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PESTPRO (ISSN 1553-4693) is published Jan.–Feb.,  
March–April, May–June, July–Aug., Sept.–Oct., and  
Nov.–Dec. by:

Pest Management Education, Inc.  
5814 Nob Hill Blvd.  
Port Orange, Florida 32127  
Phone (352) 392-2326

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Inc., a nonprofit corporation working to help UF  
Urban Entomology. Technical information provided  
by the University of Florida and other sources.

POSTMASTER: Send address changes to:

**Pest Management Education, Inc.**  
5814 Nob Hill Blvd.  
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## CONTENTS

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### FEATURES

- 6 Insecticides:  
Bees vs. Mosquitoes
- 11 Permethrin-Treated  
Military Uniforms
- 12 Diagnostic Networks  
For Effective Pest Management
- 14 Urban Lab Alum Profile  
Dan Suiter
- 16 Invasive Tegu Lizard:  
Argentine Black-and-White Tegu
- 21 Florida's Bold, Bizarre  
and Beautiful



### DEPARTMENTS

- 4 **FPMA President's Message**
- 5 **Editorial:** Search for Urban Entomology Excellence
- 9 **An Angle on IFAS:** Longstanding Relationship of  
Urban Entomology and Pest Management Industry
- 19 **Past President's Corner:** Anne-Marie Tulp
- 23 **Pest Detective:** Bagworms
- 27 **Risky Business:** Medical Marijuana in the Workplace
- 29 **PCO Pointer:** Training is the Key



### ON THE COVER

A mosquito truck sprays insecticide in Marion County,  
Florida. Comparing bees and mosquitoes, University  
of Florida research reveals the rates of toxicity for six  
different common products that target mosquitoes.

*Photo by Jaqui Janetzko*



# Top of the Agenda: Serenity

## Message from the President of FPMA

Suzanne Graham

**A**FTER MANY phone discussions with our members, both PMP and Allied, would-be attendees and exhibitors, we decided to cancel the FPMA Business and Operations EXPO 2021. We had previously rescheduled the event from January 21–23 to March 9–11, hoping the later date would allow for a successful physical/hybrid show. Like so many other decisions we have had to make since the pandemic began last year, this was especially difficult, but the feedback we received after the announcement reassured us that it was the right one. Nothing is more important to us than the health and safety of our members, our colleagues, and their families.

Just because the event did not take place does not mean that a tremendous amount of effort had not already been made to try to make it happen. Our Event Manager, Stacey Miller, was in constant touch with the sponsors, vendors, and the hotel. Every week she organized the Planning Committee meetings and provided valuable input on what she had heard and learned. Ultimately, it was Stacey who renegotiated this year's contract for something that we could live with. During this time, HQ was also in full EXPO mode, updating the website, sending emails, posting on social media, getting speaker information, bios, and the myriad of other details that go into marketing the event. Thank you,

Melissa Tyler and Christine Updike. And I would be remiss if I did not mention the Education Committee, chair Andrew de la Chappelle, Derek Pumphrey, Cory Goeltzenleuchter, Steve Mock and Desire Straubringer, who worked so hard to pull together what was to be the launch of FPMA's new education initiative — the Compass Program. And lastly, thank you, Leslie Herren, for keeping it all together.



The serenity prayer entreats God, grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know the difference. We plan on doing just that, and will continue to change and adapt as needed the ways we serve our members and the industry.

This year, for the first time ever, we will hold our Annual Business Meeting virtually. Members, by the time this has been printed, you will have already received an email with the date, time and Zoom link. As I mentioned in my last update, the current slate of officers

will be nominated to again fill their positions for 2021, and they will be sworn in at this time.

We will also be presenting some changes to the by-laws for approval and vote. This will be an important meeting, so please plan to attend. For those of you who have never had the opportunity to participate, it will be your chance to see how the Association functions and seeks to serve you.

Since many of you get your CEUs at EXPO, we have decided to do a series of live, online CEUs. Look for the series to begin in March. Members, you will be receiving emails; those of you who are not yet members, check the website under Events.

And finally, we still haven't given up on having a live event this year. Mark your calendars for this year's Summer Conference at the **Tradewinds at St. Pete Beach** on June 14–16. We had planned on launching FPMA's Compass Program at EXPO, but we now plan to launch at the Summer Conference. The Event Planning Committee, Stacey, HQ, and the Education Committee are undaunted, and planning is already under way.

We know this situation is frustrating, but this too shall pass. We are here to help. Stay well. **PP**

Suzanne Graham  
President, FPMA

Visit [flpma.org](http://flpma.org) for currently scheduled meetings and more.

# Search for Urban Entomology Excellence

**B**ACK IN JULY, I retired and became an emeritus professor of entomology at the University of Florida. I plan to continue to contribute to the continuing education of the pest control industry in Florida. However, my retirement has left a professor position vacant in urban entomology. At the Urban Lab, we hoped that even with the COVID-19 crisis, the University of Florida would move rapidly to fill that vacancy with an experienced urban entomologist so the important work of educating students and conducting important research for the industry would continue.

We were excited that the University of Florida and the Entomology Department were authorized to fill the urban entomology professorship. It is an exciting time because this is an opportunity to bring in the most talented and ambitious academic person to lead urban entomology into new frontiers of research and to continue preparing students for careers in urban pest management.

Full details of the urban entomology professor position are posted online.<sup>1</sup> The position is 70 percent research and 30 percent teaching. The following is the description of the position:

“Florida is regularly challenged with emerging and invasive urban pests. The incumbent will be expected to develop successful research and teaching programs with an emphasis on biology and management of urban and structural pests.

“The candidate will be expected to engage in and contribute to addressing issues of importance to stakeholders in our state and to broader collaborative efforts related to urban pest management. This is a broad-based search. Research areas could include, but would not be limited to behavior, ecology, genetics, physiology and toxicology of urban/structural pests, especially invasive species.

“Entomologists that are strongly motivated to address important questions promoting sustainable and integrated pest management-based solutions for urban pests are encouraged to apply. Urban pest management is a departmental strength at UF, and the incumbent will be expected to contribute to establishing UF as a recognized center of excellence for urban pest management.

“Opportunities exist for collaboration with urban entomologists on the Gainesville campus, at UF Research and Education Centers, IFAS County Extension, regulators for the Florida Department of Agriculture and Consumer Services, and the various urban pest management associations in Florida, nationally and internationally.

“The successful candidate will participate actively in scholarly activities related to instruction, including teaching undergraduate and graduate courses that are required for the urban pest management certificate, chairing and serving on graduate committees, supervising undergraduate and graduate research and creative work, publishing results with graduate students, participating in curriculum revision and enhancement, producing learning tools, and engaging in professional development activities related to teaching and advising. Faculty are encouraged to support and participate in the CALS Honors Program, distance education, and international education.

“The faculty member will aggressively seek contract and grant funding to support their program and must consistently publish scientific publications both in peer-reviewed journals and other appropriate venues. Faculty are expected to participate in professional development activities such as training in mentoring, grant writing and intercultural competency.”

SPECIFICALLY, candidates are expected to be familiar with termites, ants, cockroaches, stored product pests, occasional invaders, and/or biting and venomous arthropods in urban environments. In addition, teaching and postdoctoral supervision experience are desirable. Dr. Dan Hahn is the search and screen committee chair and can be contacted at [dahahn@ufl.edu](mailto:dahahn@ufl.edu) about the status of the search.

This is an important position for the urban pest management industry in Florida and the rest of the country. Urban entomologists have retired in other states, and those positions have either been lost or reallocated to agricultural entomology. I am extraordinarily glad that UF has seen the importance of the urban pest management industry and has allocated this position

to be filled with a senior professor that has demonstrated experience in urban entomology.

To prepare for the new professor, there are some changes in assignments of current professors. The most important is for Dr. Roberto Pereira. He has been named the FPMA Endowed Professor of Urban Pest Management. His appointment has been changed to be 100 percent Extension, so he will be responsible for many online and in-person education programs for the industry.

Dr. Faith Oi will continue to be director of Pest Management University at the Apopka Mid-Florida Research and Education Center, which conducts important hands-on urban pest management education. Dr. Rebecca Baldwin will continue in her excellence as undergraduate coordinator so outstanding students will be recruited for entomology and the urban entomology profession.

Dr. Bill Kern is responsible for pest management instruction at Ft. Lauderdale. Dr. Nan-Yao Su is a world-renowned termite bait expert at Ft. Lauderdale and inventor of the Sentricon® termite colony elimination system. Dr. Thomas Chouvenec is responsible for the important termite research and education programs at Ft. Lauderdale, including the Fumigation School that is conducted yearly there.

This group of scientists and educators are the most talented in the United States and the world. In fact, the Entomology Department at UF is rated the No. 1 entomology department in the world. It is also the largest department in the world, based on membership in the Entomological Society of America.

THE NEW professor will be expected to continue to provide the Florida pest management industry with cutting edge research to support the industry. Also, the new professor will be responsible for preparing some of our entomology students for careers in urban pest control.

Stay in touch with the progress of this search. It is an important search for the future of urban pest management. **PP**

— Dr. Philip Koehler,  
Managing Director, *PestPro*

<sup>1</sup> <http://entnemdept.ufl.edu/employment-opportunities/>

# Bees vs.

Which insects are more susceptible to six insecticides?

EUROPEAN HONEY BEE



(1493–1541)

**FUN FACT**

Paracelsus was the first to give a name to zinc due to its pointed chemical structure. He is credited with documenting that people with “poor blood” needed iron. These are medical principles we still use today.



**When calculating a chemical dose for human or insect, we apply the same principle at a different scale.**

**A**S YOU studied for your pest control license, you likely studied how toxicity is measured. Do you remember learning that the LD50 is the lethal dose for 50 percent of the test population, as measured by milligrams of toxicant per kilograms of body weight? We can attribute this principle to Paracelsus, a medical

doctor from the 16th century who is considered the “father of toxicology.”

One of his notable writings includes the phrase, “*Sola dosis facit venenum*,” or “Solely the dose determines that a thing is not a poison.” To simplify, students often say, “Only the dose makes the poison.” This is a principle used when researchers

document dose-response relationships that are used to make decisions on how pharmaceuticals and pesticides are used.

We calculate that through common types of exposure for a particular pesticide. In the case of honey bees, that would be **contact/dermal** exposure. Other types of exposure may be **inhalation** or **ingestion**.

