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## ON THE COVER

Two termite species join and prosper, but little is understood about the secret of their success. On Page 8, Thomas Chouvenc and Nan-Yao Su shed some light on the mysterious world of the hybrid termite of South Florida.

*Termite photo by Thomas Chouvenc, and photo illustration by Jane Medley, UF/IFAS.*



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# Consolidation:

## The Next Big Change for the Pest Management Industry?

**A**BOUT 30 years ago, I speculated that the pest management industry might consolidate into a few major companies. What would that mean for an industry that was founded by hardworking individuals who believed in providing outstanding service for their friends and neighbors? That consolidation did not happen 30 years ago. However, a few large companies have been working on changing that dynamic by paying large sums to buy out established family and regional businesses in order to become or remain the biggest providers of pest management for people in Florida and the United States.

Other industries have consolidated. The village five-and-dime store is now replaced by the big-box stores. The local corner drug store is now replaced by two big pharmacy chains that dominate the market. Mom-and-Pop grocery stores in communities have disappeared, and supermarkets have replaced the neighborhood grocer everyone knew. That consolidation has persisted, and now there are nine national supermarket chains in the United States.

The same has happened to the family farm. The small family farm has virtually disappeared. Small family farms now account for only about 25 percent of agricultural production, and the food is packed and produced by a few large corporations. Meat in a hamburger and milk in a bottle may come from hundreds of cows originating from several states. In recent years the average age of a farmer increased from 52 to 57 years. As that generation retires, the younger family members want to sell the family farm and move on to jobs in larger, more stable companies.

Do these situations sound familiar? The pest management industry may be in the process of undergoing a similar change. That change would move the wealth from local companies to big-city investors who initially fund mergers and acquisitions.

### **Why has the pest management industry not consolidated?**

Is consolidation in our near future? The pest management industry in Florida has a history of being composed of about 80 percent family-owned pest management companies and 20 percent larger corporations. It is a large, competitive industry, and revenues are equal to or larger than the farm income for citrus. In fact, one-third of all pest management in the United States occurs in Florida.

Pest management is unique because it involves a highly technical service delivered by technicians who need to have a consistent

positive relationship with the customer. So consolidation is dependent on whether a national or international corporation can deliver 1) dedicated technicians, and 2) highly technical services that differ locally.

The most difficult part of the business is getting good employees. A good pest management company values its employees and has low employee turnover. The companies with 300 percent turnover every year don't have a history of lasting long in the industry. The most successful companies have employees who have worked for a company for more than 20 years.

Of course, an owner/operator company will have only one or a few dedicated employees. If employees leave or the owner retires, the business closes. Nobody is more dedicated than the business owner/operator who personally delivers service to long-standing customers.

Many of these family-owned businesses have aging certified owner/operators. Their children often do not want to carry on the family business. As a result, the pest management industry will change as these aging owner/operators retire from these family businesses.

We need to encourage the next generation to see the potential in working in pest management. It is difficult. No student at the University of Florida comes here to become an exterminator, but we have found that once they see the potential jobs, there are a select few who want to join the industry and make a positive impact. We are proud to highlight those students in *PestPro* magazine. They are part of the future of the industry.

Another important issue for the industry is the highly technical and personal services needed for a successful business. The pest management industry is unique in its need for technical information from researchers. Several soap/cleaner or waste companies entered the pest management industry and left as fast as they entered. They found out that without the ability to acquire and integrate the technical information or educate their staff, they could not compete.

Consolidation may be occurring more smartly with the large companies building national/regional training and education centers for their employees. Their goal is to deliver a uniform service to every customer by training internally. This cookie-cutter approach to educating employees works for many industries. Some of the large pest management companies now have their own training centers and employ educators internally, and they do not need or utilize the training centers at universities. They also don't send more than one or two

employees to educational programs at association meetings. If this approach to handling technical information is successful, consolidation in the industry will occur in a manner similar to what happened with big-box stores, pharmacies, supermarkets, farming, and meat packing.

**S**EVERAL FACTORS have slowed and prevented pest management consolidation. One major factor is that technical information for pest management is often local or regional. Pest management companies need to respond locally to change as it happens. For instance, if products or procedures fail in certain places because of resistance, can a national company respond to those local conditions without training every employee nationwide? If a new pest is introduced, can a national company identify and control that new pest for their customers? Can a national corporation educate and retain the motivated technician who understands his local clientele and pests?

### **With all these challenges, will the owner/operator companies survive?**

The small companies need to be more sophisticated and flexible with their services. A small company will not out-muscle the larger companies. People want to recognize a brand and know that there is a reliable solution for their problems. They must have faith that the smaller company has credibility and knowledge to solve their problems. If a product or procedure fails, a smaller company needs to be flexible enough to adjust and control the pest. If a new pest is introduced, a smaller company needs to rapidly adopt the most current practices for that pest. A small company can't build a training center for employees. It needs to utilize association meetings and current literature for the most appropriate methods of management.

We have continued *PestPro* magazine from the University of Florida to provide technical information to the industry regardless of company size. Large national companies and small owner/operators have equal access to the information.

Without resources like *PestPro*, the majority of the industry will not be able to change and progress. We are proud to provide the latest technical information to all companies and help the industry progress and change with the times. Our ultimate goal is to help the industry provide safe and efficient service for their customers. **PP**

— Dr. Philip Koehler,  
Managing Director

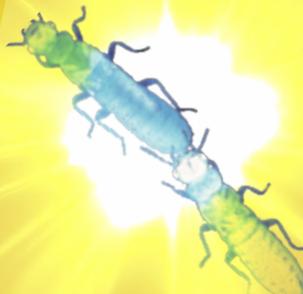


Breaking News: Threat of Turbo Termite

# What We Know About The Hybrid Termites In South Florida

Thomas Chouvinc  
and Nan-Yao Su





**IN APRIL 2015**, the news broke and spread like wildfire over the Internet and the local news stations: “*New turbo termites living in Florida.*” “*Two termite species fall in love and give birth to super termites.*” “*Humanity likely doomed by new hybrid termites found in Florida.*”

THESE WAS a long list of titles like these, and they were as sensational as they were distorted from the reality of the situation. It is the joy of living in an era of internet sensationalism, where each news title is formulated to be a click-bait, and where scientific rationalism is, to an extent, out of the picture.

So, there is new hybrid termite in Florida. Well, while the discovery of this potential hybridization may have important implications for Florida, it may be appropriate to look back at the original study and make a little reality check. First thing: We know very little about it. Second: We are working on it. Let’s review the termite situation in Florida and see where this “new menace” fits in the picture.

As we all know, Florida has its fair share of native and invasive insects that impact our lives in many ways. This is one of the perks of living in a subtropical climate. Florida has at least four major invasive termite species, and all of them are potential structural pests. Among them, the Western drywood termite, *Cryptotermes brevis*, and the Formosan subterranean termite, *Coptotermes formosanus*, have had a major economic impact on the Florida pest management industry over the past 40 years. More recently, the Asian subterranean termite, *Coptotermes gestroi*, was detected in Miami, and it has since spread to many South Florida cities, from Key West to Riviera Beach.

The Asian subterranean termite has a similar biology to the Formosan subterranean termite, except it is adapted to a tropical climate, while the Formosan is established in warm temperate regions. Because of this difference in ecological niches, their geographic distribution overlaps only in three counties in the United States: Miami-Dade, Broward and Palm Beach, where it is just warm enough for Asian termites and just cold enough for Formosan termites. Even with

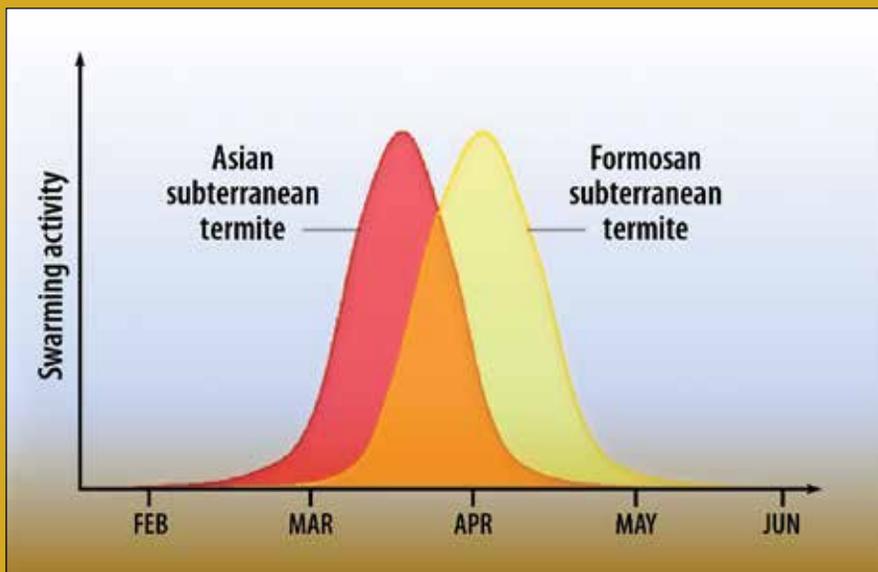
this overlap, we did not think swarms of these two highly destructive species had any chance to meet, because records before 2012 showed that the Asian subterranean swarmed between February and April, and Formosan subterranean termite swarmed between April and June. But we were wrong.

