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magazine is a publication of

Pest Management Education, Inc.

5814 Nob Hill Blvd.
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A nonprofit corporation working to help
UF Urban Entomology. Technical information
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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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POSTMASTER: Send address changes to:

Pest Management Education, Inc.
5814 Nob Hill Blvd.
Port Orange, FL 32127

FOR ADVERTISING information contact our
advertising manager, Lisa Ashley, at (850) 832-2101,
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CONTENTS

FEATURES

- 8** War on Mosquitoes:
We Have New Weapons
- 12** Microscopic Mites:
How to ID, and What to Do
- 16** Africanized Bee
Sampling and Identification
- 20** Student Profile:
Holly Beard
- 23** Cool! A DIY “Magic Wand”
To Stop Biting Flies
- 25** Palm Tree Fertilizer:
A New Balance
- 29** Bustin’ Out the Bugs
For Bug Week 2015

DEPARTMENTS

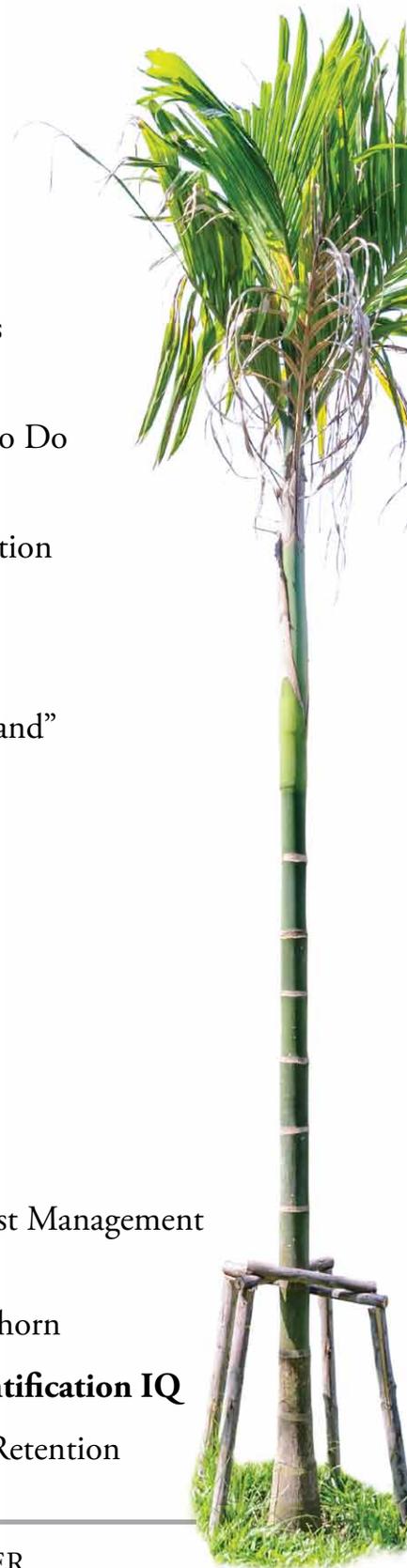
- 6 Founders List**
- 7 Editorial:** Why We Need Pest Management
Regulation in Florida
- 15 Pest Detective:** Basket Stinkhorn
- 18 Test Your Pest Control Identification IQ**
- 22 Executive Suite:** Employee Retention



ON THE COVER

Demonstrating the future of mosquito
pest control, Dr. Claude Thomas sprays
residential vegetation for adult mosquitoes
in Jacksonville using a new type of
backpack misting/fogging machine.

Photo courtesy of Dr. Claude Thomas



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Florida Pest Management

Why Professional Regulation Matters

THANKS TO ALL who have provided support for *PestPro* magazine. We want to be able to continue to provide technical information to the industry and we are indebted to our founding partners and folks who have contributed to keep *PestPro* going. We are limping along financially during this first year, with Pest Management Education, Inc., our allied nonprofit corporation, funding the printing and distribution of the magazine. Anyone who has started a company from scratch knows the cash flow problems we are having during the first year of service to the pest management industry.

One of the major problems for the pest management industry is uncertified operators in the state. There are probably thousands of untrained, uncertified operators selling pest control illegally in Florida. These are dangerous people because in most cases, they do not have the knowledge or training to do pest control safely and effectively. I have been at the University of Florida for 40 years now. Illegal operators were a problem 40 years ago, and they remain a problem. There are really good reasons that we have the oldest pest control certification program in the country. There are all sorts of problems that an illegal operator can cause.

The UF certification program goes back to the mid-1940s. Dr. John Creighton was a professor at the University of Florida, and Dr. John Mulrennan was in charge of entomology and mosquito control for the state of Florida. They recognized several huge problems with pest control and wanted to protect consumers. One of the foremost problems was people who lived in New York and other northern states where pest control is a seasonal business. They would come to Florida in the winter, sell pest control service, and then return to the north. Their customers were left without service when they left. When summer came in Florida, the person who sold the service was back up north with their money. The solution was

to require proof of continued residency in Florida for any individual who wanted to become certified and sell a service.

People who wanted a pest control service used to expect pesticides to be applied everywhere as a preventative service. So the main job of a pest control technician used to be mixing and applying product. Now we tell people that they are hiring the knowledge of the pest control company. The days of people wanting pesticide everywhere are disappearing fast. They want assurance that their pest problems will be controlled with a minimum of pesticide. That means technicians need more education in order to identify the pest, evaluate the situation, and provide the best quality service. People can buy the same pesticides over the counter or from web providers, but that does not mean that an uneducated person can apply the product successfully and safely. The pest management industry provides a valuable service by doing an excellent job of educating their personnel, who in turn protect the public from pests.

Without regulation, pest control would be a very dangerous profession where uncertified, uneducated, and poorly trained people try to control pests. I can think of several times during the past 40 years when this fact was driven home to me. For instance, there was a guy who opened up a business of treating dogs for fleas using a cattle pesticide. He opened the business one morning, and every dog he treated died within a few hours after he applied pesticide. My phone started ringing about 10 AM and continued all day.

I also think about the situation in Mississippi where cotton insecticides were applied by illegal operators into homes and day care centers for pest control. Many children and people were sickened, and the structures were the most costly EPA superfund cleanup sites ever.

Recently in the news, illegal trading in pesticides and the use of these products by untrained and uneducated people has

cost lives. Aluminum and magnesium phosphide, which produce phosphine gas, have caused deaths around the world from illegal trade in pest control products¹. In fact, people in Canada have died as a result of using phosphine gas for bed bug control². And of course, everyone knows about the recent situation in the Virgin Islands with methyl bromide affecting a family staying in an adjacent condominium³. So pest control needs to be regulated, and illegal and poorly trained operators should be reported and put out of business.

ANOTHER reason for professional pest management that usually is not discussed is that homeowners do not have adequate facilities for storing pesticides. In fact, most pesticide poisonings are usually when children contact or ingest improperly stored pesticide concentrates in the home. A pest control company overcomes that problem because no pesticide concentrates are ever in the home. So pest control companies prevent most pesticide poisoning cases from occurring. Nobody ever talks about how professional pest control saves harmful human exposure to pesticides.

