# Forest Health Review

December 2021

*Beech leaf disease (Photo credit: Valerie Huelsman, Prince William County)*

*Beech leaf disease*

## In this issue...

# Greetings

The exciting, and often frustrating, aspect of a forest health program, is that there tends to always be new emerging pests to research and monitor. In that sense, 2021 was a thrilling year! In addition to the routine work of monitoring native and established pests, Virginia Department of Forestry (VDOF) forest health staff were busy with a few new non-native pests in 2021. The elm zigzag sawfly was found in Winchester (page 8), which was the first time this non-native insect was confirmed in the United States. Additionally, two tree diseases were detected in Virginia for the first time in 2021 – beech leaf disease in Prince William County (page 7), and laurel wilt disease in Scott County (page 6). While these detections were unfortunate news, it was impressive to witness how local, state, and federal agencies worked together to confirm and survey the site of detection for each species. The network of entomologists, pathologists, and foresters in Virginia is quite extensive. Even more notable, however, is the network of community scientists that gather data and report observations to further scientific understanding. Community scientists help trap and monitor spotted lanternfly in Virginia, and have the potential to significantly expand other forest health monitoring and reporting efforts. The VDOF Forest Health program will continue to investigate ways to involve volunteer groups in our work to fully utilize this resource.

We hope you enjoy this edition of the VDOF Forest Health Review. Please contact us with any questions and have a good 2022!

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# Forest Health 2021 in Numbers

**651,989 acres** of aerial survey with digital mobile sketch mapping
**18,538 acres** with moderate *Lymantria dispar* defoliation
**2,445 Salem Red Sox baseball fans** learned about emerald ash borer (EAB)
**2,181 acres** of pine thinned with southern pine beetle prevention funds
**2,006 southern pine beetles** caught in funnel traps
**435 silver flies** released for hemlock woolly adelgid (HWA) control
**224 attendees** (virtual) at the Virginia Forest Health conference
**166 eastern hemlock trees** treated for HWA
**150 ash trees** treated via VDOF EAB cost-share program
**103 forest health ground observations** reported by VDOF staff
**42 surveys** for spotted lanternfly egg masses
**15 yellow pan traps** for EAB parasitoids
**12 forest health presentations**
**9 spotted lanternfly traps**
**2 new tree diseases** (see pages 6,7)

# Spotted Lanternfly

The beautiful, but problematic, spotted lanternfly (SLF) made moves through Virginia this year. This invasive insect is native to China, first detected in North America in 2014, and discovered in Virginia in 2018. The SLF is a serious concern due to its long host list and its potential to be a significant agriculture and nuisance pest (long-term impacts to forestry are still unknown). Since female SLF will lay egg masses on any flat surface, their spread is greatly accelerated when outdoor items with egg masses are moved to a new location.

The Virginia Department of Agriculture and Consumer Services (VDACS) regulates a SLF quarantine in Virginia which previously included Frederick County and the City of Winchester. Early in 2021, the quarantine expanded to include Clarke and Warren counties. Additional SLF infestations have been identified in Shenandoah, Rockingham, Page, and Prince William counties as well as the City of Lynchburg. While control is still possible at these locations, the localities are considered infested with a reproducing population. Individual lanternflies have been discovered in other locations around the Commonwealth, but subsequent scouting by VDACS, VDOF, or Virginia Cooperative Extension (VCE) revealed that SLF were not established or widespread.

Researchers are investigating the potential impacts to forests; damage has been observed on many different species of trees following feeding by SLF. Even if SLF doesn't kill a tree outright, it is a source of stress, and compounded factors of stress can kill trees. The forest health staff at VDOF assists and supports efforts to slow the spread of SLF. In late winter of 2021, forest health staff and forest health liaisons conducted SLF egg mass surveys. This involved visiting high-risk sites (parks, rest areas, and parking lots) and visually surveying trees and surfaces for egg masses. These surveys occurred during the winter since SLF overwinters as egg masses and no other life stages are present. In total, there were 42 surveys conducted and no SLF egg masses found (although one surveyor did find a look-alike gypsy moth egg mass at a state park!). Additionally, from June through the beginning of September, nine SLF traps were placed at high-risk sites in central Virginia to monitor for nymphs and adults. These traps are placed on or near tree-of-heaven and catch SLF that move up the tree. Our surveys and traps did not recover any SLF, but we will continue to monitor high-risk sites in Virginia since early detection and rapid response is the best strategy. If you suspect you have found a SLF, please report to the local VCE agent or local VDOF forester.