# Mosquitoes

Rebecca Baldwin, Roberto Pereira,  
Hussein Sanchez-Arroyo, and Philip Koehler



ASIAN TIGER MOSQUITO

Next time you visit your health care provider, notice how they document your weight in kilograms. If they prescribe you any medication, they are calculating your dose based on your weight. So, what does this have to do with honey bees, mosquitoes and insecticides? Well, the same principle applies, but we have to look a bit closer, since insects are small beasts of our planet.

## Scale It On Down

In 2013, the Environmental Protection Agency added a Bee Advisory Box<sup>1</sup> to pesticide labels as an effort to strengthen protection of pollinators. If you take a detailed look at that advisory box, you will see the dose response is not measured, like those of mammals, in milligrams/kilograms. Because of the relatively small size of insects, the impact of exposure is measured in dose per *micrograms* of body weight.

Did you catch that? Micrograms, not milligrams. A microgram is a small measurement: You can think of it as one-millionth of a liter. To get a microgram, you divide one milligram by 1,000, so it is .001, or one-thousandth. A paperclip or a pinch of salt weighs about one gram, so a milligram would weigh one-thousandth of that, and a microgram would weigh

one-thousandth of *that*. Wow, talk about a pinch of salt — that would be a pinch of a pinch of a pinch! That is how the EPA requires toxicity testing for insecticides on honey bees.

## Zero In On the Target

Now we have the proper tools to compare toxicity of an insecticide between insects.

Let's look at an example. Dr. Hussein Sanchez-Arroyo, a visiting professor from the Colegio de Postgraduados, Mexico, and a Gator graduate, worked with researchers from the University of Florida Urban Entomology Lab and Honey Bee Research and Extension Lab, with Dr. Phil Koehler, Dr. Roberto Pereira, and Dr. Jamie Ellis, to measure the toxicity of insecticides to both mosquitoes and honey bees.

Why are UF researchers considering honey bees and mosquitoes? You may have seen online articles asking if outdoor spraying, such as that for mosquitoes, should be halted during the COVID-19 pandemic<sup>2</sup>. How do we, as pest managers, address those concerns?

The authors of these provocative headlines list concerns about pollinator health, so let's take a look at Dr. Sanchez-Arroyo's research to see some important correlations. Mosquito adulticides are commonly applied

as residual barrier treatments, ground ULV aerosols, or aerial atomized droplets. The pesticide labels and application methods are designed to reduce exposure to nontarget organisms.

Examples have recently hit the media of negative impact on pollinators when these products are applied without pollinator behavior in mind. We know that the label must be followed, and we must observe for flowering plants and pollinator foraging to avoid a nontarget impact.

## Size Matters

Now for the nitty gritty — the details of small sizes. First, we need to look at the comparative weights of both mosquitoes and honey bees. Dr. Sanchez-Arroyo measured the toxicity of insecticides to European honey bee, *Apis mellifera*, and Asian tiger mosquito, *Aedes albopictus*. On average, a honey bee is 80 times heavier than a mosquito. That is like the weight difference between an average American adult at 172 pounds and the estimated size of a T-Rex or elephant.

Dr. Sanchez-Arroyo performed several experiments: one to measure the effects of mosquito adulticides in the lab, and one to measure a ULV truck-based spray to caged insects. He tested commonly used mosquito adulticides, including Mosquitomist™ (chlorpyrifos),



Mosquito-to-bee  
weight ratio  
is equivalent to

human-to-T-Rex!

<sup>1</sup> <https://tinyurl.com/EPA-Bee-Box>

<sup>2</sup> <https://tinyurl.com/mosquito-spray-article>

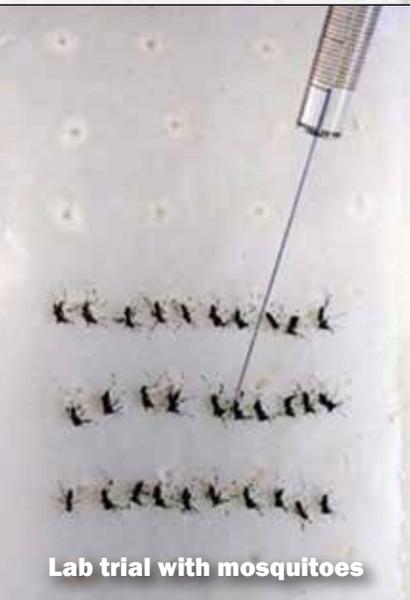
Times more toxic to mosquitoes than bees\*

Deltamethrin	18.56
Bifenthrin	215.22
Chlorpyrifos	2,338.14
Phenothrin	931.20
Permethrin	321.80
Prallethrin	10.91

\*microgram to kill a bee / microgram to kill a mosquito



Field cage trial with mosquitoes and honey bees



Lab trial with mosquitoes



Lab trial with honey bees

Aqualuer® (permethrin), DeltaGard® (deltamethrin), Duet® (prallethrin + phenothrin), and Talstar® (bifenthrin).

In this bioassay, Dr. Sanchez-Arroyo applied each product directly to the thorax of the insect. The application device was a syringe with a tiny needle. Four of the products, chlorpyrifos (29×), phenothrin (11×), permethrin (4×), and bifenthrin (3×), were all more toxic to mosquitoes than to bees. In the other two products, prallethrin (7.5×) and deltamethrin (4×), the toxicity was greater to bees than to mosquitoes.

### Weight Matters

Wait, I thought weight was important. Remember the quote by Paracelsus? Indeed, weight is very important, and toxicity testing requires that you measure the lethal dose by body weight (mg/kg). This lab trial was from direct contact, where the insecticide was directly applied to the insect. We must do further calculations to compare that dosage to the body weight of the insect before we can use that data to explain the results. When you compare the toxic dosage relative to the body weight of the insect — remember, bees are 80 times heavier than mosquitoes — you find that all products were more

toxic to mosquitoes than to bees. In fact, the products ranged from 11 to over 2,000 times more toxic to mosquitoes than to honey bees, shown in the table at left. So, if asked, the products listed here are *all* more toxic to mosquitoes than to honey bees, and you can explain to your customers the relationship between dose and toxicity.

### Taking It Into the Field

Once you prove effectiveness in the lab, it is important to see how it works in the field. Permethrin was 321.8 times more toxic to mosquitoes than to honey bees, so this product was chosen for the ULV field trials. When mosquitoes and bees were placed in small cages elevated to the area where they would be found in flight, they were exposed to a vehicle ULV spray at increasing distances from the spray plume. In each trial, and at every distance, the ULV spray was more toxic to mosquitoes than to bees. At 150 feet from the road, 80 percent of the mosquitoes were killed, as opposed to 44 percent of the honey bees.

This trial was performed during the day, and the insects were purposely exposed to the spray plume. This lets us know that bees outside the hive can succumb to ULV sprays

if exposed. When performing mosquito adulticide spraying, the label must be followed, and honey bee foraging activity must be considered. When bee foraging behavior is not considered, bee kills, like the one that made national headlines in 2016, can occur<sup>3</sup>.

Generally speaking, mosquitoes forage at dusk and dawn, so they would be flying at that time. Honey bees forage during daylight hours. Pesticide labels now take those behaviors into consideration with the EPA Bee Box.

To research the products you are using, take a look at the label for directions for use and environmental hazards to see if there are specific instructions for protecting pollinators. For literature to share with your concerned customers about the impact of mosquito control on honey bees, please check out the University of Florida Prevent & Protect website<sup>4</sup>. **PP**

*Rebecca Baldwin is Associate Professor, Roberto Pereira is Endowed Professor, Hussein Sanchez-Arroyo is Visiting Professor from Colegio de Postgraduados, Mexico, and Philip Koehler is Endowed Professor Emeritus at UF/IFAS Entomology and Nematology Department.*

<sup>3</sup> <https://tinyurl.com/bee-kill-2016>

<sup>4</sup> <https://tinyurl.com/UF-bees-info-sheet>



# An Angle on IFAS

J. Scott Angle

## Urban Entomology and the Pest Industry: A Longstanding Relationship

FOR SIX months, I have been drinking from a fire hose. The scope of what the University of Florida's Institute of Food and Agricultural Sciences does is so vast. Our employees still have I-didn't-know-we-did-that moments decades into their careers here. UF/IFAS is as multifaceted as Florida's agriculture and natural resources.

Among the delightful surprises since I arrived to lead UF/IFAS in July has been my "discovery" of the excellence of our urban entomology program. And when I dug for the source of that excellence, the evidence kept pointing to the industry that supports it.

Even at a university where a government-academia-industry alliance is baked into its land-grant mission, the Florida pest management industry's support for UF/IFAS is remarkable.

### Industry Leaders Support IFAS Research, Teaching Endeavors and More

A few data points made the case to me:

- ▶ The building that houses the UF/IFAS Department of Entomology and Nematology carries the name of a pest control legend — and Gator — and benefits from the financial support of Charles and Lynn Steinmetz.
- ▶ The industry provided about \$400,000 to build the Urban Entomology Lab building 26 years ago.
- ▶ Margie and Dempsey Sapp donated \$1 million to endow a professorship 21 years ago.
- ▶ The Florida Pest Management Association donated an additional \$400,000 to endow an FPMA professorship.
- ▶ The industry's donation of about \$250,000 to expand the Urban Entomology Lab 17 years ago, which allowed us to house more students and visiting faculty.
- ▶ Industry grants helped fund an associate research scientist position in 2007. Roberto Pereira has since been promoted to research scientist and was named FPMA endowed professor, a title previously held by Philip Koehler, who recently retired from UF.
- ▶ The subterranean termite research lab at the UF/IFAS Ft. Lauderdale Research and Education Center was built with royalties from Sentricon®, whose termite control system is based on technology developed by Nan-Yao Su at the research center.
- ▶ Pest Management University at the UF/IFAS Mid-Florida Research and Education Center in Apopka would not have been possible without industry support. The model "home" and furnishings used to demonstrate pest management

techniques was largely funded by Rollins, Inc.

Maybe some of this is due to loyalty to your alma matter. Jerry Gahlhoff, a double entomology Gator, is the current president and COO of Rollins, Inc., and is becoming a huge advocate for the Urban Entomology group.

Triple Gator George Pickhardt is a past honoree in our Gator 100 awards recognizing the world's fastest Gator-owned or Gator-led businesses in the world. He was also recognized as a Distinguished Alumnus of the College of Agricultural and Life Sciences in 2019. His support for our entomology program has been invaluable.

### UF/IFAS and Industry: A Strong Relationship

You don't need an entomologist to appreciate the scale of the challenge of controlling Florida pests. We have the largest pest control industry in the nation. Our pest pressure is also the highest in the nation, with introduced species such as the Formosan and Asian subterranean termites, "tawny" crazy ant, and Africanized honey bees among the pests.