Florida has a tremendous track record of certified operators and companies providing quality service in the safest possible manner. Everyone likes to complain about the laws and the necessity to comply with regulation. However, as our experience shows, pest control can be dangerous when it is in the hands of uneducated and poorly trained individuals. We at *PestPro* are proud to contribute to the education of pest management professionals in Florida and elsewhere. The education *PestPro* magazine provides is due to the generosity of our advertisers and our authors who want to contribute to the advancement of the industry, protection of the public, and the safety of our society. **PP**

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

¹ <http://gulfnews.com/xpress/bomb-that-kills-pests-and-humans-1.1073764>

² http://www.nccch.ca/sites/default/files/Phosphine_Poisoning_Bed_Bug_Treatment_March_2015.pdf

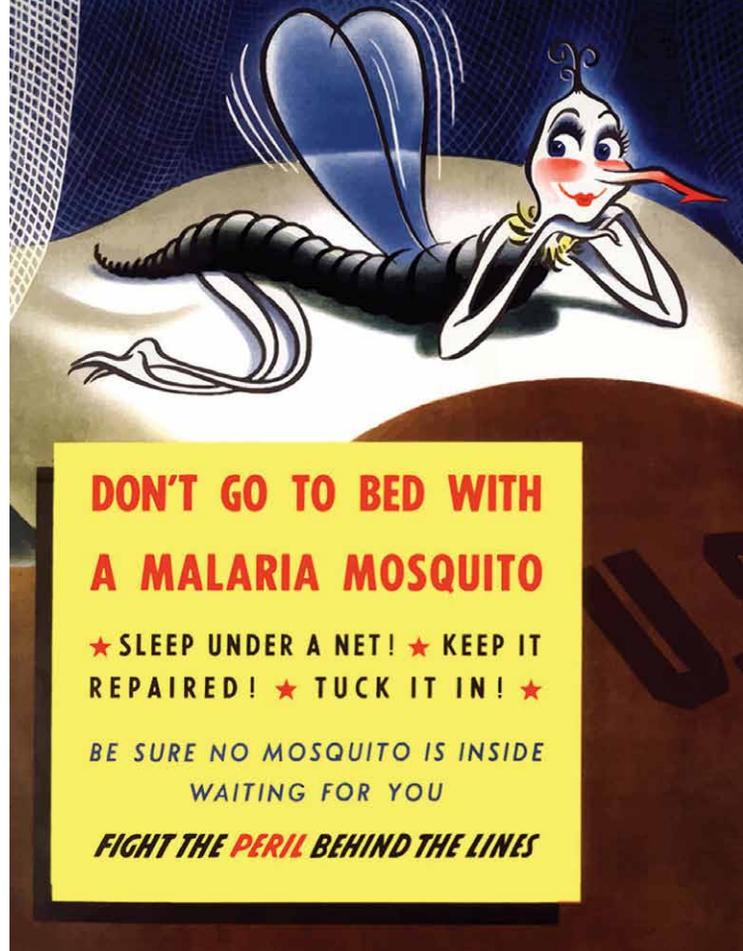
³ <http://www.cnn.com/2015/04/10/health/virgin-islands-vacationers-pesticide-exposure/>

Mosquitoes: Winning The WAR?



**AEDES AEGYPTI,
A VECTOR OF YELLOW FEVER**

Mosquito netting was the main malarial defense used by WWII soldiers, as shown in this 1940s-era poster.



They Spread Diseases, But We Have New Weapons

Roberto M. Pereira and Philip G. Koehler

Fear is an important factor when customers decide to use a pest management service. Mosquitoes are the essence of fear for pest control customers.

AS WE CONTEMPLATE the arrival of summer, with all its opportunities for outdoor activities, it is hard to imagine a time when Florida was a very dangerous place for outdoor activities. In its natural state, Florida was a very large swamp with dry spots here and there. It was certainly much more a mosquito heaven than a proper place for human habitation. Of course, Native Americans had been around for quite some time, and they actually had to deal with a problem that prevented massive occupation of Florida for quite some time: mosquitoes and mosquito-borne diseases.

“A malaria-cursed desert!” That is how Florida was described by Iza Hardy in his 1887 book, *Oranges and Alligators*. In certain areas of the state, it was not uncommon for the majority

of the population to test positive for malaria. Mosquitoes were responsible for numerous cattle deaths and much human suffering. Mosquitoes made life unbearable in Florida 100 years ago. Places that attract millions of tourists now were within “Mosquito County,” the original name for what is now Orange County.

Not far from where we sit in our lab and offices in Gainesville, one of the worst disasters in the history of Florida occurred. In 1877, the mosquito-borne disease yellow fever affected a great part of the population in Jacksonville, and almost decimated the population there.

Although most people are not completely aware of Florida’s mosquito-driven history, news on recently introduced mosquito-borne diseases such as chikungunya and dengue has raised the

level of fear in people’s minds. The fear of getting bitten by mosquitoes carrying diseases and the desire to avoid any mosquito-borne diseases drive pest control customers to seek a customized service for their residence or business. The pest management industry is in a great position to provide the service people desire.

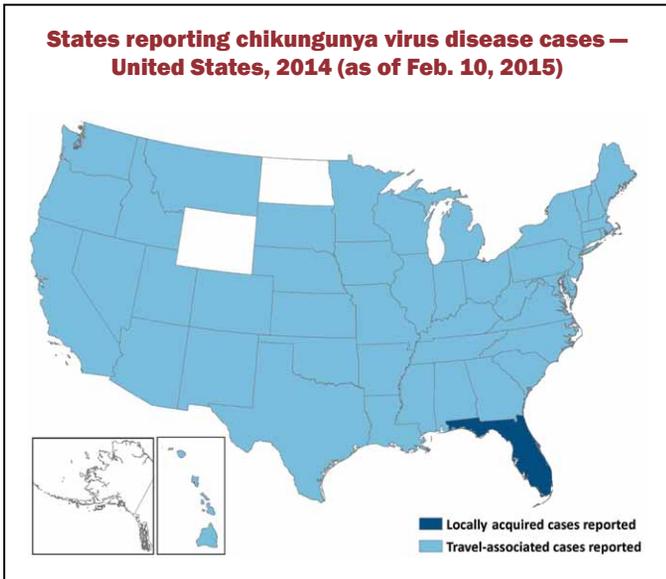
MOSQUITOES GRAB HEADLINES

Last year, several news outlets reported on cases of new mosquito-borne diseases in Florida. From a CBS TV station in Miami: “*New Dengue Fever Cases Reported In Miami-Dade*,” in August 2014. An online posting in July 2014 declared, “*Dengue Fever Erupts In Florida With Cause Being Local; World Health Organization Extremely Concerned*.” Later, in December 2014, Medscape Medical News online declared, “*Chikungunya: 11 Locally Spread Cases Confirmed in Florida*.”

When your customers read the headlines and hear the news again this year around June to August, they will wonder if they can purchase mosquito control so they can protect their family from potential mosquito-borne disease.

Philip Koehler is Endowed Professor and Roberto Pereira is Associate Scientist at UF/IFAS Entomology and Nematology Department.

States reporting chikungunya virus disease cases — United States, 2014 (as of Feb. 10, 2015)



Florida is the only state where chikungunya virus disease cases have been acquired locally, according to the US Center for Disease Control. From <http://www.cdc.gov/chikungunya/geo/united-states-2014.html>. Page last updated: April 7, 2015.

