

East Texas Forest Entomology Seminar 2019

Thursday May 9

Moderator: Stephen Clarke

1:00 – 1:20 State Reports and Other Announcements

1:20 – 1:45 Methods for detecting SPB infestations: do you believe in evolution?

Jim Meeker, USDA Forest Health Protection

From the 1950's to present day the conventional method of detecting southern pine beetle infestations has been through the use of trained aerial observers flying in fixed-winged aircraft on low-level (1000-3000 ft.) survey missions.

Historically observers manually marked the location of infestations (and other spot attributes) on paper maps/photos; whereas now observers digitally record spots on geo-referenced moving maps/imagery on laptop computers. The use of helicopters to perform SPB detection surveys during the 2012 outbreak on the Homochitto proved to be more effective over fixed-wing surveys, but escalating costs and safety concerns have since limited their use. National Forests in Region 8 have more recently been utilizing remotely sensed digital imagery from various satellite sources, as well as a high-resolution, geo-referenced digital imagery from low-level (below cloud) flights, as a means of detecting (and evaluating) SPB infestations. Examples of the various imagery sources and their usefulness and limitations will be presented.

1:45 – 2:10 Results of an exotic wood-boring beetle survey of pine, oak, maple, redbay and walnut trees in Eastern and Central Texas.

Ashley Morgan-Olvera and Autumn Smith-Herron, Texas Invasive Species Institute - Huntsville, TX

In 2016 and 2018, the Texas Invasive Species Institute (TISI) received two USDA grants (CAPS and Farmbill, respectively), which focused on bundled bark beetle surveys for potential invasive and destructive pests. The survey target species were: Oak Gold Spotted beetle, *Agrilus auroguttatus*, Oak splendor beetle, *A. biguttatus*, Oak ambrosia beetle, *Platypus quercivorus*, Japanese pine sawyer, *Monochamus alternatus*, Sakhalin pine sawyer *M. saltuarius*, Six-toothed bark beetle, *Ips sexdentatus*, Mediterranean pine engraver, *Orthotomicus erosus*, Large Pine weevil, *Hylobius abietius*, Ambrosia beetle (ncn) *Megaplatypus mutatus* and the Redbay Ambrosia Beetle *Xyleborus glabratus*. Our survey areas covered over 30 Texas Counties in Eastern and Central Texas. Wet, multi-funnel traps lured with either *Ips* specific (*Ips sexdentatus* and *Orthotomicus erosus*), alpha-pinene+EtOH+monochamol (*Monochamus* spp. and *Hylobius abietius*), Manuka

Oil (*Xyleborus glabratus*) lures were placed for those species. Purple, prism traps without lures were placed for *Agrilus auroguttatus* and *A. biguttatus* while wet, multi-funnel traps with lures were placed for *Platypus quercivorus*. Lastly, wet, cross-vane traps with *Megaplatypus mutatus* lures were set up for that species. We present the initial distributional reports we have of target and non-target invasive bark beetles as well as native bark beetle species collected.

2:10 – 2:35 A citizen science EDRR program for reporting insects of special concern in Texas

Hans Landel

The Sentinel Pest Network is a citizen science program designed to train Texas citizens to identify and report species of special concern. Among the species are nine insects including "pests of high regulatory significance" such as the emerald ash borer (*Agrilus planipennis*), gypsy moth (*Lymantria dispar*), and cactus moth (*Cactoblastis cactorum*). The program operates as an early detection and rapid response (EDRR) system. Designed to be easy, the volunteers trained in the program can submit observations of potential pests either online or using the Texas Invasives mobile app (Android and iOS). Citizen reports of potential pests are passed on to experts for validation and, if necessary, action. In this presentation I will describe the program, the reporting system, and the training.

2:35 - 3:00 Houston Area Exotic Wood Borer/Bark Beetle Survey: An Overview

Dixie Hull and Xanthe Shirley, USDA-APHIS Plant Protection & Quarantine (PPQ)

The Exotic Wood Borer/Bark Beetle (EWBBB) survey supports USDA-APHIS' goal of safeguarding U.S. agricultural and environmental resources by ensuring that new introductions of harmful bark beetle and wood boring pests are detected as soon as possible. This science-based survey targets specific EWBBB pests not known to occur in the United States, or EWBBB pests with limited distribution, which are selected by the national committee of the Cooperative Agricultural Pest Survey (CAPS) Program, in cooperation with the USDA-APHIS Forest Service (FS). EWBBB surveys are conducted by USDA-APHIS-PPQ along with other agencies and departments under cooperative agreements. We present a summary of the ongoing PPQ EWBBB survey in the Houston area from logistics of supplies, site selection, and trapping (D. Hull), to sample processing and identification (X. Shirley).

