IMPACT©

THE INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES MAGAZINE | VOL. 21 NO. 2 | SPRING 2005

Managing the Mosquito Menace

UNIVERSITY OF FLORIDA
IFAS

perspective

THE FUTURE OF THE UNIVERSITY OF FLORIDA'S INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES (UF/IFAS) IS BRIGHT. Our comprehensive educational and research programs are ranked among the best, and our faculty are among the nation's most honored. UF/IFAS is well positioned as a national and international leader to meet new and continuing challenges.

UF/IFAS has an impressive history of accomplishments. Our statewide teaching, research and extension programs have a tremendous impact in Florida, the nation and in many other countries. Our "society-ready" graduates are prepared for the professional opportunities and challenges in today's changing job market. Our research achievements range from developing basic scientific knowledge to applied technologies that impact every agricultural commodity and resident in Florida – as well as the natural resource base and environment. Extension education programs provide research-based information to residents in every Florida county. When it comes to county support for Extension education programs, Florida leads the nation – a strong indication of the value of these programs to our citizens. Since assuming my new role, I have been impressed by the statewide support for our programs.

These research and education programs are vital for the continued success and sustainability of Florida's agricultural and natural resource industries, life sciences, families and youth.

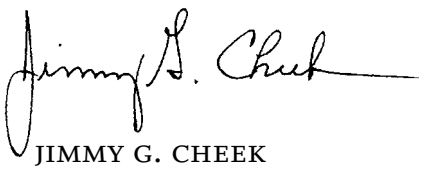
To become one of the top two or three programs in the nation, we must increase extramural support for research and education programs, strengthen graduate education, significantly enhance facilities, increase public and private financial support, and continue to attract and retain excellent faculty. In addition, one of my primary goals is to increase involvement of individuals and groups to help establish priorities, launch new initiatives and develop support for our programs.

At a recent meeting of the Florida Agricultural Council, a committee was established to restructure and broaden the scope of the council. In addition, regional advisory committees are being planned to seek more local input for identifying priorities and program initiatives. These regional committees will also provide increased opportunities for communication with stakeholders, industry, state and county leaders, and alumni. This will help UF/IFAS become more relevant, responsive and valued in the years ahead.

We have a national and internationally recognized faculty, and we look to them for continued improvements in productivity and program quality. We must work together to develop better public and private support for our programs.

This year the legislature is considering several key initiatives to strengthen our research and educational programs. There is significant support for these initiatives from our clientele. Initial meetings with legislators and governmental officials have also been very encouraging.

This issue of IMPACT presents examples of how UF/IFAS faculty and staff members provide cutting-edge research and education with local and global impacts – enhancing our health, environment and Florida's economic well-being.



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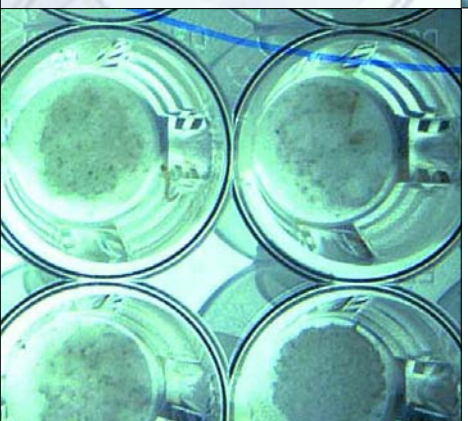

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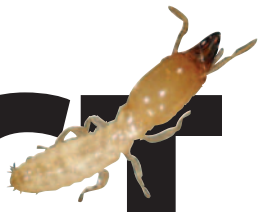
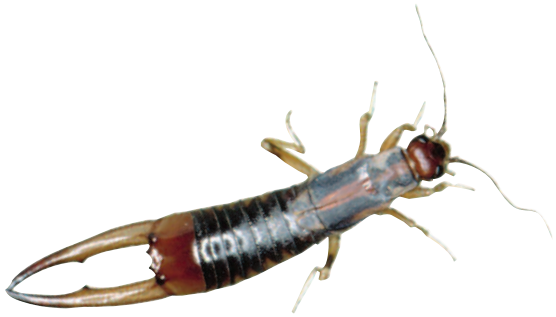


THE INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES MAGAZINE | VOL. 21 NO. 2 | SPRING 2005

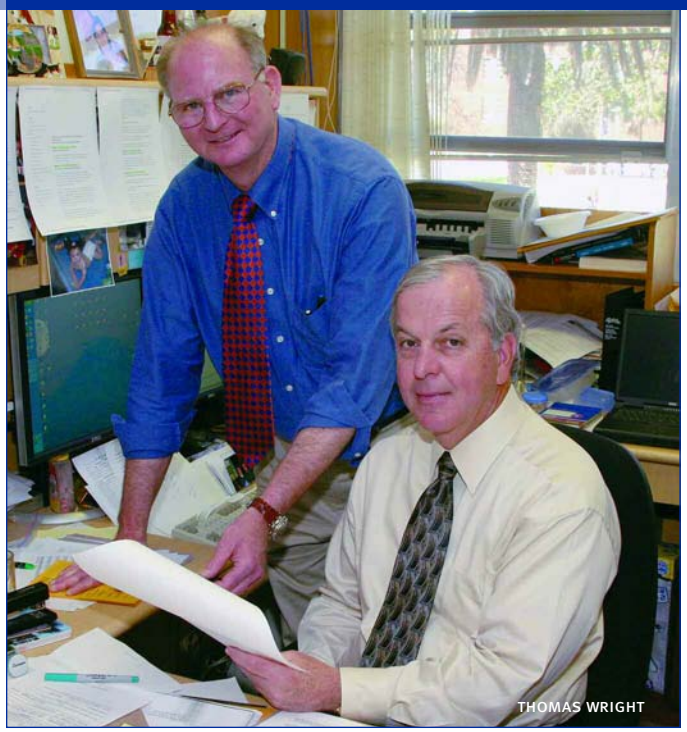
NEWS UPDATES

FEATURES



On the Cover

Jonathan Day, a professor of entomology at the Florida Medical Entomology Laboratory in Vero Beach, evaluates the effectiveness of various insect repellents against mosquitoes. Day recommends repellents containing the active ingredient DEET, and he says devices such as electric bug zappers are not effective and kill more beneficial insects than mosquitoes. His research is part of a wide-ranging program at the UF/IFAS laboratory to control mosquitoes and other medically important biting insects. COVER PHOTO BY THOMAS WRIGHT.



Ron Muraro, left, and Tom Spreen review data from their new economic study that shows that the benefits of the citrus canker eradication program outweigh the costs eight to one.

Benefits *of* Canker Eradication Outweigh Costs

While the state's citrus canker eradication program has been mired in controversy and legal action – resulting in a stop-and-go approach to removing infected trees – a new University of Florida study indicates the benefits of the eradication program outweigh the costs.

"Without the eradication program, citrus canker will become widely established in Florida, with serious long-term consequences for the state's $9.1 billion citrus industry," said Ron Muraro, a professor with UF's Institute of Food and Agricultural Sciences. "It would jeopardize our position in the world market."

If citrus canker were to become endemic in Florida, exports of fresh fruit to Europe would likely cease, he said. Over the long run, the economic loss due to an endemic canker problem would be nearly $2.5 billion.

The bacterial disease, which causes lesions on the leaves, stems and fruit of citrus trees, weakens citrus trees, causing a loss in yields and higher production costs. Removal and burning of infected or exposed trees is the only way to stop the disease.

According to the study, the canker eradication program saves producers $169.2 million annually in production costs for items such as extra bactericide sprays in groves, and processing steps at packinghouses to grade out blemished fruit and disinfect clean fruit for foreign and domestic markets. The eradication program also helps the citrus industry avoid $84.9 million per year in lost revenues that would be caused by lower fruit yields and unmarketable fruit. By contrast, the annual cost of the eradication program in 2005 is estimated to be $44 million.

"When the annual impacts are extrapolated over time, the cost to the industry would exceed $2.5 billion, and the disease would be well on its way to destroying the Florida citrus industry," Muraro said.

Total cost of the current eradication program, which began in 1995, is estimated to be $477 million, which includes the destruction of infected or exposed trees and compensation to homeowners for lost trees. In 2004, producers received approximately $28.4 million in compensation from state and federal agencies for production lost to canker or exposure. The eradication program is administered by the Florida Department of Agriculture and Consumer Services and the U.S. Department of Agriculture (USDA).

Muraro, based at the UF/IFAS Citrus Research and Education Center in Lake Alfred, said specialty fruit would be the only segment of the citrus industry that might experience a net gain in revenue associated with endemic citrus canker. The disease would reduce shipments of certain fresh fruit varieties, thereby boosting the market price of fruit harvested from canker-free groves. The net gain in prices for specialty fruit would reduce the benefits associated with the canker eradication program by $44.5 million. Nevertheless, he said, an endemic citrus canker situation would still have an overall negative impact on revenue for the industry.

The two-year study, funded by USDA, was conducted by Muraro and Tom Spreen, professor and chairman of the UF/IFAS food and resource economics department in Gainesville. Marisa Zansler, an economist at USDA's Animal Plant Health Inspection Services in Washington, D.C., contributed to the study.

The economic analysis of the citrus canker eradication program was developed using the predicted values of the benefits and the costs associated with the program. The summary reports, FE 531 and FE 532, are available on the UF/IFAS Electronic Document Information Source Web site: http://edis.ifas.ufl.edu/.

Spreen said the study did not measure changes in consumer demand

that might occur if the citrus disease is not eradicated. "Although citrus canker will not adversely affect human health, the mere image of consuming a product that is visually unappealing may have a negative impact on the demand for Florida citrus," he said.

"Opponents say Florida should abandon the current eradication program and learn to live with the citrus canker problem," Muraro said. "They contend that the citrus industry will not incur losses that are big enough to outweigh the cost of the eradication program, but our research clearly indicates that this would not be the case."

The study also shows that the current, expanded-phase eradication program, which ramped up with renewed state and federal funding in 2000, could have removed all trees infected or exposed to the disease by the end of this year. However, because of legal challenges that halted tree removal in Miami-Dade and Broward counties, the eradication program will have to continue until January 2008, the report says.

Spreen said the 2004 hurricane season "throws another unknown into the equation" because the disease is spread by rain-driven wind.

"Our cost estimates for concluding the eradication program in 2008 were developed in June 2004 before the storms passed through the state," Spreen said. "Now we are beginning to see new outbreaks of citrus canker in Southwest Florida and the Indian River area, which means the program may have to continue beyond 2008."

Jim Graham, a professor of soil microbiology at the Lake Alfred center who is studying the pathology of the disease and evaluating various control methods, said decisive action is the best policy when canker threatens the Florida citrus industry. Outbreaks of the disease have plagued the industry since the early 1900s but have been throttled by eradication efforts in earlier campaigns. Previous programs eradicated canker from the state in 1933 and 1994.

"If another outbreak should occur after Florida has been certified canker-free, a policy will probably remain in place for immediate eradication," Graham said. "Stopping the disease as quickly as possible minimizes the considerable costs of residential and grove surveillance for canker and the removal of infected and exposed trees to Floridians, the federal government and the citrus industry." ■

– CHUCK WOODS

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Sandra Vardaman, left, land manager with the Alachua County Department of Environmental Protection, Peter Colverson and Geoff Parks, land manager with the City of Gainesville Department of Nature Operations, participate in a recent field workshop presented by the academy.

THE NATURE CONSERVANCY *Training Program*

To help meet the growing need for professionals who manage and protect important natural areas in Florida, The Nature Conservancy is offering a training program in cooperation with the University of Florida.

The Natural Areas Training Academy – the result of a partnership between the nonprofit, international conservation organization and UF's Institute of Food and Agricultural Sciences (UF/IFAS) – is designed for public and private resource managers.

During the past four and a half years, more than 700 participants have participated in 30 academy workshops that provide up-to-date, practical training and management strategies for protecting natural areas in Florida. Five new workshops are being offered by the academy during 2005.

Peter Colverson, an associate professor who manages the Conservancy's training academy in Gainesville, said the state has added millions of acres to its protected lands during the past 15 years, which has created a need for more and better-trained professionals to manage those lands.

"These professionals provide a critical service – managing the state's conservation lands to ensure that important biological resources are protected for future generations," Colverson said. "The training academy's workshops provide land managers with the techniques and strategies they need to protect these valuable natural resources."

Those who complete a series of five workshops earn a Certificate in Natural Areas Management from the academy. Colverson said the credential has been adopted by five Florida counties as a basic qualification for land management work. As of March 2005, 55 professional land managers have earned the certificate, which has been endorsed by the Natural Areas Association and used as a template to establish nationwide standards for conservation land-management training.

> "Since 2000, the partnership between the Nature Conservancy and UF's Institute of Food and Agicultural Sciences has been a key factor in the academy's success."
>
> –PETE COLVERSON

"Since 2000, the partnership between The Nature Conservancy and UF's Institute of Food and Agricultural Sciences has been a key factor in the academy's success," Colverson said. "The partnership combines the expertise of a well-respected international conservation organization with 50 years of land-management experience and Florida's land-grant university."

