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Managing Director

Philip Koehler (352) 392-2484
pgk@ufl.edu

Managing Editor

Roberto Pereira (352) 392-2485
rpereira@ufl.edu

Production Editor

Jane Medley (352) 871-1809
medleyuf@gmail.com

Advertising Manager

Lisa Ashley (850) 832-2101
lisa@fusionflorida.com

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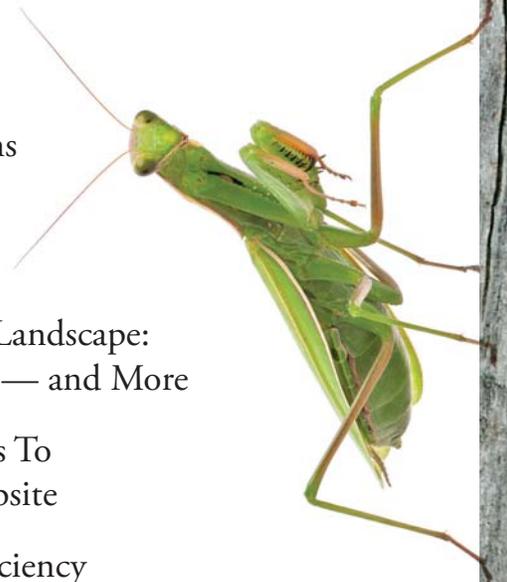
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ON THE COVER

More than ever, cats and dogs are part of the family — but topical flea treatments are failing. Successfully fight the fleas, and you can win your customers' hearts.

Scanning electron micrograph of a flea by Nancy Hinkle



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PestPro Magazine

Your Partner in Moving the Industry Forward

PESTS HAVE REALLY started to pop up all over the place now that summer has arrived. This is the time of year when pest control businesses thrive. People are calling about all kinds of pests. Formosan termites are swarming. Fleas are jumping. Weeds are growing. Ants are crawling. Mosquitoes are biting. Wasps are stinging. What a great time to be in the pest control business. If you take a vacation now, you will miss all the fun and profit.

Hopefully your company is ready for all the business. Do you realize that Florida's population is now almost 20 million residents? Between 2010 and 2014 there was a 5.8% growth in Florida's population. If your business is not growing at the same rate as your customer base, perhaps it is time to think about new approaches to your business. After all, you are in pest control paradise. The pests are thriving, and the number of potential customers is growing. Your company is not keeping pace if its accounts and revenue have not grown at least 6% since 2010. With the median family income at almost \$50,000, people have money and can afford your service.

Pest control should be done by pest management companies. The problem is that almost 50 percent of the population does not use a professional for pest control. For small problems, 74 percent of our residents use over-the-counter pesticides. When they have a large problem, or don't want to take care of it themselves, 54 percent will use a pest control service. The industry has the knowledge and skill to provide good pest control. Your job is more than spraying. It is selling your knowledge and experience.

PestPro magazine and the University of Florida Urban Entomology Laboratory are dedicated to moving the industry forward



Alex Catalano, UF/IFAS

Roberto Pereira, left, and Phil Koehler encounter the two ant statues installed at the Florida Museum of Natural History in early July. The giant bronze ants, known as "X" and "O," weigh 1,100 pounds each. The ants are a temporary installation by artist Susan P. Cochran.

by providing the industry the information needed to move from a "spray service" to an integrated pest management service. Part of that movement is emphasizing customer communication. Your customers don't want more pesticide applied, they want solutions to their pest problems. Some may not even want much pesticide around them, so you may want to offer special services to different segments of the consumer population.

The industry is evolving to be more specialized in providing service. We first saw that specialization with the fumigation part of the industry. Companies in South Florida started subcontracting work to fumigation specialty companies. Now you can see that

specialization spreading to other segments of the industry. Wildlife removal services are often provided by specialty companies now. Bee and wasp removal is being provided by specialists. Mosquito control will move from government to pest control companies in the same way.

Remember when doctors were general practitioners? It didn't matter what ailed you, the doctor treated it. Now if you have a sore throat you go to an ear, nose and throat doctor. If you have a skin rash, you go to a dermatologist. The industry will need to specialize for the pest problem. The general pest practitioner will refer or subcontract a specialty company to provide the needed service.

Along with specialization in the industry, there will be a need for more specialized technical information for the industry. The number of sources for technical information is dwindling, and this is no different than what has happened to the news media. As information has moved to the Internet, printed information sources have evaporated into history. *PestPro* is a major conduit

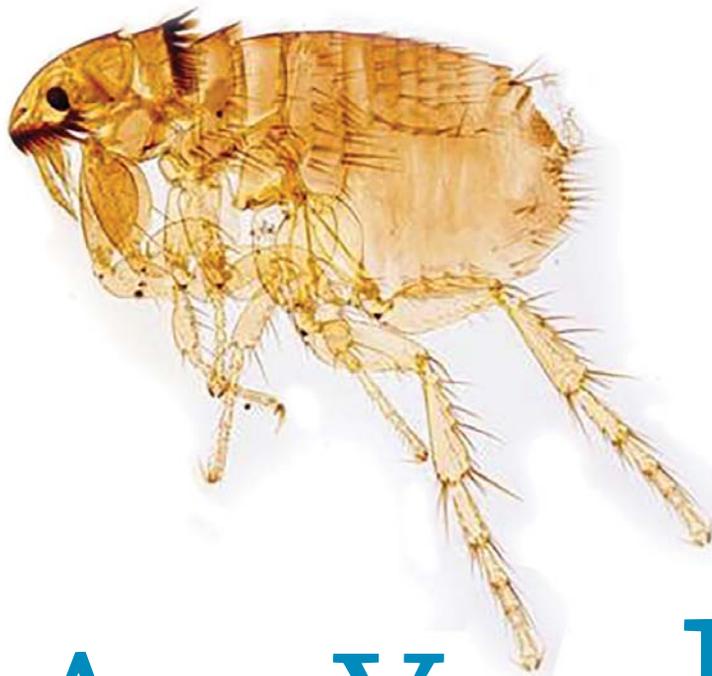
of information from researchers to the pest control industry.

PestPro is also available through a web site: PestProMagazine.com. Visit our website, where there is an archive of past issues. You can look at the *PestPro* issues, print off some of the articles as training for your employees, and explore features we will be adding soon. While there, you may want to send us suggestions, criticisms, or just drop us a line to say hello. In the next few weeks and months, we hope to expand *PestPro* services to the industry with the support from our founding partners and advertisers. **PP**

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

Fleas Are Back ...





Flea control is a great way to get to the hearts of your customers. Your service not only protects them from fleas, but it also protects their beloved pets and family members.



Are You Ready?

Philip G. Koehler and Roberto M. Pereira

CATS AND DOGS have become a part of your customer's family, and the biggest problem pets have on a consistent basis is cat fleas. Cat fleas attack both cats and dogs, and have been found on more than 50 species of animals. That doesn't mean that they can suck the blood and successfully reproduce on these animals. It just means that they can jump onto them and hitch a ride from a neighbor's yard to your customer's yard. For instance, a squirrel may be jumping around a neighbor's yard, and a flea will hop onto the squirrel, which then carries it into your customer's yard, where it can later infest their dog and start a huge infestation.

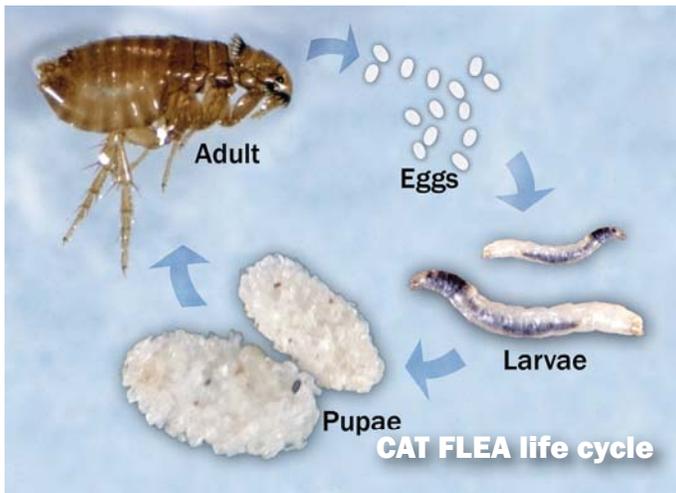
These days, people not only love their pets, they love the wild animals around their houses. There has been an explosion in the populations of raccoons and possums, which are also satisfactory hosts for cat fleas. That is why there are lots of flea complaints from people who have no pets. They have these wild animals living outside their house or office, and fleas jump onto them when they walk from their car to the building. Then they have

fleas attacking them inside. Because fleas cannot successfully live on people, they bite, but they use all their energy jumping and moving rather than producing eggs. The solution to this situation is to recommend wild animal removal. If your company does not usually do animal removal, you may want to subcontract that service to a specialist. Animal removal is better left to companies that have the equipment, personnel and experience to deal with the multiple aspects of this task.

Flea control is mainly based on understanding the life cycle of fleas. The flea life cycle starts with the egg stage. Fleas lay their eggs on the host cat or dog. Because flea eggs are not "glued" to the animal as lice eggs are, they readily fall off when the animal grooms or scratches. Animals that are bitten by fleas scratch because flea saliva is highly irritating. In fact, it is considered one of the most irritating compounds known to man.

When the pet scratches due to the irritation of the flea bite, it causes the eggs and adult flea feces to fall off the animal at the same place. Eggs and flea feces accumulate mostly in places where the pet





molt to the 3–5 mm long third stage.

