

SPECIAL ISSUE

R out Pests & Plant Diseases starting on page 6

Spider Mites Might be a Big Problem

Bacterial Leaf Scorch on Common Woody Plants PAGE 7

An Update on Rose Rosette Page 11

Disease Management Options for Downey Mildew PAGE 14

New Pests on Crape Myrtle Identified PAGE 17

PLUS:

- 27 Notes from SFA Gardens
- 31 GreenVi\$ions
- 37 Calendar of Events



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SPECIAL ISSUE

6 Unearthing the Truth About Pests and Plant Diseases in Texas

with an Introduction by Guest Editor Kevin Ong, Ph.D. This year's issue of the pest/pathogen management issue will cover topics that have been raised over and over by landscape professionals, arborists and growers.

Bacterial Leaf Scorch on Common Woody Plants of Texas Landscapes 7 by David Appel, Ph.D.
Still Not Rosy: An Update on Rose Rosette
Disease Management Options for Downey Mildew
New Pests on Crape Myrtle Identified17 by Mike Merchant, Ph.D.
Having Spider Mites Might be a Big Problem

COLUMNS:

- 27 Notes from SFA Gardens by Dawn Stover
- **31** GreenVi\$ions by Menmeng Gu, Ph.D.

DEPARTMENTS

- 35 New Members
- 35 Newly Certified
- 37 Calendar of Events
- 38 Advertisers Index







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TNLA GREEN

PEST & PLANT DISEASE SPECIAL ISSUE

UNEARTHING THE TRUTH ABOUT Pests & Plant **DISEASES IN TEXAS**

NOTES FROM THE GUEST EDITOR, KEVIN ONG, PH.D.



I am very thankful for TNLA allowing me to serve as a Guest Editor to compile some contributed articles on pests and pathogens that are of interest. This year's issue of the pest/pathogen management issue will cover topics that have been raised over and over by landscape professionals, arborists and growers.

Dave Appel, Ph.D. explores issues with bacterial scorch disease. This disease appears to be more serious in drought years. With the past several years of drought conditions in Texas, this disease may continue to become a larger issue for us. Rose rosette disease continues to be a hot item issue for the North Texas region and in other parts of the US. Efforts in studying rose rosette just got a boost in the form of a federal grant. I provided a brief update on the situation in Texas and some proposed activities highlights of the federally funded project which we hope will benefit all who like roses. Texas A&M AgriLife Extension Services IPM program specialist, Erfan Vafaie contributes an article on mites - how to deal with them effectively. Aaron Palmateer, Ph.D., my counterpart at the University of Florida, has been working on impatiens downy mildew since the early outbreak in 2011. He has graciously contributed some of his observations on his fungicide trials and management methods that are being tested in Florida. Mike Merchant, Ph.D. shares the history and thought on the crape myrtle bark scale in Texas - how an insect somehow found a new home in North Texas and it took us a while to figure it out.

I hope that you will enjoy these articles and provide feedback for future articles that may be of interest to you. ∞

BACTERIAL LEAF SCORCH on Common Woody Plants of Texas Landscapes

BY DAVID N. APPEL, PH. D.

Department of Plant Pathology and Microbiology, Texas A&M University

n the early 1950s, a diagnosis of drought stress on American elms growing on the National Mall in Washington D.C. was met with skepticism by the National Park Service. A team of scientists conducted a series of experiments in which they took branch cuttings expressing scorch symptoms and grafted them onto healthy elm trees. The recipient trees came down with the same symptoms. These experiments demonstrated that, rather than water stress, the scorching on the diseased trees was caused by a transmissible pathogen. The identity of the causal agent could not be determined. Thirty years later, the pathogen causing leaf scorch of elms was determined to be a newly described bacterium, Xylella fastidiosa. Subsequently there was a proliferation of previously misdiagnosed diseases properly ascribed to X. fastidiosa, along with descriptions of this littleknown bacterium. One of the most notorious of those diseases is Pierce's disease (PD) of grapes, the cause of

huge losses in vineyards growing in the Coastal Plain and Hill Country of Central Texas (Figure 1).

In addition to PD in commercial vineyards in Texas, several other important plants are affected by X. fastidiosa. Elms, sycamores, red oaks, oleanders, and blueberries have been confirmed to be infected with the pathogen by the Texas A&M AgriLife Extension Service, Texas Plant Disease Diagnostic Laboratory (TPDDL) in College Station, TX. There are probably many others yet to be found. X. fastidiosa causes disease by growing in the vascular xylem of a plant and thus preventing the normal flow of water. Although there may be variations, foliar symptoms on different tree species are fairly consistent and responsible for the common name of the disease, bacterial leaf scorch (BLS). Leaf scorching may be caused by a wide variety of environmental causes, including water stress, salts, air pollutants and nutrient disorders. Typically, (continued on page 8)



Figure 1. Vineyard in Central Texas affected with Pierce's disease. Insert depicts classic foliar scorching symptoms of Pierce's disease in grapes.



Figure 2. Drought stress on a blackjack oak. Insert shows foliar symptoms.



Figure 3. Bacterial leaf scorch symptoms on elm with typical features of irregular scorch and yellow halo (Sandra Jensen, Cornell University, Bogwood.org).



Figure 4. Red oak species showing crown symptoms of BLS (Jason Sharman, Vitalitree, Bugwood.org). Insert shows foliar symptom on a red oak (John Hartman, University of Kentucky, Bugwood.org).

(continued from page 7)

drought causes uniform wilting and desiccation of leaf margins that are expressed uniformly throughout tree crowns (Figure 2). However, the symptoms caused by infection with X. fastidiosa are somewhat different. Scorching on trees and other woody hosts with BLS is irregular around the leaf margin, and there may be a yellow "halo" emerging from the brown necrotic tissue (Figure 3). In the crown of the tree, infections will be initiated on a few irregularly dispersed branches. The infection will then spread throughout increasingly more of the crown, sometimes taking a number of years to completely encompass the tree (Figures 3, 4 and 5). A tree may decline for several years, dying slowly branch by branch, sometimes taking as long as 10 years or even longer to succumb.

There are several reasons why a definitive diagnosis and identification of the BLS bacterium on elms was delayed while many other pathogens had been thoroughly described. X. fastidiosa is very difficult to isolate in the lab from diseased plants, in part because of its demanding nutrient requirements and very slow growth. A definitive diagnosis of BLS is usually accomplished with sophisticated lab tests, such as ELISA (enzyme linked immunosorbent assay) or QRT-PCR (quantitative real time polymerase reaction). Although culturing of the bacterium in the lab from a diseased tree is possible, the diagnoses may be further complicated by the presence of many different strains of the bacterium. The strains

differ in host ranges, ability to cause disease, nutritional requirements and genetic composition. For example, the strain of the bacterium causing oleander leaf scorch will not infect sycamores. Even further complications arise because there are some hosts, including weeds, that may be infected but express no symptoms. Similarly, X. fastidiosa probably exists in some trees with no evidence of infection.