In recent years, swarming activity has increased for Formosan and Asian subterranean termites in many South Florida areas. Such observation is due to the particular biology of subterranean termites, as it takes five to eight years for a colony to mature and produce a dispersal flight. As a result, during the first 20 years after the initial establishment of the species, infestations could be found only in isolated areas, with only a handful of colonies swarming every year. However, over the years, more and more colonies were established and reached maturity. These colonies synchronized their dispersal flights during the swarming season. Larger and larger swarms were therefore observed during the past few years because winged individuals, or alates, are now produced simultaneously from hundreds of colonies in some areas.

One of our research projects was to monitor the swarming activity of Formosan and Asian species in South Florida. During the 2015 swarming season, we estimated that in the greater Fort Lauderdale area alone, about 1 billion alates of the Asian subterranean termite were produced by at least 20,000 mature colonies. Large swarms of the Formosan subterranean termite were also recorded. Both species have reached a critical mass in some areas and have become a serious threat to trees and structures. With the spread of the geographical distribution of Formosan and Asian subterranean termites in South Florida, both species are now fully established in some areas of Miami, Fort Lauderdale and Riviera Beach.

---

*Thomas Chouvenec is Research Scientist and Nan-Yao Su is Professor at UF/IFAS Entomology and Nematology Department.*



Asian and Formosan termites, two distinct species, have swarmed at the same place and time for the past three years.

**D**URING the span of our monitoring of the swarming activity of both species in the Ft Lauderdale area, we observed something we did not expect: In 2013, 2014 and 2015, the two species swarmed simultaneously from mid-March to late April. Asian and Formosan subterranean termites therefore swarmed at the same place and the same time at least three years in a row. Because we thought this to be an irrelevant coincidence, we did not expect consequences from such simultaneous dispersal flights. After all, these are two distinct termite species!

However, to our surprise, we observed that a male Asian subterranean termite would initiate a mating behavior when encountering a female Formosan subterranean termite in the field. The interspecies pairings were brought to the laboratory to test if such mating would result in colony establishment. The mating of the two species resulted not only in a viable brood with larvae, workers and soldiers, the hybrid colonies developed faster than colonies of Formosan or Asian subterranean termite colonies that were established at the same time.



In the field, male Asian termites initiated mating behavior with female Formosan termites. Lab results confirmed mating success.

Laboratory results showed that mating between the two species in the field can result in the establishment of a hybridized colony, but we do not know if such colonies are yet established in South Florida. As simultaneous swarms were observed only for the past three years, hybrid colonies, if established, are still too young and too small to detect. It may take years, maybe decades, to see a fully established hybrid colony that would be detected and identified as such.

The current research is investigating many unknowns:

1. While hybrid colonies displayed high vigor in the laboratory for the first few years, it will take many years to determine if these colonies can actually reach maturity and produce fertile alates. Such hybrid alates may be like mules, the offspring of a horse and a donkey, in the sense that they may not have the ability to reproduce.
2. The two species are morphologically different regarding alates and soldiers. However, it is unknown what are the characteristics of alates and soldiers of mature hybrid colonies, which makes the discovery of field colonies even more difficult.
3. It is unknown if hybrid colonies can establish in cooler or warmer areas compared to South Florida. If that occurs, and if fertile alates are produced, hybrid colonies may eventually spread beyond South Florida.
4. Will the hybrid colonies be controlled with current methods, or will we need a new strategy to manage populations of Formosan/Asian hybrid termites?
5. While we know the hybrid colonies grow faster, the final population size of a hybrid colony also may be larger than the parent species.

6. Faster growth implies that the hybrid termites may consume more wood at faster rates.

**R**ESearch at the UF/IFAS Fort Lauderdale Research and Education Center aims to answer these questions, as the hybrid termite may have important consequences for homeowners and the pest control industry in the years to come. While the hybrid termite may not be an immediate concern, it may become a major problem in South Florida in the long term, especially if our preliminary laboratory observations reflect the reality of hybrid colonies establishment in the field.

Even in the best-case scenario where established hybrid colonies are not able to produce alates, which would prevent any further spread, hybrid colonies that display high vigor can still grow faster than Asian or Formosan subterranean termite colonies. In such a case, hybrid colonies may cause major damage in less time. Because colonies are expected to live up to 20 years, it will still be a major pest in areas where both Asian and Formosan subterranean termites can mate every year.

With swarms bigger than ever, and the rapid spread of both species, the overlap of distribution of Asian and Formosan subterranean termites is deemed likely to increase over time, which will result in increased opportunity for the two species to mate and establish hybrid colonies. The years to come may change how we deal with termite issues, as the threats change:

- ◆ The Western drywood termite remains the major termite problem in South Florida, as it is ubiquitous, and infestations in structures are extremely common. However, structural fumigation has proven to be the best remedial treatment against such infestations, and houses in heavily infested areas may just need to be fumigated every five to 10 years to eradicate new infestations.
- ◆ The coneheaded termite, *Nasutitermes corniger*, currently established in a small area in Dania Beach in Broward County, may be a potential threat. However, large colonies are usually detected and eradicated before causing major damage. This termite displays its activity above ground, and fully developed colonies usually occur only in undisturbed areas.
- ◆ In comparison, subterranean termites remain the biggest challenge to homeowners and the pest management industry because the discovery of a colony in a structure usually happens after a significant amount of damage occurs. As the pressure from both Asian and Formosan subterranean termites continues to increase over the years, structural damage is also expected to increase in the area, with or without the establishment of the hybrid termite.

Liquid termiticide treatments and baiting technology are currently used to protect structures and reduce or eliminate subterranean termite activity. Due to their cryptic habit and large foraging territory of up to 300 feet, subterranean termites can do extensive damage before being detected. Liquid termite

treatments are intended to create a barrier beneath or around a house to deny subterranean termites entries. While such treatments can efficiently provide protection to a structure, application of soil termiticides may not always kill the entire colony, especially when the underground galleries can extend hundreds of feet away from the treated areas. Subterranean termite colonies that survive soil termiticide treatments may continue to thrive and produce alates, which may further infest other areas. The industry's heavy reliance on soil termiticides is one reason the Formosan subterranean termite spread from a few areas in the 1960s to the entire southeastern United States by 2000.

One way to reduce their population pressure is the application of baits that can kill subterranean termite colonies. Our data showed that placement of durable baits in an area-wide project can create a relatively termite-free zone. If such baits are placed in areas infested by the Formosan and Asian subterranean termites, there is a good chance that their populations may be reduced over time. Such reduction would also decrease the chances for the two species to mate and create hybrid colonies.

To conclude, there is a need to keep a cautionary eye on the spread of the Asian and the Formosan subterranean termites in South Florida. The spread of both species is worrisome on its own as it comes with important structural damages. With the potential hybridization of the two species with fully established colonies in the years to come, what may



only be a South Florida problem may become a more widespread problem in a few decades.

The detection of Asian, Formosan or hybrid subterranean termites mostly relies on pest control operators, since they are usually the first on site. The dialogue and cooperation between scientists and the pest control industry has always been

critical for adapting to new threats, especially in South Florida, where these threats are always changing. Hopefully, such lively collaboration will continue in order to improve and innovate how to deal with these novel threats. **PP**

*Some sections in this article were previously published in CPCO Advantage, June 2015.*

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**VIRGINIA  
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# Virginia Opossum

William H. Kern, Jr.