Over the years, there has been a lot of argument about what the flea larvae eat. They usually feed on adult flea feces, which is basically dried blood. The adult flea feces are dark red or brown and are often deposited as coils, or spherules. The adults produce lots of feces, which

blowing onto the cocoons. The vibration of the air, the warm breath, and carbon dioxide was all it took to get thousands of fleas to emerge simultaneously. This same stimulation occurs when you walk into a room with flea pupae. The adults will emerge and jump onto a host almost immediately.

When people move their pet to a new residence, or if the pet dies, the flea larvae left behind will develop into pre-emerged adults and wait for a host. These pre-emerged adults are inside the cocoon and protected from any treatments that might be put out by a technician. No matter what is done, these fleas will continue to jump onto new residents for up to four months until the supply of pre-emerged adults is exhausted. These pre-emerged adults, and the protective walls of the cocoon, are a major cause of failure for flea treatments.

spends most of its time. For instance, a cat sleeps 80 percent of the time, and eggs and feces accumulate where the animal spends most of its time sleeping. We found that when the cat jumped down from its resting place, there was an area of about 2 square feet where the flea eggs fell and started development. That location is the most important place to target when controlling fleas. Technicians need to ask the homeowner to direct them to the place where the animal rests and deposits flea eggs so they can target those areas for treatment.

A Prolific Pest

Fleas lay about 25 to 40 eggs a day. They also take about 20 blood meals a day, so we assume that they are pooping that many times. Back a few years ago when we still had a flea colony in the laboratory, we had one cat from which we got about 10,000 eggs in one day. That means that there was probably an infestation of about 250 to 400 female fleas on the cat.

One infested animal can produce a major infestation in a short period of time. Those eggs will hatch in about two to five days, depending on the conditions. We found that the eggs will survive and hatch year-round outdoors in Florida, even in the winter months. Florida is flea egg heaven.

Flea larvae develop inside the deposited egg. They rotate around the inside of the egg and use an egg burster spine on their heads to slice open the egg and emerge. The larvae are 1-2 millimeters long as first-stage larvae. They molt to second stage larvae that are 2–3 mm long, and then

is probably a form of parental care. It is not formally considered proctodeal trophallaxis — feeding on feces from the adult — but in reality that is probably what is happening. The eggs and feces are deposited at the same place, and the larvae consume the feces as their main source of nutrition. Larvae can also feed on skin pieces and spilled dog or cat food. So it has been reported that they feed generally on organic debris, though most of that organic debris is mostly flea feces.

Understanding flea larval food is critical to understanding where and when fleas are prevalent. Flea feces are water soluble. When you wash an infested animal with a thick fur coat, the abundance of flea feces in the fur will turn the wash water red. Feces dissolved in water are no longer available for larvae to eat. Florida's heaviest outdoor populations of fleas are usually seen during our driest months — February through May. That is because during the dry months, rain does not dissolve the flea feces, and the larvae have a great source of nutrition.

Mature flea larvae pupate before turning into the adult stage. The larvae migrate to a dry location for pupation and spin a silken cocoon. The cocoon is covered with debris from their surroundings. It is really difficult to find the cocoons because they are so well camouflaged. It takes about one to two weeks for the adult to develop inside the cocoon. These pre-emerged adults can wait inside the cocoon for months until they are stimulated to leave the cocoon and jump onto a host. In the lab, we used to stimulate fleas to emerge by

Fleas Breed Complications

The adult cat flea spends its entire life on the host. Rodent fleas leave the host and hide in the rodent burrow. But cat fleas have evolved to stay with their host, which in the wild is a free-ranging animal that is not tied to a burrow. Adult male fleas are about 2–3 mm long, and females are about 4 mm long. Adult fleas are flattened laterally, so they can move adeptly through the fur and evade grooming by the animal. However, some pets are better groomers than others. Cats, for instance, have special hairs on their tongues to lick off fleas. They can ingest these fleas. If the fleas have tapeworm stages inside them, the cat or dog will get a tapeworm infestation from the fleas.

When fleas bite the host, they have short mouthparts and inject very irritating saliva. The proteins in the saliva can cause an allergic reaction in the pet. That allergic reaction is called flea allergy dermatitis, or FAD. FAD can cause animals much more irritation than the flea bite that caused the disorder. Bacterial infections of the skin can then occur. In severe cases of FAD, the animal can shed most of its fur and the pet will have bald spots. Most topical flea treatments are designed to kill fleas quickly, but a single flea bite can cause a cascade of immunological responses that end up with FAD.

How to Control Fleas

There are several important techniques for controlling fleas that can be used by pest control companies. Your customer needs to know that you will not apply topical treatments to pets. That is a job for veterinarians or the pet owner. Do not apply any of your insecticides to the pet. First, you do not want to harm the pet with your treatments. Second, insect growth regulators like methoprene and pyriproxyfen can be applied to the entire pet living area. These growth regulators are available in trade names like Precor, Ultricide, Nygard, and Archer.

Methoprene is a great product for flea control indoors. It is not photostable, so it breaks down in sunlight. Therefore, outdoor applications can be problematic. However, methoprene can be applied to flea breeding areas to prevent the larval fleas from turning into adults. Killing the larval fleas is important not because they cause problems, which they do not, but because they will eventually turn into

adults — which cause great discomfort to pets and humans and can even transmit some diseases. Pyriproxyfen is photostable and can be applied both indoors and outdoors. Pyriproxyfen is very stable in the environment. Years ago, we were able to prove that it will kill fleas up to seven months after application, even when exposed to sunlight and rain.

FINALLY, a residual spray can be applied to kill fleas that are currently in the house or yard. Permethrin or esfenvalerate are products registered for carpet/floor treatments. However, flea resistance to these pyrethroid insecticides is prevalent. Often, pyrethroid resistance can be overcome by tank mixing a synergist (piperonyl butoxide, PBO) into the sprayer. Synergists like Zenprox, Kicker or Exponent are good additions to the residual products normally applied to infested indoor and outdoor areas.

Read the label carefully for the locations that may be treated for flea control.

For instance, permethrin (Dragnet) has rather liberal label language allowing broadcast application to areas such as rugs, carpets, pet beds, pet resting surfaces, and crawl spaces. Label directions include treatment of upholstered furniture by applying the product between and under cushions. Of course, these treatments should be particularly made to areas most frequented by pets. Additionally, borate dusts can be applied to pet bedding and pet resting places so the flea larval food is contaminated. Borate products, like Borid, are labeled for application to carpets and pet bedding.

The flea control business is back. Are you ready? The topical treatments made to the pets are starting to fail. Your customers love their pets and want to do anything to protect them. Be ready to provide a service that will protect your customers, their children, and their pet family from flea attack. This is a great way to grow your business. **PP**



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Zoysiagrass For Florida Lawns

J. Bryan Unruh, Laurie Trenholm and John Cisar

Floridians finally have several good types of zoysia from which to choose. Like any grass we grow in Florida, each variety has its own challenges such as weeds, insects and diseases.

ZOYSIAGRASSES (*Zoysia* spp.) were introduced into the United States from Asia and provide attractive turf throughout much of the United States. In recent years, dramatic improvements in zoysiagrass have been made by turfgrass breeders. These improvements include insect resistance, accelerated establishment, and overall performance. Zoysiagrasses are adapted to a variety of soil types and have good tolerance to shade, salt and traffic. They provide an extremely dense sod that resists weed invasion, but certain pests can be problematic. Zoysiagrass maintenance is different from that of other Florida lawn grasses. When improper maintenance practices are followed, undesirable results are likely to occur.

SPECIES and CULTIVARS

Several species and varieties of zoysiagrass are used for residential and commercial landscapes, athletic fields, and golf course tees, fairways, and roughs. They vary widely in leaf color, texture and establishment rate.

Proper lawn maintenance practices are the best means for avoiding pest problems and maintaining a healthy lawn. Zoysiagrass requires inputs of fertilizer to maintain good cover and healthy growth characteristics. During certain times of the year, it may require supplemental irrigation, especially during periods of extended drought, to remain green. Pesticides may be needed periodically, but their use can be minimized if other cultural practices such as mowing, irrigation and fertilization are done correctly.

SPECIES

Zoysia japonica

This species was introduced into the United States in 1895 and is commonly called Japanese or Korean lawn grass. Cultivars from this species are generally coarse-textured grass with hairy, light green leaves. Of all the zoysiagrasses, this species has a faster growth rate and exhibits excellent cold tolerance. *Zoysia japonica* is the only zoysiagrass for which seed is commercially available. However, the seeded varieties generally do not produce as high-quality turf as do the vegetatively propagated (sodded or plugged) varieties. They can be used for lawns or general turf areas where convenience of establishment by seed is more important than quality.

Zoysia matrella

Also called Manilagrass, this species was introduced into the United States in 1912 from Manila. It produces a finer and denser turf than *Zoysia japonica*, but is less winter hardy and slower growing. Manilagrass resembles bermudagrass in texture, color and quality and is recommended for a high-quality, high-maintenance turf where a slow rate of establishment is not a disadvantage.

Zoysia tenuifolia

Also called Mascarenegrass or Korean velvet grass, this species is the finest-textured and densest zoysiagrass available. It has good wear tolerance but poor cold tolerance and is only adapted to the central and southern areas of the state. It also produces an excessive thatch, giving it a puffy

appearance. This species is often used for low-growing, ornamental specimen plants, especially in Asian-themed gardens.