FLORIDA: A STATE OF CONCERN

A quick inspection of a map produced by the Center for Disease Control of chikungunya cases in the United States shows clearly why folks in Florida should worry about transmission of this and other diseases by mosquitoes. Florida stands out because last year it was the only state with locally acquired chikungunya, as opposed to other



Adult Asian tiger mosquito, *Aedes albopictus*.



Larval Asian tiger mosquito.

Sean McCann, UF/IFAS

Michèle Currow, UF/IFAS

states, where the chikungunya cases were all acquired in other parts of the world. There is a real possibility that we will also be tracking cases of locally acquired dengue fever as it occurs in Caribbean and Latin American countries.

For the pest control industry, the occurrence of these mosquito-borne diseases can be quite similar to what happened about 15 years ago when we were facing the invasion of Africanized bees.

When these bees were finally established in Florida and people grew to fear them, we predicted that eventually there would be companies that would primarily be known for their great bee-control work. That prediction has come true, and we now have companies that specialize in bee removal work. Despite the existence of mosquito control districts, the same could be true for mosquitoes and mosquito control. Management of mosquitoes in people's yards to prevent customers from being bitten may be a tremendous growth sector of the pest management industry in the next few years.

PCOs CAN FIGHT LOCALLY

The trick will be how to implement a service for your customers. Actually, it can be quite simple and could be a part of routine service. There is scientific data supporting the idea of locally controlling mosquitoes in individual urban lots. The service will not consist of solely space spraying insecticides or aerially applying pesticides to neighborhoods. Mosquito control by pest control companies can be done with residual barrier treatments and potentially by other technologies being tested and commercialized.

Residual barrier mosquito treatments are applied to the vegetation around

houses where mosquitoes rest. Mosquitoes do not survive if they are in open areas and exposed to the wind and sun. They need to stay in protected areas where the humidity is high and they are not disturbed—like among the leaves of landscape plants. When residual pesticides are applied to landscape plants near residences, they can be very effective in reducing mosquito populations. Reclaiming a safe, mosquito-free outdoor environment for your clients' enjoyment may be the next opportunity for your pest management business.

What insecticides are best for treating plants and building exteriors for mosquito control? Bifenthrin (Talstar One), deltamethrin (Suspend, Suspend Polyzone), and lambda-cyhalothrin (Demand CS) were evaluated by researchers for mosquito kill on the leaves of plants. In one Florida study, bifenthrin was shown to provide 77% mortality of *Aedes albopictus* for up to 35 days after treatment, when applied to azaleas. In another Florida study, bifenthrin applied to vegetation was shown to suppress mosquitoes below an annoyance threshold for up to five weeks. The leaves were used in bioassays, and the pesticide on them killed more than 70% of mosquitoes for four weeks. In a Kentucky study, researchers found that in suburban residential properties, mosquito populations of the most common anthropophilic mosquitoes were reduced for a period of four to six weeks after treatment with residual pyrethroids.

Spraying vegetation with residual insecticides can be most easily done with a power backpack fogger/mist blower. Some of the models on the market can be adjusted to either deliver either a space spray or residual mist for surface treatment. The great thing about power spraying vegetation with a backpack misting machine is that the air flow will push the leaves up, so the underside as well as the top surface of the leaf is treated. It also is a very efficient method of completely treating the landscape plants. If needed, the sprayer can also be adjusted to produce a fine fog to knock flying mosquitoes out of the air, which is most useful before outdoor parties or other gatherings.

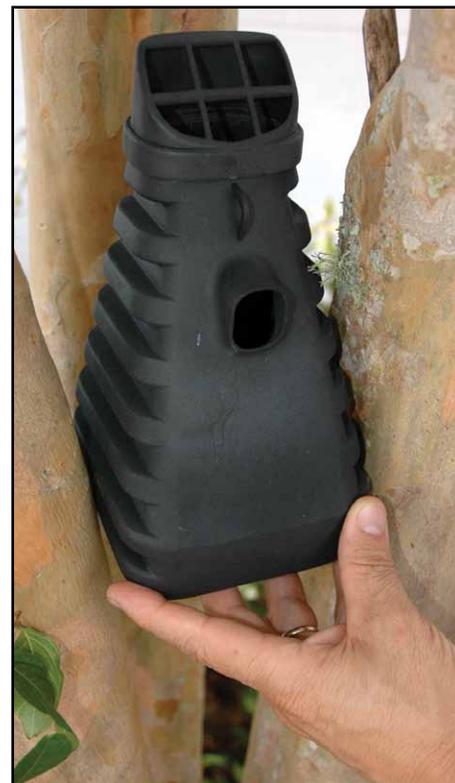
SO THE DATA are clear: Spraying vegetation for mosquito control around a residence can suppress the most important mosquito vectors of dengue and chikungunya viruses. Homeowners receiving these treatments will appreciate your pest control service by seeing a great reduction in mosquito bites. However, a pest control company should never promise protection of people from diseases like West Nile virus, dengue, or chikungunya. Residual barrier treatments applied by the pest control industry can not only do a lot to improve your customer's overall satisfaction with your pest management programs, but expand your service and revenue to your existing customer base.

Other options exist for the control of mosquitoes. For the mosquitoes that transmit dengue and chikungunya, which breed in tree holes and countless artificial containers, aerial applications of mosquitocides are not an effective control method. You may need to teach your clients to eliminate all potential mosquito-breeding sites from their

property. Of course, not much can be done if mosquitoes are coming from other areas. Some of our nondisease-vector mosquitoes, like salt marsh mosquitoes and those breeding in the Everglades, can migrate for many miles.

Another option we have been working on is a mosquito-lethal ovitrap. This ovitrap is a container that appears to the mosquito female as a good place to lay eggs and have them develop. But the container is treated with insecticides to kill the egg-laying mosquito female. Our version of the trap also incorporates a very safe insect growth regulator larvicide that prevents the development of the mosquito, so the immatures die before becoming adults. Without the pesky female mosquitoes to bite you, there is no transmission of diseases.

With a little creativity and some information on mosquito biology, development, breeding and vector capacity, it should be easy to capture some of the mosquito control market, increase the level of comfort for your clients, and maybe even save a few lives. **PP**



Jane Medley, UF/IFAS

Mosquito-lethal ovitrap. This can be placed in a tree or other outdoor location, where it attracts and kills egg-laying mosquitoes.

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THE LOWDOWN ON Microscopic Mites

Lynn Griffith



CYCLAMEN MITES

As a citrus inspector for the US Department of Agriculture in the 1970s, I used to watch spider mites feed on citrus leaves. The mites would actually run in order to gain enough speed for their proboscis to penetrate the waxy citrus leaf cuticle.

MOST OF US know about twospotted mites and red spider mites. We can see them easily with the naked eye or a decent hand lens. However, there is also a whole different side of the spider mite world — one we cannot see without significant magnification. Even a hand lens is not enough to view these critters. You need at least a dissecting scope or a microscope that will give you 40× power or higher. I'm talking about the microscopic mites, many of which feed on plants. They are generally categorized as Eriophyid mites and Tarsonemid mites, though there are other groups as well.