*Spotted lanternfly adults and egg masses on maple tree*

*SLF circle trap on tree-of-heaven*

# Southern Pine Beetle Survey

The southern pine beetle (SPB) is the most destructive native pest in the Southeastern United States. This small beetle lives within the inner bark of southern yellow pines and can cause significant tree mortality during outbreaks. Historically, SPB outbreaks have occurred about once a decade, lasting an average of 2-3 years. However, Virginia has seen little southern pine beetle activity since the early 2000s, a trend that is reflected across much of the Southeast. This can be attributed, among other factors, to silvicultural practices, such as pre-commercial thinning, that improve forest health and decrease a stand's susceptibility to bark beetles.

Virginia participates in a southwide SPB survey, coordinated by the USDA Forest Service and the Texas A&M Forest Service. This program monitors populations of southern pine beetles using pheromone traps that are deployed each spring. This year, 25 traps were placed in high-risk areas in the counties listed in Table 1. VDOF foresters helped collect samples for four weeks and VDOF forest health program staff sorted and identified beetles. All results are entered into a southwide Pine Beetle Prediction ArcGIS Online application that shows results in real time.

There was a slight increase in southern pine beetles trapped in 2021. Chesterfield County had the most beetles; some were found in Cumberland, Gloucester, New Kent, and Prince Edward counties; and just a few beetles were found in Accomack, Hanover, and Sussex counties. A Pine Beetle Prediction Portal models the potential for a SPB outbreak within certain counties based on survey results and the number of documented SPB spots over the past two years. These predictions are summarized in Table 1. We will continue to monitor the entire state for pine bark beetle activity, but will pay close attention to Chesterfield County where the most SPB activity is expected. Reporting all southern pine beetle spots will help improve the accuracy of SPB predictions in the future.

*Table 1. 2021 Southern Pine Beetle Predictions**

| County | Probability of any spots | Probability of an outbreak |
|---|---|---|
| Accomack | 11.50% | 1.91% |
| Chesterfield | 18.60% | 3.78% |
| Cumberland | 5.68% | 0.68% |
| Franklin | 5.99% | 0.74% |
| Gloucester | 4.47% | 0.48% |
| Halifax | 5.82% | 0.71% |
| Hanover | 6.10% | 0.76% |
| Henry | 5.10% | 0.59% |
| New Kent | 6.38% | 0.81% |
| Prince Edward | 4.66% | 0.51% |
| Sussex | 6.42% | 0.82% |

*Predictions are based on a zero-inflated Poisson model fit to historical data from 1988-2009 (Aoki 2017). The most important drivers of the model predictions are SPB trap captures in the current spring and SPB spots the previous year. The SPB prediction project is supported by USDA Forest Service: Science and Technology Development Program (STDP).

*Small SPB spot in Chesterfield County*

*Southern pine beetle funnel trap*

# Grand SLAM (Slowing Ash Mortality) in the South

The emerald ash borer (EAB) is an invasive insect that attacks and kills ash trees in North America. It became established in Virginia in 2008, and has wreaked havoc killing ash trees throughout the state. In 2019, VDOF was awarded a USDA Forest Service Landscape Scale Restoration grant titled Grand SLAM (Slowing Ash Mortality) in the South. One objective of this project is to conduct education and outreach with minor league baseball teams, a sport that utilizes ash wood. VDOF began connecting with baseball teams in 2020, but restrictions due to COVID-19 caused a delay in outreach activities. Games resumed in 2021 and VDOF was able to work with three baseball teams in Virginia: Salem Red Sox, Richmond Flying Squirrels, and Norfolk Tides.

Since the first ash baseball bat was used professionally in 1884 in Louisville, Kentucky, ash bats have been the go-to for baseball greats including Babe Ruth, Joe DiMaggio, Hank Aaron, Jackie Robinson, and countless others. But ash trees are dying because of the invasive emerald ash borer. Fewer ash bats are made each year, with only a small percentage of professionals using them today. As ash trees die, so does a huge part of baseball history. Joe Lehnen, VDOF forest utilization and marketing specialist, coordinated the production of eight baseball bats from declining ash trees. Two demonstration baseball bats were created by Shaun McKim, with assistance from Duff McCully, both part of the Washington D.C. Urban Forestry Program. These bats were engraved with EAB messaging and displayed during outreach activities. Additional bats were produced to give away during select baseball games at our partner team stadiums. Four of these bats were created by Juan Baret of Baret Bat and Glove Company, a small veteran-owned company that uses a purpose-driven approach to help ballplayers be their best on and off the field. All bats were made of local ash wood!