Like many plant pathogenic bacteria, X. fastidiosa relies on insects to spread from tree to tree. The primary insect vectors are the leafhoppers (subfamily Cicadellidae) known as sharpshooters. Spittlebugs and possibly cicadas may also spread the pathogen. There are many reasons why the sharpshooters are effective vectors for X. fastidiosa. In feeding, the insects repeatedly probe prospective hosts with piercing and sucking mouthparts in order to draw and subsist on the xylem fluid of the tree. Once an adult sharpshooter acquires the pathogen, it can be transmitted throughout the life of the insect because the bacterium also lives and multiplies in the vector. Sharpshooters will feed on multiple different hosts during a season, potentially moving the bacterium from weeds or non-economic hosts to nearby healthy trees. Although this relationship between the sharpshooter vector and bacterium is well characterized for grapes, there is less known about transmission in trees. For example, there are many species of sharpshooters, such as Graphocephala and Oncometopia, involved in Pierce's disease, with

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Although there is no cure for BLS, combinations of the treatments below may stabilize tree health and slow the rate of deterioration.

varying abilities to spread the pathogen. Although these same insects are found in shade trees, their relative roles in successful transmission of the pathogen are unknown.

Due to the limitations of our understanding of the epidemiology of BLS in trees, our recommendations for control are equally incomplete. Although there is no cure for BLS, combinations of the treatments below may stabilize tree health and slow the rate of deterioration. As mentioned previously, proper diagnosis is challenging but important to effectively deal with BLS. Pruning, if done properly, can prolong the useful life of trees and is even considered therapeutic in grapevines. The injection of trees with the antibiotic oxytetracyclene is available as a treatment, but research results have been inconsistent, at best providing only temporary alleviation of the symptoms and requiring repeated annual injections. Another compound, called Cambistat®, is also available for treating trees with BLS by soil drench. Again, this treatment has resulted in both successes and failures. The first line of defense in grapes is the use of imidacloprid to prevent feeding by sharpshooters and eradicate them from the vineyards. This approach

is impractical in shade tree pathology where total elimination of vectors in urban environments would be expensive and unlikely.

The best and most widely recommended method to control BLS in urban environments is to address issues of tree health. Measures should be taken to avoid all potential sources of stress in order to maximize vigor and the tree's effective response to potential infections. For example, BLS can be expected to be worse during drought due to the diminished health of suffering trees. Good growing conditions with sufficient, but not too much water, proper nutrition, and a healthy soil are important. Tree species that match the site should be selected for planting. Only the healthiest of planting materials should be used. For a list of trees affected by BLS, you can visit a website of the American Phytopathological Society (http://www.apsnet.org/edcenter/ intropp/lessons/prokaryotes/Pages/ BacterialLeafScorch.aspx). When designing landscapes, a diversity of tree species not found on that list should be planted, with consideration to how well they will perform in the often stressful growing conditions encountered in Texas. ∾



Figure 5. BLS symptoms on oleander (Sheila McBride, Texas Plant Disease Diagnostic Laboratory, TAMU College Station, TX).



Figure 6. Dieback in sycamore caused by BLS. Insert is image of foliar symptoms.

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STILL NOT ROSY!

BY KEVIN ONG, PH.D.

Associate Professor & Extension Plant Pathologist | Dept. of Plant Pathology & Microbiology Director - Texas Plant Disease Diagnostic Laboratory, Texas A&M AgriLife Extension Service

everal years ago I wrote an article on rose rosette (TNLA Green Magazine, September 2011) noting that we were getting report of incidences, particularly on Knock Out roses. Today, rose rosette remains a problem for many rose enthusiasts and gardeners. In Texas, this problem still appears to be localized in the Dallas-Fort Worth area. Most reports in the past year are coming in from the four county area of Dallas, Tarrant, Collin and Denton. There have been reported sightings of rose rosette in Houston and Waco areas, but to date – there has not been confirmation of the presence of that disease in either area.



Figure 1. Rose rosette disease on a Knock Out rose. Notice the bunching growth (witches' broom) and excessive blossom clusters.

What Is Rose Rosette Disease?

This is a disease of roses that manifest with several visually interesting symptoms. Those symptoms include witches' broom (tight clustering of growth), enhanced reddish coloration and excessive thorniness. Please note that all these symptoms do not need to occur on an infected rose plant. Further, these symptoms represent growth that is abnormal or atypical to that particular cultivar.

The earliest rose rosette disease report dates back to the 1940s. Until 2011, diagnosis of this disease was based on symptoms, host plant and/or presence of the eriophyid mites. In 2011, a research group from the University of Arkansas reported the detection of a virus from a survey of rose plants showing rose rosette symptoms. They also characterized this virus as a negative strand RNA virus (an Emaravirus) and called it Rose Rosette Virus (RRV). This work also resulted in the development of a detection tool using genetic approaches.

(continued on page 12)



Figure 2. Close up of the infected canes and flower clusters. Note the excessive thorniness and abnormal coloration on rose leaves.

(continued from page 11)

How Does It Spread?

The RRV is spread by the eriophyid mite, Phylocoptes fructiphilus. This mite is extremely tiny (~150 microns long). This mite can acquire the virus when feeding on an infected plant and transmit it to a healthy plant when it feed on the "new" plant. The presence of the eriophyid mite does NOT mean that the rose is infected. It is possible that the mite may NOT be carrying the virus. However, when eriophyid mites are found on plants with rose rosette disease symptoms - it is very likely that the plant is infected with RRV.

Current Recommendation In Extension Publication And Our Rationale

Last year, Texas A&M AgriLife Extension Service published a factsheet on rose rosette titled "Rose Rosette Demystified" (http://www. agrilifebookstore.org/Rose-Rosette-Disease-p/eplp-010.htm). This factsheet looked at the history of this disease in literature and provided the best recommendation based on current available scientifically-sound information:

1. *Remove confirmed and/or symptomatic plant quickly.* There is no remediation for this virus infection. An infected plant can serve as a reservoir of the disease pathogen. Removal reduces the exposure or availability of the virus to be picked up by the eriophyid mite and transmitted to a healthy plant.

- 2. Treat nearby plants with miticide. This approach aims to slow down, not stop, the spread of the disease. By reducing populations of the eriophyid mite, there are less vectors available to carry the virus.
- 3. *Monitor symptoms often.* Early detection hopefully means taking action earlier. The quicker the response means less time for the virus (and the mite) to spread.