CULTIVARS

Although information is available on the Internet about a number of zoysiagrass varieties, only a few are commercially available in Florida. Based on research information and anecdotal observations, the following is a summary of what to expect.

De Anza

De Anza is a medium- to small-leaf zoysiagrass patented by the University of California in 1995. It has good shade and drought properties and retains color longer than most zoysiagrasses during the fall. 'De Anza' ranked favorably in the National Turfgrass Evaluation Program (NTEP).

Diamond

Diamond is an improved *Zoysia matrella* that is vegetatively propagated. It was released from Texas A&M University in 1996. 'Diamond' is distinguished from other zoysiagrasses by its fine texture and excellent salt and shade tolerance. It performs best when mowed at a height of ½ inch or less. In fact, 'Diamond' has been planted on several experimental golf greens mowed at ¼ inch or lower. Like other zoysiagrasses, it has poor cold tolerance, which may limit its use in northern parts of the state, and it is highly susceptible to tropical sod webworms.

El Toro

El Toro is an improved *Zoysia japonica* released in 1986 from California. It has a faster establishment rate, improved cool-season color, better cold tolerance, and less thatch buildup than 'Meyer' zoysiagrass. 'El Toro' is also reported to have early spring green-up, more shade tolerance, and improved resistance to rust disease. 'El Toro' performed well in the NTEP trials conducted in Gainesville, Florida, and the greater Pensacola, Florida, area from 1997–2000.

Emerald

Emerald zoysiagrass is a selected hybrid between *Zoysia japonica* and *Zoysia tenuifolia* developed in Tifton, Georgia, and released in 1955. This hybrid combines the winter hardiness, color, and faster growth rate of one parent with the fine texture and density of the other parent. 'Emerald' resembles Manilagrass in color, texture, and density, but is faster spreading and has a wider adaptation. 'Emerald' zoysiagrass is highly recommended for top-quality lawns where time and money allow for adequate maintenance. 'Emerald' produces an excessive thatch layer and is susceptible to dollar and leaf spot. Large (brown) patch disease also can occur.

Empire

Empire is a cultivar that is gaining popularity in Florida. It is similar in texture to 'El Toro' and has a very dense growth habit. It maintains a nice green color and, compared to other new zoysiagrass cultivars, it has a moderate rate of establishment. 'Empire' has performed well in sandy and clay soil types with aggressive growth from its stolons and rhizomes, but it can be mowed with a standard rotary mower due to its broader leaf and open growth habit. It does not do as well in shade as other zoysiagrass cultivars. 'Empire' is being planted in numerous communities in Florida and seems to do well in many areas throughout the state. However, it is susceptible to large (brown) patch disease.

JaMur

JaMur is a medium coarse-textured cultivar that has performed well in many areas and is now produced in limited quantities in Florida. It has a very attractive color and does well in moderate shade. 'JaMur' has an excellent rate of establishment, performs well at normal home lawn mowing heights, and can easily be mown with a rotary mower. It is susceptible to large (brown) patch disease.

Meyer

Meyer (Z-52, Amazoy[®]) has been in use since the 1950s and is often seen in ads as the "miracle grass." It is very slow to establish, and hunting billbugs and nematodes pose serious problems with 'Meyer', limiting its use in Florida. 'Meyer' zoysiagrass performed very poorly at the Florida locations of the NTEP trial conducted from 1997–2000, and its use in Florida is discouraged.

PristineFlora™

PristineFlora™ is a *Zoysia matrella* cultivar released by the University of Florida. It is recommended for use in high-maintenance situations, including high-end home lawns. This variety is fine textured, extremely dense, and has a dark green color. 'PristineFlora™' does not produce seed heads as prolifically as other fine-textured cultivars, such as 'Emerald' or 'Diamond'. 'PristineFlora™' is similar in appearance and maintenance to 'Diamond'. However, it has a much faster rate of growth and recovers more quickly from scalp damage.

UltimateFlora™

UltimateFlora™ is a *Zoysia japonica* developed by the University of Florida. It has a similar leaf texture and upright growth habit to 'Meyer', but it has a faster rate of spread and better adaptability for use in Florida. This cultivar is used for home lawns and was selected for the lawn at the Birmingham Home & Garden

Inspiration Home in Vestavia Hills, Alabama, and at the 2006 New Southern Home in St. Cloud, Florida.

Zeon

Zeon is a fine-textured *Zoysia matrella* that has performed well in Florida, though its availability is limited in the state.

Zenith

Zenith zoysiagrass is one of the few commercially available seeded varieties. Generally, the seeded cultivars do not perform as well as the vegetative cultivars. 'Zenith' zoysiagrass is dark green and medium textured.

Zorro

Zorro is a fine-textured *Zoysia matrella* released by Texas A&M University. 'Zorro' establishes well, has good shade tolerance, and is easier to mow than some fine-textured cultivars. This turf performed moderately well in Florida in the 1997–2000 NTEP trial.

MAINTENANCE OF ZOYSIAGRASS

Nutrient Management

Proper fertilization is very important for sustaining a healthy lawn. Fertilization and other cultural practices influence the overall health and quality of the lawn and reduce its vulnerability to numerous stresses, including weeds, insects, and disease. A soil test should be done to determine soil pH and what nutrients are available to the lawn. Since many Florida soils are high in phosphorus, it is often not necessary to add phosphorus to a lawn once it is established.

As a general rule, the first fertilizer application of the year should be early April in Central Florida and mid-April in North Florida. In South Florida, fertilizer applications may be made throughout the year since growth is year-round. UF/IFAS guidelines for lawn grass fertilization offer a range of fertilizer rates over which a particular species may be successfully maintained in the various regions of the state. These ranges account for individual homeowner preferences for low-, medium-, or higher-input grass.

Localized microclimatic effects can have a tremendous impact on turfgrass growth. A range of rates allows for these environmental variations. An example of this would be a typical home lawn that is partially shaded and partially sunny. The grass growing in the shade needs less fertilizer than that growing in full sun. Fertilization is also affected by soil type, organic matter in soils, and practices such as clipping management. Recycled clippings provide some nutrients back to the turfgrass and may reduce the need for fertilizer inputs.

A newly sodded lawn on a sand soil with no organic matter requires more fertilizer than



Sutichak, iStock Photo

Laying sod produces an instant lawn.

a lawn that has been fertilized for years. In Florida, new homes and new developments may be next to much older developed landscapes, and a one-size-fits-all approach to fertilization is not reasonable. Thus, the guidelines provide a base range from which the end user can begin a fertilization program. The homeowner is encouraged to initiate a program based on these guidelines and to adjust it over time based on how the turfgrass responds.

Zoysiagrass responds better to a “spoon-feeding” fertilizer regimen of smaller quantities applied more frequently rather than supplying larger quantities infrequently. UF/IFAS

recommendations state that zoysiagrass should receive three applications a year in North Florida and six a year in South Florida, in most situations. Research suggests that new cultivars of zoysiagrass can persist on less nitrogen, and the UF/IFAS recommendations for zoysiagrass are under review. Avoid applying nitrogen fertilizer simply to promote green color. Instead, monitor growth and apply only when the growth rate has dramatically declined. Potassium nutrition also is important and should be applied at rates equal to nitrogen. During excessively rainy periods, potassium may need to be applied more frequently due to its leaching ability.

Since zoysiagrass is very slow to green up in the spring, avoid applying fertilizer until after the turf has become fully green to avoid premature green-up, which is prone to frost injury. This is especially important in North Florida, where late spring frosts may damage the grass. Delaying spring fertilization until the turf is actively growing and can use the fertilizer also reduces the potential for nitrogen leaching from fertilizer. Likewise, don't fertilize too late in the year, as this can slow regrowth the following spring. An application of iron can enhance spring green-up. Applying nitrogen on zoysiagrass in early spring and late fall significantly increases the risk of large (brown) patch disease.

On high-pH (> 7.0) soils or where high-pH water is applied, yellow leaf blades may be an indication of iron or manganese deficiency. Application of soluble or chelated sources of these micronutrients can provide a green-up due to elevated pH.

For iron deficiency, spray ferrous sulfate at a rate of 2 ounces in 3–5 gallons of water per 1,000 square feet, or a chelated iron source — referring to the label for rates — to temporarily enhance color. Iron applications every six weeks help maintain green color and, unlike nitrogen, do not promote excessive top growth.

Note that iron is not a substitute for nitrogen, which provides the building blocks for turfgrass growth and is required for turf health. While both iron and nitrogen deficiencies result in yellowing of turfgrass, they are distinctly different deficiencies in plants. Applying iron does not cure yellowing due to nitrogen deficiency, and iron fertilizer is not a substitute for nitrogen fertilizer. Foliar iron fertilizers, such as iron sulfate or chelated iron solutions, help cure iron deficiencies, and nitrogen fertilizers applied according to BMPs cure nitrogen deficiencies.

Mowing

If fertilized as recommended, zoysiagrasses require frequent mowing during the summer to look their best. Medium- to coarse-textured zoysiagrasses should be mowed weekly, or when they reach a height of 3–4 inches. They should be mowed at a height of 2–2.5 inches with a rotary mower. Fine-textured zoysiagrasses maintained at heights below 1 inch require more

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frequent mowing. Because zoysiagrass leaves are very coarse, they can be quite difficult to mow. Clippings should be left on the ground after mowing. They do not contribute to thatch buildup, as is often assumed, but are actually readily degraded by microorganisms. A sharp, well-adjusted rotary or reel mower should be used.