The Virginia opossum, also known as “possum,” is an abundant, medium-sized mammal that occurs in all habitats in the state



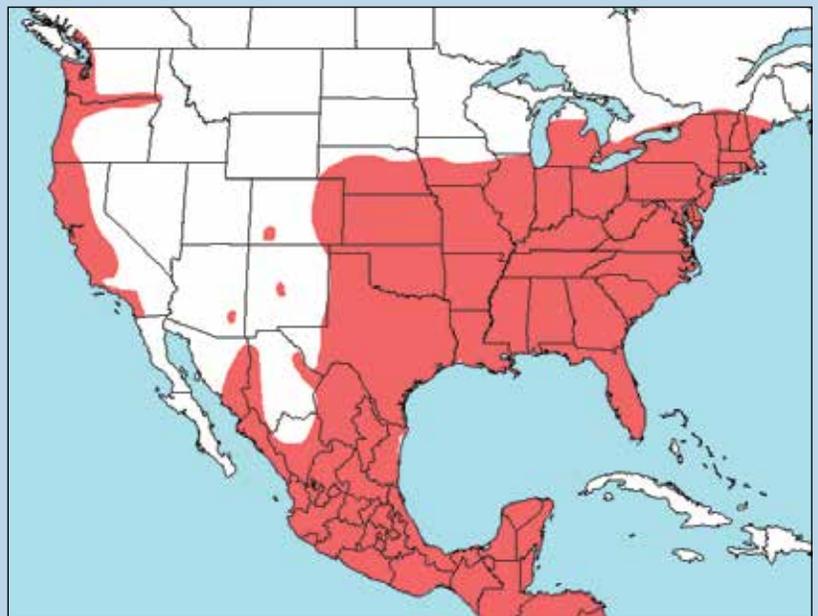
of Florida and the southeastern United States.

Opossums are *marsupials*, meaning they give birth to tiny, barely formed young that grow and develop in their mother's pouch. The pouch is more like an old-fashioned coin purse than a pocket seen in cartoon kangaroos. The opossums seen in this photo were released unharmed.

**T**HE VIRGINIA opossum is in the Order Didelphimorphia (New World marsupials). It is only distantly related to all of the Australian orders of marsupials. The opossum family, Didelphidae, is known via the fossil record from North America that goes back over 100 million years and was dodging dinosaurs for almost 35 million years. While many people call the opossum a “possum,” *possums* are actually Australian marsupials. Opossums occur in the Americas, while possums occur in Australia, New Guinea, and now New Zealand.

Generally, opossums are rarely more than a minor nuisance to homeowners and property managers. They will eat some fruits like grapes, tomatoes, plums, figs, persimmons, cherries, and palm fruits, and fallen, overly ripe mangoes, peaches, papayas. They do not eat citrus or avocados.

*Continued*



The modern range of the Virginia opossum. Human-provided habitats have allowed the opossum to extend its range northward.



The front foot (left) and hind foot (right) of a Virginia opossum.



The droppings of the opossum tend to be small and may contain seeds, fruit fibers, insect parts, dirt, fur or feathers. They most closely resemble cat droppings in size and shape but not contents.

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**O**POSSUMS may prey on small, unprotected livestock, especially poultry and rabbits. Their normal food is insects, earthworms, fruit, and carrion. Raccoons, cats and dogs are always a much greater threat to livestock than opossums.

Opossums may den under sheds, decks, overturned boats, in crawlspaces and attics. The main problems this causes are irritating the family dog and being a source of cat fleas to infest both dogs and cats. In some parts of the United States, opossums and cat fleas can serve as reservoirs and vectors of urban murine typhus. This is not known to occur in Florida.

Opossums can serve as both reservoir and vector for *Sarcocystis neurona*, the causative parasite for equine protozoal myeloencephalitis (EPM). The infective stage is shed in the opossum's feces. If the feces should contaminate a horse's food or water, the horse may become infected with this potentially fatal parasite. EPM causes no symptoms in humans or other livestock.

Many people fear opossums as rabies vectors, but opossums are highly resistant to the rabies virus. Their physiology is so different from the carnivores that are the normal host for rabies that opossums are virtually immune to it and therefore not a potential vector.

### SIGNS

Opossums leave few signs and do little damage. Most people only know of opossums in their yard by seeing one. The tracks are distinctive, with a "thumb" on the hind foot. The front foot could be confused with the fore paw of a raccoon, but the toe length to foot pad size proportions are different between these two species.

The skulls have several distinctive features that help with identification. Opossums are the only land mammal in the United States with five upper incisors and four lower incisors. All other mammals have three or less at top and bottom. Opossums are also the only land mammal to have four molars as adults.



Opossums that become a nuisance are easily live trapped. Because they are not a rabies vector species, there is much less concern about relocating them and fewer restrictions.

## CONTROL

Generally, exclusion is an effective control for most opossum complaints. If an individual becomes a nuisance, they are easy to live trap. Good baits include cat food, chicken necks or giblets, and eggs. The greatest difficulty is not catching stray cats or foraging raccoons before the opossum can find the bait. **PP**

### Photo credits

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Virginia opossum adult in tree by Nicholas E. Lowe, iStockPhoto.com

Juvenile opossum by Tree and J. Hensdill, Wikimedia Commons

Map of opossum range courtesy of the Smithsonian – National Museum of Natural History at [http://www.mnh.si.edu/mna/full\\_image.cfm?image\\_id=905](http://www.mnh.si.edu/mna/full_image.cfm?image_id=905)

Droppings photo from <http://wdfw.wa.gov/living/opossums.html>, originally produced by Acorn Naturalists



The upper teeth of an adult male opossum, showing the five upper incisors, four molars, three premolars, and two very large canine teeth.



SEASONS GREETINGS  
FROM PEST PRO

# Christmas Tree Bugs

Philip G. Koehler

EVERY YEAR we get calls about Christmas trees that are infested with bugs that then invade the house. Christmas trees are grown in natural settings, and it would be odd if insects would NOT be found on them. Most Christmas trees are grown in patches adjacent to woods, with broadleaf plants and grasses serving as ground cover around the trees. The bases of Christmas trees are therefore a good place for insects to overwinter. So a wide variety of insects can be found associated with the trees. In fact, one entomologist did the research and found that a Christmas tree can host 25,000 overwintering insects, mites and spiders. The pests can reawaken when the tree is brought indoors and warmed up. Even the eggs of some insects may enter the home on a tree, and hundreds or thousands of young can hatch from these eggs.

Most insects stay in the tree, die of dehydration, and will never be seen by the homeowner. However, your customers need to be aware that when a Christmas tree is brought into a house, a little bit of nature is introduced into their living room, including some bugs.

Here are just a few pests detected on Christmas trees: **Ticks** hide at the base of trees and sometimes lay masses of 2,000–3,000 eggs, which can hatch when warmed in the house. **Aphids** are sometimes mistaken for ticks. They are about the same size as a tick and are brown or black. **Praying mantids** can lay their egg masses (frothy-looking and dried), with 200–400 eggs, on tree limbs. Once warmed, the young disperse through the house. **Spider mites** are tiny red and brown dots. They feed on the tree and do not affect people. None of the **spiders** that have been found in Christmas trees are considered poisonous. Just vacuum them up.

What should you recommend to your customers? Here are some tips:

- ◆ Shake the tree before taking it home, and look under it for crawlers.
- ◆ Vacuum up any pests that might awaken from the tree and start crawling.
- ◆ Remove the tree from the house if it is heavily infested.
- ◆ Don't mash the insects, as some will stain furniture, walls and floors.
- ◆ Don't spray the tree with aerosol insecticides. They will damage the tree, and the oily residue could be a fire hazard as the tree needles dry.
- ◆ Don't worry about storing the ornaments—any insects will dry out and die. **PP**

Philip Koehler is endowed professor at the UF/IFAS Department of Entomology and Nematology.

# Understanding



*Rose photo by Peter Griffin*

# Phytotoxicity

Lynn Griffith

**I**N THE pest management business, we apply pesticides in numerous ways for our clients. Spraying is extremely popular, although there are also granular applications, dusts, injections, fumigants, and other styles of applying pesticides in order to achieve control of the target pest. Most of the time, this works fine. However, there are occasions where pesticide applications can cause plant injury, which can be used as a general definition for the term phytotoxicity. I will discuss here only plant-related injury, without referring to potential injury to people, pets or structures.