You can't see 'em, so how can you tell they are there? These fellows are so tiny that they can generally only feed upon brand-new, very tender bud or leaf tissue. A mature leaf to them is like eating an elephant. They have fairly limited mobility, though some are known to attach themselves to the legs of whiteflies. Who knew they hitchhiked? Microscopic mites can also move by wind, plant-to-plant contact, and other means. They also seem to be a growing and often misdiagnosed problem. Let's take a closer look.

Eriophyid Mites

There are hundreds of types of Eriophyid mites. They are pale yellow to white and truly microscopic. They are known to attack camellias, black olives, podocarpus, boxwood, juniper, gumbo limbo, green buttonwood, maples, and fruit trees such as citrus, apples and peaches. Their feeding on tender new tissue causes leaf distortion, twisting, and sometimes galls, russetting, witches' broom or bronzing effects, depending on the host plant. Eriophyid mites are thought to have chemicals in their saliva that act as growth regulators, altering the form of growth of plants upon which they feed.

Eriophyid mites reproduce very quickly, going from egg to adult in about seven days. You can have microscopic mite problems pretty much any time of year in Florida, though they particularly seem to like hot, dry weather. Rainfall can serve to physically wash them off of foliage and flowers, and may contribute to fungus diseases in the mites.

Broad Mites

Broad mites are members of a larger category called Tarsonemid mites, as are cyclamen mites. Common hosts include begonias, aralias, ivy, geraniums, New Guinea impatiens, *Fatsia*, and many bedding plants, as well as *Cannabis* and vegetables. They are generally straw colored, often with a white stripe down their broad back. They are fast-moving, seemingly always running around. The eggs are white with numerous little white bumps on them.

Broad mites feed on cells on the underside of new plant leaves, generally causing them to curl downward. Foliage may also become bronze or purple. Flowers are often severely distorted, fewer in number, and the flowers may fail to open. Broad mites reproduce very quickly as well, going from egg to adult in around four to six days in Florida. These can also be a problem pretty much any time of year, but especially in hot, dry conditions.

Cyclamen Mites

Cyclamen mites are also part of the Tarsonemid group of microscopic mites. Like most others, they cannot be seen with a hand lens. You need either a dissecting scope or at least 40× magnification. Besides cyclamen, these mites also feed on strawberries, African violets, gerbera daisies, snapdragons, begonias and ivy. The mites are yellow-greenish and transparent. Very young, tender growth is often attacked. They like to hide in flower buds and around emerging leaf tips.

Cyclamen mites are a little larger than broad mites. Their damage can look somewhat different from broad mite injury. The leaves may become very thick and brittle, and they often curl upward as opposed to downward. I see these a lot in gerbera daisies in greenhouses. The new foliage becomes very thick and extremely stunted, and is often darker green than normal leaves.

Continued on next page

Your Cheat Chart for Microscopic Mites

Eriophyid Mites
Many types. Pale yellow to white bodies.

Broad Mites
Straw-colored with white stripe, white bumps on eggs. They move fast.

Cyclamen Mites
Yellow-greenish, transparent bodies.

Brevipalpus Mites
Larger, flat, reddish bodies. They do not make webs.



Eriophyid mite galls on a vine's leaf.

Eileen Buss, UF/IFAS

Brevipalpus Mites

These mites are less well known, but they have become quite a problem in the last 50 years. *Brevipalpus* is considered a false spider mite, in that they do not make a web. Known host plants include ficus, tabebuia, gardenia, holly and citrus. I also encounter these mites often on aglaonemas and *Ficus 'Alii'* in interior landscapes. They are known to be a vector for citrus leprosis virus as well as several other viruses. The *Brevipalpus* are a bit

larger than the other mites mentioned in this article. They are about half the size of a twospotted mite, and with these you do have a chance of seeing them with a good hand lens. The mites are reddish with somewhat flattened bodies.

Brevipalpus mites are known to inject toxins into their host plants as they feed. Plant symptoms often include bronzing of foliage, blistering, chlorosis, and irregularly shaped necrotic spots. Like the other mites mentioned here, *Brevipalpus* reproduce quickly. They are capable of doubling their populations in five and a half days, and they live longer than the other microscopic mites. Hot, dry weather seems to be most favorable, though they can proliferate in interior environments as well.

Diagnosis

As I wrote earlier, you can't see these microscopic mites, so how can you tell when they are causing damage? The first clue is just that: You can't see anything associated with the damage, either with the naked eye or a hand lens. Second, only very new growth is usually affected. The older leaves will look fine. Third, look for odd leaf distortion. Microscopic mite injury is sometimes misdiagnosed as virus or 2,4-D injury. Leaves may be very small, crippled and strappy, not unlike sublethal Roundup injury. Microscopic mites tend to stay home, being less mobile than some other mites. Therefore, one plant may be badly affected, and another of a few feet away may look just fine.

To really confirm microscopic mite injury, you are going to have to get some plant specimens to somebody with a decent microscope. My pathologist diagnoses microscopic mite injury all the time in the course of his searching under the microscope for plant pathogens. The Entomology Department at the University of Florida is always a great place to go to confirm or deny the presence of microscopic mites. Collect plenty of material, preferably newly developed shoot tissue. Microscopic mites sometimes seem to either die or disappear in transit. Put the specimens in a plastic bag, and try not to let the sample get hot in your vehicle. You can also agitate new shoot tissue in

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small vials of rubbing alcohol, or tap the shoots onto a white piece of paper and look yourself, if you have at least 40× magnification.

Management and Control

There are a number of control options available to pest control professionals once microscopic mites are diagnosed. From the biological side, there are about five commercially available species of predatory mites that can be pretty effective in certain situations. For best results, determine which type of microscopic mite you are dealing with, and talk to your biological control suppliers. For those preferring an organic approach, some of the insecticidal soaps, oils, and neem products can be helpful, though repeat applications will likely be required.

For chemical control options, understand that not all of the commercial miticides necessarily work against the microscopic mites. They are a different animal. Chemical control options for microscopic mites include Avid, Floramite, Sanmite, Pylon, Akari and Judo. Be aware that not all of these control every type of microscopic mite, so try to match the type of mite you have with the pesticide label.

These mites are so small that the distance between spray droplets can be like miles to them, and they are good at hiding in tiny crevices. I always recommend using a wetting agent, spreader, or surfactant when spraying for microscopic mites. With their very short life cycle, spraying every couple of weeks may not be frequent enough. You may have to spray every five or six days in hot, dry weather. As is always the case with mite control, good coverage is critical to success. Rotate your chemistries and modes of action. Read and follow pesticide labels before making any applications. **PP**

Lynn Griffith is a tropical plant and soil expert, A&L Southern Agricultural Lab



BASKET STINKHORN

Photo by David Gough

Basket Stinkhorn

Lynn Griffith

IF YOU WANT WEIRD, we've got your weird right here: *Clathrus ruber* is commonly known as the basket stinkhorn, red cage fungus, or lattice fungus. It looks to me like it comes from another planet. Roughly the size of a baseball, this organism is now present in Florida and Georgia, having been known in the Mediterranean region since at least 1560.