VDOF's Grand SLAM outreach activities bring attention to the emerald ash borer and encourage good practices such as preventative ash treatment and buying local firewood. In addition to posts on social media, articles in newsletters, and graphics displayed in stadiums, VDOF staff attended a Salem Red Sox game for in-person outreach. Baseball game attendees were able to speak with program staff about EAB and how to protect ash trees. In celebration of Smokey Bear's 77th birthday, Denny McCarthy and David Tompkins (Blue Ridge Work Area staff) helped Smokey Bear throw out the ceremonial "first pitch" of the game. Smokey stuck around to interact with fans and help distribute educational material. Every person that stopped by the VDOF table was reminded to hit EAB out of the park!

*Demonstration bats made from local ash wood*


*Teagan O'Brien (previous VDOF forest health technician) and Smokey hand out EAB information at the Salem Red Sox baseball stadium.*

*The emerald ash borer. (Photo credit: Leah Bauer, USDA Forest Service Northern Research Station, Bugwood.org)*

*Hit EAB out of the park! (Photo credit: Focus On Sport/Getty Images)*


*Smokey throwing the first pitch at a Salem Red Sox game*

# Laurel Wilt Disease

The confirmation of laurel wilt disease (LWD) in Virginia was inevitable, and something the VDOF forest health staff has been expecting the past few years. This disease complex, involving both a fungal pathogen and an ambrosia beetle, has been moving through the Southeast since its original detection near Savannah, Georgia, in the early 2000s. LWD had been confirmed in Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, South Carolina, North Carolina, Tennessee, Kentucky, and now Virginia (see map, page 12).

Laurel wilt is a vascular wilt disease that affects all species in the Lauraceae family. In Virginia, at-risk species are redbay, sassafras, and spicebush. LWD is initiated when a redbay ambrosia beetle enters a host tree, carrying the fungal pathogen *Raffaelea lauricola* in its specialized mouthparts. As the beetle tunnels through the host, spores are left behind in the gallery allowing them to grow as a food source for the beetle. As the fungus grows, it colonizes water-conducting cells in the plant tissue, causing a reaction that disrupts water movement in the tree. This leads to the wilting and browning of foliage, and eventual death of the host. The disease can also spread via root grafts, similar to Dutch elm disease. In evergreen hosts, such as redbay, wilted foliage is retained through the winter whereas in deciduous hosts, like sassafras, foliage drops after wilting. In all hosts, peeling bark will reveal discolored sapwood running in the direction of the woodgrain. Sometimes small "toothpicks" (packed sawdust) will stick out of host species, a result of the ambrosia beetle tunneling into the tree. However, it is important to note that many other ambrosia beetles also create sawdust toothpicks so this cannot be used as a diagnostic tool on its own.

In June, forest health and urban and community forestry staff held a training for VDOF foresters at a confirmed LWD site in Sullivan County, Tennessee, just over the TN-VA state line. In total, six VDOF staff and five Tennessee Division of Forestry staff attended the event to learn about LWD, observe symptomatic sassafras, and discuss management options. After crossing back into Virginia and entering Scott County, a symptomatic sassafras was immediately observed. This tree had wilted and discolored foliage, and peeling back the bark revealed vascular streaking. A sample was collected and sent to the Virginia Tech Plant Disease Clinic for initial review, and then USDA-APHIS for official confirmation. This was the first confirmed case of LWD in Virginia.

Unfortunately, there are few management options available for LWD. High-value landscape or specimen trees can be treated preventatively with a macroinjection of fungicide, but this is not practical in a forested setting. Infected trees can be chipped down to 1-inch pieces or burned to prevent the spread of this disease. If you suspect a tree has LWD, please reach out to the VDOF forest health staff for more information on how to collect a sample.

*Vascular streaking in a sassafras infected with LWD*

*Sawdust "toothpicks" on a tree infested with the redbay ambrosia beetle*

*Dead sassafras along a field edge*

*continued on Page 12*

# Beech Leaf Disease

The last thing Virginia needed was another tree disease, but it arrived nonetheless. Beech leaf disease (BLD) has been confirmed in Virginia. This disease affects our native American beech trees and can cause tree mortality after several years, mostly in smaller trees. Plantings of other beech species such as European, Oriental, and Chinese beech are also susceptible. When BLD was first detected in Ohio in 2012, the causal agent was unknown. A wide variety of insects and pathogens were found on symptomatic trees, but none appeared to be directly associated with the disease. It was not until years later that nematodes were investigated.