You do need an entomologist to do something about it. One could argue that our urban entomology researchers and Extension agents all over Florida touch more lives of urban Floridians than any other area of UF/IFAS.

We have the largest university-based entomology and nematology department in the nation, as measured by membership in the Entomological Society of America. Support from industry likely played a role in elevating the department to the No. 1 ranking in the world among university entomology departments.

That means plenty of bandwidth to specialize in what's most relevant to our stakeholders like you in the pest control industry. Pest Management University holds 15 to 18 courses annually, with instruction by a team from UF/IFAS, the Florida Department of Agriculture and Consumer Services, and industry.

When I visited Su, Thomas Chouvenc, and Bill Kern at FLREC, I was astounded at the size of Chouvenc's termite collection, which he claims is the largest under one roof in the entire world. I see no reason to doubt him.

In addition to their research lab that industry made possible, I am also impressed by their School of Structural Fumigation, aka "Fume School." This one-of-a-kind, internationally renowned training program teaches all the rules and procedures to perform structural and commodity fumigations.

The urban entomologists in Gainesville have been holding the Southeast Pest Management Conference in Gainesville for

the past 24 years (had to skip the 25th anniversary meeting due to COVID-19), bringing close to 400 people to the UF campus every spring to refresh their knowledge on urban pest management. They have also taken over publishing this magazine, *PestPro*, which offers a direct line of communication between UF and the pest management clientele.

Clearly, our department in general, and our urban entomology program specifically, are among the best in the business and do much to help your business. My job is to support that continuing excellence and partnership. Here are a few ways I'll do it:

- ▶ I have authorized the hiring of a successor to Phil Koehler, securing an exception to the university-wide hiring pause as we absorb the economic hit of the pandemic.

- ▶ Phil has my encouragement to keep teaching and to keep running this magazine. Not that he needs much encouragement. After 45 years with UF/IFAS, he appears to be as enthusiastic as ever as an active retiree.

- ▶ I will view the pest control industry as a significant agricultural as well as residential/commercial-focused business. That puts it under the purview of FDACS instead of the Department of Business & Professional Regulation.

- ▶ I will look for ways to tell the story of the importance of the pest control industry and the University of Florida research, teaching and Extension that support it.

- ▶ I will support our continuing outreach as our entomologists train school district personnel to keep our students safe from pests and technicians that keep

places like hospital operating rooms free of flies and other pests that can contaminate.

- ▶ I will seek resources to build upon our already excellent work on invasive species. New pests regularly arrive in Florida through its many ports and the more than 100 million tourists that come into our state annually. Not only can some of these pests ruin homes, but even a handful of pests can cost our agricultural producers money if their exports are turned away from ports in other states or nations because of infestation.

- ▶ I've launched the Vice President's Promise to expand our efforts to give all UF/IFAS CALS undergraduates more opportunities to gain real-world experience. Please consider joining me in this effort by offering opportunities for our graduates.

I recognize the tremendous need for research to manage new pests and to evaluate the control methods being developed to combat them. Our scientists' impartiality means they are not trying to sell you something, only to tell you if something you're being sold is effective.

I hope I can count on you to continue to support our research, teaching and Extension. There's much to do. To ensure future success we can rely on the partnership that has worked up to now. Every Floridian —student, homeowner, businesspeople, government official, and resident— is counting on you to do so. **PP**

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*Scott Angle is the University of Florida's Vice President for Agriculture and Natural Resources and leader of the UF Institute of Food and Agricultural Sciences (UF/IFAS).*

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# Permethrin-Treated Military Uniforms:

## Lessons Learned For Continuous-Force Health Protection

Mohamed E. Sallam, Erica J. Lindroth, and Joseph W. Diclaro

*For most of history, more wartime casualties have resulted from infectious diseases than from combat. Of the 488,000 soldiers who perished in the American Civil War, two-thirds died of disease caused by arthropod-borne pathogens.*



HM2 Quentin Foley and HM3 Austin Swagart treat uniforms with permethrin using an AG25 sprayer at the Navy Entomology Center of Excellence (NECE).

**D**ISEASE nonbattle injuries, especially arthropod-borne diseases, continue to threaten modern militaries and often jeopardize mission readiness and operational success. For example, trench fever is a disease caused by the bacteria *Bartonella quintana*, which is transmitted by body lice. Trench fever affected armies in France, Poland, Italy and Russia in World War I. From 1915 to 1918 almost one-third of all British troops contracted trench fever, while about one-fifth of German and Austrian troops were affected by the disease.

These stark statistics are proof that protecting military personnel against vector-borne disease (VBD) is critical for mission readiness and success. However, it is not just in the interest of military readiness, but also overlaps with general public health.

According to the CDC, in May 2018, arthropod infections quadrupled over a 13-year period. Historical context and public health concerns support the Department of Defense (DoD) rigorous evaluation of

current tools, and development of new technologies to protect personnel against VBD that pose a significant threat to force health and military readiness.

### Arthropod Repellent System: Uniform Treatments

The first line of defense against VBD in the military inventory is the DoD Arthropod Repellent System. These personal-protection measures include approved topical (skin) repellents, properly worn and treated uniforms, bed nets, and malaria chemoprophylaxis. When used properly, the DoD Arthropod Repellent System provides good protection against disease-carrying arthropods. Because service members spend so much time in uniform, uniform treatments are a very important part of personal protection.

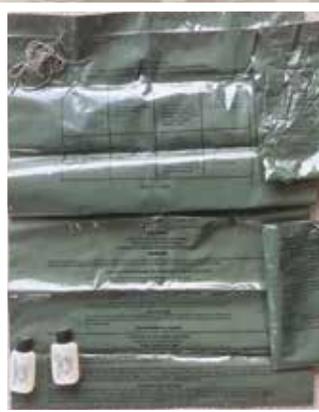
The first uniform treatments were developed during World War II to protect Allied Forces from the mites that transmit scrub typhus. These uniform treatments were not durable through more than one or two washings and could irritate the skin. Safer, longer-lasting

treatments were investigated, which led to the U.S. Department of Agriculture Center for Medical, Agricultural, and Veterinary Entomology (USDA-CMAVE) developing permethrin as a clothing treatment.

After receiving Environmental Protection Agency registration in 1979, permethrin was the only repellent approved for clothing application until the 2016 registration of etofenprox. Both active ingredients are now available for use in uniforms as a factory treatment. However, only permethrin is currently available for treatment of civilian clothing. Novel chemical or other bite-protection technologies for clothing that may provide increased protection and performance are continuously sought.

Uniforms may be treated in one of four ways. The majority of service members use factory-treated uniforms, which means service members buy uniforms that are already treated with repellent. In the 1990s, pad rolling was registered with the EPA as a method for factory-treated uniforms.

*Continued on Page 22*



Contents of an Individual Dynamic Absorption (IDA) kit: Two 1-gallon bags, two 50-ml permethrin bottles, and wrapping thread.

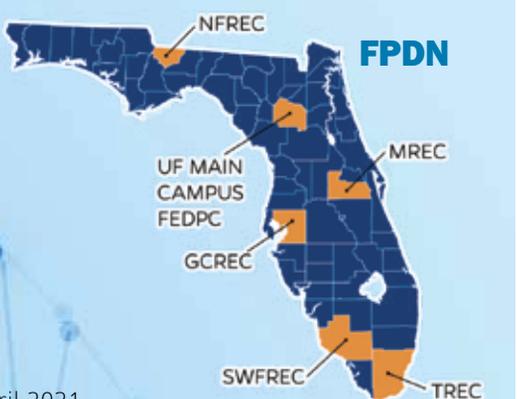
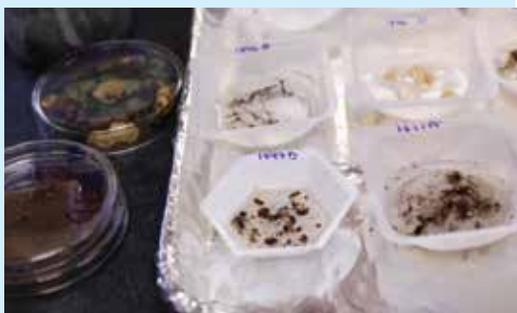


**THE PROCESS OF** diagnosis starts long before we ever see a sample in the lab. Diagnosis starts wherever somebody sees something wrong with their plant.



Diagnosis is the process of identifying a pathogen based on a combination of the symptoms of disease and signs of a causal agent. Efficient integrated pest management requires accurate knowledge of causal agents such as pathogens or pests.

Successful pest management programs depend on a correct diagnosis.



**T**HE University of Florida Institute of Food and Agricultural Sciences has a long, trusted relationship with those involved in agriculture. UF/IFAS has an existing infrastructure, the Cooperative Extension Service, that interacts closely and rapidly with growers, industry and urban clients.

It makes good sense to capitalize on UF/IFAS expertise—a staff of plant scientists with vast experience in integrated pest management and well equipped plant pest diagnostic labs. Given the enormous range of land over which Florida farms, forests, rangelands, and agriculture-related facilities are dispersed, it is critical that we have a similarly widespread capacity to detect, diagnose, and provide decision support in response to exotic plant pathogen, arthropod, nematode and other pest introductions.

### **NPDN** A Brief History: **SPDN** National and Southern Plant Diagnostic Networks

Federal and state agencies monitor U.S. borders for plant pest introductions and survey for pest outbreaks throughout the nation. Still, new pests often are first detected by those involved in crop production and are identified by professionals at land-grant universities and state diagnostic labs.

Since 2002, the National Plant Diagnostic Network and the Southern Plant Diagnostic Network have provided support for a cohesive system to quickly detect and identify pathogens and other pests that have been accidentally or deliberately introduced into agricultural and natural ecosystems. When warranted, the NPDN reports pests to appropriate state and federal responders and decision-makers.

Strengths of the NPDN system include:

1. Rapid evaluation and reporting of potential pest threats;
2. Quick response time for diagnosis, specifically real-time consultation with experts through Distance Diagnostics and Identification Systems;
3. Web-based, secure communications links among regional and national diagnostic labs;
4. Established links to regulatory agencies including APHIS and FDACS;
5. High-quality and uniformity of information associated with samples;
6. High-quality recordkeeping and reporting of pest outbreaks; and
7. A trained network of “first detectors,” or first responders.