This basidiomycete tends to like warm, moist, protected areas. It feeds on organic matter. I have generally come across it in mulched planter beds. It's not a pest exactly, but it smells terrible, like rotting meat, giving off dimethyl sulfide and other stinky substances. When mature, the latticelike fungus is orange or red, containing the same pigments that color tomatoes. The spores are spread by flies that feed on the foul-smelling fungus.

If that's not weird enough, the basket stinkhorn is also bioluminescent, giving off its own light like a firefly. The fungus also bioaccumulates manganese, so it may favor certain types of mulch or compost.

I have generally encountered the red cage fungus during moist periods in winter. Under the right environmental conditions, it can create odor problems for customers. Physical removal is the best control option, though it's not something you want to put in your truck. You may also want to spray the area with a fly control product to help reduce the spread of the fungus. **PP**

Lynn Griffith is a tropical plant and soil expert, A&L Southern Agricultural Lab

Sampling and Identification of Africanized Bees



Below: A colony of 40,000 Africanized bees was removed from a home in St. Petersburg.

TOO MANY TIMES people have told me the bees that moved into their yard couldn't be African because no one has been stung. My response is that they forgot the word "YET."

William H. Kern, Jr.

Associate Professor of Entomology at University of Florida / IFAS
Ft. Lauderdale Research and Education Center



THE PRESENCE of Africanized honey bee hybrids or African-derived honey bees has been confirmed in Florida since 2005. Prior to 2005, Africanized colonies discovered in Florida were considered interceptions. We have both African-derived and European races still in Florida. In South Florida, most feral colonies — those not in hive boxes — are very likely Africanized. Homeowners often want to know if the bees nesting in their property are Africanized before having them removed.

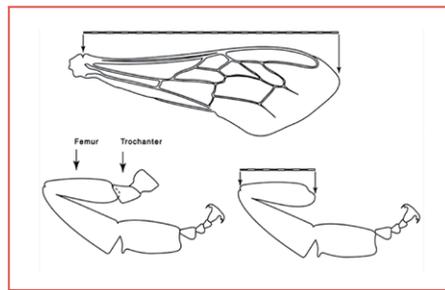
- It is not possible to identify an Africanized honey bee, or AHB, from a European-derived honey bee, or EHB, just by looking at it.
- Swarms are the reproductive process by which a colony splits to become two colonies. Swarms are more frequent in Africanized honey bees, with six to eight swarms a year, than European races, at one swarm a year with a rare fall swarm.
- Swarming bees, AHB or EHB, are not usually defensive because they have no resources to defend. If you disturb a swarm it will fly a short distance away into a higher location.

Some people, especially experienced beekeepers, can use behavior clues to determine the likelihood of a colony being Africanized. Defensiveness, running on the comb when the colony is opened, and even the sound the colony makes, have all been used to guess the colony's degree of Africanization. There are websites that claim to use behavioral clues to identify a colony as African vs. European, such as "How to Identify Africanized Honey Bees!" However, these clues require a good deal of experience to use properly.

GET A RELIABLE IDENTIFICATION

There are three proven methods used to identify a colony of bees that is Africanized. All methods require a sample of 30 to 50 bees from the same hive, colony, or swarm preserved by either freezing them in a deep freezer or storing them in 70–90% alcohol — ethanol is preferred, but isopropyl alcohol is satisfactory.

- 1** The first method is Fast Africanized Bee Identification System (FABIS).

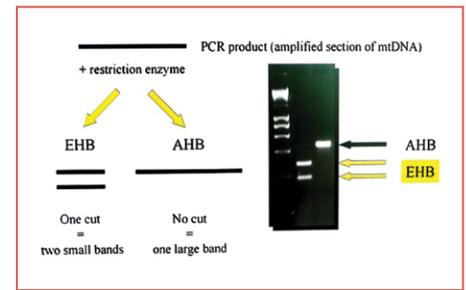


The measurement location for the forewing length and the hind leg femur length.²

This method depends on three exact measurements to assign a probability of Africanization. Ten sample bees from a single colony or swarm are measured for hind leg femur length, forewing length, and fresh weight; or femur length, forewing length, and dry weight. These 10 sets of measurements are averaged, and that is used to determine the probability of Africanization³.

- 2** The next method is USDA Morphometric Analysis for the identification of African honey bee samples. Morphometrics is a system of accurately measuring size and shape characteristics to determine honey bee type. Because the USDA method is so much more complicated, FABIS is usually performed first. Then if the results indicate Africanization, the much more involved test is run. The USDA morphometric method uses 25 data measurements for each sample bee and may take several hours to prepare the sample and collect the data. The data is taken by microscopically precise measurement of the forewing (four lengths, 10 vein angles), the hind wing (two lengths and number of wing hooks), hind leg (four lengths), and the sternite (four lengths). The bee parts must be mounted on microscope slides before they can be measured.

Both tests 1 and 2 are performed at the Apiary Inspection Service, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Bureau of Plant and Apiary Inspection at the Doyle Conner Building, 1911 SW 34 St., Gainesville, FL 32608. The Apiary



A piece of mitochondrial DNA is copied hundreds or thousands of times (amplified), then exposed to an enzyme that only cuts between a specific set of bases. The EHB piece is cut once to produce two bands, but the AHB piece is not cut, so there only one larger segment that moves slower through the gel producing a single band.⁴

Inspection Service will test samples if they are related to a stinging incident or occur outside of what is considered the AHB zone, south of Interstate 4. Feral honey bees south of I-4 are assumed to be Africanized unless they come from a managed apiary.

- 3** Analyzing mitochondrial DNA is an additional accurate method. It determines if the mitochondrial DNA is from an Africanized queen or a European queen, but it doesn't tell you anything about the drone's genetic background. This method uses an enzyme to cut the DNA at a very specific site. It cuts the European DNA into two products, but doesn't cut the AHB DNA. The result is two bands present from European honey bee mitochondrial DNA, but only one band from Africanized honey bee mitochondrial DNA.

Use of nuclear DNA has been much more problematic in developing a clear-cut test. Numerous labs have been working on this problem for more than 25 years, with no clear, simple method available.

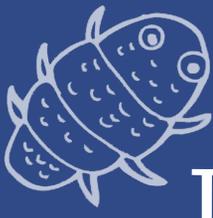
For more information about Africanized honey bees, go to the African Honey Bee Extension & Education Program at the University of Florida / IFAS Entomology and Nematology Department website at <http://entnemdept.ifas.ufl.edu/afbee/>. **PP**

¹ <http://www.wikihow.com/Identify-Africanized-Honey-Bees>

² Figure by David R. Tarry, Department of Entomology, North Carolina State University.

³ <http://www.beesource.com/point-of-view/africanized-honey-bees/fabis-manual-fast-africanized-bee-identification-system/>

⁴ From the FABIS Manual – Fast Africanized Bee Identification System, Dr. H. Allen Sylvester and Dr. T. E. Rinderer, USDA, ARS, Honey-Bee Breeding, Genetics & Physiology Research Laboratory, 1157 Ben Hur Rd., Baton Rouge, Louisiana 70820



Test Your Pest Control IDENTIFICATION IQ



THE PICTURED PESTS were submitted by *PestPro* readers. Can you correctly match all three pests by looking at the pictures and clues below, for a perfect Identification IQ? Send in your pest photo and it might appear in a future issue.