There Is Still Much To Learn About Rose Rosette

Surprisingly, there are still a lot of unknowns about this disease, even though its existence has been known since the 1940s. Only recently, the causal agent was definitively identified as a virus.

In 2014, I was privileged to be part of the team that was awarded a federally funded Specialty Crop Research Initiative to combat rose rosette disease. This project is being led by Dave Byrne, Ph.D., professor (prunus and rosa breeding and genetics) in the Department of Horticultural Sciences at Texas A&M. This team includes plant pathologists, entomologists, economist, geneticist and diagnosticians from several states. Some of the results that would be generated from this project include:

• More efficient and reliable detection/ diagnostic tools (for diagnosis and to have the ability to study the epidemiology of the disease). TNLA GREEN

- Best management practices on the use of chemical and biological controls.
- Information and tools to develop rose rosette disease resistant plants.

An aspect of this project that I will be responsible for is to develop a nationwide monitoring network rose rosette disease. Much of this work would include educating participants on rose rosette disease to increase symptom recognition and to encourage incidence report whereby these suspects could be tested. Due to the variance in the



Figure 3. A Knock Out rose sample that tested positive for RRD. Excessive thorniness and unique reddish coloration on foliage and on stem.

Surprisingly, there are still a lot of unknowns about this disease, even though its existence has been known since the 1940s.

symptoms that have been reported on different cultivars nationwide, we hope that this effort would also enable us to identify potential resistant plants that could be used in future breeding program.

I Am In Texas. What Can I Do?

Currently, this disease has not been confirmed on established landscape plantings in the areas south of the Dallas-Fort Worth-Tyler line. If you happen upon a rose plant which shows symptoms suspicious of rose rosette in a previously unreported county, please take a photo and record the site. Send this information to plantdr@tamu.edu with the subject heading "RRD sighting?" I would very much appreciate your help in ascertaining how widespread this problem is in Texas.

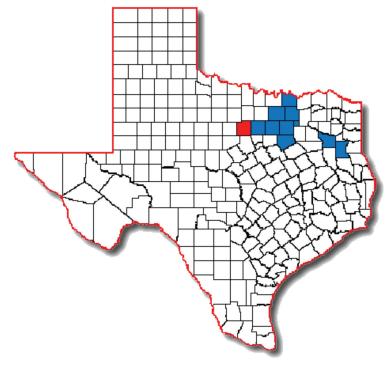


Figure 4. In a 2002 publication (red), RRD was reported in 6 counties (Rusk, Smith, Collin and Grayson, Tarrant and Palo Pinto). The blue overlay are counties where RRD was confirmed through symptoms observation and presence of eriophyid mites on diseased plants and/or PCR (genetic detection) positive.

Disease Management Options for IMPATIENS DOWNY MILDEW

AARON J. PALMATEER, PH.D.

Tropical Research & Education Center, Department of Plant Pathology, University of Florida, IFAS

he causal agent of impatiens downy mildew (IDM), Plasmopara obducens, is part of the plant pathogen group known as oomycetes, or water molds. The pathogen thrives in humid climates. Host-specific solely to Impatiens genus, it affects I. walleriana and its hybrids along with a select few other Impatiens species. Its inoculum is available as two different spore structures. Airborne inoculum is the primary way in the form of sporangia. These may infect in the presence of available water via zoospores or directly. The other method is



Figure 1. Heavy sporulation of Plasmopara obducens on the underside of an Impatiens walleriana leaf

by oospores, which are the overwintering structures. These can survive most commonly in the soil of infected flowerbeds as well as in the stems of infected plants. There is no evidence of this pathogen being seed transmitted. Typical symptoms begin as chlorosis and inconspicuous mottling of the lower leaves. As the disease progresses, leaves showing signs of sporulation become distorted and exhibit downward curling. There is then rapid defoliation of the entire plant, and finally the remaining stems (known as "green-stick syndrome") collapse.

Since the widespread outbreak of downy mildew in 2011, many commercial producers have significantly reduced production or even stopped growing gardening impatiens. These decisions were made as a result of having to replace diseased plants in the landscape and box stores. Landscape professionals who choose to install impatiens are faced with the challenge of managing a highly aggressive and most often fatal disease. Several highly effective fungicides used in greenhouse and nursery production are either not labeled for landscape use, or the expense of application is just not feasible. Collaborative teams from multiple universities with funding from the farm bill have directed their efforts to researching the genetics, epidemiology, and disease mitigation strategies for IDM. This will lead us to a better understanding of IDM and hopefully improved management strategies, including cultural and chemical control.

To address the introduction of impatiens downy mildew into Florida, numerous nursery and landscape trials testing fungicide efficacy for disease management have been conducted at the University of Florida's Tropical Research and Education Center in Homestead, Florida. Early trials of containerized production under shade house conditions found that Orvego (ametoctradin + dimethomorph), Pageant (pyraclostrobin + boscalid) and Stature (dimethomorph) treatments sharply reduced the number of leaves with sporulation and leaf drop and the percentage of canopy affected in inoculated plants when applied using an air blast applicator or as a foliar spray to runoff. Additional nurserv trials demonstrated the effectiveness of a 7-day fungicide rotation with treatments of Adorn (fluopicolide),

Aliette (fosetyl Al), Subdue Maxx (mefenoxam), Dithane (mancozeb), Heritage (azoxystrobin), Micora (mandipropamid) and A14658C (potassium phosphite), which all maintained 100% disease-free impatiens. These exciting results led us to initiate trials in the landscape, so that we could evaluate the (continued on page 16)



Figure 2. Early symptoms of downy mildew affecting gardening impatiens in the landscape

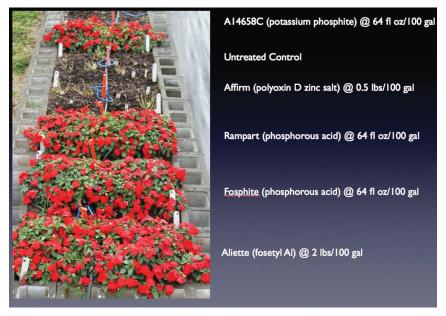


Figure 3. Eradicative fungicide trial in the landscape showing drastic differences between treated and untreated impatiens with downy mildew



Figure 4. Difference between mefenoxam treated and untreated impatiens in the landscape with heavy pressure from downy mildew

(continued from page 15)

residual control offered by fungicide treatments in the nursery.