# Diagnostic Networks

## for Effective Pest Management

### Who might want to submit samples to FPDN clinics?

- Pest control and landscape maintenance companies
- Extension faculty
- Growers
- IPM providers
- Retailers
- Golf course managers
- Researchers
- Homeowners

A.J. Palmateer, C.L. Harmon, A. Hodges,  
N. Peres, K.R. Chung, P.D. Roberts,  
L. Buss, W.T. Crow, J. Xin, R.J. McGovern,  
J.W. Kimbrough, and M.T. Momol



The Southern Plant Diagnostic Network and collaborators in Florida conduct training, produce and distribute educational materials, and provide diagnostic equipment and guidance to Extension faculty. This system creates a distributed network of capable people trained to detect, identify and respond to new and emerging pests and pathogens.

The first UF/IFAS Plant Disease Clinic was established in the 1950s. Since the 1980s, satellite disease diagnostic clinics have been established in Quincy, Immokalee and Homestead. The UF/IFAS Gulf Coast Research and Education Center at Wimauma, Florida, recently joined the network as a disease diagnostic clinic.

For high-risk arthropod or unusual samples in need of identification, the UF/IFAS Insect ID Lab in Gainesville, Florida, consults with the Florida State Collection of Arthropods and the appropriate curatorial taxonomic specialists employed by the Florida Department of Agriculture, Division of Plant Industry.

The UF/IFAS Nematode Assay Lab in Gainesville has been operating since the 1950s and provides professionals with identification services and population numbers of plant parasitic and soilborne nematodes present in samples. This information can provide a basis for UF/IFAS-recommended IPM strategies.

### FPDN The Florida Plant Diagnostic Network

In 2004, UF/IFAS formally established the Florida Plant Diagnostic Network. FPDN is a member of the SPDN and NPDN and comprises a plant pest diagnostic and reporting system that helps growers, agricultural industry personnel, county agents and all other first detectors submit plant samples, digital images, and detailed crop information for pest diagnosis.

The FPDN focuses on diagnostics, digitally assisted diagnostics through DDIS, and the creation of a statewide, real-time FPDN database, training of first detectors, and coordination of plant biosecurity activities with state and federal agencies.

The FPDN clinics are facilities of the Department of Plant Pathology and several Research and Education centers at UF/IFAS. This partnership allows the clinics to maintain a strong connection with the leading Extension specialists and researchers in the fields of plant pathology, entomology, nematology, horticultural sciences, and agronomy.

### FPDN Diagnostic Services

FPDN clinic services include analysis of plant material for fungal, bacterial and viral pathogens and providing appropriate control recommendations when available based on UF/IFAS pest management guides.

*Continued on Page 24*

### Online Resources

Florida Plant Diagnostic Network  
FPDN, <http://fpdn.ifas.ufl.edu>

Southern Plant Diagnostic Network  
SPDN, <https://www.npdn.org/spdn>

National Plant Diagnostic Network  
NPDN, <https://www.npdn.org/>

Distance Diagnostics and  
Identification Systems  
DDIS, <http://ddis.ifas.ufl.edu>

Florida Department of Agriculture,  
Division of Plant Industry  
FDACS-DPI, <http://fdacs.gov>

Florida State Collection of Arthropods  
FSCA, <http://www.fsca-dpi.org/>

UF/IFAS Insect Identification Laboratory  
<http://entnemdept.ufl.edu/insectid>

UF/IFAS Nematode Assay Laboratory  
<http://nematology.ifas.ufl.edu/assaylab/>

*Photos, this page:*

*Citrus canker, Beth Bolles, UF/IFAS*

*Leaf-footed bug, Bob Peterson*

*Rootknot nematode, Jeffrey W. Lotz, FDACS*

*Mushroom, Bob Peterson*

*Field and lab photos, facing page:*

*UF/IFAS Department of Plant Pathology,  
Plant Diagnostic Center*

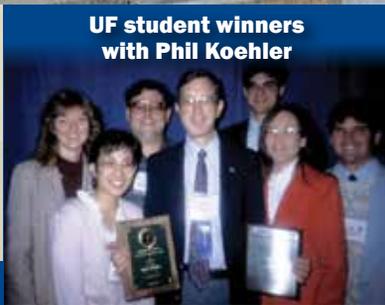
# Dan Suiter:

## YEARS AT UF Lead to FUTURE SUCCESS



A masked Dan Suiter ▲ films a segment for the Georgia Farm Monitor television show with Dr. Nick Fuhrman.

UF student winners with Phil Koehler



Born in 1963, Dan grew up in West Palm Beach as a sixth-generation Florida native. He attended Palm Beach Junior College from 1982 to 1985, where he earned his A.A. degree.

In high school at Cardinal Newman, Dan developed an interest in biology — no doubt stemming from his outdoor experiences hunting and fishing throughout South Florida, starting as a youngster in the late 1960s. Dan remains an avid outdoorsman and Florida Gator fan.

**L**IKE ALL beginning college students, my professional interests were varied: photography, veterinary medicine, and marine biology, to name a few. It was at PBJC I learned firsthand the power and influence of a teacher.

As a first-year student and unsure where I was headed, I approached my zoology teacher about careers in biology. Dr. Butler was a retired biology professor from Duke University who took a part-time teaching job at PBJC to stay busy. She told me about the field of entomology and went on to tell me that the University of Florida had a program I should investigate. I did, and for the next several years I self-advised and took classes at PBJC that would allow me to transfer into UF as a junior into the College of Agriculture and,

more specifically, into UF's Department of Entomology and Nematology.

I started at UF in fall 1985 in pursuit of a B.S. degree in entomology. The department at that time was on the third floor of McCarty Hall. Prior to arriving at UF that fall I had met with the entomology and nematology undergraduate advisor, Dr. John Strayer, to discuss academics. During my first contact with John, he caught me off-guard when he asked, "Dan, why on earth would a kid from West Palm Beach want to come to the University of Florida to study entomology?" I responded, "Because I want to get a Ph.D. and do research." That was more than 35 years ago, and I've been an Extension entomologist in support of the pest control industry for most of the past 25 years.

During my first week at UF, I had to check out an insect collecting net for a course in

general entomology. The young lady tending the entomology store, Lisa M. Ames, would become my insect collecting partner and, in October 1994, my wife.

Lisa and I both graduated in 1987 with our B.S. degrees in entomology. After graduation, Lisa went on to pursue a master's degree in nematology under the supervision of Dr. Grover Smart. I had gone back to see John Strayer to discuss with him the possibility of pursuing a master's degree at UF. He told me about a faculty member in the department who was looking for a graduate student. His lab was located at the USDA Insects Affecting Man and Animals Research Laboratory, now known as the Center for Medical, Agricultural, and Veterinary Entomology, and I'd probably have to work on cockroaches because of this professor's expertise.

I contacted the professor, known to most as Phil, and set up a meeting with him and Dr. Dick Patterson, then—research leader for the imported fire ant unit at IAMARL. After a short meeting in Dr. Patterson's office, we shook hands, and Phil asked me when I could start. "Next week," I probably said. I started in Dr. Koehler's USDA lab in the summer or fall of 1987 and was there until I graduated with my Ph.D. in 1994.

During my first week in Koehler's lab, I was given the task of writing a review article on cockroach control in kitchens. By engrossing myself in the cockroach literature at that time, this group of insects would become a focus of my career. Strayer was right!

Later in the semester, Phil arranged for us to make an evening trip to Jacksonville, at the invitation of Jennifer Leggett, to present training to a group of pest control operators. Phil told me that he'd like me to speak

on the impact of substrate on the residual efficacy of various liquid insecticide formulations for cockroach control. My first public speaking event was in a warehouse. When Phil had you captive in the front seat of a moving vehicle, your research project would often grow exponentially by the time you returned home. And so was the case during our trip to Jacksonville.

### Learning with the greats of urban entomology

At the time I was starting in Koehler's lab, retired Lt. Col. Richard Kramer was just finishing his Ph.D. degree and embarking on a long, highly successful career as a pest management business owner in the Washington, D.C., area. Dr. Kramer had worked on the development of a human drug, allopurinol, as a slow-acting toxicant for German cockroach control. My master's degree project would build upon Richard's dissertation, and the work we did would end up as the basis for one of the dozens of patents that came from Dr. Koehler's program over the next several decades.

My master's thesis work was based on foundational work by Dr. Don Cochran, then at Virginia Tech with Dr. Mary Ross and Dr. Don Mullins — all giants of urban entomology. One day Cochran and his microbiologist wife, Dr. Heather Wren, were on their way home from a Florida vacation and stopped at the lab. Koehler had me present what I had been doing with allopurinol. Here I was, a first-year master's student giving a private seminar to the person whose name was on most of the dozens of journal articles that formed the basis of my research project. It was like meeting a rock star and, admittedly, a little

intimidating. Don passed in November 2016, and I still have his obituary pinned up in my office. He was one of a handful of my academic heroes.

As I've come to learn over the years, mail received by Extension entomologists takes many forms. While checking my mail one day, up walked a new student from Alabama, who would over the next several decades become a close friend and colleague — Nancy Hinkle. While checking her mail, Dr. Koehler handed Nancy a package he had just received and asked her to look at it and see what she could find based on the three-page, handwritten, rambling letter that came with the sample. Naively, Nancy took the sample and came back a day or so later and told Koehler that no, there were no insects in the sample. The only thing she could tell from the sample was that the submitter was a "true blonde."

Some 30-plus years later, Dr. Hinkle is viewed as a world authority on Ekbom syndrome, sometimes known as delusional parasitosis. I've been a working colleague of Dr. Hinkle's for the past

15 or so years here at the University of Georgia — she in Athens, by way of UC Riverside, and I in Griffin after five years at Purdue University. It's a small world, indeed.

**B**ILL KERN, based at the Ft. Lauderdale REC for the past several decades, came to Dr. Koehler's program at about the same time as Nancy. To this day, Bill is one of the best all-around naturalists I've known. When I met him, as my TA in Vertebrate Zoology, he was studying bats and was involved with Bat Conservation International. On several occasions, I accompanied Bill deep into various stormwater drains (bat roosts) throughout Gainesville to study bats. Bill was instrumental in the establishment of the bat houses on the UF campus next to Lake Alice. ▶

I had mentioned to Bill that Koehler had a summer job opening and that he should investigate. It wasn't too long after Bill's summer job that Koehler had him working on his Ph.D. degree on cat fleas. Phil was famous for this — meet him once and the next thing you knew you were part of his program. Bill, Nancy and Bettina

*Continued on Page 20*

**Dr. Dan Suiter at University of Georgia Griffin Campus**





Bjorn Christian Torrison

**An adult Argentine black-and-white tegu, *Salvator merianae***

# Argentine Black-and-White TEGU

Invasive tegu lizards are emerging from their winter burrows in the Florida wild.