He said the academy now operates as part of the recently created School of Natural Resources and Environment, a campus-wide teaching, research and extension program hosted by UF/IFAS, which gives the academy access to a large number of academic disciplines and potential partners.

The academy training program is also supported by the Florida Fish and Wildlife Conservation Commission and the Florida Park Service, which may make the training a basic requirement for managers in the state park system.

The combination also allows the conservation organization to improve its reach and effectiveness by working with the UF/IFAS statewide extension education program, he said. As a result, the Conservancy is able to present its scientifically based land-management values to a diverse, interagency audience.

The training academy also provides university faculty and other personnel with opportunities to engage in natural resource education, Colverson said. In 2004, for example, the Conservancy cooperated with the UF/IFAS School of Forest Resources and Conservation, presenting three workshops to help private land owners adopt ecologically friendly management practices. The close working relationship also helps the Conservancy obtain grant funding from state land-management agencies.

Victoria Tschinkel, state director of The Nature Conservancy in Tallahassee, Fla., said it is well known in the conservation community that acquiring land – while critical – is not enough to ensure its long-term protection.

"Lands must be restored, if damaged, and managed over time in order to preserve their natural values," she said. "This can only be accomplished by well-trained people who have the necessary resources. The Natural Areas Training Academy has shown that Florida's resource managers are interested and committed to expanding their skills and taking their expertise to a new level."

While the majority of the lands the Conservancy helps protect are in public ownership, the organization also owns and manages several preserves throughout the state, Colverson said. These include: The Disney Wilderness Preserve in Osceola County, Blowing Rocks Preserve on Jupiter Island between the Atlantic Ocean and the Indian River Lagoon, Tiger Creek Preserve near Lake Wales, Apalachicola Bluffs and Ravines Preserve, and the Islands Initiative Preserve in Northeast Florida.

For more information on the workshops and registration, visit the training academy Web site: http://nata.snre.ufl.edu/. ■

– CHUCK WOODS

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AGRICULTURE *in Space*


JOSH WICKHAM

Kevin Folta examines plants growing under a bank of light-emitting diodes, or LEDs. He says LEDs, which are more energy-efficient than incandescent light bulbs, could be used to grow plants on a future Moon base or mission to Mars.

As the United States sets its sights on new manned missions to the moon and Mars, University of Florida scientists are helping develop some of the technologies needed for these challenging space programs.

In December 2004, researchers with UF's Institute of Food and Agricultural Sciences (UF/IFAS) gave the news media a first-hand look at their work at the Kennedy Space Center's Space Sciences Laboratory where they are helping NASA scientists develop life-support systems for future missions to the Moon and Mars.

Rob Ferl, a UF/IFAS professor of molecular biology and director of UF's Center for Exploration of Life Sciences, said long-term space travel poses difficult challenges for the life sciences.

"Astronauts on a future moon base or Mars mission will need new, more efficient ways to produce food and get rid of waste," he said. "Much is still unknown about how people, animals and plants are affected by conditions in space beyond Earth's orbit, or by long periods in low gravity and possible radiation in space. And there is also the issue that missions to Mars could contaminate the planet with microbes from Earth, complicating the search for life there."

For long missions in space – lasting 18 months or longer – astronauts will need to grow some of their own food because it would not be economical or practical to carry tons of food and water on the spacecraft, he said.

"The food needed to feed a person for a year or more presents enormous storage and transportation problems," Ferl said. "It makes more sense to use that precious space and transport capability for a growth chamber that would grow food, turn carbon dioxide into oxygen and recycle waste."

The challenge of developing these advanced life-support systems is being met by Ferl and other UF/IFAS researchers, including Ray Bucklin and Khe V. Chau, professors in the agricultural and biological engineering department; Jean-Pierre Emond, an associate professor in the department; and Kevin Folta, an assistant professor in the horticultural sciences department.

To address the questions of growing plants on future space missions, Bucklin, Chau and their graduate students are building and testing models of greenhouses that simulate growing conditions in space as well as on the surface of the moon or Mars. The growth chambers can create the same mixture of gases found in the martian atmosphere and adjust other conditions such as atmospheric pressure, temperature and sunlight to match those of the Red Planet.

Ferl said the first step in learning how to grow plants on Mars may be a small, toaster-sized growth chamber that could be part of a future NASA robotic mission to the planet. The experiment could send about a dozen seeds of the Arabidopsis plant – a small weed commonly used in scientific research – to the martian surface where they would be planted in soil dug up from the planet's surface.

"Each plant would be genetically engineered to produce a glow in the presence of a specific mineral or set of nutrients, giving researchers vital information on the potential toxicity of martian soil and how well future food crops might grow there," he said.

Folta said growing plants aboard a space ship on an 18-month mission to Mars will require artificial grow lights, and he believes light-emitting diodes, or LEDs, may be the perfect light source for space greenhouses.

"We're exploring the use of LEDs as a light source for growing plants because they last much longer and burn far less electricity than standard incandescent light bulbs," he said. "An LED can easily last 50,000 hours, which is probably more than enough to get through a mission to Mars, without having to carry spare bulbs."

Each individual LED is a tiny semiconductor, which produces light only in a small portion of the spectrum – red, for instance, or blue. Put dozens or hundreds of different-colored LEDs

together, and you can produce a white light as bright as anything that comes out of an incandescent bulb, he said.

Folta is using LEDs to explore how different light intensities, colors and durations affect plant growth. By applying the right combinations of colors at the right time, it may be possible to tell space-borne plants when to bloom, or how high to grow – or duplicate perfect growing conditions on Earth.

"The idea of light color affecting plant growth is nothing new, but we are learning how different parts of the light spectrum, both visible and invisible, affect plant growth," he said. "The goal is to limit the need for chemical growth regulators in space, controlling important processes with light. Light treatments can be controlled from Earth, allowing busy astronauts to focus on other tasks."

To help young people learn about space exploration, UF/IFAS has launched Space Agriculture in the Classroom, an educational program designed for middle-school children in Florida and other participating states. Last year, during its first year in operation, the program distributed educational materials to 395 sixth-grade teachers in five states.

Developed by the UF/IFAS agricultural education and communication department, the program provides teachers with a two-week lesson plan on agriculture in space. The lesson plans are designed for use with *Growing Space*, a publication on space agriculture designed for middle-school audiences. More information is available at the project's Web site: www.spaceag.org/.

Glenn Israel, a professor in the department, said that 70 percent of teachers who used the curriculum reported that the program increased interest in science for a majority of their students. ■

– TIM LOCKETTE

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Seminole County Inmates Raise "BENEFICIAL BUGS" *for* UF *and* UDSA Researchers

Inmates at the Seminole County Correctional Facility, who have been growing their own vegetables for more than 10 years, are now raising thousands of beneficial bugs that attack insect pests and feed on troublesome weeds in Florida.

The insect "farming" program – the first of its kind in the nation – will generate about $2,000 a year for the inmate welfare fund at the facility and help inmates develop marketable skills for future employment.

"The project is the result of a new partnership with the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) to help inmates learn about biological control – raising good bugs that prey on bad bugs and weeds – and reduce the need for chemical pesticides," said Debra Taylor, a deputy who supervises the training program at the facility in Sanford, Fla. "These beneficial bugs not only help control pests on our own veggie crops, but we are raising thousands of insects for researchers at UF and the U.S. Department of Agriculture."

Twelve women inmates participating in the biocontrol program receive training and certification from UF, which launched the project in cooperation with the USDA, Taylor said. UF training and certification as "insect scouts" – recognized by nurserymen and wholesale plant growers in Central Florida – could help the women find employment when they are released from the correctional facility.


THOMAS WRIGHT

Lance Osborne, left, checks papaya plants with Debra Taylor at the Seminole County Correctional Facility in Sanford. Inmates at the facility, who have been growing their own vegetables for more than 10 years, are also growing beneficial bugs on the plants for researchers at UF's Mid-Florida Research and Education Center in Apopka and the U.S. Department of Agriculture.

Lance Osborne, a professor of entomology at the UF/IFAS Mid-Florida Research and Education Center in Apopka who developed the concept, said the program was started because there are no commercial biocontrol insect producers in Florida.

"Raising insects for biocontrol is labor intensive and expensive, which makes the project ideal for inmates in correctional facilities," he said. "With the help of a grant from USDA's Animal, Plant Health Inspection Service, we launched the pilot project in cooperation with the Seminole County facility."

He said inmates in Seminole County are now producing two different kinds of beneficial insects. One is an insect predator that controls pests on ornamental plants in greenhouses, and the other is a beetle that feeds on the leaves of tropical soda apple, one of the most troublesome weeds in the state.

In order to manage the whitefly pest problem in greenhouses where vegetables, herbs and ornamentals are grown, Osborne developed a biocontrol system that relies on the production of "banker plants" for Central Florida growers.

"A banker plant is a plant that has been infested with both the target pest and its natural predator," he said. "For instance, papaya plants attract the papaya whitefly and a parasitic wasp that controls the whitefly on the papaya host plants, as well as silverleaf whitefly on other greenhouse plants. As a result, an infested papaya plant becomes a bank of beneficial insects that can be placed in greenhouses to control ornamental pests, such as the whitefly, without applying pesticides."

Osborne feels that the wasp is the "best natural enemy" of the silverleaf whitefly pest in greenhouses. But the wasp was not being commercially produced in large numbers, which is one of the primary reasons for starting the banker plant system at the Seminole County facility.

He said there is an increasing demand for the new banker plant technology, which is not being produced anywhere else in the nation at this time. Banker plants are grown in one- to three-gallon containers that sell for $10 to $15 per plant.

Inmates also are raising thousands of beetles (*Gratiana boliviana*) that will be released in pastures across Florida to control tropical soda apple. The weed is so invasive that other plants cannot grow around it.

To combat the pest without using harmful herbicides, UF/IFAS researchers traveled to South America where the weed originated and found a natural predator that feeds solely on the plant. After conducting extensive studies with USDA, UF/IFAS researchers have begun releasing the beetles in pastures across the state to eliminate the weed.

"Despite positive test results, we do not have enough beetles available for release," Osborne said. "That's why we turned to the inmates in Seminole County to help raise these beneficial insects; their work will be an essential part of our program to control this noxious weed."

Taylor said the guidance and instruction offered by UF enhances the existing inmate agricultural program at the Seminole County facility, and the new biocontrol program has the potential to generate revenue that will benefit inmates and support additional training programs.

"If this USDA pilot project is successful, it could develop into a system where inmates could help society by reducing reliance on pesticides and save tax payers millions of dollars in the fight against new invasive pests," Osborne said. ■

– CHUCK WOODS

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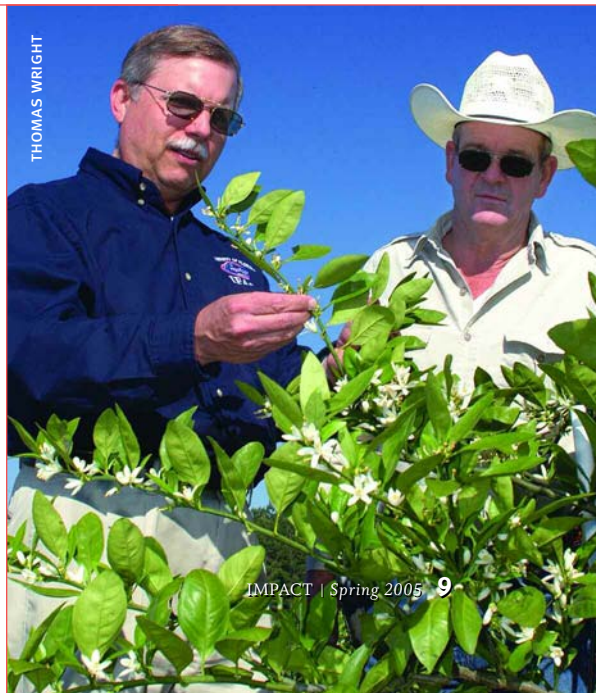
GROWING SATSUMAS *in the* FLORIDA PANHANDLE

In the heart of the Florida Panhandle – hundreds of miles north of other citrus production areas in the state – Mack Glass is growing cold-hardy Satsuma oranges and says Jackson County could regain its title as the Satsuma Capital of the World.

"Back in the early 1900s, before a 1935 freeze wiped out the 3,000-acre



THOMAS WRIGHT

George Hochmuth, left, and Mack Glass check flower buds on Glass's Satsuma orange crop. About three years ago, Glass decided to start growing the cold-hardy citrus to diversify his farming operation because of lower target prices in the federal farm program for traditional crops such as corn, peanuts and soybeans.

citrus crop in the Panhandle, our county was known as the Satsuma Capital of the World, and annual Satsuma festivals in 1928 and 1929 attracted 35,000 people," said Glass, who is growing five acres of the Mandarin orange on his farm near Marianna.