Nematodes are small, non-segmented worms that are normally invisible to all but a few specialized scientists. They tend to be microscopic and transparent, and feed on bacteria, fungi, or other microscopic creatures. While they may be difficult to see, nematodes are numerically the most abundant animals on the Earth. Four out of every five animals on Earth are a nematode worm! They are so abundant, according to nematologist Nathan Augustus Cobb in 1915, that if all the matter in the universe except nematodes disappeared, we would still see the outline of everything represented by a film of nematodes. So it's not surprising that nematodes have been found on symptomatic beech trees. The newly recognized nematode subspecies *Litylenchus crenatae* ssp. *mccannii* (Anguinata) is associated with BLD symptoms. It is a foliar nematode that overwinters in buds and detached leaves.

The first symptom of BLD is interveinal greening; leaf tissue darkens and thickens between lateral leaf veins. This is best observed by looking up into the canopy so that the leaves are backlit from the sun above. Beech leaves tend to overlap which creates dark spots at overlapping leaf areas, but the banding caused by BLD always appears as striping between leaf veins. Impacted leaves are distributed unevenly on branches and trees, so you may only see a few symptomatic leaves on a branch/tree. Later symptoms include leaf crinkling, curling, and discoloration. Reduced bud and leaf production lead to thin canopies, and tree mortality has been observed within 2-7 years, most commonly in smaller understory trees.

BLD has also been detected in Ohio, Connecticut, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, West Virginia, and the Canadian Province of Ontario. In Virginia, the only known site to date is in Prince William County. If you see impacted beech trees with the symptoms listed above, please take photos and contact VDOF forest health staff at foresthealth@dof.virginia.gov.

*Beech tree infected with beech leaf disease*

*Interveinal greening on beech leaves, an early symptom of beech leaf disease (Photo credit: Valerie Huelsman, Prince William County)*

# Elm Zigzag Sawfly

*Eric Day, Virginia Tech Insect Identification Lab*

The elm zigzag sawfly, *Aproceros leucopoda*, is a hymenopteran insect whose larvae feed on elm leaves (*Ulmus* spp.). This species is native to east Asia, but was reported in central Europe in 2003 where it has spread and become a pest of native and introduced elm tree species. In 2020, it was first detected in Quebec, Canada, and then confirmed in Virginia the summer of 2021. The detection in Virginia was the first time the elm zigzag sawfly had been found in the United States! Eric Day, manager of the Virginia Tech Insect Identification Lab, has been monitoring the elm zigzag sawfly population in Virginia, and agreed to answer some of our questions.

**How was the elm zigzag sawfly discovered in Virginia?**

A researcher in Canada saw an iNaturalist report from Clarke County with a photo that resembled the elm zigzag sawfly. The researcher reached out to VDACS and VDOF, and all inspectors and forest health liaisons were notified. One VDACS inspector remembered seeing similar damage the year before, and was able to find the photo and location from the previous year. Elm zigzag sawfly was confirmed at this site in Winchester in 2021, making it the first confirmation in the United States. This is a great example of how sharp eyes from both community scientists and trained professionals led to a new detection.

**What damage is it causing in Virginia?**

The most severe damage has been observed on Siberian elm; however, these elms were often infested with both the elm zigzag sawfly and the European elm flea weevil. Full defoliation occurred on Siberian elms in Rockbridge County north to Frederick County. Minor, incomplete defoliation has been observed on some American elm trees in Virginia. In Europe, repeated severe defoliation has led to some tree mortality, but it is too soon to know the long-term impacts to elms here in Virginia. Tree Dellinger (diagnostician at the Virginia Tech Insect Identification Lab) and I have been visiting the site of detection in Winchester every two weeks since elm zigzag sawfly was confirmed this year. We are monitoring the damage, long-term impacts, biology and phenology of the sawfly, so hopefully we will know more next year.

**What are the signs and identifying characteristics of the elm zigzag sawfly?**

Adults are small, dark brown sawflies and larvae resemble a tiny, green caterpillar. The most conspicuous sign is the zigzag notching in the leaves, followed by the rest of the leaf tissue being consumed. Young larvae create the zigzag feeding damage, while later larvae will consume the entire leaf. On many heavily defoliated Siberian elms, you can still see small green tips that were not consumed.