Watering

Zoysiagrass responds to drought by turning brown and going dormant in a short period of time (within a week under typical drought conditions). In the absence of rain or irrigation, zoysiagrass stays dormant for extended periods of time. Once irrigation or rainfall resumes, zoysiagrass will regain its green color.

Irrigating on an “as-needed” basis is the best way to water any established, mature grass as long as the proper amount of water is applied when needed. Irrigation is needed when leaf blades begin to fold up, wilt, or turn a blue-gray color, or when footprints remain visible after walking on the grass. Apply ½–¾ inch of water per application. This applies water to roughly the top 8 inches of soil, where the majority of the roots are. Be sure to follow any local watering restrictions.

To determine application rates of a sprinkler system, place several straight-sided cans throughout each irrigation zone. Run each zone to determine how long it takes to fill the cans to the ¾- or 1-inch level, then record the time. Each zone will likely take different amounts of time to give the same quantity of water. The recorded run times for each zone should then be programmed into the irrigation clock for automated systems. If the variation in the catch cans is great, a more thorough audit of the irrigation system is needed. Irrigation frequency should change seasonally, with less water needed in the fall and winter. Do not adjust the amount applied, just the frequency.

Thatch Management

Zoysiagrasses typically develop a thick thatch layer in the years after establishment—especially when overfertilized with nitrogen. This thatch must be controlled or removed mechanically to maintain a uniform grass appearance. This is most often done using a vertical mower or core aerator every year or two. Some have noted that scalping, during or shortly after spring green-up, helps reduce thatch buildup. One of the most important methods of reducing thatch buildup is to keep nitrogen fertility at the recommended levels. Proper mowing heights also help prevent thatch buildup.

Pest Management

Like other lawn grasses grown in Florida, zoysiagrass lawns encounter pest problems. Periodic control of one or more of these problems is necessary to grow a healthy turf.

Continued on page 26



Photo by Marshall Heden

Thorn Bug

Lynn Griffith

THE INSECT WORLD is full of examples of deceit and deception. A prime example of this is the thorn bug, *Umbonia crassicornis*. This insect has evolved to look very much like the thorns on a rose bush. This appearance enables it to both hide from predators and make it less attractive. The thorn bug is known in Florida since 1843. Hosts of the thorn bug include *Hibiscus*, shaving brush trees, acacia, jacaranda, royal poinciana, holly, tamarind, Australian pine, pigmy date palms, citrus and avocados. Thorn bugs inhabit all of Central and South America, as well as southern Texas. Their Florida range extends from extreme southern Dade County up to the Tampa area and to Winter Haven and beyond.

Thorn bugs can damage trees and shrubs by sucking sap from twigs. The insects also cut twigs in order to lay their eggs, which hatch in about 20 days. It is not unusual to see 15 to 50 young thorn bugs being tended by adults. Feeding can cause honeydew and sooty mold in some situations. Adults can be found any time of year in Florida.

Adult thorn bugs are about half an inch long and somewhat variable in color, from yellow to green. The females form a sharper thorn on their backs, while the males have more of a curved thorn. Damage from these insects is usually relatively minor, though in some cases young trees can be virtually defoliated. While generally not necessary, chemical controls would be similar to those of other sucking insects. **PP**

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



Around Casey Parker, Mosquitoes Don't Stand A Chance

This is a young Gator with a mission: To help stamp out mosquito-borne diseases worldwide

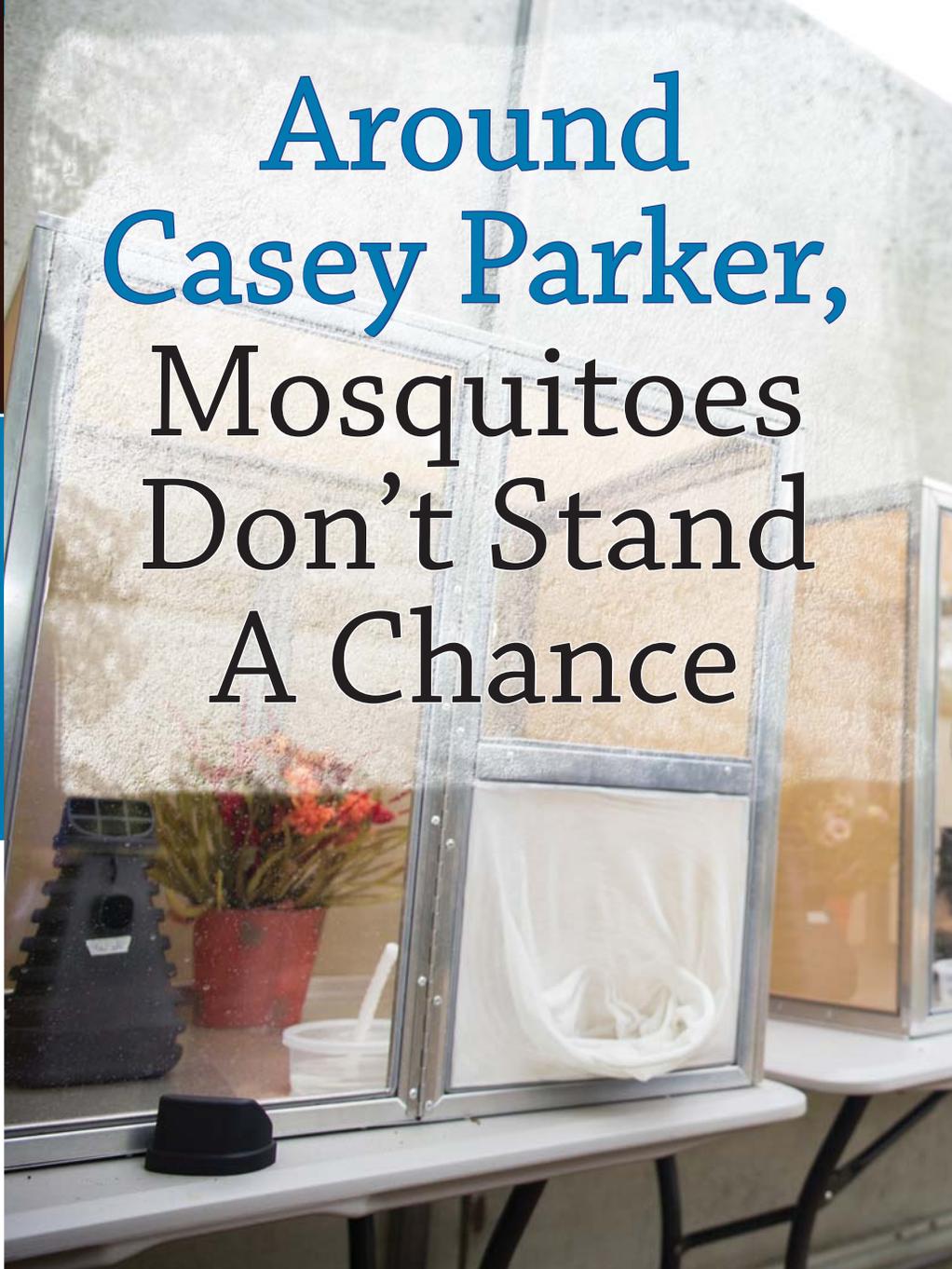
CASEY PARKER arrived at the University of Florida in 2010 hoping to become a pharmacist. She had no idea what that entailed, what courses she needed to take, or what she needed to do to get ahead.

"After taking one semester of chemistry courses, I realized that pharmacy school was not what I truly wanted to do," Casey says. "That semester I was also taking the course *Bugs and People*, and this is what sparked my interest in entomology."

Casey was really interested in insects and their impact on our world. She grew up on a horse farm in Ocala, Florida, so a major in biological science made a lot more sense to her than a major in chemistry.

After Casey realized she was into bugs, she changed her major. "I started taking entomology classes and ended up working in the Urban Entomology Lab with Dr. Koehler and Dr. Pereira," Casey says. "They taught me what science really was and how to do meaningful research."

Casey enjoyed numerous opportunities to advance her academic career while working in the Urban Lab as an undergraduate. "I conducted research, attended conferences, networked with industry professionals, gave a TON of presentations, and even got to study abroad in Greece," she says. Her undergraduate experience in the Urban Lab convinced her that she needed to continue her education after completing her bachelor's and pursue a master's degree in medical and veterinary entomology.



Casey is entering the second year of her master's degree and is working on a novel lethal ovitrap for control of disease-transmitting mosquitoes like the yellow fever mosquito, *Aedes aegypti*, and the Asian tiger mosquito, *Aedes albopictus*. She hopes to finish her master's degree in the summer of 2016 and continue on to a PhD, also in medical and veterinary entomology.

Q&A WITH CASEY

What does your research focus on?

My master's project focuses on the use of a novel dual-action lethal ovitrap for control of the container breeding mosquito species *Aedes aegypti* and *Aedes albopictus*. The trap was created here in the urban entomology lab with other collaborators. It incorporates an adulticide, a larvicide, and a polymer. The

polymer allows the pesticide to be released slowly over time. This makes the trap long lasting and cost effective. I am testing the efficacy of this trap and my hope is that we will achieve EPA registration and the trap will be available to consumers.

What is the greatest piece of advice you ever received from Dr. Koehler?

I think the most valuable thing that I have learned from Dr. Koehler is the importance of being well rounded. I love public speaking and interacting with industry members, but Dr. Koehler has showed me how to improve my writing and research skills, which were quite underdeveloped when I entered his lab. Oftentimes, people choose to focus and work very hard on the things they are good at and neglect things that need more attention.