He expects to harvest his first crop of oranges in the fall of 2005 and said two other Jackson County growers – Nolan Daniels and Herman Laramore – are also planning to start commercial production of the orange.

Glass said he expects brisk local sales of the tasty oranges, particularly at fund-raising events for churches and schools. His Satsuma crop flowers in late April and early May, and fruit can be harvested from mid-October through the second week of November.

A partner and manager of the Cherokee Ranch of North Florida Ltd. in Jackson County, he began growing Satsuma oranges about three years ago to diversify his farming operation. He said the idea to grow Satsumas came from Wayne Sherman, a professor of horticulture with the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) in Gainesville.

"It's no secret that we're having some marketing problems here in the Panhandle because the new federal farm program has lowered target prices for traditional crops such as corn, peanuts and soybeans," Glass said. "Peanuts used to be our main crop, generating about $780 per ton, but now we're getting about $335 per ton."

He said weather and pest control are the only challenges they face in producing Satsuma oranges, but these have been largely solved with the help of UF research and extension experts.

"What makes us optimistic about growing Satsuma oranges in the Panhandle is that we now have production technologies from UF's Institute of Food and Agricultural Sciences that simply did not exist back in the early 1900s – or even 20 years ago," Glass said. "We came through several freezes this year without any damage to our trees, thanks to a microirrigation system that puts out 24 gallons of water per hour for freeze protection."

> "Back in the early 1900s, before a 1935 freeze wiped out the 3,000-acre citrus crop in the Panhandle, our county was known as the Satsuma Capital of the World, and annual Satsuma festivals in 1928 and 1929 attracted 35,000 people."
>
> –MACK GLASS

He is working closely with George Hochmuth, director of the UF/IFAS North Florida Research and Education Center in Quincy, and Ed Jowers, UF/IFAS Jackson County extension director, to solve various cold protection, pest control and other production problems.

Glass said the Florida Automated Weather Network (FAWN), which provides real-time weather data 24 hours daily to producers around the state, helps him keep track of approaching cold fronts and schedule his irrigation system to prevent freeze damage.

John Jackson, a UF/IFAS Lake County extension agent who helped establish FAWN in 1997, said the weather network now covers the entire state with 33 stations linked to computers at UF in Gainesville. Each solar-powered station collects weather data and transmits it to Gainesville every 15 minutes. The network includes monitoring stations near Marianna.

The stations measure temperatures at two, six and 30 feet above ground, and soil temperature, wind speed and direction, rainfall, relative humidity, barometric pressure, leaf wetness and solar radiation, he said.

Glass said FAWN is a valuable production tool because regular weather forecasts for cities may be misleading for farmers. "Heat trapped in concrete and asphalt can make cities 10 degrees warmer than farms in rural areas. When cold weather moves through the Florida Panhandle, the difference can be devastating to citrus and other cold-sensitive crops," he said.

Growers and others interested in the weather data can access the system 24 hours daily by telephone at (352) 846-3100 or the FAWN Web site: http://fawn.ifas.ufl.edu/.

Dick Sprenkel, a professor of entomology and associate director of the Quincy center, said there have been few insect and mite problems on Glass's citrus trees.

"Overall, Mack's crop has had fewer insect pests than I normally see on dooryard citrus," he said. "This is probably due at least in part to the better quality trees that he planted and the higher level of management that the grove has received. At this time, I am optimistic that any insect problems that are encountered can be economically managed." ■

– CHUCK WOODS

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A WINNING COMBINATION *for* STUDENTS!


THOMAS WRIGHT

David Beach, a graduate of the program, is currently finishing a two-year residency in endodontics. "The program saved me the tuition expenses for a year of undergraduate studies, and it was a quicker way to achieve my goal of becoming a dentist."

Agriculture and dentistry may seem like an unusual combination of disciplines, but a growing partnership between UF's College of Agricultural and Life Sciences (CALS) and UF's College of Dentistry is proving to be ideal for students who want to become dentists.

The Honors Combined Bachelor of Sciences/Doctor of Medical Dentistry Program allows outstanding students to graduate with professional degrees a year earlier than traditional programs in the dental college.

"Students accepted into the program receive their bachelor of science and doctor of dental medicine degrees in seven years – instead of the usual eight years," said Jane Luzar, associate dean of CALS, which is part of UF's Institute of Food and Agricultural Sciences. "Saving a year is a big benefit for students."

During their senior year in CALS, program participants transfer to the freshman class in the dental college. Credits from the first year of the professional degree are used toward participants' bachelor's degrees, which are awarded after the first year of dental school.

"I knew in high school that I wanted a career in dentistry," said David Beach, a graduate of the program who is currently finishing a two-year residency in endodontics. "The program saved me the tuition expenses for a year of undergraduate studies, and it was a quicker way to achieve my goal of becoming a dentist."

Launched in 1992, the program now admits eight to 10 students per year, Luzar said. The program – offered only through CALS – was developed to help students who have shown exceptional ability and interest in a dental career.

"We have a number of students who want to pursue a career in dentistry, and they demonstrate their commitment to this goal through the quality of their academic work and activities such as volunteer work," Luzar said. "We wanted to offer these students a program that recognizes their interest and experience, and puts them on a more linear track toward their goals."

Students majoring in microbiology and cell science or food science and human nutrition may apply to the program in their freshman year, she said. Applicants must satisfy a set of rigorous admissions criteria, including a minimum 3.8 overall high school grade point average and a minimum Scholastic Aptitude Test (SAT) score of 1310. Qualifying students must also have taken two college-level science courses and received an overall grade point average of at least 3.75 (out of a possible 4.0) during their freshman year at UF.

Students admitted into the program also receive provisional early acceptance into the dental program, which is attractive to students at a time when the admissions process at dental schools across the country is becoming more stringent.

"Getting into a good dental program is getting extremely competitive," said Andrew Cooper, a program participant who is now attending dental school. "Knowing that I was already accepted took a lot of pressure off of me as an undergraduate. I still had to work hard, but I was able to be more focused and enjoy all of the interesting things that UF has to offer."

Luzar said that the honors program is one of several combined degree programs tailored to motivated students interested in professional or graduate degrees. According to Luzar, these programs are not only a good opportunity for students, they are good for the university, too.

"Our B.S./D.M.D. program is gaining national recognition now, as students call from all over the nation to talk to us about applying," Luzar said. "Our combined degree programs are becoming a big draw for students of the highest caliber from Florida and out of state." ■

– JULIE WALTERS

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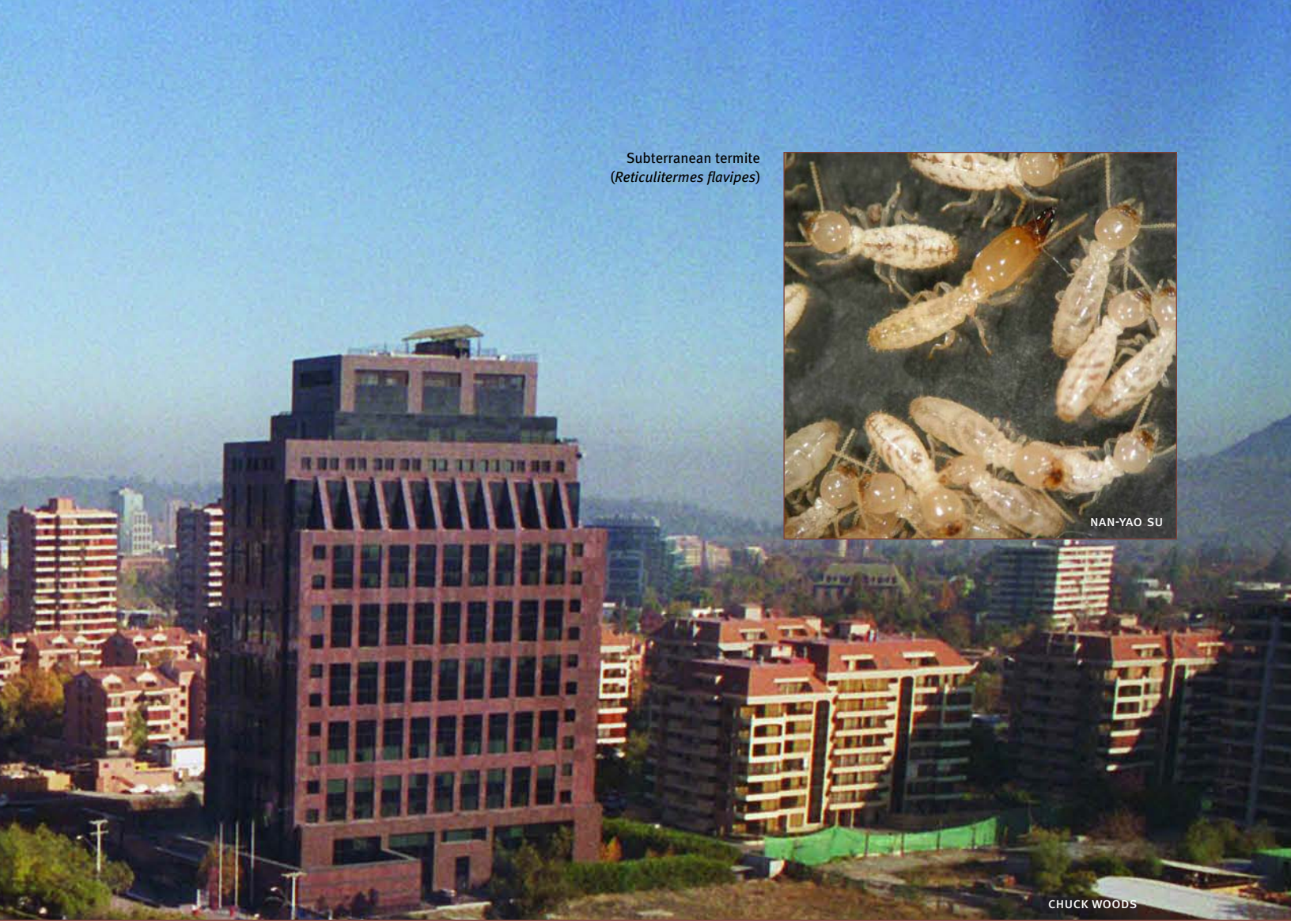
Stopping *the* Siege *in* Santiago

by Chuck Woods

First identified in Chile in 1986, subterranean termites have spread over more than 18,000 square miles, causing widespread damage to structures in Santiago, Valparaiso and surrounding areas.

Nan-Yao Su, left, Teresa Rivas and Jim Smith discuss termite damage in the municipality of Cerro Navia in Santiago, Chile. Rivas, whose property received extensive subterranean termite damage, said she replaced wood furniture, fences and other construction materials with concrete and metal to stop the damage.

In residential areas such as Cerro Navia, extensive use of wood construction – usually in direct contact with the soil – provides easy access for termites. About 15,000 homes are severely infested with termites, and the destruction is spreading rapidly.



Subterranean termite
(*Reticulitermes flavipes*)

NAN-YAO SU

CHUCK WOODS

WHEN AN INVASION OF SUBTERRANEAN TERMITES

recently became a problem in Chile, researchers with the country's Ministry of Agriculture turned to a University of Florida termite expert for help. Nan-Yao Su, a professor of entomology with UF's Institute of Food and Agricultural Sciences, is internationally recognized for his expertise on termites and is frequently called upon to help stop the destructive pest.

In Santiago and other urban areas near the sprawling capital of Chile, an invasion of subterranean termites is gnawing away on thousands of homes, causing fear and confusion among residents who don't know how to stop the destruction.

Subterranean termites were not a problem until the pest was first identified in the country in 1986, probably introduced from the United States through the port city of Valparaiso. Since then, the termite has spread over 18,600 square miles in the region around Valparaiso and Santiago, and the problem has gone from bad to worse.

"You can see it in the faces of people who are worried about the destruction of their homes," says Renato Ripa, an entomologist with the government's Instituto de Investigaciones Agropecuarias (INIA). "It's taken about 40 years for the problem to reach this point, and most people don't know anything about termites or how to control them."

In a desperate attempt to stop the destruction, people remove damaged wood and throw it out on the street, Ripa said. Others then use the discarded wood to build or repair their homes and fences – not knowing the wood is already infested with subterranean termites.

Popular remedies such as pouring bleach or kerosene on infested wood are ineffective because termite colonies are underground, often hundreds of feet from the infested structure.

About 15,000 homes are severely infested with termites, and the destruction is spreading rapidly, Ripa said.

While the problem affects people from all socioeconomic levels in the

Top: Nan-Yao Su, left, and Paola Luppichini check a Sentricon termite baiting system in Valparaiso, Chile. The termites probably found their way into the country through the port city about 40 years ago.

Below: Nan-Yao Su, left, and Renato Ripa inspect subterranean damage in Valparaiso, Chile.

region, it's particularly troublesome in poor urban neighborhoods, he said. Extensive use of wood construction, usually in direct contact with the soil, provides easy access for the wood-hungry insects. The termites also attack and kill trees.