Emma Hanslow, USGS

Antonia Florio, Science Communications Liaison, with a tegu in Everglades National Park. More than 10,000 tegus have been removed from Florida by the FWC and its partners.

**T**HE ARGENTINE black-and-white tegu, native to South America, was brought to Florida for the pet trade as early as 2002. It has become established in several areas of Florida.

Like all nonnative reptile species, tegus are not protected in Florida except by anti-cruelty law and can be humanely killed on private property with landowner permission. They can also be humanely killed year-round and without a permit on 25 public lands in South Florida.

### Description

Argentine black-and-white tegus are large lizards that can reach nearly five feet in length. They have a mottled black-and-white coloration that often is arranged into a banding pattern across the back and tail. Hatchlings display similar markings, but typically have bright green heads. The green fades after they reach about one month of age.

In both its native and introduced range, the Argentine black-and-white tegu is found in savannas and disturbed habitats such as forest clearings, roadsides and fence rows. They are terrestrial lizards that rarely climb more than a few feet off the ground, but they are strong swimmers. Tegus can tolerate marine and freshwater habitats, such as flooded marshes.

During winter, tegus retreat into burrows while they undergo a hibernationlike period known as brumation. These lizards may dig their own burrows but also invade the burrows of native species, such as gopher tortoises. In South Florida, tegus typically begin to emerge from their burrows in February.

Tegu breeding in Florida begins in early spring. Female tegus reach reproductive maturity after their second year of brumation, or when they are about 12 inches long from the tip of the nose to the base of the tail. They lay an average of 35 eggs per year.

Females construct nests of dried vegetation, often at the base of trees, in clumps of tall grass or in burrows. Eggs incubate for approximately 60 days and require stable temperatures for successful hatching. After hatching, juvenile tegus grow quickly. Tegus may live up to 20 years.

### Diet

Tegus have an omnivorous diet and consume fruits, eggs, insects, and small animals including reptiles and rodents. They are efficient egg predators that will consume the eggs of ground-nesting birds and reptiles. Tegus may also

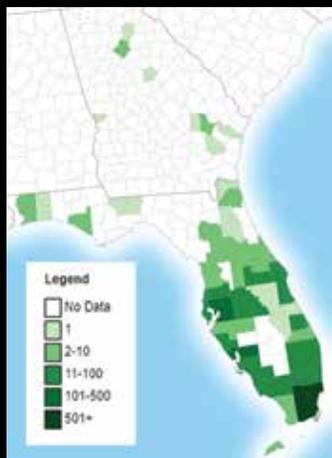
consume pet food that has been left outdoors.

Tegus are known egg-eaters and in Florida, they have been documented consuming American alligator eggs. They may also impact other ground-nesting native wildlife such as the gopher tortoise, American crocodile, sea turtles and ground-nesting birds. Tegus have also consumed gopher tortoise hatchlings in Florida.

### Florida Distribution

Reproducing populations of Argentine black-and-white tegus are established in Hillsborough, Miami-Dade, and Charlotte counties. An emerging population was recently discovered in St. Lucie County after several confirmed reports were received through the FWC's Exotic Species Hotline. Managers and researchers believe these populations occurred through escapes or intentional captive animal or pet releases.

Argentine black-and-white tegus have also been reported from other Florida counties, though these observations are most likely isolated occasions of escaped or released pets and not related to successful breeding populations. Tegu sightings have been reported as far north as Georgia: See map at left.



Argentine black-and-white tegu record density map of Florida and Georgia counties.

## Potential Impacts

Tegus are opportunistic predators and consume a variety of small prey as well as plant matter and carrion (dead animals).

Potential impacts of tegus include competition with and preying upon Florida's native wildlife, including some imperiled and protected species. Tegus prey upon the nests of other animals. Researchers have documented tegus eating American alligator eggs and disturbing American crocodile nests in Florida.

Gut-content analysis of tegus by the FWC revealed that they consume threatened juvenile gopher tortoises and agriculturally valuable foods, highlighting the impact this species may have on sensitive wildlife and agricultural lands. Tegus could become an agricultural pest or a source of bacterial contamination of food crops.

Though current population estimates are not available for this species, evidence suggests possible expansion of their populations in Florida. Adults have few predators and can give birth to large numbers of offspring per year, increasing the risk of populations spreading beyond their established ranges and impacting surrounding areas.

**PP**

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*Article adapted from Argentine black-and-white tegu profile on My FWC.com, Florida Fish and Wildlife Conservation Commission.*

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*EDDMapS. 2021. Early Detection & Distribution Mapping System. The University of Georgia – Center for Invasive Species and Ecosystem Health. Available online at <http://www.eddmaps.org/>; last accessed February 19, 2021.*

## FREQUENTLY ASKED QUESTIONS

### How is the FWC managing this species?

The FWC works collaboratively with external agencies and partners to assess the threat of this species and further develop management strategies. The FWC removes tegus from the environment with targeted trapping and works to capture and remove this species from the wild. The FWC and partners have removed thousands of tegus from Florida.

### What if I own a tegu I can no longer care for?

Released pets remain a primary source of introduced species in Florida. Through the FWC's Exotic Pet Amnesty Program, pet owners who are either unable to care for their exotic pets, such as tegus, or who no longer wish to keep them can surrender them with no questions asked and without penalties regardless of whether those pets are kept legally or illegally. The EPAP helps reduce the number of nonnative species being released into the wild by pet owners and fosters responsible pet ownership.

### How can I be part of the solution?

- Keep attractants such as pet food inside. Be sure to cover outdoor openings and clear your yard of debris to minimize hiding and burrowing areas for tegus.
- **Don't Let It Loose!** Never release exotic animals such as tegus.
- Surrender unwanted pet tegus to the FWC's Exotic Pet Amnesty Program.
- Report observations of tegus to FWC's Exotic Species Hotline (888-Ive-Got1).

### What should I do if I see a tegu?

The FWC encourages reports of Argentine black and white tegu sightings. You can help: Take a picture, note the location, and report information using the free IveGot1 mobile app. Or you can call 1-888-Ive-Got1 (888-483-4681), or report online at [IveGot1.org](http://IveGot1.org).



Bernie Dupont

**Adult Argentine black-and-white tegu**

**Juvenile Argentine black-and-white tegu**

Chucaco

**Report  
tegu lizard  
sightings  
immediately**

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**1-888-IveGot1**  
(1-888-483-4681)  
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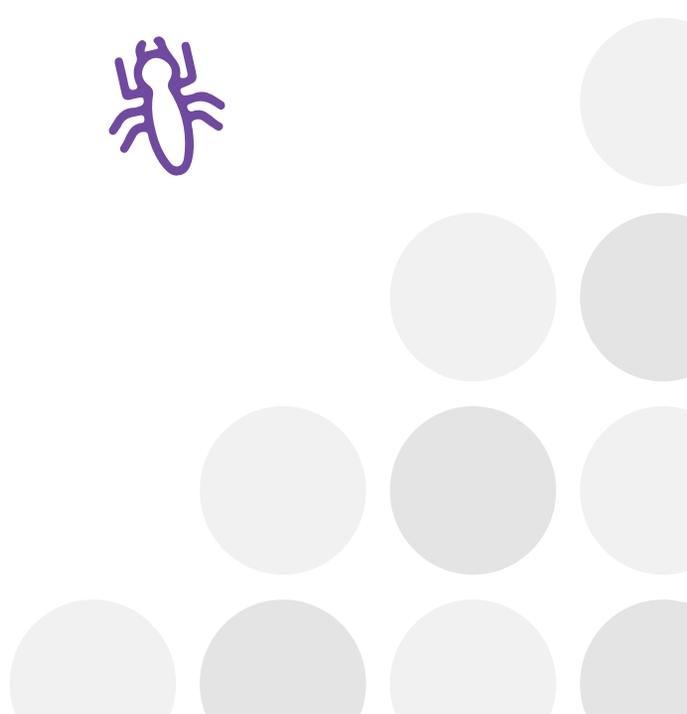
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**Name:** Anne-Marie Tulp

**Hometown:** Bronx, New York

**Where you live now:** Jupiter, Florida

**About your company:** Adam's Pest Control was started in 1990 by myself and my husband, Michael. Michael worked for the family business in New York for many years, and we decided to make a new start for ourselves in South Florida.

**First paying job and what you learned from it:** Cashier at a supermarket in New York, ShopRite. It taught me the importance of being accurate and quick, but most importantly it taught me the value of what good customer service is all about. Either you are a people person or not in life, and working in a grocery store showed me how to pivot my delivery by recognizing the personality and vibe of each customer.

**First break in the pest business:** Adam's Pest was my one and only break in the business. Coming from a banking



Anne-Marie Tulp

background, this was all foreign to me. In the early days, I quickly learned from my mistakes, and my technicians and customers were not shy about calling me out when it was warranted. As a result, I quickly decided to get my licenses and attend any conference available to sharpen my routing and pest service skills.

**Best business book:** *Hug Your Haters*, by Jay Baer. Cherish people that tell you that you suck, because they have given you the opportunity to not make that same mistake twice and do better the next time.

**Best piece of business advice you received:** Put yourself in the shoes of the customer. I expect excellent customer service from the people I do business with, and as a result I expect nothing less to be provided to our customers from the Adam's Team.

**What you would tell someone new to the pest business:** Utilize all technology available to you. Not only will it make you more efficient, it will help you

grow your business in ways you never thought possible!

**Where can we find you when you are not at the office?** Well, since March 2020 my entire office team has been working remotely, thanks to the coronavirus so, therefore, I am never at the office right now. But when I am not Zooming, Facetimeing, Skyping, Google Meeting and hangout chatting, I can most likely be found in the company of multiple space heaters in my guest bath doing a Zoom hot-yoga class. Post-vaccine, I hope my luggage never has the opportunity to cool off, as my plans are to make up for all the lost travel time.

**What is the most important trait you look for when hiring?** Always, personality and values first. I want to hire a team member who can be a good culture fit. Everything else can be learned with ambition and drive. **PP**





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\*\*Ward's Small and Large Pickup Segments compared, 2019 Frontier vs. latest in-market competitors. Based on lowest MSRP models. Price is Manufacturer's Suggested Retail Price (MSRP). MSRP excludes tax, title, license, destination/handling fees and optional equipment. Dealer sets actual price. Comparison based on manufacturer websites.