Far left: Casey's dynamic presentation earned her the grand prize in the OneWorld event sponsored by Syngenta and the Challenge 2050 Project.

Immediate left: Casey makes life miserable for a few mosquitoes soon to be caught in the ovitrap device she helped develop at the UF Urban Entomology Lab.

made me the person I am and have never failed to be by my side.

How do you expect your research to impact the pest control industry?

After the trap has been successfully registered with the EPA, my hope is that the implementation of the novel dual-action lethal ovitrap will reduce the population of disease-transmitting mosquitoes like the yellow fever mosquito and the Asian tiger mosquito. This decrease in the mosquito population will likely reduce the incidence of the diseases they transmit, like dengue and chikungunya. These diseases are prominent in different parts of the globe like South America and are now present in the United States, so I think it is important to get these diseases under control.

Most people want mosquitoes eradicated. What do you think would happen if the species you study were eradicated from the United States?

Mosquitoes are ecologically tied to different animals and organisms in an infinite number of ways. There is no way to definitively say how the extinction of mosquitoes might ecologically affect our world, but from a medical standpoint, it definitely seems beneficial. Mosquitoes infect hundreds of millions of people a year with a variety of diseases and afflictions. At least a million of those infections result in death. Ridding ourselves of the dangerous mosquito is a tempting thought, but mosquitoes elicit behavioral changes in many different animal species. How will the behavior of these animals change when the mosquito disappears? The annihilation of mosquitoes would result in an empty niche. The real question is, what would fill this niche? And will it be worse than the mosquito?

Photos by UF/IFAS

I believe being well rounded is one of the most important attributes of a scientist, and I am thankful Dr. Koehler showed me that importance.

What has been the most challenging part of completing your Master's in the UF Urban Lab?

Pursuing and earning a graduate degree is truly a rollercoaster ride. You have no idea what to expect from the time you begin to the moment you graduate. Colonies could become contaminated. Traps can break. Accidents can lead to an entire experiment going to waste. This is the challenging part: understanding that there are going to be unexpected obstacles and the only thing you can do is fix it and move on. It is frustrating when you hit roadblocks in your research, but learning how to overcome the obstacles is half of the research battle.

The knowledge we gain from our challenges or failures is just as valuable as the knowledge we gain from our successes.

Outside of your mosquito research, what else are you passionate about?

My family. They are the most supportive and loving people I could ever hope to have in my life. I grew up on a horse farm in Ocala and spent a lot of time adventuring and exploring with my dad. I think this is where my interest in biology first began, so really, without my family, I might never have become an entomologist. My mom is the principal of an elementary school and has always showed me the highest degree of patience (which she needs a lot of for me) and understanding. And my brothers have been my best friends since the day they were born. I'm passionate about my family because they have

What is it like to work in the urban entomology lab on a day-to-day basis?

Absolute craziness! It is a very fast-paced environment and every day is go-go-go, but the atmosphere is one of a kind. I am good friends with many of the graduate students in our lab, and working alongside close friends is just another form of support. Help is always around when you need it, and we are all constantly learning from one another. I am extremely comfortable in this lab and that comfort aids in my productivity.

Continued on page 28

Predators

In the Landscape

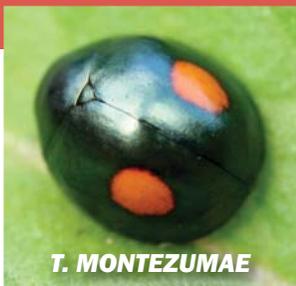
Catharine Mannion

Associate Professor of Ornamental Plant Entomology at
University of Florida/IFAS
Tropical Research and Education Center



CHINESE MANTIS,
an introduced predator,
feeding on a cricket

Often, it seems we have many pest insects and mites in the landscape causing damage to our beautiful plants. The truth of the matter is that most insects and other arthropods in the yard and garden do not harm plants.



T. MONTEZUMAE

SEARCH ONLINE to find lists of plants used for the purpose of increasing the activity of natural enemies.

OF THE MANY insects and mites that are not pests, there is a subset considered beneficial species because they can affect pest populations. Called natural enemies, they can prevent, reduce or restrict the presence of pests. These natural enemies can be loosely categorized as predators or parasites. In this article we are discussing predators in the landscape.

UNDERSTANDING PREDATORS

Predatory insects and mites, as adults and/or at immature stages, actively search out and eat prey insects. There are numerous predators in the landscape that go unnoticed. In addition to existing natural enemies, there are often efforts to move or introduce new natural enemies into an environment.

In the landscape, successful introduction of a natural enemy can be very difficult. A lot of homework must be done before introducing a natural enemy and expecting success. However, protecting the natural enemies we already have can be done by everyone. This effort, called conservation, can be done by not using pesticides or only using select pesticides for pest management, and/or by modifying the environment to favor the presence of natural enemies. Conservation may involve increasing the diversity of plants as well as establishing sources of nectar and pollen for those natural enemies that need it. For example, syrphid fly larvae are great predators, but the adult flies need pollen or nectar on which to feed.

Generally speaking, predators find their prey by searching, so they are most effective when

the pest population is high. In South Florida, you can just about guarantee the presence of a **predatory beetle, *Thalassa montezumae***, showing up when populations of croton scale get bad. A typical pattern is that there is a pest infestation. As the pest population increases, predators move in and bring the population down, which is then followed by a reduction in the predators unless the predators have alternate food sources.

These predators are often capable of keeping pest populations at a relatively low level so that damage is at a minimum. Their impact often goes unnoticed until something disrupts them, they are no longer there, and the pest populations increase.

There are also situations in which pest populations or the damage they cause become problematic even when there are predators feeding on them. For example, during the time period in which a pest population is building but before there is sufficient predator activity, there may be a need to apply other control strategies in order to minimize the pest presence or damage.

This is highly dependent on the pest and its impact as well as the environment. For instance, in a high-traffic area there may be little or no tolerance of any pest problem. Rugose spiraling whitefly became a significant pest in the landscape in recent years primarily due to the enormous mess it makes with its waxy secretions, honeydew and subsequent sooty mold growth in the vicinity of an infestation. It is now under excellent biological control by *Encarsia formosa*, a tiny, parasitic wasp. But there are still occasions in which other pest control methods are used due to the shifts in both the pest and parasite populations and the level of tolerance for the mess that the whitefly makes.



E. FORMOSA

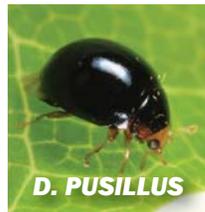
RECOGNIZING PREDATORS

The most common predators in the landscape include lady beetles, lacewings, predatory bugs, ants, and predatory mites. Lady beetles are probably the most recognizable insect predator. However, there are several lady beetle species that you may not recognize as lady beetles due to their color and size.

Most adult lady beetles are oval to round, brightly colored, and often have spots. Some well known species, such as the **Asian lady beetle** or convergent lady beetle are red or orange with many spots. However, some lady beetles can be very small and dark with no spots. For example, the whitefly predator *Delphastus pusillus*, is a shiny black beetle just 1/16 inch long. You might see these or similar beetles feeding on whitefly-infested plants. The immature stages of lady beetles can also be overlooked or misidentified. **Lady beetle larvae** are elongated and often dark with some color. In several species, such as *Thalassa montezumae*, the larvae can more resemble a mealybug than a beetle larva



ASIAN LADY BEETLE



D. PUSILLUS



LADY BEETLE LARVA



LADY BEETLE LARVAE

due to the white, waxy coating.

Both the larvae and adult beetles can be quite voracious in the number of prey they will eat. There are several other groups of beetles that are predatory — ground beetles, rove beetles, and tiger beetles — of which most are not typically used in biological control.

However, most of these beetles are generalist

feeders, and their impact in the environment can be very important. Efforts to conserve them are just as important as protecting many of the more commonly known predators.

Lacewings are another common predator in the landscape. Green lacewings are pale green with large, “lacy” wings but it is the larvae and eggs that are probably the most encountered stages on infested plants.

The eggs are distinct because they are laid individually on a hairlike stalk often on the margins of leaves. You will often see a cluster of these eggs. The **larvae** look a little like small alligators with large, hooked mandibles — toothlike jaws that are used to catch



LACEWING LARVA

and feed on their prey. Unlike the lady beetles, most of the impact is from the larvae feeding on prey. The adults primarily feed on nectar although they may consume a few insects. Somewhat related to the lacewings but very different are the mantids — i.e. praying mantis — much larger and obvious predators but not as commonly seen in the landscape.

Mantids are generalist predators that will feed on most anything of the right size.

Some of the **true bugs** (Hemiptera) are predators of insects and mites. These insects feed on their prey differently than the beetles. The beetles feed with toothlike feeding structures, and the bugs feed with a piercing-sucking mouthpart in which they pierce the prey and suck

out the body fluids. Not all bugs are predatory. In fact, many of them are serious plant pests. For example, many of the stink bugs are important plant pests — green stink bug, brown stink bug, brown marmorated stink bug. The most common predatory bugs are probably the minute pirate bugs. These predators are often seen in flowers,

where they feed on thrips, spider mites and insect eggs. Another common predatory bug is the bigeyed bug, which is named so because of its relatively oversized eyes. These predators are often found feeding on moth eggs, caterpillars, thrips, and mites.

Flies are generally not wanted — they are pests and/or nuisances. However, the syrphid flies, which are also sometimes called flower flies or hover flies, are a valuable natural enemy because the larval stage preys on insects. The adult flies are harmless and often found feeding on flowers. The larvae can vary in color but resemble a small slug. These larvae will crawl over foliage and are quite voracious on small, soft-bodied insects.