3:00 -3:20 Break

3:20-3:45 Emerald ash borer voltinism and adult emergence phenology in AR and LA

Mohammad Bataineh, University of Arkansas at Monticello; and Stephen Clarke, USFS-Forest Health Protection

Emerald ash borer (EAB) voltinism and adult phenology are expected to vary with latitude given its extensive invasion range. Expansion of the invasion range into Arkansas and Louisiana reflects a turning point in insect biology with speculations regarding voltinism and temperature control on population growth and demographics. We address the question of whether warmer temperatures at southern latitudes would result in changes in EAB voltinism and adult emergence phenology and present a growing degree day model to aid in trap setting and treatment application dates.

3:45-4:10 Comparing trap type and placement effectiveness for detection and monitoring of emerald ash borer

Benjamin Walters, Dalton Weatherly; Mohammad Bataineh, University of Arkansas at Monticello; and Stephen Clarke, USFS-Forest Health Protection

The use of traps is important to detect populations of emerald ash borer (EAB) and determine population densities. Prism traps with a combination of lures are commonly used to detect EAB. We look to determine what trap type-lure and canopy position combinations are most effective to trap EAB. A better understanding of trap effectiveness would allow for prompt detection of EAB and quicker management response times

4:10 - 4:35 Emerald Ash Borer in Texas – Movin' on up – To the (West) side.

Allen Smith, Texas A&M Forest Service

As the emerald ash borer slowly spreads throughout rural east Texas, recent confirmation of the insect in the Metroplex means new challenges in management, public relations and awareness.

4:35 - 5:00 Native vs. exotic forest insect pests: where our priorities lie, and what is the truth. A Discussion

Stephen Clarke, USDA Forest Health Protection

Poster:

5:00 - 6:00 Attitude adjustment

6:00 - 7:00 Crawfish

7:00 -7:30 Evening slide presentation: Exploring New Zealand
Ronald Billings

Friday May 10

Moderator: David Kulhavy

8:15 – 8:35 Optimizing forest management practices to minimize economic and environmental impacts of *Sirex noctilio*

Kendra Wagner, Mississippi State University;

The European Woodwasp (*Sirex noctilio* Fabricius) was previously introduced and detected in North America in 2004. It is detrimental to planted pines in its introduced ranges in the southern hemisphere. Thinning provides protection from *S. noctilio* outbreaks in Australia, except for during droughts. In this project we will explore the population dynamics of *S. noctilio* and other siricids in relation to drought and stand density on a global scale. Locations will be selected based upon cumulative drought patterns on a three-year rolling average. Trapping will be divided among 4 different treatment combinations (low and high basal area stands in droughty and non-droughty regions). This will be repeated in the Southeastern USA, upstate New York, Argentina, and Greece. With the completion of this project, we will better understand the effects of drought and forest management techniques on *Sirex noctilio* populations and outbreak potential throughout its current and potential invasive range.

8:35 – 8:55 Can Allee effects limit bark beetle establishment

Kevin Chase

xx

8:55 – 9:15 Saproxylic invertebrate biodiversity in dead wood generated by bark beetles

Kristy McAndrew, John J. Riggins, Natalie Clay, Courtney Siegert, Juliet Tang

The southern pine beetle (*Dendroctonus frontalis*) is a native pest of pine trees in the southeastern USA and is considered a keystone species due to its ability to effect ecological changes in pine forests. However, relatively little research has focused on understanding decomposition dynamics following southern pine beetle outbreaks. Recently, we discovered that ophiostomatoid fungi transmitted during bark beetle attacks are associated with greater subterranean termite feeding and presence. These findings paired with other researchers' reports of higher saproxylic invertebrate abundance being associated with termite presence led us to hypothesize that the multi-trophic interaction between bark beetles, fungi, and termites might be a significant driver of saproxylic invertebrate community composition, ecology, and biodiversity. These ecological interactions may hold

important ramifications for our understanding of decomposition processes in pine forests, as well as the terrestrial carbon cycle in general.