Some of our first impatiens downy mildew landscape trials examined the use of a granular form of mefenoxam (Subdue G) that was incorporated into the bed before transplanting impatiens that were previously treated with a fungicide rotation in the nursery. Three days after the final fungicide treatment in the nursery, impatiens were transplanted into one of two landscape beds either soil incorporated with 30 oz of Subdue G per 1,000 ft2 or left untreated for continued evaluation over a 60-day period. Disease severity ratings for all impatiens in the landscape bed treated with Subdue G remained statistically lower than the untreated bed throughout the entire trial. Impatiens deriving from fungicide rotations containing a phosphonate that were transplanted into a mefenoxam treated landscape bed remained 100% disease free for the duration of the trial (60 days).

Fungicide efficacy trials conducted with mefenoxam (January, 2013) were highly effective on impatiens in some instances and ineffective in others. Subsequently a population of Plasmopara obducens from Homestead, FL was tested and confirmed to have resistance to

Fungicide efficacy trials conducted with mefenoxam (January, 2013) were highly effective on impatiens in some instances and ineffective in others. mefenoxam. This was not surprising considering the widespread use of mefenoxam containing fungicides for control of oomycetes in both commercial production and landscapes throughout Florida. Please note that the development of fungicide resistance in downy mildew populations is at high risk, so tank mixing and rotating pesticides is essential.

We have examined fungicides representing 13 chemical classes reported to have efficacy against oomycetes. We have tested residual efficacy to monitor how long impatiens treated in the nursery will remain disease free after being transplanted into the landscape. In addition, trials are being conducted using fungicide rotations and tank mixes to minimize the risk of fungicide resistant populations of Plasmopara obducens. To date, results indicate that products containing phosphorous, mefenoxam and fluopicolide, are good candidates for long residual control of impatiens downy mildew. ∾

NEW PEST on Crape Myrtle Identified

BY MIKE MERCHANT, PH.D., BCE

Professor and Extension Urban Entomologist, Texas A&M AgriLife Extension Service

n 2004 I received a call from a local landscape company having some difficulty controlling a mealybug-like insect. The insect was one he had never seen before, but it was covering the upper branches of crape myrtle trees in a commercial landscape in Richardson, Texas. The insect turned out to be a bark scale, in the family Eriococcidae.

Bark scale insects are usually identified in the field by the kind of plant they are feeding on, but previous to this, no bark scales in the U.S. had ever been identified on crape myrtle. In fact, when we submitted samples of the insect to scale experts at the U.S. Department of Agriculture, it was tentatively misidentified as azalea bark scale, Eriococcus azaleae, a relatively uncommon scale in Texas found principally on azaleas. One scale taxonomist suggested that our new scale pest could be an exotic bark scale that infests crape myrtle in its Asian home, and known scientifically as Eriococcus lagerstroemiae. Unfortunately, the two scales are quite similar and no one knew at the

time how to separate the two scales just by looking at them through a microscope. It took ten years before the right expertise could be persuaded to run DNA testing on these new scales. In 2014 researchers Amber Tripodi, then a graduate student at the University of Arkansas, and Norman Barr, Ph.D., USDA/APHIS/ PPQ in Edinburg, Texas, each independently compared DNA of the Texas to the Chinese scale and concluded that they were identical. At the same time, Greg Evans, Ph.D. at the USDA/ARS Systematic Entomology laboratory in Beltsville, Md. figured out how to identify the scales morphologically.

Besides being a busy year for researchers, last year was also a busy time for our newly identified scale. Several additional states joined Texas, *(continued on page 18)*



Figure 1. A heavily scale infested branch on crape myrtle. Photo by author.



Figure 2. Two 'Natchez' crape myrtles demonstrate the potential impact of bark scale on the size and number of blooms in early summer. The tree on the left was treated seven weeks earlier with the insecticide dinotefuran, the one on the right was left untreated. Note the smaller blooms and mold-covered bark on the untreated tree. Photo by Jim Robbins, U of Arkansas.

(continued from page 17)

Louisiana, Tennessee and Oklahoma as sites with known infestations. The new states included Arkansas, New Mexico, Alabama, Georgia and Virginia. This rapid expansion of the scale appears to be human-assisted, as scale spread does not appear to be extremely rapid on the ground. The USDA Animal and Plant Health Inspection Service is now aware of this scale and opted last year not to impose a quarantine on infested plant material, believing that a quarantine now would not serve any useful purpose given the already extensive spread of the new pest.

So what is the crape myrtle bark scale (CMBS), and how do you recognize

it? The most obvious specimens of CMBS are the adult female and male pupal cases. Heavy infestations turn upper tree branches white, though patches of the scale will also be evident on larger branches and on the trunks of the tree at certain times of year. The scale deposits copious amounts of honeydew, which is followed by a dark layer of black sooty mold. Only rarely do infestations seem to result in death of the plant or significant branch dieback, but the sooty mold severely reduces the landscape value of this important ornamental plant. In addition, observations made by Arkansas researchers suggest that bloom size and appearance is also significantly reduced.

Crape myrtle has few insect pest s, making identification of CMBS relatively easy. If you see white, felt-like scales on crepe myrtle crush them with your finger. If they "bleed" pink you can be sure you have discovered this scale.

Several years ago, with funding from Texas Nursery & Landscape Association, our lab conducted preliminary evaluations of several insecticides for control of CMBS. We found that we got the best control from several neonicotinoid insecticides applied as granules or as drenches to the soil around infested trees. Products that gave the best results included imidacloprid, dinotefuran, thiamethoxam and clothianidin.

If you've been paying attention to the news lately, you may notice that the insecticides I've listed are currently under close scrutiny for high toxicity to honey bees and other pollinators. Although possible risks to pollinators have not yet been studied for this

A copy of the new Texas factsheet is also available online at: http://bugwoodcloud.org/resource/pdf/ TAMUCrapemrytlebarkscaleEHT-049.pdf plant, fortunately crape myrtle is not an important nectar source for pollinator insects. However, some insects, like honey bees, do visit crape myrtles for pollen. And there is some concern that tiny amounts of these insecticides may slip into crape myrtle pollen. For this reason we would like to find alternative treatments for this scale.

This summer I, along with Texas A&M AgriLife Extension Service colleagues, Mengmeng Gu, Ph.D. and Erfan Vafaie, will be looking at additional treatments for possible control of the scale, both in landscape and nursery settings. We hope to use new information about the emergence of scale crawlers to help us determine the best times to apply insecticides to the trunk and branches of the trees. Ideally we will find addition effective treatments that can supplement or replace the standard neonicotinoids that we are using now.

In the meantime, we need your help to document the spread of CMBS in Texas. This year we worked with the Early Detection and Distribution Mapping System group from the University of Georgia to publish an online information and reporting site. Simply go to http://eddmaps.org/cmbs for information about distribution, identification and control of this pest. You will also find links to new fact sheets at both Texas A&M AgriLife Extension Service and at the University of Arkansas, and a webinar done last year on this pest. Lastly, there is a Report Sightings tab that allows you to register and report new sightings of the pest. We hope

to be able to track the spread of this new pest not only around the country, but especially here in Texas.