**If folks find it, how should they report it?**

If you think you have found the elm zigzag sawfly, please report to your local Virginia Coooperative Extension agent or local VDOF forester. Take a photo of the damage and be prepared to collect a sample. Adults or larvae may be collected and stored in ethyl alcohol. We would like to learn more about the distribution of this sawfly, and are encouraging folks to look for it and report any possible finds. The initial report was made by a community scientist, so there is a lot of potential for this type of reporting.

*Elm zigzag sawfly larvae feeding on an elm leaf (Photo credit: Eric Day)*

*Adult elm zigzag sawfly (Photo credit: Eric Day)*

# Lymantria dispar

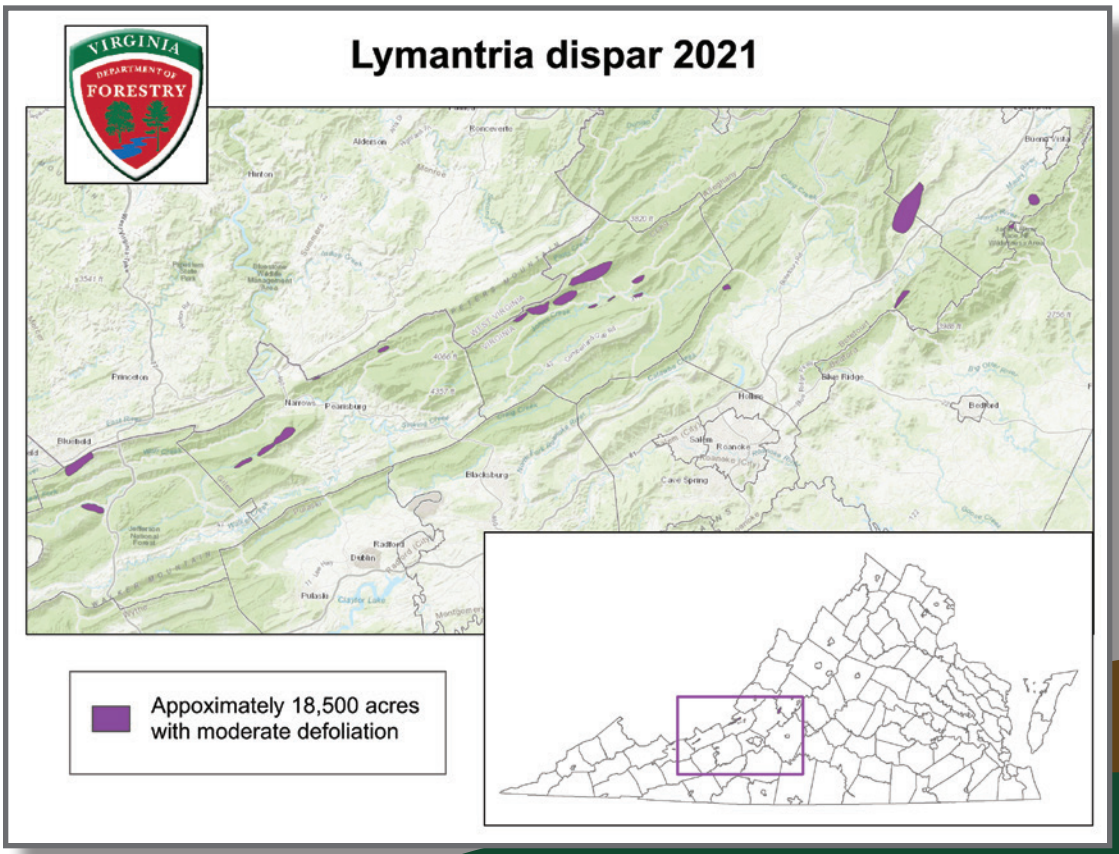
The notorious defoliator *Lymantria dispar** (previously known as the European Gypsy Moth) can defoliate hundreds of thousands of acres of hardwood forests, but has remained at innocuous levels in recent years. However, ridgetops in western and southwestern Virginia tend to be favorable sites where we've frequently seen low to moderate populations. In mid-June, 2021, biologists at Shenandoah National Park reported dead *L. dispar* caterpillars on tree trunks in the central district. *L. dispar* caterpillars are often killed by either a fungus or a virus that are present in the environment. Since the fungus, *Entomophaga maimaiga*, proliferates in wet weather, rainfall in 2021 led to increased *L. dispar* mortality. The gypsy moth nucleopolyhedrovirus also provides control when populations reach outbreak levels.