Most of us do not think about the benefits of ants because they can bite or sting and can cause damage or be a nuisance. Some species also protect honeydew-producing insects such as aphids. But ants are important predators.

Ants have been shown to feed on many soft-bodied insects and have been credited for controlling pests in agricultural fields. Whether ants are a pest or a beneficial insect is highly dependent on where they are and what they are doing. With some exceptions, their presence in a landscape is a good thing.

Many mites are serious pests. But the phytoseiid mites are important because they are predators of plant-feeding mites and other small organisms. Many feed on the eggs and immature stages of thrips, whiteflies, and scale insects. Adults of some species feed on pollen, honeydew, fungi, and leaf sap. Adults typically have a translucent teardrop shape with long front legs. Several species of predatory mites are sold commercially and are probably one of the most commonly used natural enemies. Food and environmental requirements differ with different species of predatory mites. For example, *Amblyseius swirskii* is adapted to warmer and humid sub-tropical climates and can survive and reproduce on various pollens and plant nectars which may allow them to persist during periods of low pest density. Other mite species decline as their prey population declines.

RELEASING PREDATORS

Purchasing natural enemies for release can be a viable and successful option of pest management and has most often been used in greenhouse production systems and probably to a lesser extent field production. In the landscape, there are few examples of successfully releasing natural enemies for pest control but to a lesser extent compared to plant production systems. Usually,

an individual will not be able to buy and release a sufficient number of natural enemies into a landscape to have any real impact. However, there are situations in which mass releases of natural enemies have occurred through the efforts of universities or governmental institutions.

Prior to any release, big or small, it is absolutely critical to know the pest species and the environmental conditions

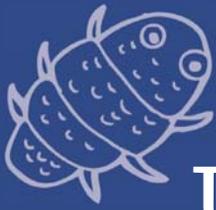
necessary for successful establishment of the natural enemy. Although many of the predators are classified as generalists (i.e. they eat many different types of prey), they may not all work well in all situations with all pests. For example, *Delphastus* sp. is a predatory beetle that is sold commercially as a “whitefly specialist.” It is an excellent predator of many different whiteflies. However, it does not do very well with the rugose spiraling whitefly, which produces excessive waxy flocculent. So in this case, this excellent whitefly predator may not be suitable for this particular whitefly. **PP**



PREDATORY BUG FEEDING ON A WEEVIL

Photo list with credits

1. Chinese mantis, Luc Viatour
2. *T. montezumae*, Graham Montgomery, Bugguide
3. *Encarsia formosa*, David Coppaert, Bugwood
4. Asian multicolored lady beetle, Paul Choate
5. *Delphastus pusillus*, Tom Murray, Bugguide
6. Lady beetle larva, James Castner
7. *T. montezumae* larvae, UF/IFAS
8. A predatory bug feeding on a weevil, UF/IFAS
9. Lacewing larva feeding on beetle larvae, UF/IFAS



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.

Flesh Fly and Secondary Screworm Fly

These flies were found by the thousands in a house on the southwest coast of Florida. They are flesh flies (*Sarcophagidae*) and secondary screworm flies (*Calliphoridae*) that were coming from a dead animal body. This type of infestation lasts for several weeks at the same time every year. Perhaps it is due to squirrels dying from squirrel bots or rodents dying from anticoagulants.

Sand Wasp *Campsomeris* spp.

This wasp is seen in the early summer digging holes in the ground. It is in the same family as the cicada killer wasp. This wasp is probably a parasite of white grubs in the lawn. They provision their burrow with insects that have been stung and paralyzed. They lay an egg on the insect host, and the larva that emerges feeds on the immobile, buried host.

Desjardin flat bark beetle *Cryptamorpha desjardinsii*

It is a small, flat beetle in the family Silvanidae that has been accidentally introduced into the United States and Florida from tropical Asia. It feeds on surface molds and mildews on a wide variety of plants, especially palms. These beetles are attracted to lights on houses and commercial buildings at night. Because of their small, flat shape, they are able to enter through small cracks and crevices around windows and doors. They are not considered damaging, but are a nuisance. They also might be confused with the sawtoothed grain beetle or flat grain beetle. This flat bark beetle is a home invader, but pest controllers spend a lot of time looking for infested cereal or dog food. The best controls are reducing outdoor lighting and sealing cracks where these beetles enter. Residual sprays applied to places where they enter also help.



1. _____

2. _____

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3. _____

1. Sand wasp, 2. Desjardini flat bark beetle,
3. Flesh fly and secondary screwworm fly

ANSWERS



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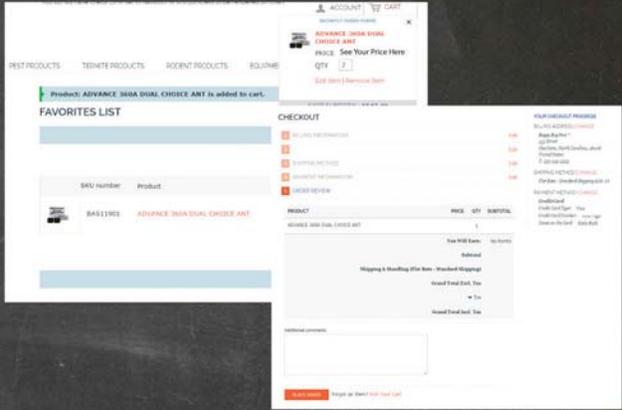
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Looking Back And Moving Forward

HARVEY F. GOLDGLANTZ

CONSULTANTS are retained for three reasons: 1) The company is moving backward, 2) The company has hit a growth wall, or 3) The company desires to move forward at an accelerated pace. All three situations require looking backward, to gain historical perspective, before making recommendations about how to proceed.

Below you will find a sampling of the questions that I ask clients when I am called in as a consultant. The depth of their response is a pretty good indicator of whether or not they have a finger on the pulse of their business. Do you?

Expenses

What percentage of revenue did you expend on payroll last year? How much did you spend on materials? What percentage did you expend on administrative and overhead costs?

Revenue

What percentage did your company grow last year? What percentage did you grow the four years prior? How much did your general pest control increase last year; your overall WDO business? Pre-treat? Baiting? Liquid? Lawn care? Weed control? Add-on services? Do you track the movement of these segments monthly? Are you on target with your goals for these segments? If not, why not? Do you project growth in these areas prior to the beginning of the year? What was your net profit last year? What is your projected profit this year?

Technicians

What is your production quota? Are your technicians good communicators? Do they sell? Do you set sales quotas for technicians? Do you have a comprehensive reward program in place? What is your turnover rate? Do you have a plan for recruiting technicians? Do you screen before hiring?

Sales

What do you project new sales to be for the year? Do you set quotas for each salesperson? What is your turnover rate? Do you have a comprehensive incentive program in place? Do you have a plan for recruiting sales people? Are your salespeople required to cold call? What is their lead-to-close ratio?

Training

Do you have regularly scheduled training programs for technicians, sales personnel, managers and office staff? Does this training include how to solicit referrals and sell add-on services?

Advertising

What percentage of revenue do you spend on marketing/advertising? How much do you commit to: 1) SEO (Search Engine Optimization)? 2) PPC (Pay-Per-Click/AD Words)? SMM (Social Media Marketing)? What is your return on directory advertising (hard-cover and web-based)? Do you have a lead tracking system? Do you pre-plan where and when your marketing/advertising will be spent?

Customer Turnover

What was your attrition rate last year? Do you track attrition monthly? Do you have a system in place to prevent, reduce and recapture customer loss?

Pricing

When was your last price increase? Do you have a set percentage that you increase prices by each year?

Strategic Planning

Do you project revenue and expenses in advance? Do you consider staffing needs before the beginning of the year? Do you bring managers together annually to do a SWOT analysis (Strengths, Weakness, Opportunity and Threats)?

Industry Barometers

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Taking your company from point A to point B — from good to great — requires a relentless commitment to planning, detail, tracking, monitoring and comparative analysis. It is how successful companies got where they are today. If you have finished reading this column and think that it applies only to “larger” companies, think again! **PP**

Harvey F. Goldglantz is President of Pest Control Marketing Company, Inc., a consulting firm to the pest management industry located in Elkins Park, Pa. His clients range in size from start-up companies to those with revenues in excess of \$30 million. Goldglantz has been in the pest control industry for more than 40 years. He served three terms on the National Pest Management Association Board of Directors.

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FDACS Website Changes Expected to Benefit PCOs

GAINESVILLE — Look soon for changes to the Florida Department of Agriculture and Consumer Services (FDACS) website. You will find new ways to submit applications for exams, certificates, licenses and associated renewal documents. We expect the new online features to better serve the industry, with more convenience and less time needed to issue certifications and licenses. Look for these changes to roll out in 2015.

EXAM APPLICATIONS

- ▶ Limited Commercial Landscape (LC/LCLM) — exam application, allowing upload of training certificate and subsequent insurance in order to issue credential.
- ▶ Limited Government Private — Structural (LS) — exam application and credential issuance upon passing.
- ▶ Limited Government Private — Lawn & Ornamental (L&O) — exam application and credential issuance upon passing.
- ▶ Limited Wildlife (LW) — exam application, certificate and subsequent insurance in order to issue credential
- ▶ Certified Operator (CPO) exams for qualified applicants — all categories — allowing upload of experience and job forms. Upon approval, person receives a voucher number that allows them to schedule their exam with UF/IFAS Extension to take computerized exam. It is graded immediately upon submission, and exam information is passed back into the FDACS licensing system. Upon passing, also allows for applicant to apply for issuance.
- ▶ Special ID Cardholder (SPID) exams for qualified applications, allowing upload of experience and job forms. Upon approval, person receives a voucher number that allows them to schedule their exam with UF/IFAS Extension to take computerized exam. It is graded immediately upon submission, and exam information is passed back into the FDACS licensing system. Upon passing, also allows for applicant to apply for issuance.