Ripa, based at the INIA research station in the town of La Cruz about 60 miles from Santiago, said he did not have a lot of experience with subterranean termites, which prompted him to seek the advice of Nan-Yao Su, a University of Florida termite expert.

Su, a professor of entomology with UF's Institute of Food and Agricultural Sciences (UF/IFAS), is internationally recognized for his expertise in controlling subterranean termites and works with government agencies in many countries. In the United States, he recently helped the National Park Service stop termite infestations at the Statute of Liberty in New York, the French Quarter in New Orleans and the Christensted National Historic Site in St. Croix.

With the help of funds from the Chilean government, Ripa and Su initiated several research projects in Chile's fifth region, which includes the nation's second largest city of Valparaiso. Chile is divided into 13 government regions extending more than 2,500 miles from north to south along the Pacific.

Paola Luppichini, an agronomist at the INIA research station in La Cruz, is working with Ripa and Su on the project.

"The goal of our research was to test the four commercial pesticide treatments now on the market and develop recommendations for controlling severe termite problems in the region," Ripa said.

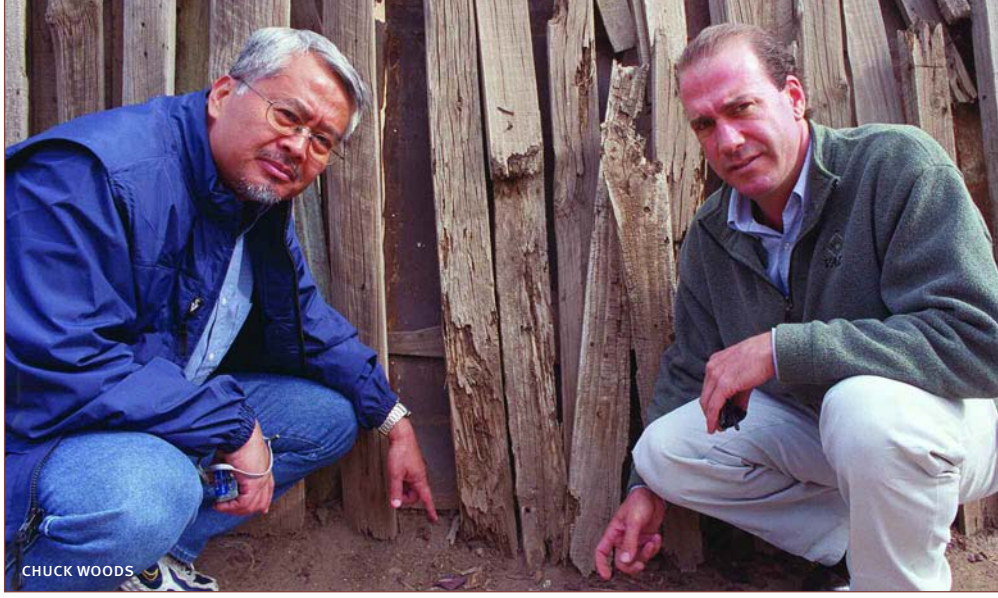
For their research, Ripa and Su selected two test sites in Valparaiso and two sites in the town of Quillota to compare barrier and bait treatment methods. Barrier treatments include chemicals applied to soil to prevent or repel termites from entering the structure. Bait treatments include chemicals that termites feed upon and carry back to their underground nests, causing the entire underground colony to slowly die.

The barrier treatments are Termidor, manufactured by BASF, and Demon, made by Syngenta Corp. The bait treatments are FirstLine, made by FMC Corp., and Sentricon, made by Dow AgroSciences.

In the early 1990s, Su helped develop the Sentricon Termite Colony Elimination System in his research program at the UF/IFAS Fort Lauderdale Research and Education Center. At the time, industry experts called Su's system the biggest advance in pest control in more than 50 years.

Su's bait system has a chemical called hexaflumuron, a growth regulator that prevents termites from molting, thereby reducing the ability of the worker population to sustain the colony. The chemical has a low toxicity to humans and the environment. Less than one gram kills an entire colony containing millions of termites.

"In Chile, after two years of anlayzing results from our field tests


CHUCK WOODS

Nan-Yao Su, left, and James Smith check termite damage to a wood fence in Cerro Navia, one of many municipalities in the Santiago metro area that are being attacked by the pest.

comparing the barrier and bait systems, we found that the barrier treatments do help protect homes and other structures from subterranean termites, but these treatments do not provide complete protection," Ripa said. "Termites are clever – they still find ways to go around barrier treatments to feed on wood in the structure. It looks like the termites are just avoiding the repellants."

Ripa said tests on one of the two baiting systems did not show effective control. "We saw little or no feeding activity by subterranean termites on the FirstLine bait, and the damage was the same as the untreated areas," he said. "However, the Sentricon baiting system provided total control of the termites at all four test sites in about one year."

Su said the long-term solution to controlling and eradicating subterranean termites in the region is to kill the underground colonies, and Sentricon is the only way to achieve this kind of result. "Otherwise, you're just chasing termites around with barrier or repellant chemicals," he said.

Ripa said the next step is to make their research data available to government agencies, pest control operators and consumers.

"Based on our test results, we are recommending the Sentricon system to eliminate underground termite colonies and chemical barriers to protect structures," he said. "We are seeking additional government funds to continue developing termite controls in the region. We also want to work with government agencies to develop new building codes to prevent future damage."

Santiago Siege

In Santiago, the nation's largest city with more than five million residents, Su is working with James Smith, an entomologist and commercial pest control operator, to battle the termite problem that now affects all areas of the city. When subterranean termites started causing widespread damage seven years ago, Smith and Su started developing solutions for area-wide management of the problem.

> **"When you consider a system such as Sentricon, which can eliminate the subterranean termite problem in Chile, you also need to remember that the cost of controlling the pest is far less than the cost of repairing or replacing damaged homes, businesses and other structures later on."**
>
> –NAN-YAO SU

Smith, who owns Terminator Systems in Santiago, said termite control may not be a high governmental priority in the poorer areas of the city where people worry about feeding and caring for their families. The problem is aggravated by the fact that almost all low-income housing is built with wood in the ground, creating a haven for subterannean termites.

"Some people just give up and think they're going to have to live with the destructive pest, but we are saying, 'no, that's not true,'" Smith said.

"So the first thing we need to do is educate people and some 30 muncipal governments in the Santiago area about the growing threat," Smith said. "Then we need to show them effective control measures that local governments will support."

To demonstrate how subterranean termites can be stopped with the Sentricon system, Smith and Su initiated test projects in two relatively poor areas of the city – the municipalities of Cerro Navia and Las Condes. Smith's company installed the underground baiting stations and monitored termite activity at the test sites, comparing results with adjacent neighborhoods that were not treated.

In Cerro Navia, the demonstration project includes 108 homesites, with half of the $100,000 cost being paid by the Chilean government and half being covered by Smith's firm. In Las Condes, which includes two different sites with 30 homes each, the municipal government is paying for 96

percent of the cost and homeowners are paying for 4 percent.

"When the Cerro Navia project started, 75 percent of the homes in the six-block test site had severe termite problems, and we were able to bring that down to just 3 percent in a year and a half – achieving 95 percent control of the pest," Smith said.

"In Las Condes, municipal inspectors said the demonstration site was 'eaten up' by subterranean termites," he said. "We installed the baiting system in September 2002 and there were no termites – zero – by June 2003."

Raul Valdez, an urban pest management specialist for the the municipality of Las Condes in Santiago, said the Sentricon system solved their termite problem, but he expressed concern that the issue is not being addressed by various government agencies on a regional level.

"The nice thing about our project in Las Condes is that it brings all people together to solve a problem," Valdez said. "The public sector is working with private business and residents in the area to show a need and respond to it in an effective way."

Su said the long-term cost of not controlling the pest in Chile will far outweigh the cost of taking corrective measures now.

"When you consider a system such as Sentricon, which can eliminate the subterranean termite problem in Chile, you also need to remember that the cost of controlling the pest is far less than the cost of repairing or replacing damaged homes, businesses and other structures later on," Su said.

"We have demonstrated that there is an effective way to stop this invasive pest in Chile, and we hope the government and other community leaders will find creative ways of bringing this pest control technology to the people," he said. ■

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EXOTIC *Tree Termite* ERADICATED

Rudolf Scheffrahn examines a nest of exotic tree termites at Dania Beach in Broward County. The termite nests and forages at or above the soil surface.

University of Florida experts and state officials have eradicated a newly introduced termite species in South Florida, and they say it's the first time an invasive pest like this has ever been stopped.

First discovered in Broward County almost four years ago, the tree termite could have caused as much as a billion dollars in property damage if it had become established in the state. Eighteen structures, including commercial facilities, homes and boats in dry dock were already infested.

"Because it damages buildings, this pest ranks right up there with citrus canker in terms of the economic damage it could do," said Rudolf Scheffrahn, a professor of entomology with UF's Institute of Food and Agricultural Sciences (UF/IFAS). "We believe we've eliminated all of the colonies of tree termites in South Florida, stopping the pest from gaining a permanent foothold here."

UF/IFAS FILE PHOTO

Brian Cabrera holds a nest of tree termites in his laboratory at the UF/IFAS Fort Lauderdale Research and Education Center. He believes the pest found its way into Florida by ship.

Scheffrahn, based at the UF/IFAS Fort Lauderdale Research and Education Center, identified the bug as *Nasutitermes corniger*, a pest commonly found throughout the Caribbean region and in Central and South America. This species was also recently discovered in New Guinea by a Belgian scientist.

Unlike most termite species in the United States, which spend most of their lives underground, the non-native termites build their nests above ground, usually at the base of trees, and travel on or above ground in search of wood. This posed a problem for local pest control operators hoping to stop the insect.

"Most termite control methods were developed for subterranean termites," Scheffrahn said. "When you apply a pest control agent to the ground around a house, the termites pass through or feed on that agent and carry it with them. Tree termites travel above ground, like ants, so those methods are not effective."

While most homeowners in the termite's native range have been fighting the insect for centuries, their experience offered little help, said Brian Cabrera, an assistant professor of entomology and extension specialist who worked with Scheffrahn on the termite control project.

"This termite is found in many areas of the developing world, where pest control services are not available or [are] very expensive, so people will attempt to control the problem with whatever they have on hand," Cabrera said. "Usually, replacement of damaged wood is the only option."

To limit the spread of the new termite in South Florida, Steve Dwinell, assistant director at the Florida Department of Agriculture and Consumer Services, created an emergency task force in 2002, which includes Scheffrahn and Cabrera as well as other state officials, pest control operators and pesticide manufacturers.

"At the time, we were not sure that we could eradicate the termite because a new population is usually well established by the time it's discovered," Scheffrahn said. "However, the tree termite is different because the nests, tubes and damage are usually obvious. Until now, no one had ever eliminated an exotic termite after establishment on land."

When Scheffrahn and Cabrera surveyed the area in 2001, they estimated the tree termite had been in Dania Beach for at least eight years before it was discovered. But the infestation appeared to be limited to an area of one square kilometer – about a third of a square mile – a relatively small area for an eight-year-old infestation. The finding raised the possibility that the task force might be able to eliminate the entire infestation, Scheffrahn said.

With a $30,000 grant from the state, the UF researchers found that a pair of widely used pesticides would kill the termites when sprayed on nests or infested trees. After three treatments with the pesticides and the fumigation of several buildings, a survey of the area in July 2004 revealed only three remaining populations, which have since been treated. With volunteers from the pest control community and logistical support from the state agriculture department, the researchers say the tree termite has effectively been defeated.

