites, lace bugs and whiteflies can all create these symptoms, so it is important to check plants and identify the pest causing the problem so the right treatment can be applied.

Taking the Bite Out of Mosquitoes

Culex larvae found collecting in standing water in a residential area. Mosquito larvae of most species have a prominent breathing siphon. The larvae rest suspended diagonally from the water surface with the end of the siphon tube penetrating its surface enabling the larvae to access their air supply.

Photo by James Gathany, Centers for Disease Control

Wayne Kramer

Mosquitoes in Louisiana may interfere with enjoyment of the outdoors almost any time of year. Yet, if you understand how mosquitoes live and multiply, you have a better chance of controlling their larval development sites and reducing their numbers. More than 60 species of mosquitoes are known to occur in Louisiana, and they have different habitat preferences, activity patterns and distributions.

Development sites, life stages

All mosquitoes require water for larval development. A vertebrate blood meal is required in most mosquito species before laying a batch of eggs. In general, mosquitoes can be divided into two groups. The difference depends whether they lay nondormant or dormant eggs.

Mosquitoes that lay nondormant eggs include most species associated with permanent to semi-permanent aquatic sites. These females usually lay their eggs, which can float, directly on the water surface. These eggs develop and hatch in three to five days depending on temperature. These species often lay several batches a year, one generation succeeding another in a single season. Female adults survive the winter by finding shelter in protected sites, such as indoors, and going into a hibernation stage.

Mosquitoes that lay dormant eggs are associated with floodwater or temporarily wet sites. In late summer or early fall, the females deposit their eggs in moist sites or areas that have been previously flooded. While the eggs undergo some development, they do not hatch immediately. Instead, they enter a dormant period over the winter and hatch during wet periods the next spring. These eggs are resistant to drying and cold temperatures and may remain viable for years. Mosquitoes laying eggs under these circumstances typically produce only a few generations per year.

Several factors influence the female's choice of an egg laying site, no matter whether she lays dormant or nondormant eggs. These factors include amount of organic matter in the water, the nature and amount of dissolved salts, and the kinds and numbers of microorganisms. In general, however, any collection of water that persists for one week or more is a potential development site for mosquitoes.

To minimize mosquito development in areas with permanent ponds and small lakes, it is best to add depth of 3 to 4 feet and eliminate emergent vegetation. When constructing new ponds and lakes, keep the sides steep and nearly vertical. Aquatic sites with these characteristics don't offer the shallow, sheltered sites that can support emergent plants and the shelter they offer developing mosquito larvae. Large, open water areas with sufficient wave action also inhibit mosquito development.

Once the female mosquito has found a favorable aquatic development site, she lays her eggs either on water, at the edge of water or on a previously flooded soil surface. The larvae that later emerge are strictly aquatic. They can't exist out of water.

In most species, the larval stage lasts seven to 10 days, depending on the temperature. Temperatures 85 degrees and above cause more rapid development. The larvae then molt and enter the

Wayne Kramer, Associate Professor, Department of Entomology, LSU AgCenter, Baton Rouge, La.

nonfeeding pupal stage, which usually lasts two to three days.

Finally, the insect moves to the adult stage. The lifespan of an adult can vary widely. For instance, some species can hibernate through winter. Usually, however, the ordinary life span of an adult in midsummer lasts two to four weeks.

Source reduction

Reducing or eliminating mosquito development sites, referred to as source reduction, is the most effective way to reduce mosquito populations. After all, doing so permanently reduces or removes the source of future mosquito production.

Large source reduction projects may be beyond the capability of a property owner. Even small projects, however, such as clearing local drainage systems with inexpensive hand equipment, can be an important preventive measure for combating mosquitoes. Any time, effort and money spent on source reduction, such as filling or improving drainage ditches, can pay dividends many times over in reduced mosquito populations in succeeding years.

Many mosquito problems are created unknowingly by property owners who allow water objects such as old tires, buckets, houseplant saucers, bird baths and other containers, to contribute to local mosquito populations.