As of the beginning of 2015, CMBS is only known to be found in a few metropolitan areas including Dallas/ Fort Worth and surrounding counties, College Station and the Houston area. You can help us track this pest by taking a minute to register on the site, and fill in location data on any trees you see infested. If possible, submit a picture of your infested tree so that your report can be verified. This is a great example of citizen science at work, and will help us gain insight into the speed of spread to expect in newly infested states.



Figure 3. Adult twice-stabbed lady beetle with several pre-pupae and pupae on a crape myrtle trunk. It is not unusual to see many lady beetle pupae on the trunk of an infested tree. Before pupating, these beetles cleaned most of the scales from this tree. Lady beetle pupae are the pre-adult stage of the lady beetle and are highly beneficial. They should not be disturbed or harmed.

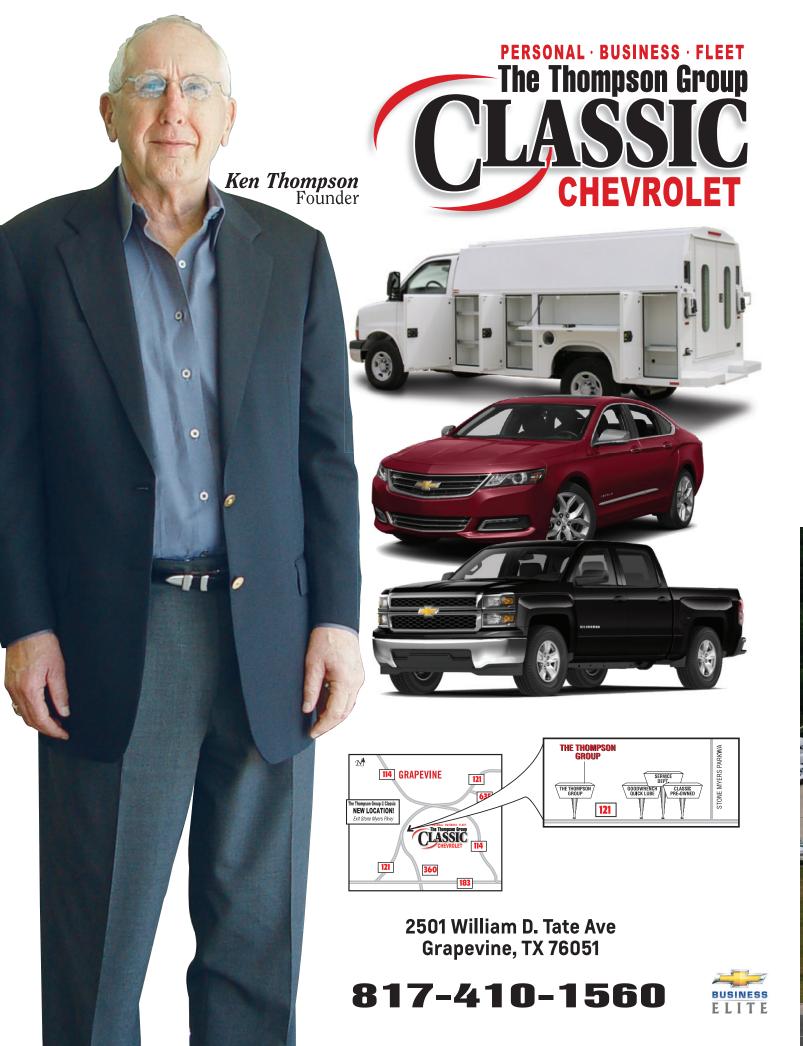
MANAGEMENT SUGGESTIONS FOR CRAPE MYRTLE BARK SCALE

Before buying crape myrtles, inspect the nursery plant carefully for signs of CMBS infestations. For heavily infested plants, wash the trunk and reachable limbs with a soft brush and mild solution of dishwashing soap and water. This will remove many of the female scales and egg masses, making insecticide control more effective. Washing will also remove much of the black mold that builds up on the bark of infested trees.

Horticultural oil has not yet been experimentally shown to be effective against this insect. However, anecdotal evidence suggests that it may be beneficial to apply horticultural oil (alone or in combination with acephate) in the winter at dormant season rates to the bark and crotches of the plants where the scales shelter. Use enough spray to reach behind loose bark and into cracks and crevices. Winter is an especially good time to treat for scales because the higher (dormant season) application rate can be used without damaging the plant. Cover the tree thoroughly with pesticide, especially when using oil.

Systemic insecticides have shown the most promise in tests to date. Apply them to the root zone as a soil injection or drench. The best control was achieved between May and July by applications of clothianidin, dinotefuran, imidacloprid and thiomethoxam.

Some insect growth regulators are recommended for control of other types of scales in woody ornamentals but have not yet been evaluated on CMBS. Some lady beetle species, especially the twice-stabbed lady beetle, are effective predators of this scale. However, control by lady beetles is often too late in the season to prevent aesthetic damage from sooty mold.



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HAVING LOTS OF SPIDER MITES Might Be a Problem

BY ERFAN VAFAIE

Extension Program Specialist IPM, Texas A&M AgriLife Extension Service

e all know spider mites suck - quite literally. And spider mites are so small that we often don't see them until we notice the damage; by that time it's already too late. But before busting out the big guns with a weekly spray schedule to manage our mites, there are some alternative economic options to consider. A strong integrated pest management (IPM) program considers all available tools to prevent pest outbreaks, such as

WHAT ARE SPIDER MITES?

"Spider mites" refer to several species of small arachnids, possessing eight legs and are parasitic to plants (i.e. twospotted spider mite). Spider mites feed on the plant by puncturing plant cells, leaving a characteristic 'stippling' damage that has the appearance of small discolored spots on the leaves, similar to the appearance of thrips damage. mechanical, biological and chemical control. There are several factors that can encourage spider mite infestations, which is why we should first consider some preventative strategies.

Prevention

Spider mites thrive on stressed plants. The right amount of water and fertilization can go a long way to reduce plant stress, and as a result, reduce mite populations. Several studies support that the level of drought or water stress of a plant can impact the lifespan and number of offspring a spider mite will have. Depending on the plant, slight drought stress can be beneficial for reducing spider mite populations and over-watering can increase spider mite populations (along with other pests, such as fungus gnats). Closely regulating irrigation will help prevent water or drought stress, which will promote spider mite populations. In addition to water stress, excess fertilization (such as nitrogen) in the soil can result in higher spider mite populations. Spider mites, like many plant-sucking insects, need nitrogen to produce proteins, which are needed to produce more offspring. Only use the amount of fertilizer required for optimal plant growth and don't overfertilize, unless you like the spider mites to keep your plants company.