Green Horse Fly *Chlorotabanus crepuscularis*

This picture was sent by for identification by a pest control operator in Jacksonville. The fly landed for a blood meal on the hand of a pest control technician. Green horse flies are active in the evening and morning hours. These flies are the only horse flies active at crepuscular times of day and are attracted to lights. Other horse flies are daytime fliers. Green horse flies attack people in the spring and summer months.

Furniture mite *Glycyphagus domesticus*

This mite was collected from a house in Florida. The mite was too small to photograph, but the closeup scientific photo shows the general features of the mite. The furniture mite is found in foods and grains, and it thrives in infested high moisture foodstuffs and in damp areas, where it feeds on molds. In this case, it was probably in feeding in food crumbs dropped in stuffed furniture. It is one of the mites known to cause a skin condition called grocer's itch. It can also cause allergic respiratory symptoms when inhaled.

Leaf beetle *Chrysomelidae*

The homeowner was concerned that this beetle was going to cause a problem. The image is not good enough quality to tell what species. Leaf beetles are one of the most commonly seen beetles around houses. There are more than 35,000 species known. Leaf beetles feed on foliage and plant vegetation.



1. _____

2. _____

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ANSWERS
1. Leaf beetle, 2. Green horse fly, 3. Furniture mite



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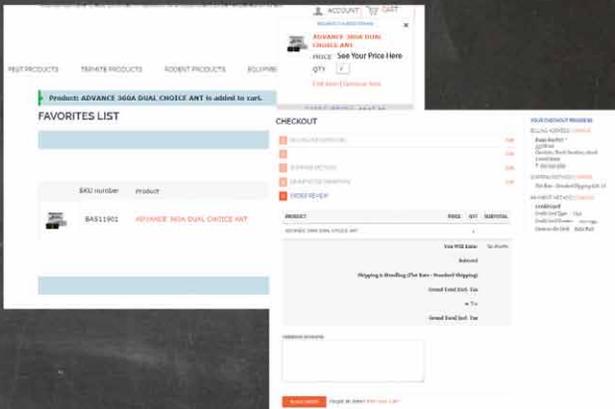
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As a child growing up in South Florida, Holly Beard discovered her talent for bicycle racing. Now she plans to build a career on her curiosity for insects and the talents she has found as a student in the UF Urban Entomology program.

Holly Beard

RACES to the FINISH

Intrigued by insects — and bike racing — as a young girl, a grown-up Holly discovers a great way to have it all.



ONE NIGHT in her childhood home, Holly's twin sister Amber woke up with one of her legs almost twice the size of the other. Amber was in so much pain that she was unable to walk. Amber woke Holly up to ask what she should do. "I told her she should draw a circle around the center of the swelling on her thigh," Holly said. "We took her to the emergency room to check out what could have caused this reaction."

The swelling was rapidly spreading. Amber was hospitalized for three days before doctors knew how to handle the situation. The doctors knew she was bitten by something, but also thought it could have been blood poisoning. "After determining that the bite was from a brown recluse spider, the doctors pierced through the bite location to release the necrotic infection and she fully recovered," Holly said.

A couple months later, Holly's family went out to dinner, and a flying insect flew into Amber's eye as they walked into the restaurant. Amber tried to push the insect out of her eye, but it was stuck. Holly went to the bathroom with her to attempt flushing out the insect, but it would not come out of her eye. It had suctioned itself to the inside of Amber's eyelid and could have scratched her eyeball. Holly's entire family rushed Amber to the emergency room again for doctors to flip her eyelid inside out and use tools to hold her eye open. The medical team successfully removed the insect using multiple forceps to pull the insect in different directions to release its suction.

"That was when I realized the impact spiders and insects have on people," Holly said. "I became hungry to learn how I could help my family and others with their problems caused by insects and spiders."

THE STARTING LINE

Holly's first semester as an undergraduate at the University of Florida was when she signed up for "Bugs and People" to learn more about the relationship between the two. She was fascinated and read everything she could find on entomology.

Holly frequently asked the professor, Dr. Carl Barfield, for more research material and advice. She was originally majoring in biology with a preprofessional track when Dr. Barfield suggested she do something that would open up more opportunities in the future. "Learning about insects came naturally to me," Holly said, "and it became an exciting field that I looked forward to studying."

In Holly's first year of college, her best friend Ela Jaworski applied for a work-study program. With a focus on genetics at UF, the program tried to match Ela up with research that correlated to her degree. Ela was directed to talk to Dr. Phil Koehler and ended up helping him with termite collection and colony maintenance at the University of Florida Urban Entomology Lab.

Holly thought Ela's lab work was interesting, so she joined Ela whenever she went in to help. "I started visiting the Urban Entomology Lab more frequently to learn about research and the experimental process," she said. "I felt like a child asking as many questions as I could."

Eventually, Dr. Koehler offered Holly a research position with a focus on ants. She jumped on the opportunity to learn about ant biology. She applied for the University of Florida's Institute of Food and Agricultural Science internship and dove into her first independent research project. The research subject was tawny crazy ant presence on different tree species during the year in relation to sugar presence (aphids),

and how ant presence correlates to the blooming season of the trees.

Not too long after Holly's work in urban entomology, a position at the United States Department of Agriculture LAB opened up as a biological science aid for Dr. Dan Kline, working with mosquitoes. "I got the job, which opened up a world of possibilities in medical entomology, through setting up experiments and maintaining colonies of different mosquito species," Holly said. "Diving into the mosquito realm made my passion grow exponentially for blood-feeding insects."

DRAFTING in the SLIPSTREAM

In 2013, Dr. Koehler pulled Holly into his office and asked what her intentions were for the future. "At the time, I thought I wanted to go to medical school, but I did not have a plan to get there," she said. Dr. Koehler expressed an alternative option — to further Holly's research and experience in urban entomology through a master's thesis project on bed bugs. When he talked to her about this position, she said, "I was ecstatic because I was not aware of different options other than medical school!"

As she grew up, Holly was asked every couple of years what she wanted to be, and the answer would change every time. "Most people name careers they are aware of, and my answers were doctor, lawyer, professional soccer player, musician, and/or engineer," Holly said. "I wanted to do it all."

This career question brought up some fear, because Holly did not want to choose the wrong path. "Fear was not something I was accustomed to," she said. "The opportunity to attend graduate school at the University of Florida not only changed my opinion and view on what I wanted to

Continued on Page 26



Employee Retention Value Consider an LTIP

NORMAN COOPER, John Corrigan and Dan Gordon

IF YOU are a PCO business owner you know how difficult it can be to find and retain employees in critical areas of the business, who become assets almost as valuable as the customer list and routes. Those prized and loyal team players can strongly contribute to enhance the company's value and reputation that you are likely expecting to sell at a premium to a potential buyer someday. Accordingly, employee retention is a critical aspect in managing a PCO business in a profitable and low-risk manner. Identifying your "key employees" (e.g., supervisors, sales, technicians, administrative) that merit additional retention efforts is the first step in the process.