9:15 – 9:35 Outbreak of *Ips* in the Dominican Republic.

Ronald Billings, Texas A&M Forest Service (ret.)

A severe outbreak of *Ips calligraphus* is occurring in native and exotic pine forests of the Dominican Republic, incited by the worst drought on record in this country. Actions being taken to address the outbreak of this invasive pest is discussed together with recommendations to make the control program more effective.

9:35 - 10:00 Break

10:00 - 10:20 Effects of ophiostomatoid fungi on cellulose digestion in subterranean termites.

Natalie Dearing

Subterranean termites have many well-documented fungal symbionts, with relationships ranging from mutualistic to antagonistic. Until fairly recently, the only known fungi able to elicit a feeding response from lower termites have been from the same group, Basidiomycota, and also typically contribute to the decay of woody debris. In 2012, a new fungal associate (ophiostomatoid fungi, or “blue stain” fungi) of subterranean termites was discovered. Interestingly, ophiostomatoid fungi are also closely associated with bark beetles, the primary herbivore of pine trees. These fungi metabolize resin sugars, proteins, starches, and fats in the sapwood as opposed to cellulose and lignin like decay fungi in Basidiomycota. The mechanisms behind this feeding response remain unknown. Presented research will focus on the physiological responses of native subterranean termites after feeding on wood infected with ophiostomatoid fungi.

10:20 – 10:40 Bark beetle research that you can use.

Brian Sullivan and Matt Cloud, USDA Forest Service Southern Research Station, Pineville, LA; Holly Munro, Bailey McNichol, and Kamal Gandhi, University of Georgia, Warnell School of Forestry and Natural Resources

Currently the preferred strategy for direct control of southern pine beetle (SPB) infestations is cut-and-remove; growth of infestations is terminated and value is obtained from the salvaged timber. Typically the salvage is accumulated at storage yards of mills where it may stay for extended periods of time. State foresters have expressed concerns over whether SPB brood emerging from the salvage might help expand outbreaks or pose a risk to pine forests adjacent to mills. The common practice for storage of timber at mills is to maintain it under

a continuous spray of water. The intended purpose of this treatment is prevention of infestation of the timber by wood-boring insects and fungi, but impacts of water treatment on insects already infesting timber are unknown. In laboratory studies managed by USFS-SRS technician Matt Cloud, storage of SPB brood-infested logs under continuous water spray for two weeks caused an estimated 93% brood mortality and completely prevented emergence of adults while the treatment was being applied. Further studies will investigate variables in the application of water treatment that may influence its efficacy.

Monitoring and detection of SPB is conducted with traps baited with an attractant composed of the aggregation pheromone of SPB and one or more volatile components of the resin of host pines. In research led by graduate student Holly Munro (University of Georgia, advisor Kamal Gandhi), we performed a systematic investigation of the individual pine resin constituents that might contribute to the SPB aggregation attractant. Electroantennogram studies with volatiles arising from fresh host resin and synthetic mixtures of pine resin components indicated several compounds that were olfactory stimulants for SPB. Subsequent trapping experiments identified *alpha*-pinene and 4-allylanisole as particularly strong synergists of the SPB aggregation pheromone, both separately and in combination. This result was unexpected since previous research indicated that 4-allylanisole was an attraction inhibitor for SPB. Nonetheless, it appears that 4-allylanisole has the potential to substantially increase the sensitivity of the lure currently used for detection of SPB populations.