## Fundamental Phytotoxicity

This is simply a situation where a pesticide and a plant variety do not get along. Most pesticides are generally considered safe to use on a wide variety of plants. However, experience shows that sometimes the pesticide may be fundamentally injurious to a particular type of plant, even when applied correctly and at label rates. In the old days, such examples might include Malathion on hibiscus, Agri-Mycin on ivy, Chipco 26019 on peace lily, and copper on bromeliads. I once saw an entire greenhouse full of gardenias defoliated by a proper application of a mancozeb formulation whose label strictly prohibited use on gardenia.

Modern pesticides are usually tested more thoroughly than products from decades ago. Often during such product testing, investigators will discover that certain plant varieties simply do not like certain chemicals. For example, Heritage is a terrific strobil fungicide that I and others recommend frequently. However, experience has shown that Heritage is not safe on some apple and cherry varieties, nor on leatherleaf fern. The label therefore strictly prohibits use of this product on these varieties. It is fairly common today for pesticide labels to permit use of a product on a wide variety of turf and ornamentals, yet specifically prohibit use on others. Such counterrecommendations are often listed toward the bottom of the pesticide label after the permitted varieties, so check your pesticide labels carefully.

## Dosage Phytotoxicity

We all know that some people think “if a little is good, more is better.” That generally does not apply in the realm of pesticide applications, and it may be downright illegal. You all know that applying the correct dose of a pesticide is critical. Apply too much, and you can risk plant injury, as well as waste money and product. Apply too little, and you may invite pest resistance. Pay attention not only to dilution rates, but to formulation rates per unit area, such as ounces per thousand square feet. Applicators can not only sometimes mix a chemical too strongly, but

they can also apply too much of a properly mixed formulation per unit area. The pesticide label can be your best friend in such situations. Also, do not ignore sprayer calibrations, and remember that nozzles do wear over time.

## Cumulative Phytotoxicity

Most of the time, pesticide applications can be properly made according to the label, without incident. Occasionally, if multiple applications are made to the same plants or turf with the same product, phytotoxicity can develop over time. One application may be fine, but multiple applications of the same product can lead to larger accumulations in the plant, resulting in injury. In my experience, this is especially possible with systemic products — both fungicides and insecticides. Watch your rates, and rotate your chemistries to help avoid this. Many pesticides today also limit how much product can be applied to a specific area per year.

## Environmental Phytotoxicity

I am referring here not to potential injury caused to the environment from pesticide applications, but to plant injury that can happen when pesticides are applied during unfavorable environmental conditions. Applying atrazine during summer is a classic example.

We Floridians know that chemical injury risk to plants increases during hot weather or when plants are drought stressed. Any kind

of plant stress can potentially increase the risk of spray injury, so keep those factors in mind. When I was a spray man for large ornamental nurseries in the 70s, we tried to avoid spraying when the temperature was above 85°F. Landscape plants and turf can generally be sprayed when temperatures are somewhat higher than that, but drought stress greatly increases susceptibility to injury.

*Continued on Page 28*



*Phytotoxicity symptoms on rose bush. Photo by Mississippi State University.*

# Landscape Mulch

## And Associated Pests

Mary L. Duryea and Philip G. Koehler



BOOKLICE



CENTIPEDE



MILLIPEDE



AMPHIPODS



EARWIG

MULCHES are an integral part of the urban landscape, but they can also serve as a habitat for a variety of pests.

**T**HE EFFECT of mulches on pest problems is an issue that needs to be addressed so pests do not proliferate in mulch and become a problem both indoors and outdoors around homes and businesses. Many insects and other pests can find a home in mulch, including cockroaches and ants. Asian cockroach infestations are usually found in mulched areas around homes and other buildings. Some other pests associated with mulch and moisture include:

### Booklice

Small, pale-brown to white insects shorter than 6 mm. Wings may be present or absent, and they have a large, swollen area above the mandibles (clypeus). Often they are found in books, on floor molding, and in closets. They do not suck blood, but feed on mold and mildew.

### Centipedes

They are often called “hundred-leggers” and have one pair of legs per segment. They are wormlike and long — up to 6 inches. The 40 to 50 body segments are flattened, and the head has one pair of antennae. Some species can bite and penetrate the skin with their mandibles. Centipedes are beneficial outdoors, feeding on insects and other arthropods.

### Millipedes

They are often called “thousand-leggers” because they have many legs — two pairs per body segment. They have many cylindrical body segments and one pair of short antennae with seven segments. Millipedes feed on

decaying organic matter and are found in decaying vegetation and mulched areas. They are nocturnal and are known to have mass migrations from swampy areas of Florida.

### Amphipods

These are crustacea with a shrimplike appearance and are commonly known as “lawn shrimp.” Amphipods live on the surface in the top ½” of mulch and moist ground. They are usually pale brown when alive. After rains, large numbers of amphipods can migrate into garages or under the doors of houses. They die quickly in the drier environment and turn reddish.

### Earwigs

These insects have forcepslike cerci that can be used to capture prey or to defend themselves against predators. Earwig adults are ¼” to 1” long. Their bodies are flattened and are pale- to dark-brown. The antennae are threadlike and about half the length of the body. They are active at night and often crawl into homes under door sills, as they are attracted to light. They are beneficial, eating insects and other pests.

### Pillbugs

They are often called “roly-polies” because they roll into a tight ball when disturbed. They are Crustacea in the order Isopoda and are about ⅝” long. Pillbugs

have seven pairs of legs and two pairs of antennae, one of which is very tiny. They live in wet areas under logs, flower pots or mulch. They feed on decaying organic matter.



PILLBUG

### Sowbugs

These are similar to pillbugs but cannot roll into a tight ball. They also have seven pairs of legs and two pairs of antennae. Sowbugs have prominent taillike appendages, or uropoda, that project from the rear end of the body. Sowbugs are active at night and often are found under debris, in mulch and under flower pots. They often enter homes by crawling under doors.

### Fungus gnats

These small flies breed in damp soil or decaying vegetable matter. Often they are brought into houses in potted plants or are found in commercial buildings in planted areas. Fungus gnat adults are attracted to light and often are found around windows.

### Springtails

These are tiny insects about 1 mm to 2 mm long. They are in the order Collembola and are white to grayish, with no wings. They have a forked structure, or furcula, on the rear of the body that enables jumping. Springtails live in mulch and wet soil, but can migrate into homes and swimming pools in large numbers. They feed on molds and decaying vegetation.

### Elimination of Harborage

In addition to food and moisture, pests require a place to live, so harborage is critical to their survival. Pulling mulch away from the house is a good way to prevent large number of insects from invading buildings. Other measures important in pest management include:

- ▶ Stack firewood off the ground and well away from the house.
- ▶ Fill tree holes with cement to remove prime harborage for some insects.
- ▶ Keep shrubbery and ornamental plants well trimmed and away from the house.
- ▶ Reduce use of ivy near or on buildings, because it is a good breeding place for outdoor cockroaches and other pests.
- ▶ Keep clutter such as newspapers, bags and clothing from accumulating.

Normally, it is better to use only a thin layer of mulch that extends 1 foot out from the foundation of the home. This will allow drying time and make conditions less conducive to pest survival.



**SOWBUGS**



**FUNGUS GNAT**



**SPRINGTAIL**



**DARK SOUTHERN  
SUB TERMITE**

### Termites

Termites are another potential problem that can be made worse with mulch. Subterranean termites occur throughout the temperate and tropical regions of the world and cause the majority of damage to wood in use. They live in the soil in colonies which that can number more than 1 million workers and soldiers. In nature, their role as decomposers of dead and fallen trees is a valuable one. However, termites also consume wood in service, and so there is great interest and concern over their threat to wooden buildings and structures.

The dark southern subterranean termite, *Reticulitermes virginicus* (Banks), and eastern subterranean termite, *Reticulitermes flavipes* (Kollar), are two of the five principal subterranean termite species in the United States, causing 95 percent of the termite damage to wooden structures. They do not build distinct nests, but instead have dispersed colonies underground with a collection of feeding sites.

Subterranean termites forage for food as far as 250 feet from their colony. To lessen the effect of air currents and reduce attack from ants, these termites build mud tubes between the soil and food sources.

Landscape mulches are commonly used in today's urban forest to provide many benefits including water and soil conservation, weed control, soil temperature buffering, and soil organic matter improvement. These benefits and the increasing interest in utilizing yard waste have resulted in a wide array of mulches being used for weed and water management and for decorative purposes around houses.