Many PCO owners are hesitant to issue stock (if a corporation) or membership units (if a limited liability company) and formally make an employee a true owner, given that minority ownership interests impose fiduciary duties on the controlling owner. An employee will have certain rights under state law as an owner to review the books, records, and tax returns of the company and other rights like attending shareholder meetings and voting. To issue real equity requires thoughtful planning and formal legal documents to control and restrict what the minority owner can do with their equity, especially if they were to die, resign or get divorced.

In addition, if a well-intentioned owner is not deterred from the above issues and simply wants to gift 2–3% of the company stock, then tax issues arise that are always not fully understood. When there is an employer–employee relationship, the IRS says it is not a gift when an employer gives equity at zero cost or bargain price. Under IRC Sec.83, such a transaction is viewed as extra compensation to the employee in an amount equal to the value of the equity award so conveyed. Essentially it is as though the employer gave the employee a cash bonus and then the employee, in turn, purchased the equity at its then-current fair market value. The problem is that a valuation of the company (an added cost) is now needed to support the value

of equity being issued. Moreover, now the employee has to come up with cash from some other source to pay the taxes due on the value of the equity just issued.

As a result of the above headaches, many owners simply ignore the issue and try to give annual bonuses when cash is available due to a profitable year and give lip service to the concept of allowing for minority owners in the company. However, cash can be limited at times if profits are reinvested in new equipment, and putting stress on a business by reason of trying to share with employees usually results in employee expectations being disappointed when they see the size of the bonus check, if they get one, as compared to what they think their relative value to the business was for the year just closed.

Since your employees are valuable assets that can walk out the door — a liability as well — ask yourself how you can create a long term incentive plan, or LTIP, to entice employees that it is worth sticking around with you for the long haul instead of continuing the same old, same old. Giving employees another option instead of leaving for a competitor for higher pay or, alternatively, starting their own business (to be like you) is a worthwhile goal, as employees want to feel like owners. Adopting an LTIP for key employees can accomplish this. Basically, the LTIP would contain the following parameters:

1. No shares of stock or membership units are actually issued to an employee. Therefore, they are not an owner in the legal sense that has the fiduciary duty concerns and state law rights previously mentioned.

2. The employee receives a contractual cash-only award, also known as a Phantom Equity Award. Depending on the type of legal entity involved, these awards are sometimes called Phantom Stock, Phantom Units, or similar names to distinguish that it is not real stock or membership units involved. Regardless, the Phantom Equity has the same economic value as owning real equity in a company.

3. S-corporations have rules on no second class of stock, and the Phantom Stock does

not violate such prohibition. From an LLC perspective it is not a concern, as there are no such restrictions.

4. The LTIP would expressly provide that payment to the employee would only occur when the company is sold or the employee retires, whichever occurs earlier. Other trigger dates for payment could be death or disability. The LTIP can be flexible, depending on the goals of the owner.

5. Some LTIPs provide vesting over a period of years to ensure the employee sticks around to vest in the Phantom Equity awarded.

6. The LTIP could also provide for forfeiture of the award if the employee were to violate restrictive covenants, like quitting and soliciting customers. Now the employee has more to risk and makes the temptation to go to a new employer not as exciting unless it was for a big increase in wages.

7. If there is no plan to sell the company, then the employee is not going to be very excited about an award that only gets paid out when a sale of the company occurs. For such situations where families are seeking to transfer the business to the next generation, then the LTIP can provide that the employee gets a cash payment upon termination of employment, with a formula value for the company and payable over a period of years to ensure the company's cashflow is not adversely affected if a lump sum had to be paid when an employee resigned.

The LTIP puts employees on par with owners in terms of cashing in on the value being created, which employees are for sure contributing alongside the owner. The plan, if thoughtfully implemented, can reduce employee turnover as well as create a new excitement in the team that it is a business that is "one for all and all for one." **PP**

The authors are Directors of PCO M&A and Succession Planners, LLC, an affiliate of PCO Bookkeepers. For more information visit www.pcosuccessionplan.com or send us an e-mail at info@pcobookkeepers.com.

How to Control Horse Flies and Deer Flies

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When you hold the magic wand and walk through an area filled with horse flies or deer flies, they are attracted to the blue color rather than you. They get caught and die. It is a great way to keep horse flies and deer flies from biting you.

The deer fly species that was caught, *Chrysops vittatus*, is very common during spring and summer. **PP**



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UF Study Shows Nitrogen and Phosphorus Are Not Necessary Palm Nutrients Year-round



DR. TIM BROSCHAT

“Most palms do not need phosphorus to be healthy.”

New palm fertilizer recommendation expected to help preserve Florida's soil and water quality

GAINESVILLE, Fla. — A University of Florida scientist has developed a fertilizer for palm trees that should keep them healthy and reduce water pollution.

Environmental horticulture Professor Tim Broschat found that applying a palm fertilizer with no nitrogen or phosphorus could prevent the harmful effects of lawn fertilizers on palms.

“We also found that most palms do not need any phosphorus in their fertilizer to be healthy, and by not applying this element, we can eliminate one possible source of water pollution in Florida,” said Broschat, a faculty member at UF's Fort Lauderdale Research and Education Center.

Palms have special nutritional needs, including nitrogen and phosphorus,

to stay healthy and look their best. But those same nutrients can harm the soil and the water below the soil. So, scientists such as Broschat are investigating ways to balance the nutrient needs of palms while preserving water quality.

Broschat conducted his experiment from 2010 to 2013 at the Fort Lauderdale REC, part of the Institute of Food and Agricultural Sciences.

During heavy rainfall or irrigation, Florida's soils have very little capacity to retain nitrogen and phosphorus in the area of the soil around the plant that touches the plant's roots.

By using the palm fertilizer with no nitrogen or phosphorus during the rainy summer months and a regular palm fertilizer with these nutrients during other seasons, palms grew as well as when they were fertilized year-round using nitrogen and phosphorus-containing fertilizers, Broschat's study found.

Fertilizer is usually not a pollutant when it's applied to the landscape. But if the wrong kind of fertilizer is applied at the wrong time, it can wash off of the landscape and flow untreated into bays and streams. Broschat's fertilizer finding is critical because a state law limits the amount of nitrogen and phosphorus that people can put on their lawns.

Furthermore, some Florida counties do not let people use nitrogen or phosphorus fertilizers from June through September because they think these fertilizers could get into waters via storm water runoff and possibly harm coastal water quality.

Although Broschat conducted his experiment on areca palms, popular in Florida, the results should apply to all kinds of palms used in home and commercial landscapes, he said.

Broschat's study was published in the March issue of the journal *HortScience*. **PP**

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Holly Beard, Continued from Page 21

be, but it also changed my life.” She began discussing options with Dr. Koehler about future directions, and it became clear to her as time progressed.

Holly really enjoyed working as a teaching assistant responsible for three different classes. Sharing knowledge and passion for insects with other students was one of her most rewarding experiences in graduate school.

She also enjoyed the atmosphere in Dr. Koehler’s laboratory. “Having so many students working on different projects and insects really motivates everyone to work harder and be the best they can be,” Holly said. “Everyone always managed to prank each other or lighten the mood with good humor.”

“Dr. Koehler pushed me to grow into the individual I have become. His strong support and wisdom guided me to graduation this August 2015 and exposed me to the industry I intend on working in. He inspired me to focus on communication, and to learn to inspire those around me.”