Scheffrahn said the program saved the state from a potentially costly pest – at little cost to state government. For their efforts, the Tree Termite Task Force received a 2004 Davis Productivity Award that recognized the team's innovative and cost-cutting approach. The $500 award was donated to victims of the 2004 hurricanes. ■

– TIM LOCKETTE

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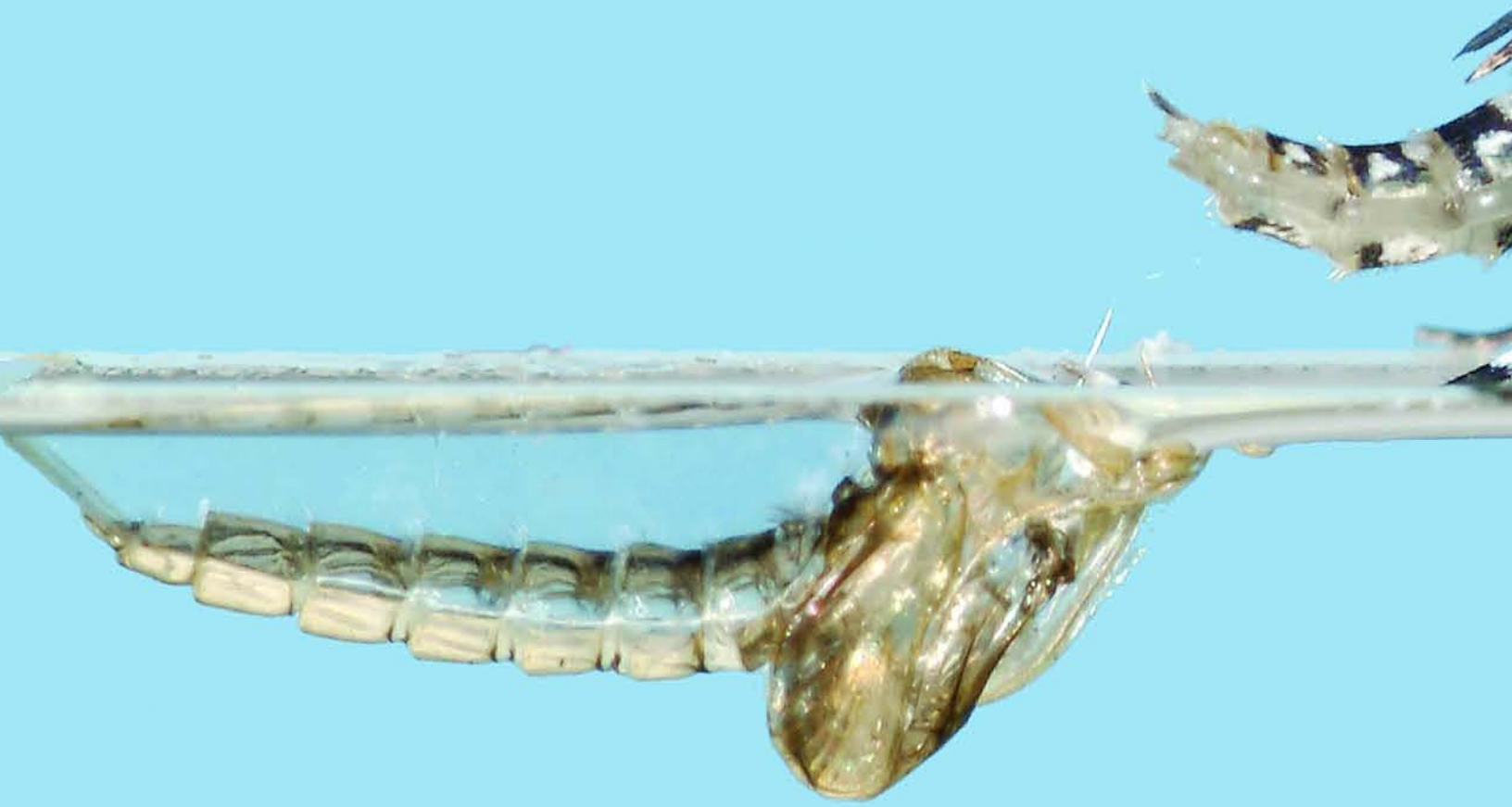
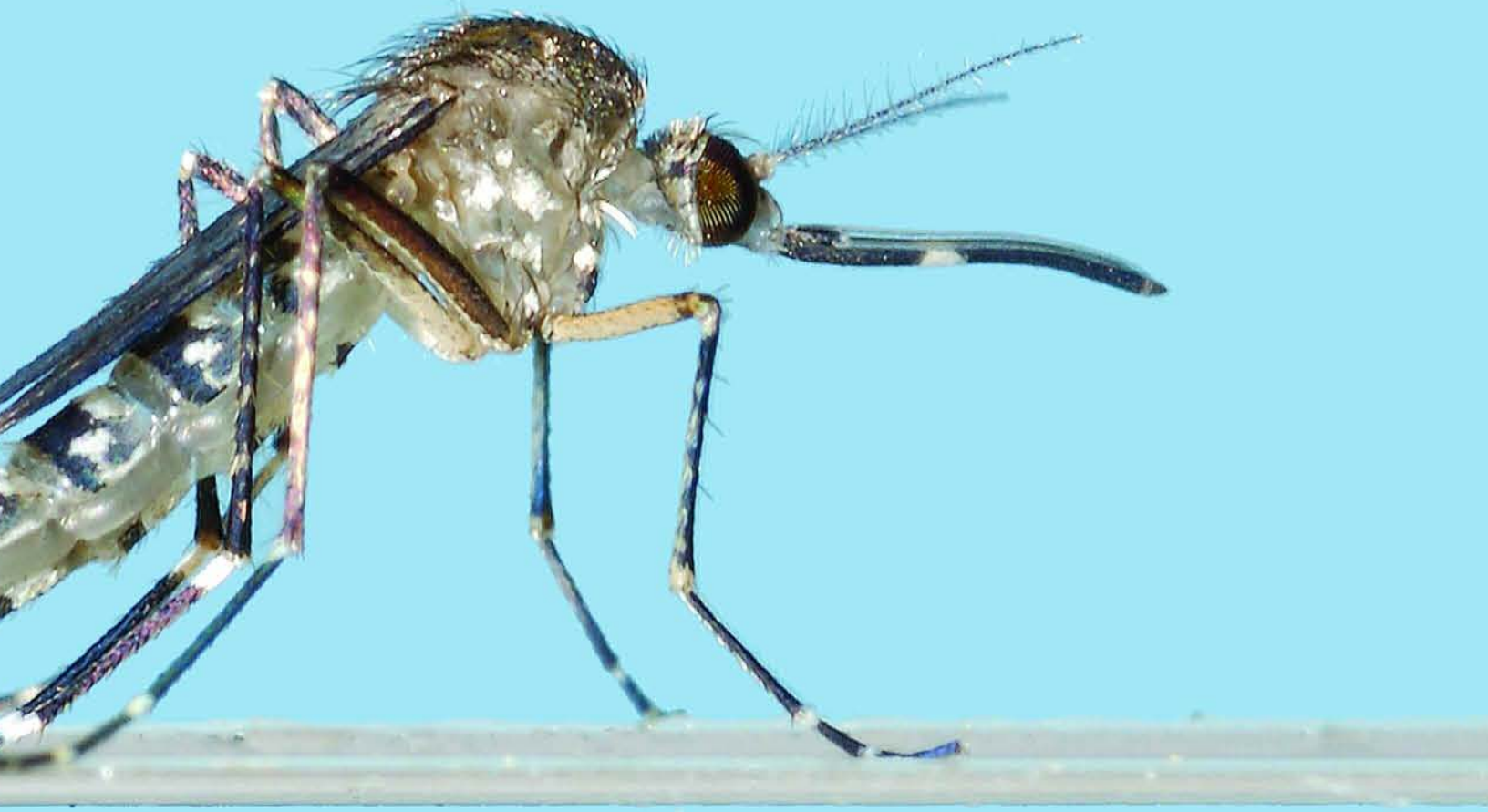
Managing *the* Mosquito Menace

by Chuck Woods



A female black salt marsh mosquito (*Ochlerotatus taeniorhynchus*) emerges from the pupal skin. This species is a major pest in Florida coastal areas because large numbers of adults frequently emerge from aquatic habitats in salt marshes and mangrove swamps, and then they fly several miles in search of a blood meal. (PHOTO BY JAMES NEWMAN)



THE FLORIDA MEDICAL ENTOMOLOGY LABORATORY IN VERO BEACH *is one of the world's largest facilities devoted to understanding and controlling mosquito-borne diseases such as West Nile virus, St. Louis encephalitis, eastern equine encephalitis, dengue fever and malaria. The lab – part of UF's Institute of Food and Agricultural Sciences – provides vital, research-based information to mosquito control districts, public health agencies and consumers in Florida and the nation.*

Chelsea Smartt studies the ability of mosquitoes to resist pesticides commonly used to control these pests and prevent transmission of disease.

George O'Meara uses a fine mesh net to collect mosquito larvae and pupae in the water of a stormwater catch basin.

With summer on its way and mosquitoes beginning to buzz, the threat of West Nile and other diseases transmitted by these blood-feeding insects will only increase. And Florida could become the next hot spot for mosquito-borne diseases.

Ever since West Nile virus first appeared in North America in 1999 and Florida in 2001, it has upended early assumptions that it is a mild disease that only affects the elderly. The virus has the potential to cause massive human epidemics on a scale not seen in the United States in the past 100 years, according to researchers at the Florida Medical Entomology Laboratory in Vero Beach.

In fact, West Nile epidemics have already hit Illinois, Colorado and Arizona during the past five years. Every state except Alaska, Hawaii and Oregon has experienced human cases or animal infections. In 2003, the number of human cases across the nation exceeded 9,800 – more than double the previous year. The death toll in 2003 was 262, slightly lower than the 284 in 2002.

Health officials believe most infected people show no signs of the illness, but some experience flulike symptoms such as fever, headache and body aches. In some cases, the virus may cause encephalitis or meningitis that can be fatal. Since there is no vaccine for West Nile, prevention is crucial.

"Although Florida has been spared so far, we certainly have all the ingredients for a massive West Nile epidemic, which makes accurate surveillance and prediction even more critical," says Walter Tabachnick, director of the Vero Beach lab. "The disease could have a severe impact on the health and well-being of Florida residents and visitors, and hit the state's tourist industry hard."

Tabachnick said birds are the natural host of the virus, which was first identified in 1937 in the West Nile region of Uganda in Africa. Mosquitoes, which become infected after biting infected birds, can infect humans, animals and uninfected birds with their bites.

In its mission to control mosquitoes and other disease-carrying arthropods, the Vero Beach lab works closely with Florida mosquito control districts, health departments, the Florida Department of Agriculture and Consumer Services, and other government agencies, including the Centers for Disease Control and Prevention, the National Institutes of Health (NIH) and the World Health Organization.

Tabachnick said researchers at the lab are working on more than a dozen different projects that will help alert and protect Florida and the nation from mosquito-borne disease epidemics. Work is being done on West Nile, St. Louis, eastern equine, and dengue viruses, malaria, their mosquito vectors, and new strategies for their control. Although focused in Florida, studies at the laboratory include international projects in Belgium, Brazil, Israel, Peru and Uzbekistan. The research has worldwide implications.

Mosquito-Borne Viruses

Cynthia Lord, an associate professor of entomology who leads a faculty team at the lab working on a five-year, $2.5 million NIH grant, said their research project includes three

major components: mathematical modeling to understand factors that affect mosquito outbreaks, laboratory research on how well different mosquito species can transmit the virus, and field experiments to measure transmission rates by mosquitoes. She is using data from all three components to construct models that best predict the epidemiology of West Nile.

"This multidisciplinary approach will improve risk assessment for West Nile and utilize state-of-the-art information to develop new strategies to reduce the risk of this and other arthropod-borne pathogens to public health," Lord said.

She said these viruses are maintained in nature by cycling between the mosquito vector and wild birds. Her mathematical models on the transmission cycles of West Nile virus and St. Louis encephalitis demonstrate how the natural cycle functions and how to improve surveillance and control efforts.

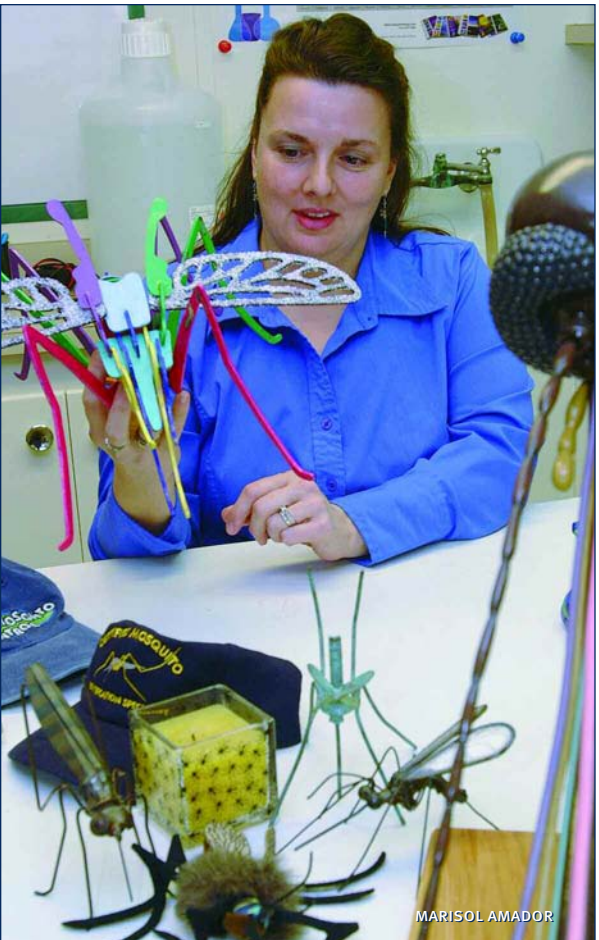
"Outbreaks of West Nile virus could become more cyclical in different areas of the United States over time – dying down one year and flaring up the next," she said. "It is a common pattern for viruses transmitted by arthropods such as mosquitoes, sandflies and ticks."

Lord said these are very complex transmission cycles, which can be difficult to understand and control. Understanding the cycles, however, is crucial to predicting the risk of large-scale epidemics and human disease.