But questions have been raised about organic mulches being possible attractants to termites. Results of two studies comparing six common Florida landscape mulches helped determine if termites consume various commercially available landscape mulches currently used in Florida.

### The Studies

After collecting colonies of subterranean termites, *R. virginicus* and *R. flavipes*, from forests and backyards in Gainesville, Florida, two experiments were conducted to determine if these insects would eat mulches, and if they would eat certain kinds of woods. So termites were fed both heartwood and sapwood of cypress and melaleuca and pine sapwood.

The six tested mulches were:

- ▶ Cypress — bark and wood from *Taxodium distichum* and *Taxodium distichum* var. nutans
- ▶ Eucalyptus — bark and wood from *Eucalyptus grandis*
- ▶ Melaleuca — bark and wood from *Melaleuca quinquenervia*
- ▶ Pine bark — mostly bark from *Pinus elliottii* and *P. taeda*
- ▶ Pine straw — needles from *P. elliottii*
- ▶ Gainesville Regional Utility (GRU) mulch.

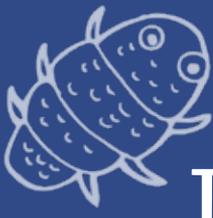
The GRU mulch contained utility prunings of leaves, bark and wood; chopped wood from oaks *Quercus laurifolia* Michx., *Q. rubra* (L.), and *Q. virginiana* Mill; cherry (*Prunus serotina* Ehrh.); and a small amount of cedar *Juniperus silicicola* (Small) Bailey; camphor, *Cinnamomum camphora* (L.) J. Presl; and southern pines, *Pinus* spp. The other mulches were purchased from commercial gardening stores.

Wood samples from three tree species were also tested, including:

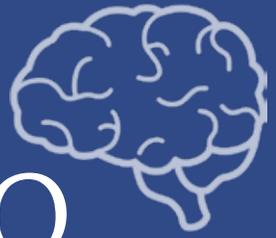
- ▶ Southern pine sapwood — used as a standard, because termites are known to feed on pine
- ▶ Cypress sapwood
- ▶ Cypress heartwood
- ▶ Melaleuca sapwood
- ▶ Melaleuca heartwood

The mulches and woods were air dried and placed in plastic containers with worker termites. These containers were placed in a humidity chamber, and we observed termite activity. At the end of the experiments (three weeks), live termites were counted, and mulch samples were dried and weighed in order to determine how much of the mulch or wood had been consumed.

*Continued on Page 29*



# 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.

## Dark Southern Subterranean Termites *Reticulitermes virginicus*

These termites usually swarm in the spring, but they will also swarm during October through December. The spring swarms are usually at midday, 11 AM to 1 PM, but fall swarms are usually earlier in the morning, 8 to 10 AM. Evidently, some homeowners think these are plant pests such as whiteflies, because of the appearance of their wings and occurrence on lawns and vegetation. Fall swarms inside structures tend to be really rare.

## Ambrosia Beetle Frass Tubes *Xylosandrus crassiusculus*

Ambrosia beetle larvae boring into wood will exude frass tubes such as the ones pictured. These types of tubes also have been seen in cedar wood beams that were probably air dried rather than kiln dried. The kiln drying process kills all insects in the wood and leaves the wood without enough moisture to allow most insects to survive.

## Cuban Tree Frog Droppings *Osteopilus septentrionalis*

The Cuban tree frog is now found in 36 of Florida's 67 counties. It is an invasive species that is displacing the green tree frog. Cuban tree frog droppings look a lot like rat droppings and can easily fool your customers into believing they have a rodent problem. While frogs themselves may be harmless, they leave feces wherever they go — especially on window ledges and at the base of buildings.



1. \_\_\_\_\_

2. \_\_\_\_\_

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- Developing the deal structure in order to maximize after-tax proceeds.

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ANSWERS  
 1. Ambrosia beetle frass tubes, 2. Cuban tree frog droppings, 3. Dark southern subterranean termite



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# Are You Willing to Change Now To Grow Your Business in 2016?

HARVEY F. GOLDGLANTZ

**I**F THERE'S one thing that you can depend on in business, it's the principle that nothing remains the same. Change is ongoing, inevitable and yes – constant. As far as I see it, you have three options when considering change:

Option #1: You can try to stay ahead of it; by exerting your influence over it.

Option #2: You can choose to be pulled along by it; after much ruminating and consternation over its implications and ramifications.

Option #3: You can resist it altogether; refusing to give in to the unfamiliar –relying instead on the tried, “true” and familiar.

Which of the above three options best describes how you handle change? Your response can be viewed as a mirror into your operating style; reflecting your confidence level, management style, leadership characteristics and vision (or lack thereof).

## Staying Ahead of the Curve

A healthy business environment is evolutionary – ever changing. Enlightened managers, owners and leaders understand this. Growing businesses embrace change, cause it, and utilize it as a lynchpin and advantage against the competition. Strike first, often and with innovation is the mantra of all great companies.

Now, don't get me wrong. I'm not suggesting change for change's sake. I am however sounding the trumpet for well thought out strategic planning; the forerunner of constructive change.

Companies that launch programs and services, before their competitors, enjoy a number of calculated rewards, such as: being the first in their marketplace to introduce a new product or service, realizing minimal competition and pricing advantages while competitors try to figure out their tactics (by developing a counter strategy and response) and a significant degree of credibility that comes without the challenges of a barrage of competitive forces.

The ability to encourage, steer and implement constructive change is an essential hallmark of leadership.

## Being Pulled Along by Change

If you're the type that doesn't move easily or quickly when it comes to making business decisions, then this heading applies to you! You probably view this push-me, pull-me tact

as prudent conservatism with a dose of appropriate caution. In reality, there are genuine consequences for being content with staying in the middle of the pack, not the least of which is being viewed as a follower.

Were you one of the last companies to incorporate pay-per click/Google ad words into your Internet strategy? Are you still contemplating hiring a company to manage your search engine optimization? Are you still allocating 3%–5% of last year's revenue for next year's advertising budget?

Most people are willing to change, not because they see the light, but rather because they feel the heat — and that's unfortunate.

## Memories of the Way Things Were

“I will not change it Sam I am. I will not eat green eggs and ham. I want things how they used to be. No risks, no losses, no threats for me!” Sound familiar? Perhaps you could have written this addendum to Dr. Seuss yourself.

And to that I respond, No pain no gain. No risk, no growth. No change = status quo. Status quo = contentment. Contentment = regression.

## Becoming a Member of the “Change” Gang

For those of you who are uncomfortable with change; afraid of what might await you at the end of the “change” road, I can assure you that proceeding down the path of trying new things (action) and failing, beats looking back and lamenting over the “what might have beens” and “what ifs.”

For you see, the concepts of change and chance are fused forever together by potential. For an individual or company to achieve greatness, moving into uncharted territories is a rite of passage.

You've heard the age-old adage; “The greater the risk, the greater the reward.” In order to achieve one's potential, one must reach. Of course, you may fall now and then but the lessons learned build character.

Personally, I don't believe in luck. I believe that when preparation meets opportunity, change becomes the agent of accomplishment. 2016 is just around the corner. Perhaps it's time to consider professional help. **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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# Introducing Blair Siegfried

New Department Chair at  
the UF Entomology and  
Nematology Department



GAINESVILLE, Fla. — An internationally renowned insect scientist with expertise in safe and sustainable pest management has been appointed to lead the UF/IFAS Department of Entomology and Nematology.

Blair Siegfried, formerly a professor of entomology at the University of Nebraska-Lincoln, started at UF/IFAS on Sept. 1. He said his interest in the department chair position was based on an interest in pursuing new challenges and opportunities.

“I am extremely excited by the opportunity to work with an outstanding group of scientists and personnel from the entomology and nematology department and to build relationships with other units from the Institute of Food and Agricultural Sciences and broader campus,” Siegfried said.

Jack Payne, UF senior vice president of agriculture and natural resources, said Siegfried provides the background necessary to lead the UF/IFAS entomology program to new heights.

“People in Florida and, indeed around the world, need pest-control solutions as they impact homeowners and all aspects of agriculture and the environment,” Payne said. “Dr. Siegfried is well-positioned to steer UF/IFAS educational, research and Extension programs to help solve global entomological issues.”

As department chair, Siegfried is responsible for 30 faculty and 30 staff members in Gainesville, plus 40 faculty and staff members at research and education centers around the state.