Moser, a graduate student from Germany, worked on cat flea biology and management and all made significant contributions to our understanding of this pest. Bettina went home during the historic fall of the Berlin Wall and brought back pieces of the wall, still with paint on them, as gifts for everyone back in the lab. ▲

Karen Vail, now a professor in the University of Tennessee Department of Entomology, was a technician in Dr. Dave Williams's imported fire ant research program at the same time Nancy, Bill, Bettina and I were working. Karen decided to leave her job and pursue her graduate career in entomology. She's been at UT for years now and served

as department head for a stint. Dr. Vail is known for her work on ants, and the background she received at IAMARL positioned her well for a long career in urban pest management. She's a highly sought-after speaker throughout the United States, and has since started a research program on bed bugs.

**I**N 1990, the department relocated from McCarty Hall to what is now Steinmetz Hall. Our new department head, Dr. John Capinera, began to host departmental potluck get-togethers. One event was held at Lake Wauburg, a UF-owned lake and recreation property just south of town.

A young couple new to the department arrived with potluck in hand and introduced themselves: "Hi, I'm Faith, and this is my fiancé, David." They had come from Hawaii — Faith to study termites under Dr. Nan-Yao Su, and David to a post-doc position in the Entomology and Nematology Department. David and Faith Oi, over the next 30 years, would become household names in the pest management and imported fire ant and pest ant research communities.

Faith became my coffee-drinking buddy — still is. As graduate students, we both took pride in each having taken more courses in statistics — at least nine — than any of our student colleagues. Faith and I would graduate with our Ph.D. degrees during the same ceremony in August 1994.

With just a few years left in my program, I remember meeting Dini Miller for the first time. Dini came from California to work with Dr. Koehler. She had just graduated from UCLA, and, if I recall, had received her four-year degree in geography. From the beginning, Dini had a natural-born knack for public speaking and was immediately comfortable with speaking in front of groups. To see her speak today, it's easy to see the influence of Phil Koehler. She's been at VA Tech for around 20 years, and in that time has become an industry mainstay and icon the world over. She and I had an office mate: Marcie Downing, who went on to a career with DowAg in Miami following graduation. Owing to Dini's sense of humor, she affectionately had nicknamed Marcie "the marsupial."

*Continued on Page 26*

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FL West Coast	<b>SOLD</b> Gross \$2.1 million	GA Coast	<b>SOLD</b> Gross \$300,000
South FL	<b>SOLD</b> Gross \$700,000	Indiana	Gross \$200,000
FL West Coast	Gross \$500,000	Maryland	<b>SOLD</b> Gross \$1.8 million
FL West Coast	<b>SOLD</b> Gross \$680,000	Central FL	<b>SOLD</b> Gross \$1,000,000

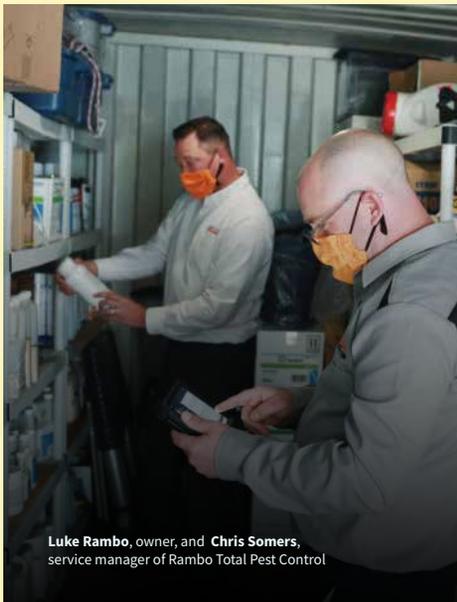
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Luke Rambo, owner, and Chris Somers, service manager of Rambo Total Pest Control

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**Closeup of oak treehopper**  
*Platycotis vittata*



**Closeup of thorn bug**  
*Umbonia crassicornis*



Judy Gallagher

PEOPLE HAVE SPENT an unprecedented amount of time at home in the past year. Some might have spent more time in their backyard than ever before. It may have given them a chance to observe some of the more interesting insects found in Florida.

As professionals, we tend to focus our attention on pests that do the most damage or the ones we see the most. However, it is always a good idea to pause and learn about some of the lesser-known insects that may occasionally come across your desk.

# Florida's **Bold, Bizarre** and *Beautiful*

Erin Harlow



Various forms of thorn bugs

## Between Two Thorns

The oak treehopper, *Platycotis vittata*, and the thorn bug, *Umbonia crassicornis*, are often confused because of their coloring and interesting body shapes. While they are both in the Order Hemiptera (true bugs), they are different species. These striking insects are often mistaken as thorns and may go unnoticed until they move.

### Oak Treehopper *Platycotis vittata*

Oak treehoppers are found throughout Florida on evergreen and deciduous oaks, *Quercus* spp. In Florida, recorded host trees include water oak, *Q. nigra*; turkey oak, *Q. laevis*; laurel oak, *Q. laurifolia*; and live oak, *Q. virginiana*.

Oak treehoppers may congregate in large enough numbers that homeowners become concerned and call a pest management professional.

However, these insects rarely do any damage and are not typically controlled.

Oak treehoppers are triangular insects that usually have a frontal horn. However, this insect is highly variable both in shape and color — enough so that four distinct varieties are recognized. There are both a striped and mottled version, and while most adults have frontal horns, some do not.

The nymphs are black with yellow and red markings and typically have three horns. Eggs are oviposited into twigs and result in long scars, but don't usually damage the tree in significant amounts.

### Thorn Bug *Umbonia crassicornis*

Thorn bugs are found near Tampa, Orlando, and into South Florida. Host plants include trees and shrubs such as jacaranda, *Jacaranda acutifolia*;

powder puff, *Calliandra* spp.; royal poinciana, *Delonix regia*; and others.

Thorn bugs that gather in large numbers can damage trees and may warrant control. They use their piercing mouthparts to feed on sap and create cuts in the bark to oviposit their eggs. Because they are sap-feeders, they produce honeydew that can cause sooty mold to form, resulting in a sticky, black mess.

Thorn bugs vary in color and shape. Generally, they are green with reddish stripes and brown markings. Males have a large pronotal horn that can be widely varied. A female thorn bug has a pronotal horn that is perpendicular to the body, vs. the oak treehopper, where the horn faces forward. Thorn bug nymphs have three horns.

*Continued on Page 28*



Judy Gallagher

**Thorn bugs on a twig**



From left:  
Lt. Mohamed Sallam sprays a combat uniform with permethrin using a hand-can sprayer.

The small pouch is an Individual Dynamic Absorption kit for application in the field.

*Permethrin, continued from Page 11*

In general, three techniques are used to factory-treat uniforms:

- the absorption method, where fabrics are individually treated by dipping or spraying;
- the incorporation method, known also as “Eulanisierung,” that uses heat and salt gradients to bind permethrin into wool or silk fibers; and
- the polymer-coating method, achieved by specific polymerization of permethrin onto fabrics before the tailoring process.

Factory treatment provides a safe and effective distribution and binding of active ingredient in the fabric to protect against mosquito bites for at least 50 washes.

Untreated uniforms may be treated at the unit level by a certified pesticide applicator using a 2-gallon pressurized sprayer or, for larger uniform spray operations, a 25-gallon AG sprayer. Individual service members may use an Individual Dynamic Absorption (IDA) kit or aerosol can to treat their own uniforms. Recently, EPA amended the label for the 2-gallon permethrin product. Now, uniforms treated using the permethrin product for the 2-gallon hand-pressurized sprayer may be retreated with this same product after 50 launderings, so uniforms can provide insect-bite protection for approximately an additional year of wear.

**How Effective is the Treatment?**

The first trials investigating permethrin as a uniform treatment were performed in the late 1970s by Carl Schreck at USDA-CMAVE. Their standardized “arm-in-cage” protocol now serves as the laboratory standard for determining the effectiveness of treated military uniforms against mosquito vectors. However, strictly controlled laboratory trials may not measure the true level of protection provided by treated uniforms. Moreover, the DoD encourages applying dermal repellents and using other personal protection measures in combination with repellent-treated uniforms as part of a DoD Arthropod Repellent System.

A number of different projects have attempted to quantify the ability of permethrin clothing treatments to prevent arthropod bites under field conditions, both alone and in combination with other personal protection measures. Measuring bite protection is difficult, and correlating bite protection to disease prevention is even more difficult. While

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large-scale randomized control trials with epidemiological endpoints are the gold standard for product evaluation, in practice, these types of studies are very expensive and extremely time consuming. Available evidence thus far indicates that treated clothing, alone and in combination with dermal repellents, is effective at preventing VBD, but there is still a great deal of work to be done in this area.

## New Research Forthcoming

The Navy Entomology Center of Excellence was recently awarded a Deployed Warfighter Protection Program grant for an operational study to evaluate the true protection provided by permethrin-treated and untreated uniforms, with and without topical application of DEET on exposed skin. This study will expand the knowledge base regarding personal protection measures for the deployed warfighter. This will be done by quantifying the protection against mosquito vectors, which is achieved by DoD Arthropod Repellent System on factory-treated military uniforms. The study will assess the durability of permethrin factory-treated uniforms after 10, 20, 40, 80 and 100 washes in providing protection against insect bites. The results from these studies will provide empirical evidence on how much bite protection of the whole body may be provided by treated and untreated uniforms, with and without dermal repellent, under semi-field conditions. **PP**

*This article was written by Lt. Mohamed E. Sallam, Research and Development Department, Navy Entomology Center of Excellence, Jacksonville, Fla., Maj. Erica J. Lindroth, Armed Forces Pest Management Board, Silver Spring, Md., and Lt. Cmdr. Joseph W. Diclaro II, Acting Officer in Charge, Navy Entomology Center of Excellence, Jacksonville, Fla.*

*The views expressed in this abstract are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U. S. Government. This work was prepared as part of official duties. Title 17, U.S.C., §105 provides that copyright protection under this title is not available for any work of the U.S. Government. Title 17, U.S.C., §101 defines a U.S. Government work as a work prepared by a military Service member or employee of the U.S. Government as part of that person's official duties.*



Adult emerging from pupa



Exposed female



Bagworm



Bagworm crawling with its bag

Joe Caputo



Prochalia pygmaea on palm



Prochalia pygmaea, a bagworm

Photos by Lyle J. Buss except as noted.