The Vero Beach laboratory research focuses on the ability of different mosquito species to transmit West Nile virus and how the age of these mosquito populations affects transmission rates. Current research is aimed at measuring virus transmission by two common species of mosquitoes: *Culex nigripalplus* and *Cx. quinquefasciatus*. These mosquitoes can be long-lived, so the effect of age on transmission is important. Another important question being addressed is the relationship between the number of mosquitoes that are infected and the number that are able to transmit the virus.

Faculty members working to characterize mosquito West Nile transmission capability include Tabachnick and Chris Mores, Roxanne Rutledge and Chelsea Smartt, assistant professors of entomology.

The field component of the research, led by Jonathan Day, a professor of entomology, uses sentinel chickens to detect virus transmission by mosquitoes. Mosquito collections at the same sites are used to determine the age structure of natural populations and how it affects transmission. Rutledge also serves as liaison to mosquito control districts to locate field sites and mosquito populations. George O'Meara, a professor of entomology, provides ecological information on the primary mosquito vectors of West Nile virus.

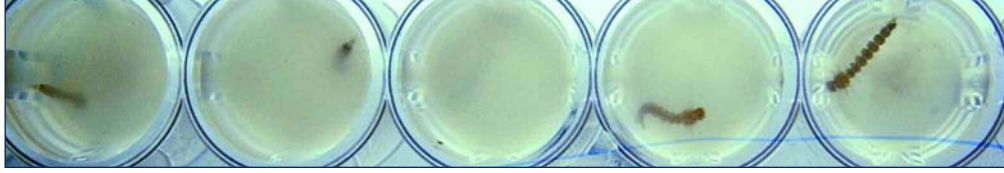

MARISOL AMADOR

Roxanne Rutledge, left, holds a scale model of a mosquito used in her extension education programs. The model demonstrates how mosquitoes feed on blood, how the blood is digested, and how mosquito-borne diseases are transmitted to humans and animals.

Walter Tabachnick, below, extracts DNA genetic material from mosquitoes at the Florida Medical Entomology Laboratory.


MARISOL AMADOR


UF/IFAS FILE PHOTO



These tiny containers, above, allow researchers to observe the growth and development of mosquito larvae feeding on genetically modified yeast cells that produce TMOF. Cells that produce TMOF starve the larvae to death.

Cynthia Lord, left, uses a pipette to collect mosquito larvae for a research project at the Florida Medical Entomology Laboratory in Vero Beach.

Below: Cynthia Lord, left, Walter Tabachnick, George O'Meara, Roxanne Rutledge, Jonathan Day and Chelsea Smartt review plans for various research projects at the Florida Medical Entomology Laboratory.


MARISOL AMADOR

Mosquito Mapping

In another project, Day is working with state and federal agencies to predict outbreaks of mosquito-borne diseases. Using the St. Louis encephalitis virus as a model, he has developed a reliable system for predicting outbreaks in Florida, and he works closely with state and national mosquito control districts and other public and private groups to disseminate the information.

By combining weather information from the Florida Division of Forestry and the National Oceanic and Atmospheric Administration, data on sentinel chicken surveillance from the Florida Department of Health and reports from local mosquito control districts, Day has developed a forecasting system for Florida that is now available as a risk map, with accompanying explanation, on the lab's Web site: http://eis.ifas.ufl.edu/.

"The map changes as various indicators for encephalitis show up or disappear across the country," he said.

He posts the current-year maps in January and updates them monthly through June, after which updates become weekly through the end of mosquito season.

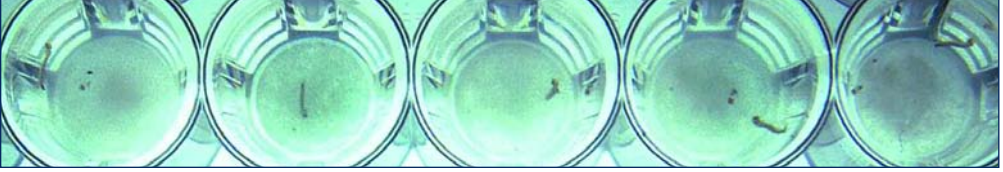
Day's other research and education work – which has attracted national media attention – includes studies on mosquito attractants and repellants. Recently, he warned consumers that electric bug zappers are not effective in controlling mosquitoes, and the devices end up killing more beneficial insects than mosquitoes.

Tiger Mosquitoes

Researchers at the Vero Beach lab are also studying invasive, disease-carrying pests such as the Asian Tiger mosquito (*Aedes albopictus*) that invaded Florida in the late 1980s. Native to East Asia, the mosquito is now one of the most prevalent biting pests in the warmer regions of North and South America, Europe and Africa.

To learn more about the health risks associated with this aggressive mosquito in Florida and South America, scientists at the lab are working on an NIH-sponsored project in cooperation with Illinois State University, Yale University and the Oswaldo Cruz Institute in Brazil. This project was originally supported by NIH, which provided $1.5 million for a four-year project. Funding was recently renewed by NIH, which provided an additional $2 million to continue the project for five more years.

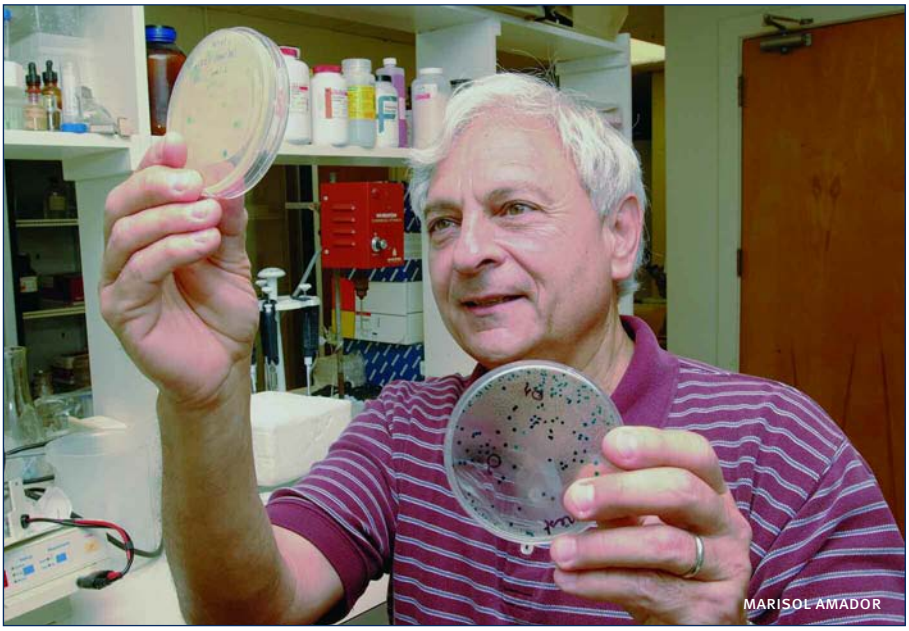
Phil Lounibos, a professor of entomology at the Vero Beach lab who leads the project, said their goal is to learn more about the ecology and genetics of the Asian Tiger mosquito, which can transmit several diseases. He said the mosquito is a good model for studying invasive mosquito species. The significance of learning why certain mosquito



THOMAS WRIGHT

Jonathan Day, right, counts mosquitoes collected in a light trap set on the grounds of the Florida Medical Entomology Laboratory in Vero Beach.

Dov Borovsky, below, examines Petri dishes with TMOF colonies.


MARISOL AMADOR

species make excellent invaders is critical for protecting the United States from new pests. The project is receiving international recognition.

"In the tropics, the Asian Tiger mosquito carries dengue virus, which infects millions of people annually but is usually not fatal," Lounibos said. "Dengue is epidemic in Brazil right now, and we're trying to understand how invasive mosquitoes transmit it. There is very real risk for the arrival of dengue virus into Florida and the U.S. We must know more about the mosquitoes capable of transmitting dengue if we hope to reduce the impact of this disease."

In research on the population dynamics of mosquitoes, O'Meara, another member of the team, found that the Asian Tiger mosquito forced the common *Aedes aegypti* mosquito out of its native habitats in Florida – causing that mosquito to disappear in many areas of the state. The distribution of these mosquitoes is key to determining the risk from dengue, since both species are capable of transmitting dengue virus to humans.

O'Meara also found that a new mosquito (*Culex biscaynensis*) in South Florida occupies habitats that Asian Tiger mosquitoes would normally colonize. This and other native mosquito species that live as larvae in bromeliads fill one of the habitats where Asian Tiger mosquitoes could breed.

Nutrient-Rich Mosquito Breeding Sites

O'Meara, along with Jorge Rey, a professor of entomology, and Sheila O'Connell, a biological scientist, are examining mosquito production in nutrient-rich aquatic systems, especially those created by human activities.

"We are investigating both underground systems such as stormwater catch basins and above-ground habitats, particularly stormwater and wastewater treatment areas," O'Meara said.

"Large numbers of mosquitoes, including those that transmit West Nile virus and other disease-causing organisms, can develop in these nutrient-rich habitats," he said. "The primary goal of our research is to develop information for designing and maintaining stormwater and wastewater habitats that are less likely to generate mosquito problems."

Biological Control

Researchers at the Vero Beach lab are also developing environmentally friendly ways of controlling mosquitoes without pesticides. One solution: rugged little crustaceans that attack mosquito larvae with a vengeance.

The eastern treehole mosquito (*Ochlerotatus triseriatus*) can often be found in water-holding cavities of live oak, hackberry and other types of trees. This mosquito is engorged with blood.

"We're using the native organisms to control mosquitoes when they breed in standing water, usually in ponds, tires and other open containers," Rey said. "By adding tiny crustaceans called copepods to the water, we can kill mosquito larvae before they become adults that may spread West Nile and other diseases.

"Tests at our lab show that the copepods (*Macrocyclops albidus* and *Mesocyclops aspericornis*) feed on mosquito larvae at an amazing rate, killing up to 90 percent of the larvae," he said.

His research shows the copepods prefer young mosquito larvae, usually those not older than four days. But they will attack older larvae when the number of young larvae declines.

He said copepods are native to Florida and common throughout the world. They pose no danger to people, animals or plants. However, copepods do not exist in every body of water and would have to be introduced in order to be effective on a wide scale.

Once the copepods become established, they reproduce in high numbers for effective natural control – or biocontrol – of mosquito larvae, Rey said. Copepods survive so well because they feed on a wide range of insect prey in the natural environment.

"Over the years, a variety of other biological control agents ranging from viruses to fish have been tried for mosquito control, but nothing seems to work as effectively as this microscopic natural predator," Rey said.

Current restrictions on pesticides, along with the growing problem of insect resistance to many chemicals, make biocontrols such as copepods increasingly attractive, he said.

Rey's research shows that the copepods are easy and inexpensive to raise and deliver to target areas. Large numbers of copepods can be reared in small plastic pools, plastic garbage cans and other inexpensive containers. Copepods thrive in warm climates but can survive freezing temperatures for short periods. Pesticides commonly used for mosquito control do not kill the copepods.

He said more research is needed on ways to distribute the copepods in the environment for effective mosquito larvae control.

"Standard spray equipment can be easily modified to dispense copepods," Rey said. "Since they can withstand almost dry conditions, storage and transportation will not require large quantities of water."

He said biocontrol techniques, such as using copepods for controlling mosquito larvae, are attractive for developing countries where human resources usually are more available than money for expensive control alternatives.

Rey, Rutledge, O'Connell and Richard Escher, a biological scientist, have developed mosquito copepod kits for Florida teachers. The kits contain all the materials needed to establish cultures of copepods that are predators of mosquito larvae.

"With the kits, students can study the complete mosquito life cycle," Rutledge said. "The kits, available free to Florida teachers, also contain a CD with illustrations and background information on mosquitoes and copepods."

For ordering instructions, visit http://fmel.ifas.ufl.edu/kits/.

JAMES NEWMAN

In Florida, this species of mosquito (*Culex nigripalpus*) plays a major role in the transmission of disease-causing viruses. This mosquito is engorged with blood.

Biotechnology

Research on mosquito biochemistry and molecular biology at the lab has resulted in a promising new pest control method that is efficient and safe for the environment.

Dov Borovsky, a professor of entomology, has developed a mosquito "diet pill" that alters their digestion, making it impossible for them to feed, lay eggs or survive.

He discovered that the TMOF (trypsin modulating oostatic factor) hormone can stop digestion in mosquito larvae, causing them to die of starvation. And he is using biotechnology to incorporate the TMOF hormone into a variety of microorganisms that mosquitoes eat.

"As a result, the same pond scum that nourishes young mosquitoes can now deliver their death blow," Borovsky said. "We have genetically engineered the aquatic organism chlorella found in marshes as a means to help to control mosquito larvae that eat chlorella and algae. After eating the chlorella, the larvae cannot digest food, and they die from starvation."