10:40 – 11:00 Using Lethal Trap Trees to Reduce the Infestation Potential of Southern Pine Beetle at the Landscape Scale

John Thomason

Traditional southern pine beetle (*Dendroctonus frontalis*) control measures are increasingly difficult to implement because of changing timber markets. Our objective is to examine the efficacy of lethal trap trees deployed at the landscape scale as an IPM tool. Live un-infested pine trees in Alabama were injected with emamectin benzoate in January 2018 and baited one month after injection to induce attack. Three treatment densities (25, 13, & 0 injected trees per block) with three replicates each were implemented on nine adjacent 2,331 hectare pine forest blocks. These 9 forest blocks and the rest of the Oakmulgee National Forest were monitored for SPB infestations for the rest of 2018. There was 1 naturally occurring southern pine beetle infestation in the high treatment blocks, 4 in the low treatment blocks, and 2 in the control blocks. However, the western half of the Oakmulgee NF that contained the treatment blocks had fewer infestations/hectare (0.000563) and fewer total trees infested/hectare (0.010) than

the eastern half of the Oakmulgee, which contained no lethal trap trees (0.00135 infestations/hectare and 0.029 total trees infested/hectare). Further study is needed to determine if lethal trap trees have potential as an effective IPM tool for limiting SPB infestation potential.

11:00 – close Insect Alphabet

David Kulhavy, Stephen F. Austin University

Posters

Berlese funnels as a method for invertebrate extraction from deadwood

Annabelle Grounds (Louisiana Tech University), John Riggins (Mississippi State University), Juliet Tang (USFS), Courtney Siegert (Mississippi State University), Natalie Clay (Louisiana Tech University)

Developing efficient and effective methods of invertebrate extraction from dead wood is important for quantifying and identifying biodiversity of decomposers. Here we tested collapsible Berlese funnels as a means of wood invertebrate extraction with the hypothesis that the body size and life history of individual taxa will affect rate of extraction. Invertebrates were extracted from three equal-sized slices of a decomposing log using collapsible hanging Berlese funnels at 1, 6, and 15 days. The number of invertebrates extracted increased as a linear function and did not level off after 15 days suggesting that further tests need to be conducted at longer time periods in order to see the rates slow down. As predicted, large body size caused rate of extraction to be higher earlier on whereas small body size and life history caused slow extraction to start. This method will improve research in forest ecosystems through the ability to estimate invertebrate populations in wood in a short time to better understand their diversity and ecosystem functions.

Impacts of low-level sodium additions to riparian forest soils on water quality, decomposition, and detrital invertebrates.

Maggie Herrmann (Louisiana Tech University), Sally Entrekin (Virginia Tech), Michelle Evans-White (University of Arkansas), Natalie Clay (Louisiana Tech University)

Freshwater is an essential resource that impacts ecosystem functions and services as an essential resource, habitat, and location for recreation. Fluctuations in water quality can have large impacts on freshwater and riparian ecosystems. Freshwater salinization is a global problem that is increasing in part from agriculture practices such as irrigation that contribute to increased salt runoff into nearby riparian zones and streams. Increased salt input can stimulate or decrease decomposer

activity in aquatic and terrestrial zones depending on the quantity. To test the hypothesis that low-level sodium inputs in riparian zones direct water inputs or indirectly via salt-enriched litter from riparian plant sodium uptake will stimulate decomposer activity and increase the amount of dissolved organic carbon leached in streams, we setup two mesocosm experiments. The first experiment manipulated salt deposition in water (e.g., like from irrigation water) where half the 1 L riparian soil mesocosms with natural leaf litter received 0.5g/L NaCl water and the other half were watered with deionized water. The second experiment manipulated sodium content in artificial litter. All mesocosms with artificial litter (Experiment 2) were watered with deionized, but half of the artificial litter was soaked in 0.5g/L NaCl water solution at the beginning of the experiment and the other half in deionized water. Leachate from mesocosms was collected monthly and analyzed for chemistry and conductivity. After three months, leachate conductivity in both direct and indirect Na-enriched mesocosms was higher as was Na^+ content than control leachate. Other leachate chemistry was consistent between mesocosms except for Ca^{2+} which was higher in direct Na addition mesocosms than control leachate. Decomposition rates did not differ in direct Na addition mesocosms but decomposition trended toward slower rates in indirect Na-enriched litter mesocosms than controls. Diversity and abundance of invertebrates in all mesocosms were lower than natural communities. These results suggest that even low-level Na increases in riparia can directly (through runoff and leachate) and indirectly (through Na-enriched litter) increase salinity of freshwater systems that may cause them to eventually exceed the EPA benchmarks 300 $\mu\text{S}/\text{cm}$. This experiment provides insight essential to understanding how low-level sodium inputs from agriculture processes such as irrigation can impact freshwater resources.