## Bagworms

Lyle J. Buss

PEOPLE often send me photos of strange cases made of leaves. The cases contain a type of caterpillar called a bagworm. Bagworms are members of the family Psychidae, a small family of moths with about 10 species in Florida. Most of the caterpillars feed on leaves and construct their cases using silk and pieces of leaves or twigs. You may be able to figure out what a bagworm was feeding on, based upon the material in its case. Bagworm cases are generally ½ to 1½ inches long, which is larger than the cases of other caterpillars that you may be familiar with — like casemaking clothes moths and household casebearers. Bagworms are found outdoors, while clothes moths and household casebearers are generally indoor pests.

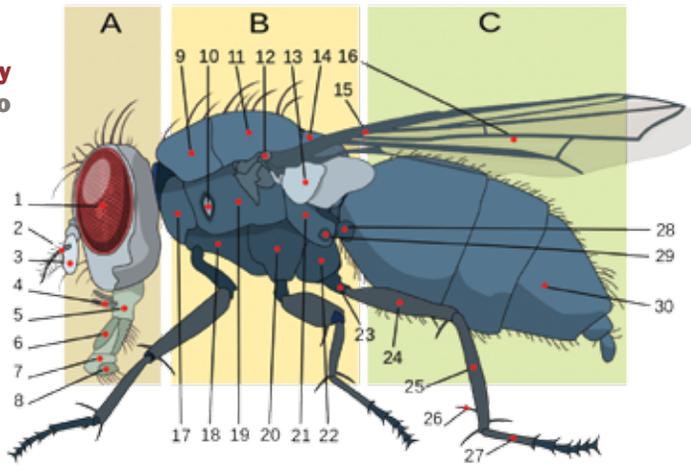
A bagworm caterpillar builds its case soon after hatching from the egg. It lives inside this case and carries it around wherever it goes. It will stick its head and thorax out when feeding or crawling, but it never fully leaves the case. When it has finished feeding, it fastens the case to a twig or other surface and then pupates inside the case. The adult male has wings like a typical moth. The adult female is wingless, and stays inside her case. She emits a pheromone to attract a winged male, and after mating she lays her eggs inside her case.

The largest species in Florida is called Abbot's bagworm, and its case is about 1½ inches long. It feeds on the leaves of a wide variety of trees and shrubs, including both hardwoods and conifers. In South Florida, a bagworm called *Prochalia pygmaea* is often seen on the trunks of palms. It feeds on lichens rather than leaves. Its case is small, about ½ inch long, and is made of small pieces of lichen material. It looks like a thorn sticking out from the palm trunk. It does no harm to the palm.

Bagworms are commonly found on various trees and shrubs. They rarely get abundant enough to cause defoliation, so control isn't necessary. Sometimes they wander away from the host plant, and people find them crawling on the ground or stuck to buildings or fences. Usually we see just one or two at a time, so they are more of a curiosity than a pest. Their silk is quite strong, and cases are surprisingly tough to remove. **PP**

*Lyle J. Buss, Scientific Photographer, manages the Insect Identification Lab at the UF/IFAS Entomology and Nematology Department.*

**Insect morphology is used by FPDN to identify insects, in most cases.**



*FPDN, continued from Page 13*

In addition to classical diagnostic techniques, PCR (polymerase chain reaction) and ELISA (enzyme-linked immunosorbent assay) are being used for specific and sensitive detection and identification of plant pathogens.

Entomology-related FPDN clinic services primarily focus on morphological identification of specimens, but in some cases the FPDN communicates and collaborates with various groups to facilitate molecular identification of specimens on an as-needed basis. The collaboration of FPDN with specialist expertise at FDACS-DPI is integral to the quick, timely and accurate identification of unusual specimens.

The FPDN works primarily through UF/IFAS Extension offices in Florida. If there is an Extension office near you, you may want to contact them for assistance with your plant disease or pest problems. The UF/IFAS Extension personnel will be able to help you immediately. The clinics provide accurate plant disease diagnosis, professional services, and up-to-date control recommendations.

Please follow the instructions online for submitting samples.<sup>1</sup> It is very difficult to make a diagnosis if a sample is collected, packed, and/or shipped improperly.

**Distance Diagnostic and Identification System**

A web-based Distance Diagnostic and Identification System for the diagnosis of pest problems based on the electronic transmission of digital images operates in Florida counties. UF/IFAS Extension agents, specialists, and the faculty of UF/IFAS Information Technology jointly developed this web-based system.

Several clinic and UF/IFAS Extension specialists receive digital images of plant samples to enhance diagnostic capabilities. If you would like to learn more about how to submit plant pest samples using DDIS, please contact your county Extension office. DDIS allows users to submit digital samples obtained in the field, and related descriptive text provides a tool for identification of plant pests.

The system provides an environment for UF/IFAS Extension agricultural agents and specialists to share information on plant-insect issues.

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## First Detector Training

The FPDN is establishing a “first detector” network to enhance monitoring the introduction of pests or unusual pest outbreaks. First detectors are an integral part of the system and include:

- ✓ Growers;
- ✓ Cooperative Extension Service personnel;
- ✓ Crop consultants and pesticide applicators;
- ✓ Master Gardeners; and
- ✓ Commercial chemical and seed representatives.

The FPDN provides training to first detectors on proper techniques for sampling, monitoring, and identifying pests and procedures for reporting pest problems. Through their county Extension service, first detectors will have access to the web-based diagnostic system and can report unusual pest occurrences, existing crop conditions, or other information through the FPDN database. FPDN first detectors receive the SPDN newsletter and alerts of new pest information when available.

A detailed list of plant pest and disease diagnostic and identification services provided by UF/IFAS in conjunction with the Cooperative Extension Service is available online.<sup>2</sup> **PP**

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*This document is PP-229, one of a series of the Plant Pathology Department, UF/IFAS Extension.*

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*A.J. Palmateer is former Associate Professor and Extension Specialist, UF/IFAS Tropical REC; C.L. Harmon is Director, UF/IFAS Plant Diagnostic Center, Plant Pathology Department; A. Hodges is DPM Director, Department of Entomology and Nematology; N. Peres is Assistant Professor, Plant Pathology Department, UF/IFAS Gulf Coast Research and Education Center; P.D. Roberts is Professor, Plant Pathology Department, UF/IFAS Southwest Florida REC; L. Buss is Senior Biological Scientist, Department of Entomology and Nematology; W.T. Crow is Professor, Department of Entomology and Nematology; J. Xin is Senior Associate Instructor, Department of Agricultural and Biological Engineering; and M. Paret is Associate Professor, Plant Pathology Department, UF/IFAS North Florida REC.*

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<sup>2</sup> <https://edis.ifas.ufl.edu/pp151>



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The semester I was leaving, I was asked to show Clay, a new prospective graduate student from the University of Central Florida, around the department. I left just as Clay Scherer was coming on board, but later learned that Clay became UF student body president and a member of the influential Florida Blue Key. Clay was a leader from the beginning. His meteoric rise at Syngenta came as no surprise to any of us who knew him. Dr. Scherer moved to Europe to take on a higher profile role within the company.

Rumor had it things got kind of crazy in the Koehler lab with the overlapping tenures of Scherer, Gahlhoff and Cooksey, et al. There was probably an instigator in the group, but from what I gathered, this cohort didn't need to be convinced to do anything. Probably a good thing walls can't talk.

**Paying it forward**

I came to my current position in April 2000 and will soon celebrate my 21-year anniversary at the University of Georgia's Griffin Campus. When I arrived at UGA, Brian Forschler took me under his wing, and

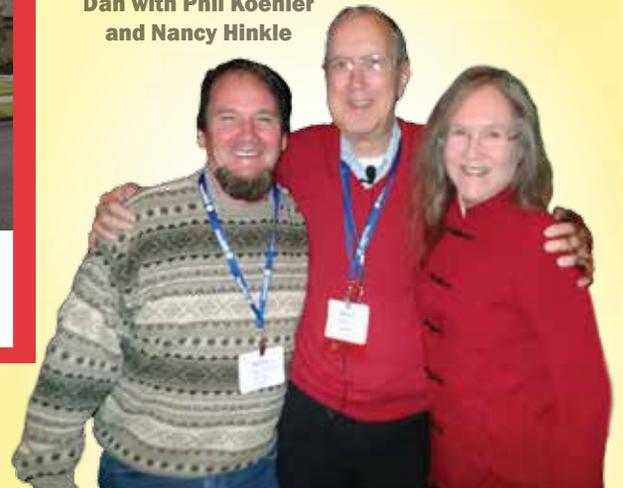
we became close colleagues and friends — he in Athens and I in Griffin. My career has been spent as an Extension entomologist, and my primary effort has been in support of the pest control industry and county-based Extension agents. I have maintained a small research program and have stayed engaged with graduate students. The best part of my job has always been my personal interactions with members of the pest control industry while helping them solve their insect-related problems.

**I**N OCTOBER 2020, my wife, Lisa, and I celebrated our 26-year anniversary. We still collect insects together! Although our freezer is no longer packed with frozen insects in vials, like any true entomologist, whenever an insect or spider manages to wander into our house, we run for the camera, not the bug spray. Lisa still catches spiders that have wandered inside and releases them outdoors. She has been the University of Georgia's insect diagnostician and a valued partner to my program for the past 20 years. Our dinner conversations often revolve around "this interesting sample I got in the mail today."

I'm closer now to the end my career than I am the beginning. I am forever grateful to Phil and my UF family for the opportunities I've been provided. Last summer I attended a Zoom celebration of Dr. Koehler's long, impactful career. Not surprisingly, there were nearly 100 in attendance to show their appreciation for Phil and what he had done for them. During the Zoom session, Phil suggested that anything that came his way in the form of accolades and recognition was because of those he worked with.

Actually, it all started with Phil back in the 1970s when he came to Gainesville. The UF Urban Entomology program could never have grown into what it has become without him. And for that, we are forever grateful. Thanks, Phil. And **Go Gators! PP**

**Dan with Phil Koehler and Nancy Hinkle**



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# Risky Business

Allen Fugler and Karen Madden

## Medical Marijuana in the Workplace

**T**HE CHANGING societal attitudes toward marijuana for medical and recreational use is most clearly evident in state legislatures: 14 states have now deemed possession and use fully legal, 33 states have created legal medical uses, and only three states still prohibit all uses. With the wide date range of legislative sessions, the legally permissible status and use is truly a “work in progress” and has created a highly variable patchwork of laws.

Regardless of state laws, the federal Drug Enforcement Agency deems marijuana as a Schedule I drug, which places it in the same category as heroin, cocaine and other opiates. The DEA does not recognize its medicinal qualities, in opposition to majority of states’ positions of medical use. With the recent change in administrations and control of federal congressional changes, it is reasonable to assume that there will be changes in federal positions.