Dust can create a nice habitat for many mites. Periodically wash down walking rows in greenhouses to reduce the built-up of dust. Dust can also accumulate on leaf surfaces and can be washed off with a hose to reduce favorable habitat for mites. Although you may be taking several preventative measures, a spider mite population is bound to appear, and that's why it's important to monitor so that control can be timely and effective.

Monitor

Would you ever get a car wash before seeing whether your car is dirty? How about renovating a house before seeing the interior? We don't take action before we know what we're working with, and pest management is no exception. Integrated pest management calls for good monitoring and scouting to determine which pests and beneficial insects we have, and in what abundance, before deciding a

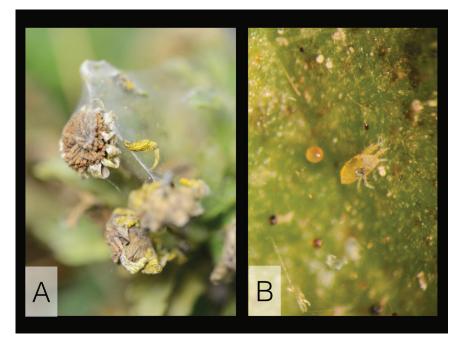


Figure 1. A sign of a heavy spider mite infestation is the formation of webbing (A) on the plant foliage or flowers. A microscope is a great asset to determine the species of the spider mite. Twospotted spider mites can be distinguished by the two spots on their back (B). A small mite egg is also found to the left of this adult.

course of action. Spider mites can be easily integrated into your monitoring program by keeping an eye open for some of the symptoms of spider mites during a weekly monitoring program: stippling damage, curled leaves and webbing. Take a closer look at symptomatic areas with a magnifying glass for the culprit.

Make monitoring more efficient by knowing your crop. Check your crops weekly, scanning enough plants to take a representative sample of your entire crop. It's not uncommon to have certain cultivars or crops that tend to be more susceptible to spider mites year after year – consider such cultivars an asset to help with early detection of spider mites and be sure to check them every week to help forecast the onset of more widespread spider mite populations.

In addition to looking for pest spider mites, keep eyes open for beneficial mites and other insects. Some of the other organisms that feed on spider mites include:

- Predatory mites
- Western predatory mite
- Phytoseiulus mite
- Six-spotted thrips (Scolothrips sexmaculatus)
- Spider mite destroyer lady beetle (Stethorus picipes)
- Minute pirate bugs
- Bigeyed bugs
- Lacewing larvae

It's not uncommon to think that relying on natural enemies to manage pests is a load of poppycock, but

there are many farms that, equipped with the knowledge of their beneficial insects and how to preserve them, are able to reduce the number of control applications they need to maintain crop quality. Certain features, such as being active and mobile (i.e. predatory mites), are common signs of beneficial insects, since pests tend to sit still while feeding on the plant, while predators are constantly moving in search of prey. Seeing an abundance of beneficial insects makes drastic control measures less necessary, and in some cases, detrimental. So make sure you're keeping eyes open for beneficial insects. Sometimes infestations are so low and localized that you can just control them by removing infested plants promptly or dislodging them from the plant leaves using a water spray (mechanical control).

(continued on page 24)

TOP THREE WAYS TO PREVENT A SPIDER MITE INFESTATION:

- Check fertilization levels

 fertilizing too much can promote mite population growth.
- Promote plant vigor Good plant vigor, such as decreased plant water stress, will result in less beneficial habitat for mites.
- 3. Remove/treat early infested materials – Deal with infestations early, before they become an area-wide problem.

(continued from page 23) Biological Control

There are several natural enemies that will suppress spider mite populations, many of which are listed in the Monitoring section above. If you find your real estate isn't particularly favorable to good insects, there are commercially available predators of mites that can be purchased and released in your farm.

An important disclaimer with biological control is that it rarely works as a reactive control strategy



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- in other words, if you have a concerning spider mite infestation, it's too late to rely on biological control to do the job. If you have a big infestation and need to deal with it pronto, you're most likely looking at the next strategy up the integrated pest management ladder: chemical control.

Chemical Control

Choosing a specific insecticide varies greatly depending on the crop, spider mite species and location of the

WHAT TYPES OF SPIDER MITES MIGHT YOU ENCOUNTER?

- TWOSPOTTED SPIDER MITE Small (1/32 inch). Recognized by the two dark spots on the back. Spin protective webs.
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- SOUTHERN RED MITE Very small (1/50 inch or smaller) in length and reddish brown in color. Common on azaleas and camellias.
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crop (i.e. field, greenhouse, outdoor or indoor). But there are general recommendations that apply across all situations that will impact your ability to control your pests.

Specific and low residual

Although picking a broad-spectrum insecticide has the advantage of controlling several pests in one application, they are also more likely to harm beneficial insects, which may result in other future pest outbreaks. Picking an insecticide that is relatively specific to your pest of interest and has low residual will help insure that your beneficial insects are not harmed and that there's sufficient time for the

Save the Date!

insecticide to breakdown before natural enemies can safely re-enter.

Spot spray

By monitoring on a regular basis, you may find that the pest is highly localized in one region of your crop before spreading. Spraying the entire crop is unnecessary and more costly in such a case compared to spraying the infested plant and immediately surrounding area. Additionally, by spot spraying only the infested area, you have the benefit of not hurting your beneficial insects on the neighboring plants.

Rotate modes of action

If you find yourself stuck, needing

to spray on a weekly basis to keep spider mite populations in check, make sure to rotate modes of action in order to maintain effective control. By spraying chemicals that kill the pest using the same mechanism week after week, resistant populations begin to build, and the chemical that you have been relying on becomes less and less effective with each spray. Check the active ingredient on your insecticide (i.e. first ingredient on the label) using the "Modes of Action" tab at irac-online.org to see which mode of action group it belongs to, and make sure your other products belong to a different group number. ∾

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Notes from SFA Gardens The Southern Garden Girl's Guide to a Stubborn, Thriving Summer Garden



Dawn Stover is a Research Associate with the SFA Mast Arboretum in Nacogdoches, Texas. As a Research Associate, Dawn currently manages the living plant collection within the SFA Mast Arboretum and the horticulture greenhouse facilities.

by Dr. Dawn Stover

ast summer, I created a sort of alter-ego named the Southern Garden Girl. Not to be confused, of course, with my super-hero persona: The Indiscriminate Composter. Kidding aside, it's important to have a story, and it's important to remain true to your story. In this day and age where we balance, work, family, community and so much more, aided of course by electronic devices that allow our office to go wherever we go, it's easy to lose track of our story. The Southern Garden Girl was created to help remind me where my horticultural roots are: herbaceous plants that are as beautiful and strong as any classic Southern woman. Plants that are beautiful, durable, useful and resistant to the pitfalls of our hot, humid, sticky southern summers. No matter where we garden, it's pretty much guaranteed that we'll have some sort of plant envy. I've watched plenty of hosta, heuchera and



Fig 1. A colorful mix of Graffitt pentas add bursts of color but are tough as nails

calibrachoa meet an ugly, melty kind of death when the swamp of summer arrives in East Texas. I want my garden filled with annuals and perennials that are, well, as mean and stubborn as I am.