BREAKING AWAY WITH BED BUGS

As a rising young graduate student, Holly was told she had to learn how to take care of chickens so the hosts of her bed bug colonies would be happy. “I grew up in a city, so even being close to chickens was very different than what I was used to,” Holly said. “Since my project focused mainly on bed bug feeding behavior, I would have to increase the amount of chickens the lab had to withstand the growth of my research.” Holly’s first task as a graduate student was to build a chicken coop.

Familiarizing herself with bed bug behavior was Holly’s next task at hand, and through observation, she eventually overcame her fear of bringing bed bugs home. “I have three roommates, so they would give me a hard time if I had any ‘accidents’ at work,” Holly said.

Her funniest — or worst — work experience was when she dropped a container of first-instar bed bug nymphs on her lap and couldn’t find them all. “I wanted to make sure I did not bring any bed bugs home, so before entering my house, I walked to my laundry room outside,” she said.

“I took off my clothes in my laundry room to throw into the dryer and realized I didn’t have any other clothes to put on. I tried to make a quick dash inside my house, but got caught in the process by all of my roommates in the common area as I walked inside. At that point, I explained myself to my roommates — after putting clean clothes on — and they were gracious of my cautiousness.”

Setting up experiments to show significance in bed bug feeding patterns was

difficult at times, but researching previous studies helped inspire the direction Holly wanted to take. Her first project evaluated development times and egg production through different bed bug feeding frequencies at different life stages. “First instar nymphs were given the opportunity to feed once or daily until molting occurred,” Holly said. “We observed a significant difference in the proportion of the population of first-instar nymphs that molted on Day 10 of the experiment.”

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This applies to current applications because first instar nymphs have the lowest chance of survival — they have a high surface area when compared to their volume and may dry out. Since first instars are most susceptible to starvation, it is critical this stage has an opportunity to feed more than once for maximum survivability.

Having access to a host daily allows the entire population of bed bugs to molt, allowing for increased survivability, hence a faster increase in population size. In Holly's experiments, adult bed bugs were given the opportunity to feed daily or once a week for three weeks. Egg production and weight were observed in the individual male and female bed bugs to establish a graph for how much blood it costs to produce eggs. Egg size was analyzed as well to see if nutrition could affect egg size. "These experiments are foundations for future experiments to look into the entire life cycle based on a difference shown from the proportion of nymphs that molted from first to second, and adults feeding under different frequencies," Holly said.

Holly's second project focused on the relationship between relative humidity and bed bug feeding frequencies to further look at timing of meals based on the environment each bed bug was placed into. "We observed weight differences as well as molting times of fifth instar nymphs to adults," she said. "This correlates to the many different relative humidity environments around the world and evaluated nutritional intake in bed bugs."

Holly had some unsuccessful experiments and ideas that were discouraging and challenging at points. "The hardest thing I had to overcome in graduate school was failure," Holly said.

Ultimately, though, learning how to think critically and see the flaws in her idea allowed her to develop a better idea. "My successful experimental designs proved something different than what has been shown through current bed bug research," she said. "Dr. Koehler, Dr. Pereira, and the other students in the laboratory offered multiple avenues for support, and really encouraged a teamwork type

of environment, even though we are all working on our own independent projects. Sharing ideas and knowledge is an amazing foundation to the learning process."

SPRINTING ACROSS THE FINISH LINE FOR THE WIN

After she graduates in August, Holly looks forward to continuing her work in the field of urban entomology. "I am looking for positions that have a little taste of everything," she said, "Managing projects, evaluating products, communicating ideas, and developing relationships within the pest management industry."

Holly hopes to stay involved with racing as much as possible, and she just received a travel offer she can't refuse. "Cycling is how I express myself outside of my career. It allows me to exercise higher levels of mental toughness to overcome obstacles," she said. "After graduation I plan to take my bike on a month-long journey, racing in Belgium." **PP**

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Bustin' Out The Bugs

THE UNIVERSITY of Florida campus recently hosted Bug Week 2015, with various online and campus activities for students of all ages and their families. Even UF President, Dr. Kent Fuchs, joined in, handling (or being attacked?) by some creatures.

“Bugs are serious business in Florida,” said Jack Payne, UF senior vice president for agriculture and natural resources. “Learning about bugs, though, should be fun. That’s why we have Bug Week.”

Bug Week 2015 was May 18–23, but the Bug Week website at <http://bugs.ufl.edu/> still provides access to many interesting activities and facts. UF/IFAS has a number of online resources to explore including bug photos, feature stories, and the popular “Bug of the Day” and “Bug Word of the Day” items. Citizen science projects — in which anyone can participate — are spotlighted on the website, along with videos about everything from ants and butterflies to spiders and ticks.

UF/IFAS also encouraged people to post their best bug photos and — new this year — photos of original artwork during Bug Week on the UF/IFAS Facebook page, Twitter, or email them to socialmedia@ifas.ufl.edu. Facebook users were encouraged to change their profile pictures to their favorite insect for the week. Teachers and parents can still find fun and engaging lesson plans for all grade levels in the “Resources” section of the Bug Week website.

Also on the website, you’ll find information on UF/IFAS’ Department of Entomology and Nematology, the kinds of things their scientists study and

even information on how to become a scientist. The UF/IFAS Bug Week Scavenger Hunt occurred May 23 at The Florida Museum of Natural History and Samuel P. Harn Museum of Art, and participants followed clues posted on the website.

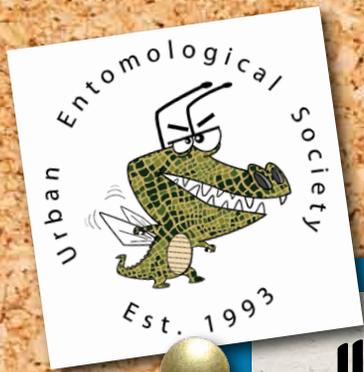
“Humans have a complicated relationship with bugs. On the one

hand, some species spread disease and threaten the existence of our citrus industry, but they also pollinate our crops and help us gauge the health of our environment,” Payne said. “We hope people will take advantage of our expertise so they can better protect themselves against bug threats and more deeply appreciate the benefits of bugs.” **PP**



University of Florida President Kent Fuchs joins in the fun during Bug Week 2015.





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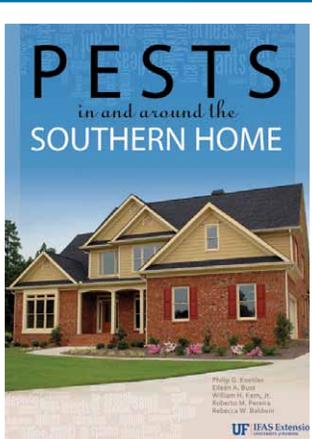
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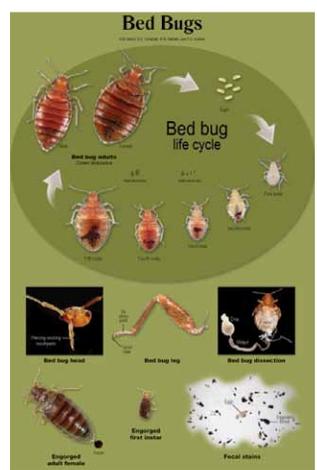
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