Biological controls

A system of biological control introduces or encourages natural enemies of the pests you want to control. For the biological control of mosquitoes, we are experimenting with predators (such as mosquito fish and flatworms), parasites (nematode worms) and pathogens (viruses, fungi and bacteria).

Another effective biological agent is the bacteria *Bti (Bacillus thuriengiensis israelensis*). In the past few years, it has become widely used as a mosquito larvicide. It is safe and widely sold in retail outlets under the name Mosquito Dunks. It was commercially developed from naturally occurring bacteria that produce a toxin specific to mosquitoes and certain other flies. The toxin in *Bti* attacks the gut wall of mosquito larvae so larvae must ingest particles of the insecticide. Formulations of *Bti* are primarily extracts of bacteria cultures rather than living bacteria. Bti is not suitable for every site and species of mosquito. For example, *Bti* is less effective in polluted water against most permanent-water mosquitoes.

Bti does have the advantage of being specific in its mortality against mosquitoes. It does not harm fish and nontarget invertebrates. Additionally, alternate wetting and drying will not reduce its effectiveness and it will keep working for about 30 days under typical environmental conditions.

Current research

Current mosquito research at the LSU AgCenter is focused on various aspects of the biology and control of mosquitoes and the involvement of Louisiana mosquitoes with the transmission of disease agents to humans and animals.

AgCenter researchers are studying the oviposition (egg laying) behavior of Louisiana mosquitoes and are trying to identify additional chemical attractants. Currently, a fish oil emulsion is used in mosquito gravid traps to attract egg laying mosquitoes. These traps are an important part of the West Nile virus (WNV) surveillance program, which monitors the presence of the virus in mosquitoes collected every year at research sites in East Baton Rouge Parish.

Since a blood meal is required for a female mosquito to lay eggs, being able to attract large numbers of egg-laying *Culex* mosquitoes allows researchers to sample and test the local mosquito population. All collected mosquitoes are identified and then tested for the presence of WNV, St. Louis encephalitis virus and Eastern equine encephalitis virus at the Louisiana Veterinary Diagnostic Laboratory at the LSU School of Veterinary Medicine. Collected ovipositing female mosquitoes have had an opportunity to acquire WNV in a blood meal from a wild bird, which may harbor the virus. Most wild birds that serve as reservoirs of the virus in nature are not negatively affected by WNV.

Additionally, AgCenter researchers are using surveillance data to correlate population levels of vector mosquitoes and WNV infection rates in mosquitoes with the numbers of human cases of WNV recorded in East Baton Rouge Parish. West Nile first appeared in Louisiana in 2001. Since that year, more than 915 human cases of West Nile virus have been recorded in the state resulting in at least 60 human deaths. This virus circulates in nature primarily in a wild bird-mosquito cycle. The virus amplifies in the spring and early summer and then is vectored to humans and horses during summer and early fall by *Culex* mosquitoes, primary *C. quinquefasciatus*, the southern house mosquito. Based on studies recently conducted in East Baton Rouge parish, *C. quinquefasciatus* mosquitoes, which live in close association with people, have been shown to feed both on birds and mammals, including people and horses.

Most of the East Baton Rouge studies are being conducted in cooperation with the East Baton Rouge Parish Mosquito and Rodent Control personnel. ■

Photo by James Gathany, Centers for Disease Control

The proboscis of an *Aedes albopictus* mosquito feeding on human blood. Under experimental conditions the *Aedes albopictus* mosquito, also known as the Asian tiger mosquito, has been found to be a vector of West Nile virus.

Photo by Michael A. Seymour.

Leaf-cutting ants often excavate soil near roads. In two recent incidents in Kisatchie National Forest and on private property near Rosepine, La., the ants excavated enough soil to cause sinkholes that swallowed vehicles. This leaf-cutting ant worker is carrying eggs and larvae. Read the article on these urban pests on pages 18 and 19.

Inside:

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