Siegfried joined the University of Nebraska as an assistant professor in 1990 and worked his way up to full professor in 1999. In 2008, he was named the Charles Bessey Professor for distinguished scholarship and creative activity. He has published more than 145 peer-reviewed scientific papers.

Siegfried earned his bachelor’s degree in biology from Lock Haven University in Pennsylvania, his master’s from UF/IFAS, and his doctorate from Penn State — both in entomology.

Coming to Gainesville is a homecoming for Siegfried and his wife. She was born and raised here, most her family still lives here, and Siegfried earned his graduate degree here.

“We have visited Gainesville many times and look forward to reuniting with friends and family,” he said. “Nebraska has been a great place to live and work for the last 25 years, and we will miss our close friends and colleagues, but will not miss the harsh winters or the long drives to the beach.” **PP**

*Report by Brad Buck, UF/IFAS science writer.  
Blair Siegfried photo by Alex Catalano.*

It is imperative  
that we develop novel  
approaches to pest  
management that  
are sustainable and  
have a negative  
impact on pests.

*Blair*

# QUICK START

Do you have a high school diploma?  
\* School must be regionally accredited.

**YES**  
Academic  
Development Options

Do you have a BA or BS degree?

**YES**

Consider enrolling in UF's distance  
master's program.

**DEGREE**  
Bachelor of Science  
in Entomology and  
Nematology\*\*

Entomology  
Specializations

- Preprofessional
- Basic Science
- Plant Protection
- Ecobiology
- Urban Pest Management

3 year  
experience  
required

**BCE Exam**  
Board Certified  
Entomologist

**NO**

Are you seeking a certificate or degree?

**CERTIFICATE**  
Are you interested in becoming a  
certified pest control operator (PCO)?

**YES: CERTIFIED PCO**  
Certificate in Pest Control Technology  
• Qualifies you for the State of Florida  
pest control exams  
• You must complete 24 college credits\*

No work  
experience  
required

**CPCO Exam**  
Certified Pest Control Operator  
State of Florida

**NO**  
Certificate in Urban Pest Management  
• You must complete 15 college credits\*

Certificate in Landscape Pest  
Management  
• You must complete 15 college credits\*

Certificate in Medical Entomology  
• You must complete 15 college credits\*

No work  
experience  
required

No work  
experience  
required

**NO**  
Vocational Professional  
Development Options

Do you want to train online or on-site?

**ONLINE**

**CEUs** Southeast Pest Management  
Conference-online activities

**CEUs** Pest Management University  
online modules

**CEUs** Florida Pest Pro-online CEU  
training modules

Do you need material to share  
with your customers?

IPest1 / IPest2 / IPest 3 apps  
• Field guide to urban pests  
• Purchase at App Store

**ON-SITE**

**CEUs** Southeast Pest Management  
Conferences, first week of May  
in Gainesville, Florida

**CEUs** Pest Management University  
on-site instruction in Apopka,  
Florida

Associate Certified  
Entomologist (ACE) Florida  
review course

5 year  
experience  
required

**ACE Exam**  
Associate Certified  
Entomologist

\* Credits toward a certificate may be taken at the undergraduate or graduate level. Up to nine credits may be transferred to a degree-seeking program.  
\*\* Undergraduate degrees are offered in Gainesville, Florida. University of Florida admission is required.

# Educational Opportunities For Pest Management Professionals

Rebecca Baldwin and Philip Koehler

**H**AVE YOU thought about continuing your education, but wondered which route is best for you? The University of Florida Entomology and Nematology Department has options ranging from continuing education courses to graduate degrees. You can take courses online and even tailor your program to gain eligibility for pest control licensing in Florida. This article will acquaint you with the terminology used in the registration process and will provide a walk-through of some of the options.

Think about where you are in your education and what goals you would like to reach. We created an infographic (left) to help you decide which option is best for you. The graphic begins with a split between vocational professional development and academic development. Let's begin with vocational options.

## Vocational Professional Development

Vocational professional development is to aid you with educational opportunities for the pest management trade. Whether you are a technician or a certified pest control operator, vocational professional development would pertain to you. Classes in the vocational professional development category provide you with continuing education units. "CEUs" are required by licensing agencies to ensure that a license holder stays up to date on the latest technologies in their field. Once you become licensed in the pest management industry, you must stay current on core areas of the industry, such as pesticide safety, integrated pest management and license specific techniques in categories such as general household pests, or landscape pests. The University of Florida offers online and in-person options for CEUs. Let's discuss a few options available to you.

## Southeast Pest Management Conference and ACE Review

The first week of May, the Southeast Pest Management Conference, or SEP<sup>1</sup>, takes place in Gainesville, Florida. This conference runs on a Monday through a Wednesday and costs approximately \$160. The education focus for Monday is general household pests, Tuesday is wood destroying organisms, and Wednesday is lawn and ornamental pest management. Besides educational programs and CEUs, the conference offers an opportunity to network with manufacturers and distributors in the industry and also includes a segment on canine certification for pest detection.



Graduation ceremony at the University of Florida. Photo by Amy Stuart, UF/IFAS.

The conference also offers a review session for the Associate Certificate Entomologist (ACE) exam and provides proctors for the ACE exam. The ACE program is offered through the Entomological Society of America Certification Corporation (ESACC), and the University of Florida offers a review session and proctors. Qualifications for the ACE exam require a current pest control license, letters of recommendation, and five years' experience in the industry. The ACE certification must be renewed every three years and costs \$375. A new study guide for this exam has just been published<sup>2</sup>. Applications for the exam should be submitted to the ESACC a minimum of thirty days before the scheduled exam.

To receive CEUs from the SEP<sup>1</sup> meeting, participants must register for the conference, sign an attendance sheet at the beginning of each educational session, and complete an attendance form at the conclusion of the session. To receive credit, include the attendance form in your license renewal to the state. Select presentations from the Southeast Pest Management Conference are also available online for CEUs.

## Pest Management University

Another resource offering both online and classroom training is Pest Management University<sup>3</sup> in Apopka, Florida. Pest Management University, or PMU, offers hands-on courses in general household pest management, wood-destroying pest management, and landscape pest management, at levels ranging from foundations to expert. Specialty courses are also offered on industry-related topics such as bed bugs and school IPM.

Course fees vary based on the class, and classes build on one another. For example, to register for an expert-level course, you must have successfully completed the foundations and masters courses.

A typical hands-on course is two-and-a-half days and costs \$375. Class participants receive a notebook of course materials and are taught through experiences with the hands-on elements. Online courses through PMU generally range in price from \$10–25.

## Florida Tech Pro

Extension specialists with the University of Florida IFAS Entomology and Nematology Department have partnered with the Florida Pest Management Association to offer Florida TechPro<sup>4</sup>. Florida TechPro is a series of ten online training modules for the beginning pest management technician. Training modules

include *IPM, Formulations, Applying the Correct Amount, Personal Protective Equipment, Pesticide Emergencies, Spill Control, Triple Rinse, Labels and MSDS, Personal Care, and Vehicle Inspections.*

## iPest Apps

Turn your iPhone or iPod Touch into a mobile field guide to urban pests with the iPest series<sup>5</sup>. You will find this guide, while not approved for continuing education credit, is a practical way to identify and educate others about common urban pests. iPest1 covers pest cockroaches, filth breeding flies, occasional invaders, and urban pest and wildlife droppings. iPest2 covers pest ants, stored food beetles, common termites in structures, and wood-destroying insects. iPest3 covers biting, stinging, and bloodsucking arthropods. Each pest has a "facts" section about habitat, biology, behavior and distribution in the United States. Each app, \$1.99, is fully downloadable.

## Undergraduate Academic Development

If you hold a high school diploma, you may want to continue your education by taking college courses toward a degree or a certificate. The University of Florida offers four non-degree certificate programs as well as an undergraduate degree with six specialization choices. You may wonder what is the difference between a degree and a certificate. The certificate is unique in that it is a non-degree program. This means you will not work toward a college degree, but you will take college courses. A college degree, like a

<sup>1</sup> [http://entnemdept.ifas.ufl.edu/sepmc/Main\\_Page.html](http://entnemdept.ifas.ufl.edu/sepmc/Main_Page.html)

<sup>2</sup> <http://www.entocert.org/>

<sup>3</sup> <https://pmu.ifas.ufl.edu/courses>

<sup>4</sup> <http://flpma.org/?page=UFTechProTraining>

<sup>5</sup> <https://itunes.apple.com/us/app/ipest1/id370421252?mt=8>



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bachelor's degree in entomology, typically requires 120 credit hours of coursework, while a certificate requires between 15 and 24 credits of coursework. A typical college course is three credits and costs approximately \$212 per credit hour.