For a good while, I was lured with the temptation of having the newest varieties of a lot of those new-fangled, branded products. All of those flashy things with colorful tags and printed pots and an army of marketing mavens behind the brand. I will admit that some of my current favorite plants are branded products, and there are some that I vow to grow in my garden for as long as I garden. But there are an awful many of them who just don't cut it in the southeastern states especially the closer you get to the Gulf of Mexico. I joke with our SFA Gardens visitors that my job is "to kill plants," and that's really not far from the truth. We have conservatively brought in more than 10,000 different plants in our 30 year history, and it's a safe bet we've killed more than a few. I don't mind trialing a myriad of material that we acquire from new plant developers, as long as they don't mind hearing the truth. How many of the newer Echinacea have you killed? I don't have enough fingers and toes to count mine.

So what is the Southern Garden Girl planting this year? According to the National Garden Bureau, this is the "Year of the Coleus" and that's a good thing since I have a great deal of greenhouse (continued on page 29)





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(continued from page 27)

real estate dedicated to none other. I like to combine coleus with Profusion zinnias, which seem to be getting better with each new introduction. The double forms are my favorite, as the hold their colors better than the single varieties. The Zahara series are tough as nails too, but the color pallet is, subjectively, a little out of my liking. Graffiti pentas consistenty impress me in the plant trials I visit, and I'm particularly fond of 'Graffit Violet.' Proven Winners' 'Senorita Rosalita' cleome is probably my current favorite summer annual. She takes an awful lot of abuse at my home garden with three dogs and some crazy lady who comes after her with hedge clippers every couple of months. Despite my vicious pruning, she bounces back and blooms her silly little head off until my next attempt to refresh her. I am so enamored with 'Amistad' salvia. It's big, velvety purple flowers are the perfect shade of SFA Lumberjack purple and seem to become more prolific as summer endures.

There are plenty of oldies and goodies too. Variegated tapioca brilliantly marries green and yellow and red, and is tremendously fun to find companions for. 'Indian Summer' rudbeckia remains my favorite annual black-eved Susan to this day. I can't stand to be without 'Black Pearl' ornamental pepper. I love how it can run either hot or cool depending on the colors used to accompany it. And it's hard to pick a favorite ornamental sweet potato; I suspect there's an appropriate variety for every situation and color combination.

The point to all of this is, grow what you know. We all have our

The Southern Garden Girl was created to help remind me where my horticultural roots are: herbaceous plants that are as beautiful and strong as any classic Southern woman.

favorites, and we owe it to our end consumers to help cultivate their favorites too. I'll happily continue to kill plants, and will happily continue to laud those that survive, no thrive, on my abuse...and that of my southern garden. We'll talk perennials next time. 👁



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GreenVi\$ion Technology for the Green Industry

by Mengmeng Gu, Ph.D.



Mengmeng Gu, Ph.D. is an Assistant Professor/Extension Specialist at TAMU. She received her BS in landscape horticulture and MS in ornamental horticulture from Beijing Forestry University

would like to take a short break from Earth-Kind landscape principals and talk about technology for the Green Industry in this article, as memories and thoughts are still fresh after a recent visit to the liner division of Magnolia Gardens Nursery in Waller, TX. Two things worth your attention: Unmanned Aerial Vehicle and robots! It started from several brainstorming sessions between me and Dr. Fengjun Chen, a visiting scholar from Beijing Forestry University. Her background is industrial engineering and her expertise is image processing. For instance, one of her current projects is image processing for to-be-developed robots harvesting jujube fruits among leaves and branches. So a computer engineer and a horticulturist were trying to find something to work together on. What can we do?

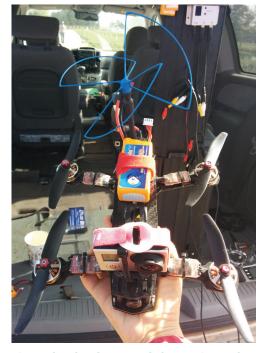


Fig 1. A handmade UAV can help save time and energy by taking inventory from above

Last year, I invited Dr. James Robbins from the University of Arkansas **Cooperative Extension** Service to present his research titled "UAV's in Nurseries: Count on It" at the Department of Horticultural Sciences at Texas A&M University. Yes, "UAV's" as in unmanned aerial vehicles. Some call them "drones". Later on I invited him to repeat the presentation in the form of a webinar (view this and many other recorded webinars at https://greenviion. wordpress.com/



Fig 2. The UAV flies above the nursery taking inventory

webinars/). Right now the most common way of nursery inventory management is probably having workers walking through the nursery with a tally counter and a notepad (a paper or electronic one). His research explored how to use UAV taking aerial pictures of nursery blocks and then process the images as a way of counting plants (a.k.a. automated inventory management).

A computer program was written to train computers to recognize each individual plant (in the ground or in a pot) based on its common characteristics - most individual plants are circles with different colors and/or shades in a bird view, in pictures taken by the camera on a UAV. If all plants are smaller than the container they are in, plants could be counted from the very regular pot shapes, mostly circles. I was told that a nursery might have two workers that their only job was to count the number of plants in the nursery. Can you imagine that? Their ONLY job was counting plants, all the time. And they may not have enough time to count the plants as often as needed to (continued on page 32)

(continued from page 31)

have the most up-to-date inventory, which is very important to a nursery. A nursery can't sell what it doesn't have, or not sell plants that are 'hidden' from inventory manager due to human counting error.

Neil Marek from the Magnolia Gardens Nursery was not only in the audience for the webinar, but also an avid UAV owner. He has built several UAV's (Fig. 1) and crashed a few. Last spring, I visited with him at the nursery with Dr. Kevin Ong, Director of Texas Plant Clinic, to discuss possibilities of using UAV's in the nursery business. Dr. Chen and I were talking about continuing research of using UAV for automated nursery inventory management when my previous UAV trip to Magnolia Gardens Nursery came up in my mind. I

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Fig 3. Robots are hard at work spacing out Knock Out roses at Magnolia Gardens Nursery

picked up the phone and found out that Neil was going to fly his UAV on March 25, so we made the trip. Dr. Chen came back with about 16 GB pictures and videos to process. Let's see what we can do about those images.