CREDENTIAL APPLICATIONS

- ▶ Limited Fertilizer (LF) — system verifies GIBMP training within UF/IFAS system and issues credentials.

CREDENTIAL RENEWAL APPLICATIONS

- ▶ Certified Operator (CPCO) certificate renewal — allows for upload of attendance verification forms.
- ▶ Special ID Cardholder (SPID) certificate renewal — allows for upload of attendance verification forms.

Search online for 'FDACS certification'

The screenshot shows the Florida Department of Agriculture and Consumer Services website. The main heading is "Pesticide Applicator Certification & Licensing". The page includes a navigation menu with links for Home, Pay Online, About, Divisions & Offices, Forms & Publications, News & Events, and Contact. A breadcrumb trail reads: "You are here: Home > Divisions & Offices > Agricultural Environmental Services > Business Services > Pesticide > Pesticide Applicator Certification & Licensing". The page lists various resources such as RUP License Requirements, License Types, License Fees, License Categories, Exams, and Study Materials, Exam Sites, License Renewal, Continuing Education Units (CEUs), Aerial Applicator Information, Out-of-State Requirements, Reciprocal Certification, Database Searches, Forms and Documents, and Frequently Asked Questions. There is also a "Contact Us" section with the Pesticide Certification Section address and phone numbers, and an "Online Payments" section with links for "New or Renewal" including "Pesticide Applicator Licenses" and "Pesticide Dealer License". A "Stay in the Loop" section mentions "Commissioner Putnam's Email Update" with a link to "Read the latest update".

NEW LICENSE APPLICATIONS

- ▶ Pest Control Business License (JB) — will allow for online application for pest control business license. Will also provide for Change of Ownership; Change of Address; and Change of Registered Business Name. Will also allow for licensees to terminate employee ID cards online, and it will allow licensees to apply online for NEW employee ID cards during their license year for any new hires. The new employee process will allow for an upload of the WDO affidavit to obtain the WDO endorsement on the employee ID card.

We encourage industry to utilize these online processes as the department continues to roll them out. Processing times will be greatly improved using the electronic system because it eliminates routing the application through the department's finance and accounting office in order for them to process the payment.

The examination systems will allow you to apply for the exam and for the department to approve the application and return a voucher number to you. The voucher will be used in the UF/IFAS Extension online system to schedule and take your exam at a location near you. **PP**

Report by Paul Mitola and Joseph Parker, FDACS personnel and environmental consultants



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Magnesium Deficiency in Turf and Ornamentals

We were all taught at one time that iron is in the middle of the hemoglobin in our blood. In a similar way, magnesium is found at the center of the chlorophyll molecule.

MAGNESIUM has been known to be essential to plants since 1860. In addition to being part of chlorophyll, magnesium helps in many other areas of a plant's metabolism.

MAGNESIUM BASICS

Magnesium sounds like it is a micronutrient, but it really isn't. Plants need about as much magnesium as they do phosphorus, and we call phosphorus a major nutrient. The average plant in Florida has about 0.3 to 0.4% magnesium in the dry weight of the tissue. This is equivalent to 3000 to 4000 ppm. Compare this to typical leaf content of 100 ppm for iron and manganese, and you can see that plants need a lot more magnesium than they do micronutrients.

Magnesium is not actively absorbed by plants. It enters into the root via mass flow. Because of this, many soil scientists believe that significant quantities of other similar elements, including potassium, calcium, sodium and, to a lesser extent, ammonium can reduce magnesium absorption. We see a lot of magnesium deficiency symptoms in South Florida in high-calcium soils. In central and north Florida, the acidic sandy soils are often intrinsically low in calcium and magnesium. Magnesium deficiency is one of the most common deficiencies encountered in Florida landscapes.

When a plant runs low in magnesium, it steals magnesium from its older leaves and moves it into its newer leaves. It can do this because magnesium is very mobile in plant tissue, and can be transported in the phloem from older leaves to younger leaves. As the deficient plant transfers magnesium from older leaves to newer leaves so it can keep growing, we begin to observe a lack of magnesium and, therefore, a lack of chlorophyll in the older foliage.

As a result, magnesium deficiency is almost always observed in the older leaves. You often see a Christmas tree effect, where the edge of the leaf is yellow but the interior portion is still green. Magnesium deficiency can be worsened when plants are frequently pruned, such as in a hedge. The newer foliage that is trimmed has a lot of magnesium in it, and the newly trimmed hedge can have difficulty replacing the magnesium it has lost.

MAGNESIUM NEEDS MAY VARY

Some plants have quite high magnesium requirements, while others have very low requirements. A lot of this has to do with the types of soils to which plants were adapted in their native environments. For example, I don't know that I have ever seen magnesium deficiency in an oak tree or a pine tree. It just doesn't seem to happen. Deficiency is fairly common in some other tree species, such as camphor, crepe myrtle, magnolia and Hong Kong orchid.

In shrubs, varieties with low magnesium requirements include ligustrum, cocoplum, azalea, hibiscus, podocarpus and juniper. Conifers in general seem to have low magnesium requirements. Shrub varieties with high magnesium requirements include pittosporum, some hollies, viburnum, jasmine, and Indian hawthorne. Among groundcovers, plants such as confederate jasmine and ivy have low requirements, while liriopoe, mondo grass, pothos and aspidistra have high requirements.

In the world of palms, it is also a mixed bag in terms of susceptibility to magnesium deficiency. Palms with relatively low magnesium requirements include *Washingtonia* species, European fan palms, windmill palms, medjool dates, and bamboo palms. Species with higher requirements include queen palms, canary dates, foxtails, arecas and pindo palms. Native species such as sabal palms, royals and saw palmetto are relatively resistant to magnesium deficiency, though I have seen it in all three of these species on occasion.

HOW TO TREAT MAGNESIUM DEFICIENCY

So, if you encounter ornamental plants in landscapes with marginal yellowing in the older leaves, what are your treatment options? When soil pH is low, dolomite is a safe and inexpensive magnesium source, generally running at least 12% magnesium. However, roughly from Interstate 4 south, the soils tend to be more alkaline, and dolomite is not a good treatment option. You can top dress with Epsom salts (magnesium sulfate), which is safe and cheap, but relatively short lived in the soil. Longer-term soil treatment options include K-mag (0-0-22 with 11% magnesium) or kieserite.

There are also sprayable forms of magnesium. Epsom salts is very soluble, and can be sprayed at 2 or 3 pounds per hundred gallons. There are also liquid magnesium chelates, often



Magnesium deficiency on ti plant.

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glucoheptonates, which are relatively inexpensive, effective, and safe to use. A third excellent source of foliar magnesium is magnesium nitrate. This usually comes as a liquid 7-0-0 with 6% magnesium. It is a direct precursor of chlorophyll, and is easily absorbed by the plant.

Realize that correcting magnesium deficiency in ornamental plants can take a little time. Several successive treatments are often needed. It can take anywhere from about three to nine months to correct the deficiency, depending on the size of the plant and the severity of the deficiency symptoms. The plant will likely not put the magnesium you apply into the deficient older leaves. It will often be transported into the newer foliage. The older deficient leaves will likely not green up significantly, though sometimes they do.

While it is possible to burn plants with magnesium, magnesium sources are generally very safe to use. You are better off with several split applications, generally monthly depending on the situation. Clients should be informed that while magnesium deficiencies can be corrected, it takes a little time. There is no quick fix. I have never observed magnesium toxicity on any plant anywhere in the world.

Regarding turf grasses, the situation is a little different. Turf grasses contain chlorophyll, so of course they have a need for magnesium. However, in my experience, turfgrasses normally don't respond much to magnesium applications. Color problems in turf are more likely due to deficiency of nitrogen, potassium, iron or manganese. It doesn't hurt to add some magnesium to applications of these other nutrients so that the turf can make chlorophyll, but magnesium by itself will only rarely improve turf. **PP**

Report by Lynn Griffith, tropical plant and soil expert, A&L Southern Agricultural Lab



UF/IFAS

Hunting billbug, a serious pest of zoysia.



Matthew Zidek, Texas A&M Agrilife Extension Service

Large (brown) patch disease, the most troubling disease of zoysiagrass.

Zoysiagrass, continued from page 15

Weeds. One of the best attributes of zoysiagrass is its ability to resist weed invasion due to its thick, dense growth habit. Insect and disease problems can damage zoysiagrass, creating voids in this dense mat where weeds can invade. Fortunately, unlike St. Augustinegrass and centipedegrass, zoysiagrass is very tolerant to many effective pre- and postemergence herbicides, giving a wide range of options to the turf manager.

Insects. The most serious insect on zoysiagrass is the hunting billbug. Billbugs feed on roots, causing the turf to die in irregularly shaped patches. The damage most often occurs in the fall and spring, when populations are high and damage may be misdiagnosed as dormancy. Stems and rhizomes break easily, have irregular feeding marks, and the turf will not hold together if cut. Most damage occurs on infertile or dry soil. If 10 to 12 billbugs are seen per square foot, control may be necessary.