### Undergraduate Certificate Programs

The certificate courses are actual college courses, so must be taken within the structure of a semester. The certificate courses are offered online, so you may complete coursework anywhere there is an Internet connection. Semesters begin in early January, mid-May and mid-August each year. There is a \$30 fee to apply to the University of Florida certificate program. Submit an application six weeks before the start of a new semester<sup>6</sup>.

Once we accept your certificate application, a subject area advisor will be assigned to you. For example, if your interest is in urban pest management, your advisor would be Dr. Phil Koehler. If your interest is in medical entomology, your advisor would be Dr. Roxanne Connelly. Ms. Ruth Brumbaugh<sup>7</sup> is the student services coordinator for the certificate program. She is your first point of contact and will help you through the application process. She will also register you for courses each semester.

Each certificate has a specific set of requirements that must be met in order to earn the certificate<sup>8</sup>. The 15-credit certificates are much like a minor, focused around a subject area. Three options include urban pest management, landscape pest management, and medical entomology. The fourth option is for those who would like to become a licensed pest control operator in Florida. To qualify for the licensing exam, the Florida Statutes require three years of experience in Florida pest control or completion of an approved entomology program at the University of Florida.

The certificate of Pest Control Technology qualifies as an approved education program. This certificate requires successful completion of 24 credits of college coursework, including an experiential course in pesticide application. Certificate students must complete each course with a grade of C or better or retake the course. Credits obtained at another university will not transfer into a UF certificate program.

If you are employed, we recommend you begin the certificate program by registering for only one course your first semester. A semester ranges from about 12 weeks in the summer to 16 weeks in the fall and spring. These are full college courses, so require some time commitment. If you do well in balancing your work, family and school, you may consider adding an additional course in subsequent semesters. A typical course load for a full-time college student is 12–15 credit hours per semester.

One question we often receive from those interested in a certificate is about financial aid. Since certificate programs are non-degree seeking, there is no federal financial aid. Students may seek alternative or private loans if needed.

Many questions about courses can be answered on the course syllabus<sup>9</sup>, an outline that provides information about the course textbook, how to access online materials, how to contact your professor and details about how you will be evaluated in the course. As soon as you are accepted into the certificate program, you should request a copy of the course syllabus.

The first week of the semester is a grace period where you can make changes to your schedule. Once that week, called drop-add week, has passed, you are financially liable for any course in which you are registered. If after that first week you decide you would be better off waiting to take the course later, you would still be required to pay for the course and must pay for it again if you register for it in the future.

Sometimes you must withdraw from a course for personal reasons. To avoid an academic penalty, like a failing grade, you must officially withdraw from the semester. It is important to communicate with the student services coordinator and your professor to avoid damaging your grade point average. In the certificate program, you may take one or more courses each semester, and may take a semester off if needed. If you do not register for courses for two consecutive semesters, you may need to reapply to the program. Upon completion of your coursework, you will receive a certificate from the University.

### Undergraduate Degree: Bachelor of Science in Entomology and Nematology

The final option we will discuss in this article is the undergraduate degree in entomology and nematology. The Bachelor of Science degree in Entomology and Nematology is only offered on site at the main campus in Gainesville, Florida, or at the University of Florida Research and Education Center in Ft. Lauderdale, Florida.

Many of our courses are offered online, but the degree cannot be obtained without taking some courses on campus. The degree requires 120 credit hours and admission to the university. After high school graduation, students may enter as a traditional first-year student in summer or fall semester, or they may enter in the spring as an Innovation Academy student. Students also may complete their first two years of coursework online, then move to campus for their final two years in the Pathway to Campus Enrollment program, or PaCE. Alternatively, a student may complete their associate's degree at a state or community college, then transfer to the University of Florida for their final two years of coursework (60 credits).

THE COURSES required for transferring into the Entomology and Nematology program are specific to the specialization, and the required courses must be completed before being accepted into the program. Approximately 70 percent of transfer students are denied admission for lack of required coursework, so if you plan to apply to UF as a transfer student, please pay careful attention to the required courses in the transfer guide<sup>10</sup>.

The Entomology and Nematology Department offers six degree specializations at the bachelor's level: basic science, ecotourism, pre-professional, biosecurity, plant protection, and urban pest management. Each specialization is tailored to the student's interest. For example, the basic science path allows students to select science electives that are of interest. One student may select courses in wildlife ecology to fulfill their electives, while another may select courses in animal science.

While any of the entomology specializations can lead to graduate school, the basic science option is designed to prepare students for graduate education by requiring an undergraduate research internship. As another example, students interested in entering the medical, dental, or veterinary field, would select pre-professional as their specialization. The pre-professional degree track includes the appropriate chemistry, math, genetics, and biochemistry for application into medical, dental or veterinary school. If a student is interested in starting a business, the urban pest management track includes 12 credits of business courses and requires an experiential learning course on pesticide application. Students really have the option to select a specialization that fits their future goals<sup>11</sup>. Applications to the University of Florida undergraduate program are due around November 1 each year. Degree admission details and deadlines are available online<sup>12</sup>.

We hope this article has inspired you to consider furthering your education with the University of Florida Entomology and Nematology Department. If you would like more information about our educational programs or would like to visit, please contact Rebecca Baldwin at [baldwinr@ufl.edu](mailto:baldwinr@ufl.edu) or 352-273-3974.

Stay tuned for a future article that details the online and on-site graduate educational opportunities in UF Entomology. **PP**

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*Rebecca Baldwin is assistant professor and undergraduate coordinator, and Philip Koehler is endowed professor at the UF/IFAS Entomology and Nematology Department.*



<sup>6</sup> <http://www.admissions.ufl.edu/start.html>

<sup>7</sup> [brumbaugh@ufl.edu](mailto:brumbaugh@ufl.edu)

<sup>8</sup> [http://entnemdept.ifas.ufl.edu/academics/distance\\_ed\\_brochure.pdf](http://entnemdept.ifas.ufl.edu/academics/distance_ed_brochure.pdf)

<sup>9</sup> [http://entnemdept.ifas.ufl.edu/academics/course\\_schedules.php](http://entnemdept.ifas.ufl.edu/academics/course_schedules.php)

<sup>10</sup> <http://cals.ufl.edu/>

<sup>11</sup> [http://entnemdept.ifas.ufl.edu/academics/About\\_Us.html](http://entnemdept.ifas.ufl.edu/academics/About_Us.html)

<sup>12</sup> <http://www.admissions.ufl.edu/>

### Placement Phytotoxicity

Pesticides may often be applied safely when applied to certain parts of a plant, but not to others. For example, granular herbicides such as pre-emergents may be fine when applied to soil at the base of plants. However, if the granules land in a whorl or cup, or on open flowers, injury can occur when it normally would not. Placement phytotoxicity is more common with granular products, though formulations diluted with water can also cause potential injury when applied to certain plant parts, such as open flowers. Applying a copper fungicide to a fruit tree may be a perfectly appropriate application, but may cause flower injury when applied at the wrong time and can substantially reduce fruit yield.

### Combination Phytotoxicity

Sometimes chemical X may be safe to apply in a certain situation, as can chemical Y. However, if the two are mixed together, potential injury can result. This can happen with herbicides as well as fungicides and insecticides. Nutritional can enter the picture as well. I have lectured extensively on tank mixing in the past. Tank mixing is generally safe, but it is a fine and delicate art. It is very dependent on experience and on application details such as weather, dosages, and plant or turf varieties. There are literally quadrillions of potential tank mix combinations, so pesticide labels are often of limited help in this area. Use your experience and be cautious.

Another type of combination phytotoxicity can occur when a singular product is applied that reacts with residue from a previously applied product. Again, either by itself may be fine, but the two together can cause potential problems. A good example of this is injury from applying acidic products too soon before or after metallic products. I know of one fungicide whose label restricts its use within two weeks before or after applications of copper fungicides.

### Pressure Phytotoxicity

Many times, I have seen pesticides applied properly in terms of application rate and all of the normal label precautions. However, injury can still occur if the pesticide is applied with too much spray pressure or if the nozzles are placed too close to tender foliage. Sometimes the spray pressure alone can cause injury to sensitive plant varieties. Other times, it seems that the combination of pesticide and pressure causes injury.