He has also genetically engineered yeast to produce TMOF. The recombinant yeast can be mass-produced, dried, formulated and sprayed over large areas like other pesticides. The recombinant yeast starves the mosquito larvae to death after they eat the cells.

What's more, Borovsky is engineering other plants to produce TMOF and control agricultural pests. "TMOF technology that started with mosquitoes can be used in agricultural applications against other insects, relying on similar molecules to control their digestive enzymes," he said.

Extension Education

Scientists at the Vero Beach lab also provide a variety of education programs through the statewide UF/IFAS extension service, local and district mosquito control organizations, the Internet and other venues.

Under Rutledge's leadership, faculty at the Vero Beach lab train more than 300 mosquito control and public health professionals annually. A course on mosquito identification offered by Rutledge and Richard Darsie, a courtesy professor of entomology, is internationally recognized by mosquito-control professionals. Over the past five years, more then 150 people have completed the two-week course, including students from throughout the United States and as far away as New Zealand and Turkey.

Information on the lab's outreach programs is available at http://mosquito.ifas.ufl.edu/. This site, which receives more than 200,000 hits annually, provides information for professionals in public health and mosquito control as well as the general public. ■

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Mission Accomplished

by Chuck Woods

AFTER A LONG FIGHT AGAINST MOLE CRICKETS, UNIVERSITY OF FLORIDA RESEARCHERS ARE DECLARING VICTORY AGAINST THE INVASIVE PESTS THAT CAUSED $94 MILLION IN DAMAGE TO TURF AND PASTURES EACH YEAR. THE MOLE CRICKET RESEARCH PROGRAM IS A PRIME EXAMPLE OF HOW UF'S INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES IS USING BIOLOGICAL CONTROL TO MANAGE PESTS WITHOUT CONVENTIONAL PESTICIDES.

Tawny mole cricket

Beneficial wasp parasitzing a tawny mole cricket

It's been an historic struggle dating back to 1978, but an invasion by South American mole crickets is being stopped, thanks to a University of Florida research program that pits natural enemies against the destructive pests.

The successful release of three biological control agents – wasps, nematodes and flies imported from South America – has reduced mole cricket populations in the Gainesville area by 95 percent, and these controls are spreading throughout Florida.

"Dramatic reductions have occurred during the past 12 years as populations of the introduced natural enemies increased and began to have a spectacular effect on the mole cricket pests," said Howard Frank, a professor of entomology who has coordinated the mole cricket research program at UF's Institute of Food and Agricultural Sciences (UF/IFAS) since 1985.

Frank said four species of mole crickets are found in Florida: northern, short-winged, southern and tawny. The northern mole cricket, which is indigenous to the state, is not closely related to the three South American invaders, and it is not troublesome because native wasp and nematode species in Florida keep it under control.

Unfortunately, the three invasive mole cricket species are not affected by native wasps and nematodes in Florida, he said.

Accidentally introduced to the Southeastern United States more than 75 years ago, the pest mole crickets quickly became a problem for Florida

vegetable growers. Arsenic baits provided poor control of the pests while pesticides such as DDT proved to be more effective. However, when the Environmental Protection Agency (EPA) banned DDT and similar pesticides in the 1970s, the pests became a nuisance once again.

"When the three invasive mole crickets left their natural enemies behind, there was nothing to stop their population boom here," Frank said. "These pest mole crickets, which tunnel into the ground and feed on plant roots, are now found from North Carolina to Texas, and they continue to spread north and west."

Of the three, the tawny mole cricket is the most destructive, eating grass roots in Florida pastures and turf as well as the roots of tomatoes, cabbages, eggplants and bell pepper seedlings, Frank said.

He said the pest crickets have a real affinity for Bahiagrass, Florida's most common pasture grass, which covers more than 2.5 million of the state's 35 million acres. Like the pest crickets, Bahiagrass was imported from South America, and it provides the insects with an almost endless food source. These mole crickets also eat Bermudagrass on Florida golf courses.

By 1978, mole cricket damage on pastures had become a major problem for Florida cattle ranchers when the most effective pesticide – chlordane – was banned by EPA. Ranchers asked the Florida Legislature for help, and the mole cricket research program was born.

Tom Walker, a professor of entomology (now retired) who coordinated the mole cricket research program from 1979 to 1985, said it was mandated by the state legislature and became the top priority in the UF/IFAS entomology and nematology department for many years.

"Early research on the three invasive pests showed how mole crickets, like moles, burrow into soil around plant roots and prevent them [roots] from absorbing water," Walker said. "We also realized that permanent control of these pests could only be achieved with a classical biological control program, and we began looking for natural enemies in South America."

Beneficial Wasp

The first stop was Brazil where researchers found a native wasp (*Larra bicolor*) that attacks the pest mole crickets, but does not threaten Florida's native northern mole cricket.

After the Brazilian wasp stings the pest mole cricket and lays an egg, the wasp grub (larva) begins feeding on the mole cricket and kills it within two weeks.

From 1981 to 1983, the Brazilian wasp was released at several South Florida locations, but it did not thrive and failed to provide effective control of the pest mole crickets.

Undaunted, UF/IFAS researchers found a tougher strain of the same wasp in the higher elevations of Bolivia, releasing it in the Gainesville area during 1988 and 1989.

"By late 1993, it was evident that the Bolivian strain of the wasp had become established," Frank said. "Four years later, the population had spread at least 20 miles east and west of Gainesville. By 2002, it seems to have spread 135 miles northwest and perhaps as far south. In time, it is likely to occupy all of Florida."

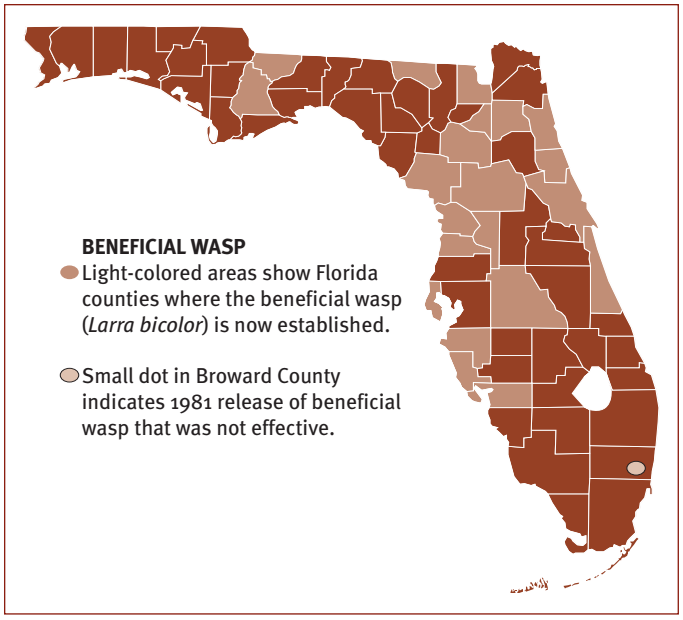
To help feed the growing number of wasps, Frank began recommending that residents plant southern larra-flower (*Spermacoce verticillata*), a wildflower preferred by the wasp, as a source of nectar for energy. Other wildflowers are still being investigated.

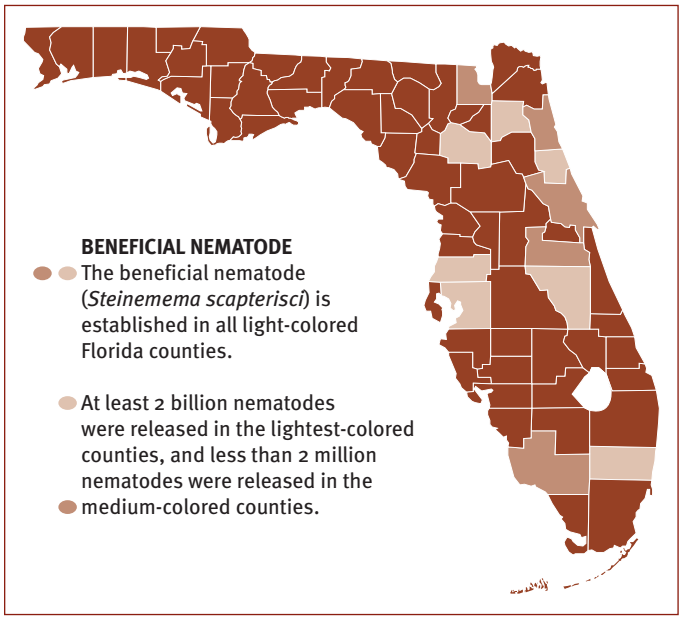

KHUONG NGUYEN

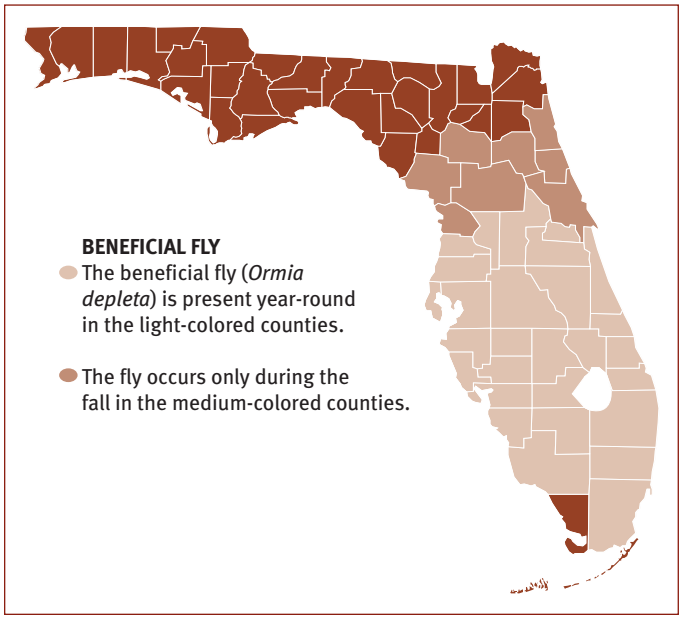
Nematodes emerging from dead mole cricket


JIM CASTNER

Beneficial fly







Beneficial Nematode

The next stop in the battle against the mole cricket invasion was Uruguay, where a parasitic nematode – a tiny, worm-like animal – was found and brought to Florida for mass rearing and release.

"While other natural enemies of mole crickets live above ground, nematodes dwell in the soil where the crickets do most of their damage – that's the real advantage of this parasite," said Grover Smart, a professor of nematology (now retired) who brought the nematode to Florida in 1985. "The nematode does not affect Florida's native northern mole crickets, but it does attack all three invasive mole cricket pests."

Once the parasitic nematode (*Steinernema scapterisci*) enters the body of a mole cricket to mature and reproduce, it kills the cricket within 48 hours, Smart said. Young nematodes emerge from the dead cricket about a week later seeking new hosts. Once infected, mole crickets can spread the nematode to new areas by flying, crawling or burrowing.

Between 1989 and 1992, scientists working on the mole cricket research program released more than 16 billion nematodes in 21 Florida counties. "We just don't see a lot of mole crickets any more in areas where we have released this parasite," Smart said.

UF holds three patents on the organism, which is now available commercially as a biopesticide marketed as Nematac S by MicroBio, a biotech firm owned by Becker Underwood Inc. in Ames, Iowa.

Norman Leppla, a professor of entomology and coordinator of integrated pest management (IPM) programs for UF/IFAS, brokered the licensing agreement between UF's Office of Technology Licensing and MicroBio. He said sales and use of Nematac S now help advance the goals of the IPM program.

Howard Frank, left, and Tom Walker check a two-part trap that uses synthesized mole cricket calls to monitor both mole crickets and the beneficial flies that locate their hosts by sound. The trap plays the calls much louder than the mole crickets actually sing and may attract hundreds, even thousands, of mole crickets in a single evening. The beneficial flies are trapped in the screen cage above, and the mole crickets fall through the netting below where they are shunted into a sand-filled bucket. From August 1979 until the end of July 2004, several trapping stations near Gainesville provided a wealth of research data on the pests. "About three years after the biocontrol agents were released, the catches of mole crickets started to fall, and the decline became greater every year," Walker said. "By the early 2000s, the numbers were 95 percent lower than they had been in the 1980s."

"If the nematode has not spread to your land, it will eventually get there," Frank said. "If you want to speed up its arrival, apply the biopesticide. It will kill a large portion of your pest mole crickets year after year."

Beneficial Fly

The third effective biocontrol is a beneficial fly from Brazil (*Ormia depleta*) that is attracted at night to two species of the pest mole crickets by the sounds they make.

"Like little guided missiles, the flies home in on singing crickets and lay their larvae on or near the singer," Frank said. "The larvae burrow into the crickets and feed, killing the host within a week."

He said entomologists in the mole cricket research program found and reared the Brazilian fly, releasing a few hundred flies in Gainesville and Bradenton in 1988. From 1989 to 1992, researchers released more than 10,000 flies across the state in cooperation with golf courses and the Florida TurfGrass Association. By 1994, the fly had spread to 38 of Florida's 67 counties, but the tropical insect does not seem to survive permanently north of the Orlando area.