Mole crickets and white grubs also can harm zoysiagrass. Mole crickets feed on grass roots and leaf blades, and their tunneling activity dislodges plants from the soil, causing them to dry out. White grubs, like billbugs, feed on roots, causing the turf to turn yellow, wilt, and eventually die. Both of these insect pests often attract raccoons, skunks, armadillos, and birds, which may actually cause more damage than the insect itself.

Sod webworms can cause periodic cosmetic injury but are not believed to severely damage the turf. These insects mine the green tissue from the leaf tips, but they do not “notch” the leaf blades.

Nematodes. Many turf managers state that nematodes are serious pests on zoysiagrasses; however, this is not well documented in scientific literature. UF/IFAS researchers and turfgrass breeders are aggressively working to identify the extent of zoysiagrass susceptibility, and they are identifying superior cultivars that can withstand nematodes. The UF/IFAS Extension Service Florida Nematode Assay Laboratory¹ in Gainesville can diagnose whether nematodes are a problem by looking at a soil sample taken from the margin of the affected area. Proper cultural factors to encourage zoysiagrass root growth lessen nematode stress. These include applying less nitrogen, providing less frequent but deep

A comparison of common lawn grasses grown in Florida

	Centipedegrass	St. Augustinegrass	Zoysiagrass
Mowing Height	1.5" – 2.5"	Cultivar dependent (2" – 4")	Cultivar dependent (0.25" – 2.5")
Mower Type	Rotary	Rotary	Reel-type or rotary
Insects	Spittlebugs Ground pearls	Chinch bugs Sod webworm White grubs	Hunting billbugs Mole crickets White grubs
Diseases	Centipedegrass decline	Take-all root rot Large patch Gray leaf spot	Large patch Dollar spot Rust
Comparative Water Use	Persists on less water, but can wilt quickly in the absence of water.	Moderate – wilts, but some leaves remain green longer.	Moderate, but can wilt quickly in the absence of water. Within 1–2 weeks, the leaves brown and the turf is dormant.

watering, and ensuring adequate soil potassium and phosphorus.

Diseases. Without a doubt, the most troubling disease for zoysiagrass is large (brown) patch. This disease becomes active when soil temperatures at a 4-inch depth are between 65°F and 75°F each fall and can be a problem through the following spring. Although zoysiagrass is probably not more susceptible to this disease than St. Augustinegrass, recovery can be slow due to zoysiagrass’s prolonged dormant to semidormant condition. Zoysiagrass is the first turf species to go off-color in the fall and the last to green up in the spring. Therefore, if a large (brown) patch disease outbreak occurs, damage will be visible well into the next summer. With this in mind, it is important to treat preventively to ward off any likelihood of this disease. Additionally, avoid excessive applications of soluble nitrogen, keep thatch levels to a minimum, and avoid irrigating at a time that will not allow the turf to dry prior to nightfall.

Other diseases that impact zoysiagrass include dollar spot and rust. Dollar spot typically occurs when nitrogen is below optimal levels. This

can easily be corrected with a light application of nitrogen. Rusts occur during mild, humid weather and appear as small yellow to orange to reddish-brown pustules on the leaves. Fungicides are effective, but most often, frequent mowing with clipping removal will keep this under control.

Other Problems

Other factors also can decrease the quality of a lawn. Excessive shade, compacted soils, over- or underwatering, improper mowing, traffic, and high or low pH can all cause a lawn to perform poorly. It is important to recognize the source of the problem and correct it if possible. **PP**

J. Bryan Unruh is Associate Center Director and Professor at West Florida Research and Education Center; Laurie Trenholm is Professor and Turfgrass Specialist at Department of Environmental Horticulture; John Cisar is Professor and Turfgrass Specialist at Ft. Lauderdale Research and Education Center; all UF/IFAS.

¹ <http://nematology.ifas.ufl.edu/assaylab/>

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What has been the greatest challenge thus far in your pursuits within the field of urban entomology and how do you overcome it?

Shockingly enough, public speaking was very hard to get used to. Dr. Koehler LOVES to take new students to different conferences and talks and put them at the podium. Giving my first talk with Dr. Koehler was one of the most terrifying things I have ever experienced. He speaks to groups with knowledge, ease and lightheartedness. How was I supposed to follow that up? Eventually, I realized that his presence came from a lifetime of experience and practice. This is exactly what Dr. Koehler tries to give his students. He gives us the knowledge through our research in the lab and gives us the practice and experience by throwing us into talk after talk.

You've had the benefit of having many great mentors in the field. Do you see yourself being a mentor like that to others? And in what way?

It would be great to have the chance to mentor others one day. I have been mentored by many of urban lab graduates and they have helped me develop into the student/ researcher that I am now. Maybe I will do research that inspires the next generation of scientists to come to me and ask questions about how to achieve their goals.

After spending a summer in Greece, what was the biggest impact that experience had on you?

I will never be able to forget the incredible food I enjoyed, but I learned a lot more than just how to eat good food.

Living in Greece for a summer increased my cultural respect and forced me to look beyond the bubble of the United States. I love to travel, but this was the first opportunity I have ever had to look deeper into a culture other than my own and see the struggles that other parts of the world face. The financial, political and even personal atmosphere were completely different than what we experience in the United States. It was a great chance to increase my cultural appreciation.

To which people in your life would you accredit your scholastic, academic, and research success?

That list is a very long one! Just to name a few, my mom and dad have always pushed me academically and encouraged me to seize every opportunity. Dr. Koehler and Dr. Pereira have showed me what a joy and pain research can be at the same time. My friends were always the ones there with coffee when we had to pull an all-nighter studying for an exam. So when you ask who I accredit all the success to, it's a variety of different people who helped me be successful in different ways.

What is your favorite memory as a Gator so far?

My favorite experience so far was giving the commencement speech at my graduation. I spoke to over 5,000 people and got to talk about entomology and thank the people that helped

me make it. It was an honor to represent my college and show my gator pride.

Once you graduate with your Master's, you will have been a Gator for over six years. What is your favorite part of being a Gator?

I think it is awesome that I am a part of the global community known as the Gator Nation. It seems that no matter where you go, you always meet a Gator. On top of that, I am a second-generation Gator. My dad graduated from UF in and couldn't have been prouder when I received my acceptance letter. No matter what comes after UF, I will always bleed orange and blue!

Tell us a funny bug story.

I did mention that many of the other graduate students in the lab are my friends — but they can also be evil at times. One day, I came to my desk to check emails and work on my computer. As I begin to type, one of my lab mates (I will not name her) started talking to me about nonsense. The next thing I knew, there was a real cockroach on my shoulder. It had been lowered onto my shoulder by another lab mate while the other distracted me. As you may have guessed, pranks are not a foreign idea in our lab, but it keeps life fun. **PP**

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A New Cockroach Finds Its Way To Florida

Marc Minno, Butterfly Expert and Conservationist

IWORK for the Suwannee River Water Management District in Live Oak, Florida. In June 2015, I started organizing paperwork associated with our water quality monitoring. The floor of my office is temporarily piled with stacks of papers. On Monday June 15, 2015, I picked up one of the stacks from the floor, and out fell a small bug. I was not too surprised because beetles, millipedes and other invertebrates sometimes find their way into the building from outside.

I looked at the bug closely. What was this? The bug was dead, but still soft. It was black with an orange-red pronotum and yellow along the margins of the wings. At first glance, I thought it was a firefly, but no. This was a cockroach — a pretty little cockroach of a species that I had never seen before!

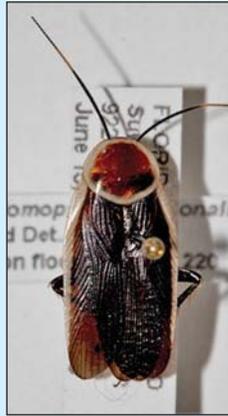
With a little searching online, I was able to find a key to the cockroaches of Florida¹ developed by Dr. Skip Choate, who was a professor at the Entomology and Nematology Department at the University of

Florida, and his students. However, none of the species in this publication matched the specimen from my office. With further investigation online,

I discovered photos of the pale-bordered field cockroach, *Pseudomops septentrionalis*, which did match the roach from my office. This tropical species is apparently native from Central America to Texas and has been spreading throughout the southeastern United States in recent years.

Dr. Paul Skelley, with the Florida State Collection of Arthropods (FSCA) in Gainesville, was not aware of any specimens of the pale-bordered field cockroach from Florida. The folks at the UF Urban Entomology Lab did not know about any infestations in Florida either.

However, Bugguide.net² does list two previous reports, so my specimen is not the first sighting of this species in Florida. Michael



Map of states where specimens of the pale-bordered field cockroach have been collected.

Riffle posted a photo of a female with an egg case taken in Tallahassee on July 31, 2013, and Fran Rutkovsky posted a photo of another specimen from Tallahassee taken on June 2, 2015. I donated the specimen from my office to the FSCA to document its occurrence, and Kyle Schnepf kindly confirmed the identification.

So doesn't Florida have enough cockroaches? Apparently not! Huge changes are occurring in insect populations, most likely in response to global warming. Luckily, the pale-bordered field cockroach is not an insect that frequents houses. It prefers outdoor, wooded habitats. How this new insect will affect Florida's ecology remains to be seen. Will it ever be a pest of concern within structures? We shall see! **PP**

¹ http://www.entnemdept.ufl.edu/choate/blattaria_new1.pdf

² <http://bugguide.net/node/view/7856/data>

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