In addition to inventory management, another possible use of UAV will be 'automated scouting'. You probably know how important scouting is. In nursery management, early detection of problems (e.g. insect and disease damage, water stress, and nutrient deficient) is an important way of reduce damage. Similar to inventory management, scouting normally involves a worker (or workers) walking through the entire nursery and inspect every plant. Significant amount of labor is needed to do a good job of scouting. Generally plants within a section of the nursery should be uniform. Abnormality could be easily recognized from an aerial photo taken at low or high latitude depending on the resolution of the photo, although the cause may still require close inspection to determine. That could cut down days of manual scouting to probably an hour flying UAV over a nursery (Fig. 2), an hour of image processing and several hours of close point inspection. Think about all the labor (and money) you can save by doing so!

While flying the UAV, two robots were also at action at Magnolia Gardens Nursery, spacing out closely placed Knock Out roses (Fig. 3). Two yellow lines defined the boundary of the plot and two robots were just picking up containers from the closely-spaced block and spaced it



Fig 4. Two nursery workers are on hand (off camera) to supervise robots spacing Knock Out roses

out based on setting. Two workers were watching the action and occasionally moved the yellow line to the next block when one block is finished (Fig. 4). I was told that one worker could easily handle the job, being the 'supervisor' of the robot. The end result is an almost perfectly lined-up spaced-out block of plants. Think about back-breaking, fatigue and not-souniform block of plants when workers do this.

These robots are not cheap. They were working in the nursery on a 'rent to own' program. The nursery is renting them for three months. After that, they could either discontinue the program or purchase the robot and the rent goes toward the purchasing cost. It seems like the two robots are working very well there.

The first time I saw these robots was at then-OFA and now-Cultivate trade show in Columbus, OH in 2013. I remember reading an industry newsletter, in which two Mennonite boys said 'that's what kids are for' when asked what they thought of the robot. Most nurseries can't hire 'kids' for jobs like this, and these robots could definitely fill the needs.

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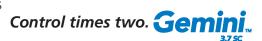
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Shauna P. Williamson, TMCNP Calloway's Nursery Store 01 Plano, TX

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Learn more about the benefits of certification at **www.tnlaonline.org**. Nominate a TNLA Young Leader Today Nominations are Due May 15th www.tnlaonline.org



The TNLA Young Leader Award, established by the Board of Directors in 1996, is presented annually to a deserving young leader age 41 and under who has displayed outstanding achievement and service to the Green Industry in Texas. TNLA and other community service by the nominee will be given special consideration by the selection committee.

2011 Young Leader Award recipient Jared Pyka and 2014 recipient Jade Hopson

Summit A w a r d

The TNLA Summit Award recognizes a member firm that has made significant, exceptional contributions to the Texas Nursery & Landscape Association and its member firms. The Summit Award is the highest honor bestowed by TNLA on a member firm. The firm successful in achieving the Summit Award exemplifies the Association's ideals: innovation, service, and highly ethical behavior in the way it conducts its affairs.



Calendar of Events

MAY

- 14 Dealing with Drought in the Landscape Series: Alternative Methods of Gardening, Austin
- 22 International Society of Arboriculture Exam, Houston
- 12 Texas Superstars Webinar... TNLAONLINE.org
- 19 Landscape Weed Management....TNLAONLINE.org
- 27 Current Situation on Emerald Ash BorerWebinar....TNLAONLINE.org

JUNE

- 2-3 Viticulture Short Course, College Station
- **11** Dealing with Drought in the Landscape Series: Preparing for the Fall Vegetable Garden, Austin
- 23 Water Issues Webinar....TNLAONLINE.org

JULY

21-23 Southern Nursery Association Conference, Atlanta

AUGUST

13-15 Nursery/Landscape EXPO, Dallas

For meeting times and additional information, please visit www.tnlaonline.org

In Memoriam



WILLIAM DONOVAN SHAW JR.

(1942-2015) William Donovan Shaw Jr., 73, devoted husband, father, and grandfather passed away on March 22, 2015. William was born January 23, 1942 to William Shaw Sr. and Lillie Muehr Shaw in Weimar, Tx. He served in the National Guard, was appointed by Governor Ann Richards to the Texas Board of Agriculture, named Chairman of the Board of Texas Association of Nurserymen, and was a long standing

member of St. Rose of Lima Catholic Church. Bill is survived by wife Mary, sons William III, Michael, and Daniel, daughter Victoria, brothers Kenneth, James, and Tommy, grandchildren Kayla, Amelia, Brady, and Tate Shaw, Kyle and Garrett Atkinson, daughter-in-laws Jill and Patti Shaw, and son-in-law John Atkinson.





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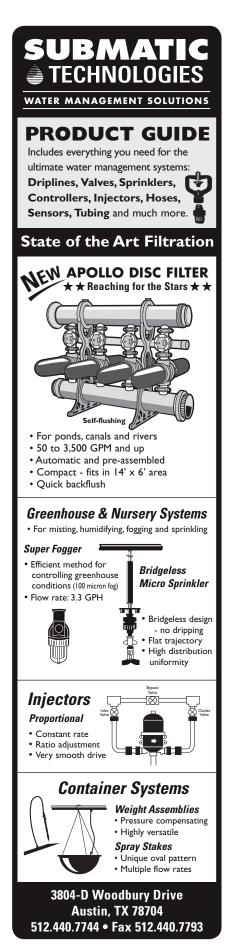
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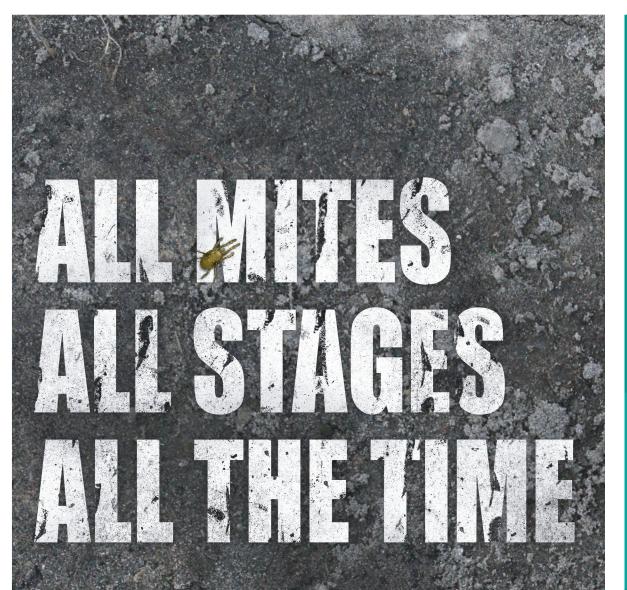




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