To date, there are no state or federal Supreme Court decisions establishing precedent or challenging the federal position on fully legal or medicinal marijuana or its impact on employment laws. However, since pest management employees can be considered as “safety-sensitive” positions, with duties including driving, handling and applying hazardous materials and working at heights, the courts may eventually weigh in on the applicability of recreational and/or medical-use statutes as they apply to the pest profession.

A company’s position and policies can have measurable financial impact. Florida employers who implement a Drug-Free Workplace Program can be eligible for up to a 5% Workers’ Compensation premium credit on a qualified program. Drug-Free Workplace status is often a criterion for bidding RFPs for municipalities and other entities, and failure to provide current status can disqualify a pest management company from consideration.

Operating a pest control business in Florida already has its challenges with finding good talent, managing employee performance, and staying compliant with state and federal laws. In 2016, Florida legalized medical marijuana, providing employers with another focus area

with the potential of facing difficult employee decisions or jeopardizing their Drug-Free Workplace status.

A key issue involving marijuana use for pest control operators is not legalization but workplace safety. Concerns with detection of on-the-job impairment is usually much more difficult to detect and test than alcohol. It can be very difficult to determine if a positive drug test for marijuana is the result of drug usage during work or nonwork hours, so continuing to maintain a drug-free workplace stance in your business is simpler to maintain.

Pest control operators with operations in Florida do not have to contend with providing accommodations under the ADA since marijuana continues to remain illegal under the federal Controlled Substance Act. If modifications are made, employee protection under the ADA would apply only to companies with 15 or more employees.

It is important to have a written Drug-Free Workplace policy that is outlined in your handbook, implemented in your position postings and job descriptions, and posted at the worksite for employees to view. In addition, review existing policies related to hiring, disciplinary action, and termination to clearly identify your company’s position related to a drug-free, zero-tolerance workplace. Adherence and consistency to this policy are imperative to continue to take adverse action for a positive drug screen result due to marijuana, even if a medical marijuana card is presented by the employee.

In the private sector, employees do not have legal recourse if they are terminated due to a positive drug test. Having clearly defined policies and protocol consistent with adherence to these policies with employees is key to defending claims of potential wrongful termination or discriminatory charges.

Ongoing review of your policies and protocol is important, particularly with the pending legislation related to the Medical Marijuana Employee Protection Act.

Being mindful of the pending legislation is important. The amendment has the following parameters:

- ✓ Prohibiting an employer from taking adverse personnel action against an employee or job applicant who is a qualified patient using medical marijuana,
- ✓ Requiring an employer to provide written notice to an employee or job applicant who tests positive for marijuana of his or her right to explain the positive test result, and
- ✓ Providing procedures when an employee or job applicant tests positive for marijuana.

Companies should review with a qualified human resources professional and employment attorney their pre-employment and post-accident drug-screening policies, and the legal implications of hiring/firing/discipline per current written company policies. The review of document language and the application of related policies can reduce the civil legal exposure from discriminatory practice allegations. Further protection can be garnered through employment practices liability insurance, which provides coverage against accusations of discriminatory and negligent hiring practices and wrongful termination as well as allowing a hostile workplace and sexual harassment. This coverage is not included in other lines of coverage, such as general liability and workers compensation.

The shifting landscape of legal marijuana has the potential to change the workforce and the policies applied to its employment. The legal rights of medical users in Florida need to be considered in company policies, and the uncertainty of future legislature and court decisions means that pest management employers need to remain up-to-date on current legislation, rely on the counsel of employment professionals, and protect their financial future with specific insurance policies. **PP**

---

*Karen Madden is an accomplished executive human resource professional with more than 25 years of experience in various service-related industries that included Comcast Corporation, Arthur Andersen and Sarasota Memorial Healthcare System. Her most recent position was at Baldwin Risk Partners, one*

*Continued on Page 30*



**Giant water bug adult, *Lethocerus uhleri***



**Ant lion larva**



**Ant lion adult**



**A male giant water bug carries the female's eggs until they hatch**



**Ant lion pit**

*Bold, Bizarre, continued from Page 21*

### **Demons of Dust and Water**

#### **Ant Lion** *Glenurus gratus*

With 22 species of ant lions, Florida holds the record for the most species of any state. This fascinating insect is in the Order Neuroptera.

The larval stage is the most recognizable — at least the pits are that it creates in the sand. The larvae are recognized by their large mandibles and can be identified by the one, two, or three sharp teeth on each side. The mandibles deliver venom and also suck out liquid.

The larva, which is around half an inch in length, will bury itself at the bottom of a small pit in a sandy area. As an unsuspecting ant falls into the pit and tries to find its footing to crawl out, it becomes a tasty meal for the ant lion. Of the 22 species in Florida, some will also lie really still and wait for their meal, while a few live in holes in tree trunks instead of the sand.

All larvae pupate into an insect that may be confused with a damselfly. Ant lion adults have four wings of similar size that are transparent and delicate. Adults also have a slender body and thin antennae.

#### **Giant Water Bugs** *Lethocerus spp., Abedus spp., and Belostoma spp.*

The largest insect in the Order Hemiptera is the giant water bug. Florida has three different genera with eight different species.

These formidable-looking creatures are brown and can reach several inches long. They have modified front legs that act like pincers that help them grab onto prey after they wait patiently to ambush their prey. The front legs are tipped at the end with a sharp point that injects venom into the prey once it has been caught. A long, piercing-mouthpart is then used to suck the liquified juices from the prey.



**A giant water bug nymph, *Belostoma spp.***

# Facts from FDACS: Training is the Key

TRAINING is the most important aspect of pest control. Florida statutes 482 and 5E-14 require all technicians to be trained.

**482.091(c)** An employee may not perform pest control without carrying on her or his person a current identification card affixed with the employee's signature and current photograph.

**(d)** An identification cardholder may use only the licensee's pesticides, equipment, and other materials when performing pest control.

**(e)** An identification cardholder shall consult regularly with the licensee's certified operator in charge concerning:

1. The selection of proper and correct chemicals for the particular pest control work to be performed;
2. The safe and proper use of the particular pesticides applied; and
3. The correct concentrations and formulations of pesticides used for the various types of pest control work performed.

**(3)** A licensee or certified operator may not assign or use an employee to perform any category of pest control without providing trained supervision unless the employee is trained and qualified in that category of pest

control. An employee may not perform, solicit, inspect, or apply pest control without first having been provided at least 5 days of field training in the appropriate category of pest control under the direct supervision, direction, and control of a certified operator.

**(10)** In addition to the training required by subsection (3), each identification cardholder must receive 4 hours of classroom training in pesticide safety, integrated pest management, and applicable federal and state laws and rules within 6 months after issuance of the card or must have received such training within 2 years before issuance of the card. Each cardholder must receive at least 2 hours of continuing training in pesticide safety, integrated pest management, and applicable federal and state laws and rules by the renewal date of the card. Certified operators and special identification cardholders for fumigation who maintain their certificates in good standing are exempt from this subsection.

### 5E-14.1421 Identification Card – Training Verification.

**(1)** The licensee shall maintain written training records for both the initial five (5) day (40 hour) training required in Section 482.091(3), F.S., and the continuing training

required in Section 482.091(10), F.S., on all identification cardholders within their employ and make those records available during routine inspection or upon request of the department. Licensees must maintain the training record for at least a two year period. The training required for Section 482.091(3), F.S., must be conducted by a certified operator or a person under the supervision of the certified operator in charge who has been designated in writing as responsible for training.

**M**OST technicians we have encountered are trained well, some very well. With all that has gone on this year, it is good to know that there has not been an increase of enforcement actions against the pest control industry. The industry has done a great job, considering all that has happened and the adjustments that have had to be made.

Remember, this reading and following the pesticide labels are key to avoiding liabilities, litigations and enforcement actions. ***"The label is the law."*** **PP**

*Report by Paul Mitola, Environmental Consultant, Florida Department of Agriculture and Consumer Services*

Normally, giant water bug adults and nymphs are aquatic and spend their time in freshwater ponds, streams and lakes. During mating season, the adults fly from pond to pond. It is then that they may come into contact with humans. They are attracted by bright lights and end up in parking lots. Normally, they are not a concern for people. However, they can pinch, so people should leave them alone.

Recently, there was a case at a county fair where several fairgoers complained of being "attacked" by giant bugs. After consulting with UF/IFAS Extension, it was determined that giant water bugs were attracted from the nearby pond to the bright fair lights at night. The people were just in the way and really weren't being attacked by bugs. They did, however, have to seek medical attention from the "bites."

Florida is a unique state with many beautiful insects. As a pest management professional, you may not get to spend as much time as you would like appreciating the more interesting creatures that live here. Perhaps soon you will be lucky enough to

stumble upon one these insects and be able to educate your clients about them and their unique characteristics. **PP**

*Erin Harlow is Commercial Horticulture Agent, UF/IFAS.*



**Ant lion larva**

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*Continued from Page 27*

of the fast-growing independent insurance distribution firms in the country, supporting client goals through implementing strategic people management and consistent policies, processes and systems. Karen is an effective advisor to leadership with strong skills in labor relations, conflict resolution, performance management and leadership development.

Prior to her most recent position, Karen was vice president of human resources for one of the fastest-growing pest control firms in the country, Environmental Pest Services, driving HR strategy in a high growth environment. Serving as the Executive HR Business Partner, she provided expertise and solutions to department leaders and senior leadership in the areas of talent management, talent acquisition, employee relations, employment law, mergers and acquisitions, HR/payroll systems, employee engagement and Rewards and Recognition.

Karen holds a bachelor's degree in Business Management from the University of Southeastern Massachusetts. She also holds a PHR (Professional in Human Resources) designation and SHRM-CP (Certified Professional) certification. Karen is an executive board member of the Boys & Girls Club of Sarasota County, focused on serving the needs of the children focused on strengthening the local community.

Allen Fugler is Director of Risk Management for Xterminator Pro, a Division of Aegis General Insurance. He is a frequent speaker at industry meetings and contributor to trade publications; he works with insureds on regulatory compliance, employee training, file documentation and risk mitigation. His 29-year career in pest management began in 1991 and includes stints in pest trade association management and with insurance programs dedicated to pest management professionals. He is a credential pest professional who also holds an OSHA certification. Loss-control resources can be found in the "Client Area" of the Xterminator Pro website ([www.aegisgeneral.com/products/xterminator-pro/losscontrol](http://www.aegisgeneral.com/products/xterminator-pro/losscontrol)). He can be reached at [afugler@xterminatorpro.com](mailto:afugler@xterminatorpro.com) or (407) 241-3037.

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