### Episodic Phytotoxicity

Many of us have experienced situations where we might have applied a pesticide in a normal situation 99 times without incident. Then, on a proverbial one hundredth application that should be just like all the others, something goes wrong and injury occurs. It is often quite difficult to figure out just what happened in the case of episodic phytotoxicity. Sometimes it can

be environmental conditions, tank or hose residue from previous applications, mixing order, agitation problems, or numerous other possibilities. Such spray injuries are not that uncommon. Both managers and applicators should be honest and straightforward in discussing these things when they occasionally happen. Phytotoxicity is a risk many of us take every day, but better understanding can help us minimize potential problems. **PP**

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



*Phytotoxicity symptoms on a leaf. Photo by Mississippi State University.*

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### What Did the Termites Consume?

- ▶ Termites consumed the pine sapwood standard and cypress sapwood much more than the cypress heartwood and melaleuca woods, Figure 1.
- ▶ In Experiment 2 the pine and cypress sapwoods had 64% and 77% surviving termites while melaleuca and cypress heartwood had less than 15% survival.

Termites survived better and consumed pine and cypress sapwoods but did not survive on cypress heartwood or melaleuca. Other studies elsewhere have shown similar results.

Heartwoods are known to be repellent or sometimes toxic to termites. Some termite-resistant woods are heartwoods of California redwood (*Sequoia sempervirens*), southern tidewater red cypress (*Taxodium distichum* var. *nutans*), very pitchy southern pine, called lighterwood (*Pinus* [L.]), and heartwood of red cedar (*Juniperus virginiana* [L.]). Cypress heartwood is very resistant, but cypress sapwood is very susceptible to termite attack, probably due to repellence to components of the wood. On the other hand, slash and loblolly pine are the most susceptible to termite attack. Termites are repelled by some wood and die from starvation.

### Mulches

- ▶ In Experiment 1, termites ate GRU mulch more than any other mulch and more than the pine sapwood. In Experiment 2, termites ate all mulches, Figure 2.
- ▶ Survival in the various mulches was not different.
- ▶ Over both experiments, melaleuca was the least preferred mulch.

Termites ate the GRU mulch more than any other mulch and more than pine sapwood. Red oak and black cherry sapwood, two of the woods in the utility mulch, are susceptible and moderately susceptible to termites. Black cherry sapwood, loblolly and slash pines are at the top of the favorite termite targets with while cypress and redwood are unfavorable foods.

Both melaleuca wood and mulch were not eaten by the termites. Another study of termite feeding on melaleuca heartwood resulted in only 1% termite survival and 2% wood weight loss, compared to 72% survival and 28% weight loss when termites fed on slash pine sapwood.

Other studies have identified some tree species that repel termites or are not eaten as much by termites. Results from a UF study indicate that termites were consuming all the mulches but preferred melaleuca less than others. The resistance of certain woods to termites could be due to their chemical composition making them distasteful, repellent or toxic.

Other authors have noted that untreated eucalyptus sapwood is susceptible to decay and

termite attack. Cypress heartwood, also known as tidewater red cypress, though scarce today, has long been known for its termite and decay resistance. Today's cypress mulch is harvested from young trees with little or no heartwood, and termites eat the same amount of cypress mulch as they did the cypress sapwood.

### Conclusions and Recommendations

Subterranean termites consumed mulches in the UF study. Therefore, it seems reasonable that termites can feed on mulches used in landscaping. If mulches do attract and support termite colonies in the landscape, the next question is whether this is a concern. Do mulches provide needed food while termites are foraging for other wood materials around or in a house? Do chemical barriers of pesticides and other preventatives such as building design provide enough protection for houses so that termite colonies in mulch are unimportant?

Little is known or mentioned in the literature about mulches and termites. When construction is complete on a new house, every piece of wood that can be picked up with a garden rake should be removed.

Moist, warm soil containing an abundant supply of wood cellulose material is the optimal environment for termites. Wood that is close to the soil surface, as mulch normally is, favors subterranean termites and wood-decaying fungi. Yet most houses in Florida with many trees and other landscape plants may already have plenty of food available for termites, and mulch may be just one more additional food source.

Mulch laid too thickly, more than 4 to 6 inches, can also provide a "bridge" over the treated perimeter of a house, allowing termites to walk over from the landscape to the house and avoid contact with soil treated with termiticides. The Florida building code requires at least a 6-inch inspection gap between mulch and siding on the home to allow anyone to see if termites are building mud tubes into a structure. Mulch that is too thick and obscures an inspection space will result in termite-conducive conditions, which may void some contracts.

Further research on mulches and termites is warranted to determine if we should be concerned about using mulch around houses. Also, research is needed on possible repellent mulches such as melaleuca, which might serve as an additional barrier for household protection against termites. The benefits of mulches such as

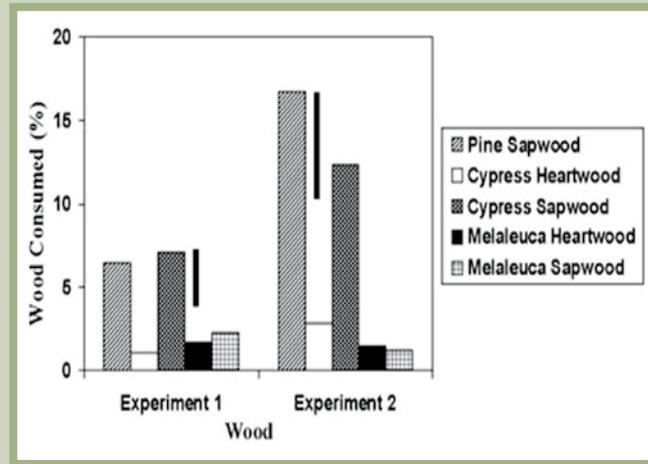


Figure 1. Termite consumption of five woods, showing that termites liked pine and cypress sapwood, but did not eat cypress heartwood or melaleuca.

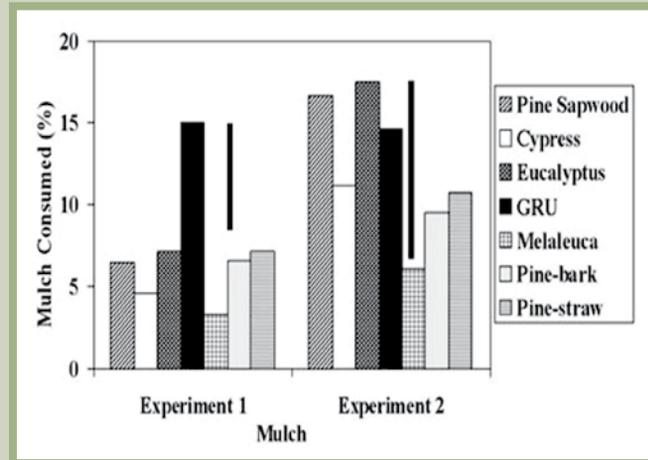


Figure 2. Termite consumption of six landscape mulches showing that termites ate all mulches but liked melaleuca the least.

water conservation, reduced used of herbicides, and reduced soil erosion are very apparent, while the risks of termite infestations due to mulches are unknown.

Homeowners will continue to use mulches in landscaping around their houses and buildings. Pest control professionals should be vigilant and up-to-date with termite inspections and treatments to avoid problems. **PP**

Mary L. Duryea is professor and associate dean for research, UF/IFAS, and Philip Koehler is endowed professor at the UF/IFAS Entomology and Nematology Department.

### Photo credits

Photos by Lyle J. Buss UF/IFAS, except as noted: Earwig and pillbug by James L. Castner; Fungus gnat by Luis Sanchez; Springtail by Gary McDonald; Dark s. subterranean termite by Gerald J. Lenhard

This article includes excerpts from the following UF publications: *Landscape Mulches: Will Subterranean Termites Consume Them?*, by Mary L. Duryea, <https://edis.ifas.ufl.edu/pdffiles/FR/FR07500.pdf>; *The Facts About Termites and Mulch*, by Faith M. Oi and Marsha Wheeler, <http://edis.ifas.ufl.edu/pdffiles/IN/IN65100.pdf>; and *Pests Associated with Mulch and Moisture*, by P.G. Koehler and J.L. Castner, <https://edis.ifas.ufl.edu/pdffiles/IN/IN03000.pdf>



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