"In counties where the fly is established, surveys show significantly less damage by pest mole crickets on golf courses, but we expect to do even better when we have researched the nectar sources the adult fly uses," Frank said.

For more information on the mole cricket research program, visit: http://molecrickets.ifas.ufl.edu/. ■

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Helpful, Harmful or Harmless?

WITH MORE THAN A MILLION DIFFERENT SPECIES OF INSECTS

– more than any other class of animals or plants on Earth – it's hard to know which ones are helpful, harmful or just harmless. Many people are surprised to learn that most insects are beneficial and serve an important role in our environment. Only a small number are pests, according to entomologists with UF's Institute of Food and Agricultural Sciences.

by Chuck Woods

Eastern Lubber Grasshopper (*Romalea guttata*) (PHOTO BY JOHN CAPINERA)

Because Florida's warm, humid climate is such an ideal environment for insects and other arthropods, one of the nation's largest concentrations of entomologists is based at the University of Florida.

John Capinera, chairman of the entomology and nematology department at UF's Institute of Food and Agricultural Sciences (UF/IFAS), said the department has statewide teaching, research and extension programs designed to help agricultural producers, pest control operators and residents manage everything from cockroaches and termites to mosquitoes and fleas.

"Our faculty are involved in a wide range of projects, with a strong focus on integrated pest management programs," he said. "IPM is the combined use of cultural, biological and chemical methods for effective, economic pest control with little effect on nontarget organisms and the environment."

Capinera said the department also cooperates with agencies such as the Florida Department of Agriculture and Consumer Services and the USDA's Agricultural Research Service. Scientists from these agencies frequently work together to solve pest management problems.

To help keep track of the many insects that thrive in the Florida environment, Thomas Fasulo, an extension entomologist in the UF/IFAS entomology and nematology department, maintains two popular Web sites. Detailed information on many of these arthropods is available on the Featured Creatures Web site at http://creatures.ifas.ufl.edu/. New developments on insect and nematode pests, and diseases are available on the Pest Alert Web site at http://pestalert.ifas.ufl.edu/.

Following are brief descriptions of some of the many arthropods that thrive in the Florida environment.

BED BUG: These blood-feeding insects have not been a serious problem in the United States since the 1940s, but they are now becoming troublesome due to increased movement of people and goods across international borders. The resurgence of the bed bug (*Cimex lectularius*) is also linked to recent changes in pest management programs for other insects, particularly the use of insect baits and growth regulators instead of sprays. While some people associate bed bugs with unsanitary living conditions, the pest can survive in many environments – including upscale hotels. Difficult to eradicate, bed bugs can live up to six months without feeding. (PHOTO BY DAVID ALMQUIST)

CYCAD AULACASPIS SCALE: Found in Miami in 1996, this armored scale insect (*Aulacaspis yasumatsui*) is spreading rapidly throughout South Florida where it threatens sago palms and other cycad plants. Although scale insects may be spread short distances by wind, long distance spread is by movement of infested plants. Damage appears as chlorotic spots, but most of the palm fronds eventually become brown and desiccated. Highly infested cycads (see photo) are almost completely coated with a white crust that includes scales of living and dead insects. This scale insect is difficult to control, but repeated applications of horticultural oil alone or in combination with insecticide, or certain systemic insecticides applied alone, can provide control. (PHOTO BY LYLE BUSS)

EARWIG: Some earwigs (*Dermaptera: Forticulidae*) are crop pests, but many others are considered beneficial because they feed on chinch bugs, mole crickets and other insects in the soil. They also feed on decaying plant material. The forcepslike appendages at the end of the abdomen are used for defense and cannot harm people. Despite their name, earwigs do not get into people's ears.

EASTERN LUBBER GRASSHOPPER: (photo on pages 30 and 31) When present in large numbers, the eastern lubber grasshopper (*Romalea guttata*) can cause serious damage to citrus, vegetable and landscape plants, especially lilies. It's the most distinctive grasshopper species in the Southeastern United States. The colorful insect, which cannot fly, jumps over short distances and is essentially harmless to humans. Adults can be up to three inches long.

FORMOSAN SUBTERRANEAN TERMITE: More destructive than native subterranean termites, the Formosan "super termite" (*Coptotermes formosanus*) was found by UF/IFAS researchers in Miami-Dade and Broward counties in the 1980s, and the pest is now well established along the Southeast coast of the state. Infestations have

been found in 14 other counties: Citrus, Collier, Duval, Escambia, Hillsborough, Lee, Leon, Marion, Martin, Orange, Pasco, Palm Beach, Putnam and Volusia counties. The pest is also spreading throughout the Southeastern United States. Fortunately, UF/IFAS researchers have developed a new baiting system that destroys the pest's underground colonies. The system is marketed worldwide as the Sentricon Termite Colony Elimination System. (PHOTO BY JOSEPH SMITH)

LADYBUG: Members of one of Florida's most beneficial insect groups, adult lady beetles (and their larvae) come in many shapes and colors. The twice-stabbed lady beetle (*Chilocorus stigma*) is valuable be-cause it feeds on many pests, including aphids, mealybugs, mites and other soft-bodied insects. (PHOTO BY MARISOL AMADOR)

LOBATE LAC SCALE: This insect – no bigger than a pinhead – has been found on more than 200 species of plants in South Florida, including many ornamental and fruit trees. A native of India and Sri Lanka, lobate lac scale (*Paratachardina lobata*) may eventually spread to other areas of Florida. Evidence of their sap-sucking destruction includes blackened leaves and branches, branch dieback and even death for susceptible shrubs and trees. UF/IFAS researchers are seeking effective biological controls for the pest.

LOVEBUGS: The infamous lovebug (*Plecia nearctica*) – shown as a mating pair with the female on the left – invaded Florida from Louisiana in the 1940s. Adult lovebugs, which do not sting or bite, swarm in the spring and late summer. While most people consider the flies pests, the larvae (immature stage) feed on decaying plant material and help reduce thatch in roadside grassy areas. Controlling them with insecticides is impractical because large populations occur over vast areas of the state. The story that this insect is the result of a research project that went awry is a persistent myth. (PHOTO BY JAMES CASTNER)

MEXICAN BROMELIAD WEEVIL: Known to bromeliad lovers as the "evil weevil," this insect (*Metamasius callizona*) feeds exclusively on bromeliads, threatening bromeliad species in South Florida that exist nowhere else in the United States. Identified in 1989 in Fort Lauderdale, the weevil probably arrived on shipments of Mexican bromeliads. UF/IFAS entomologists are attempting to rear natural enemies to control the pest. (PHOTO BY JAMES CASTNER)

PINK HIBISCUS MEALYBUG: A serious pest of many plants in tropical and subtropical regions, the pink hibiscus mealybug (*Maconellicoccus hirsutus*) was discovered in Broward County in 2002. As the pest becomes established in Florida, it could attack many crops including citrus, vegetables and ornamental plants. If growers attempt to manage mealybug populations with pesticides, crop production costs will be increased, and the chemicals may disrupt the effective natural enemies of other crop pests. For more information on this pest, visit: http://mrec.ifas.ufl.edu/lso/PinkMealybug.htm/.

PREDACIOUS MITE: Although many mites are important pests for crops and animals, there are also predacious mites that feed on pest mites. A number of predatory species are commercially available to control pest species. (UNIVERSITY OF FLORIDA PHOTO)

PREDACIOUS STINK BUG: Many stink bugs are plant feeders, and therefore pests, but many others are predators of destructive insects. In this photo, a predacious stink bug (*Alcaeorrhynchus grandis*) is feeding on a caterpillar. Predatory stink bugs, characterized by sharp spines at their "shoulders," may remain active during the winter if temperatures stay above freezing. (UNIVERSITY OF FLORIDA PHOTO)

RED IMPORTED FIRE ANT: Fire ants clamp onto their targets with powerful jaws and sting their victims repeatedly, injecting a dose of venom that causes a burning sensation. In sensitive victims, the stings can cause shock or even death. The red imported fire ant (*Solenopsis invicta*) was introduced into the United States in the 1930s or 1940s, probably through Gulf Coast ports. Since then, it has become a major pest in the Southeast, invading home lawns, golf courses, parks and other recreation areas. Feeding activity causes major damage on crops such as corn, cabbage, citrus, potatoes, peanuts and soybeans. UF/IFAS and USDA researchers are developing new biological control methods to stop this exotic pest. (PHOTO BY DAVID ALMQUIST)

SOUTHERN PINE BEETLE: The southern pine beetle (*Dendroctonus frontalis*) is the most important pest of pine forests in the Southern United States, causing more than two billion dollars in damage since 1960. Favored hosts of these beetles (male on the left and female on the right) include loblolly and shortleaf pine trees. The attack is initiated by adult females, which bore into the tree and release pheromones to attract large numbers of male and female beetles. If a sufficient number respond, they overwhelm the defenses (the resin system) of the host tree, and then the attack moves to adjacent trees. Left untreated, the infestations cover thousands of acres. The Gainesville area experienced serious outbreaks of the pest in 1994 and 2001. UF/IFAS researchers say good forest management practices – including proper planting densities and thinning of tree stands – can minimize the frequency and severity of outbreaks. (PHOTO BY DAVID ALMQUIST)

TWOSPOTTED MITE: A major pest on more than 200 species of plants – including fruit, ornamental and vegetable crops – the twospotted mite (*Tetranychus urticae*) is a worldwide problem. These tiny mites (about 0.5 to 0.8 millimeter long) generally have two large black spots on either side of their bodies, hence the common name. (UNIVERSITY OF FLORIDA PHOTO)

WHITE-FOOTED ANT: A tiny white-footed ant (*Technomyrmex albipes*) with a big appetite for sweets is the latest nuisance pest for South Florida residents, but a bait developed by a UF/IFAS researcher may help stop the home invaders. Named for their yellow-white forelegs, the ants are an exotic import from Indonesia. They probably found their way into Florida via shipping containers or imported plants. About the size of a gnat, the ants do not bite, sting or cause any known structural damage. (PHOTO BY RUDOLPH SCHEFFRAHN)

YELLOW FLY: Members of the same Tabanidae insect family as horse flies and deer flies, yellow flies are fierce biters of humans and animals. Like mosquitoes, the female yellow fly (*Diachlorus ferrugatus*) inflicts the bite. Males are mainly pollen and nectar feeders. Florida's mild and humid climate provide good breeding areas for the pest. Although there are no effective biological controls for the fly, a trolling deer fly trap has been developed by a UF/IFAS researcher. For more information on the trap, visit http://ufinsect.ifas.ufl.edu/. (PHOTO BY JAMES CASTNER)

"Our faculty are involved in a wide range of projects, with a strong focus on integrated pest management programs. IPM is the combined use of cultural, biological and chemical methods for effective, economic pest control with little effect on nontarget organisms and the environment."

–JOHN CAPINERA

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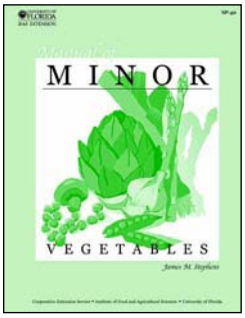
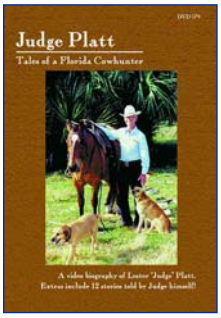


MANUAL OF MINOR VEGETABLES

Written by James Stephens, this compilation of cultural, descriptive and historical facts of more than 100 of the minor vegetables includes 175 illustrations and a brief discussion of each vegetable with its climatic adaptations, common uses and growing tips for Florida gardens. Revised pictures and captions, 2004. 123pp. **SP 40, $7.00**



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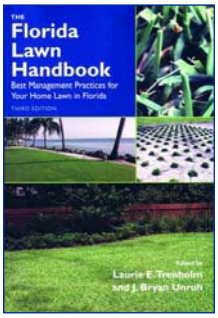

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NATION'S LARGEST COLLECTION OF *Butterflies*

Thomas Emmel, an affiliate professor of entomology with UF's Institute of Food and Agricultural Sciences and director of UF's new McGuire Center for Lepidoptera and Biodiversity, examines the green pupal stage and brown larva of a tropical butterfly. The large insect on the left is a Troides birdwing butterfly from the Philippines.

The McGuire center, which is part of the Florida Museum of Natural History, has the nation's largest collection of butterflies, second in the world to The Natural History Museum in London.

In an effort to establish a new, self-sustaining colony of Miami Blue butterflies in South Florida, Emmel recently coordinated the release of several thousand butterflies bred and reared in captivity. He said the critically endangered Miami Blue butterfly is one of the rarest insects in North America.

"At one time, it was common in the coastal areas of South Florida, but coastal development caused the population to drop to low levels," Emmel said. After Hurricane Andrew swept through the area in 1992, Emmel and other researchers thought the Miami Blue was extinct, and they were surprised to find a small colony of the insects in the Florida Keys. ■

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