While no large-scale *L. dispar* outbreaks were observed in 2021, there was light to moderate defoliation in southwest Virginia. Patchy defoliation in areas west of Roanoke and north of the I-77 corridor in Wythe County was reported to VDOF forest health staff in early July. Katlin DeWitt, piloted by the Virginia Department of Aviation, conducted an aerial survey of the region and mapped 18,538 acres with moderate defoliation.

*L. dispar* egg mass surveys are used to assess the risk of an outbreak the following year. Adult *L. dispar* moths emerge in July, mate, and then females lay egg masses on tree trunks and branch crotches. While conducting field work on Warm Springs Mountain Preserve in Bath County, VDOF forest health staff observed *L. dispar* on an adjacent property in high numbers. Some caterpillars had been killed by the *Entomophaga maimaiga* fungus, but many had survived to adulthood and were seen mating and laying eggs. These eggs will overwinter and hatch the following spring. In general, treatment should be considered if a large number of egg masses are observed, so VDOF forest health staff will follow-up with the landowner next year. A wet spring would favor *E. maimaiga* which would act as biological control.

*As of July, 2021, the Entomological Society of America no longer recognizes the common name "gypsy moth" for *Lymantria dispar*. A committee is reviewing submissions for a new common name.

*Dead L. dispar caterpillars and adult female moth laying eggs*



# Hemlock Woolly Adelgid Biocontrol

The hemlock woolly adelgid (HWA) is a small, invasive, sapsucking insect that continues to plague hemlock trees in Virginia. Feeding at the base of the needles on stored nutrients within the trees, these tiny adelgid insects stress trees, reduce new growth, and cause needle loss, branch dieback, and eventually tree mortality. It has been a priority to protect hemlocks in Virginia for many years, through chemical treatment and/or biological control.

Previously, biological control efforts consisted of releases with Laricobius beetles, either *L. nigrinus* or *L. osakensis*. These beetles are adelgid specialists and are released in the fall at the time that HWA breaks its summer dormancy period. HWA has two generations per year, and the Laricobius beetles target the generation that is active through the winter. Recently, another predator became available for state cooperators to release - *Leucotaraxis argenticollis*, a predatory fly. These flies hail from the Pacific Northwest, where the predacious fly larvae feed on HWA eggs that were laid on hemlock foliage in the spring. The timing of this feeding make *Leucotaraxis* flies unique as a biological control agent, and a promising addition to the HWA biological control toolkit.

On March 11, 2021, 435 *L. argenticollis* flies were released at Sandy Point State Forest in West Point, Va. This site is a unique habitat for hemlocks, further East than the historical hemlock range, and in an area dominated mostly by pines. It is also upslope from a tributary creek of the Mattaponi River making it not suitable for soil drench chemical treatment. In 2010, a release of 2,040 *Laricobius nigrinus* occurred at this site and while recovery efforts have been attempted, none have been found. We hope that the recently released *Leucotaraxis* will feed on the spring adelgid population and work in conjunction with any *L. nigrinus* that might still be present on site.

Forest health staff will continue to monitor HWA populations at this location and participate in recovery efforts to confirm that *Leucotaraxis* establishes a population at Sandy Point State Forest. Biological control has the potential to provide long-term protection for the remaining hemlocks in Virginia.

*Tiny L. argenticollis flies in a vial*

*Dennis Gaston releases Leucotaraxis onto a hemlock branch*

*Lori Chamberlin holding a vial of Leucotaraxis flies*

# What's This?

Can you identify the organisms in these photos?

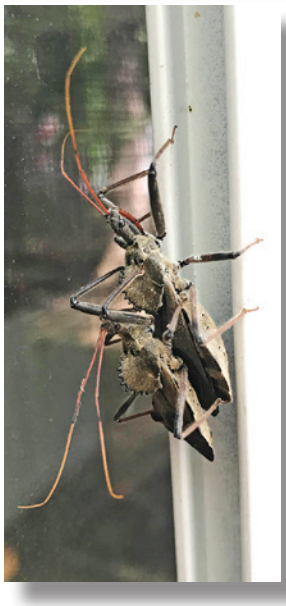
**A.**

**B.**

**C.**

**D.**

**E.**



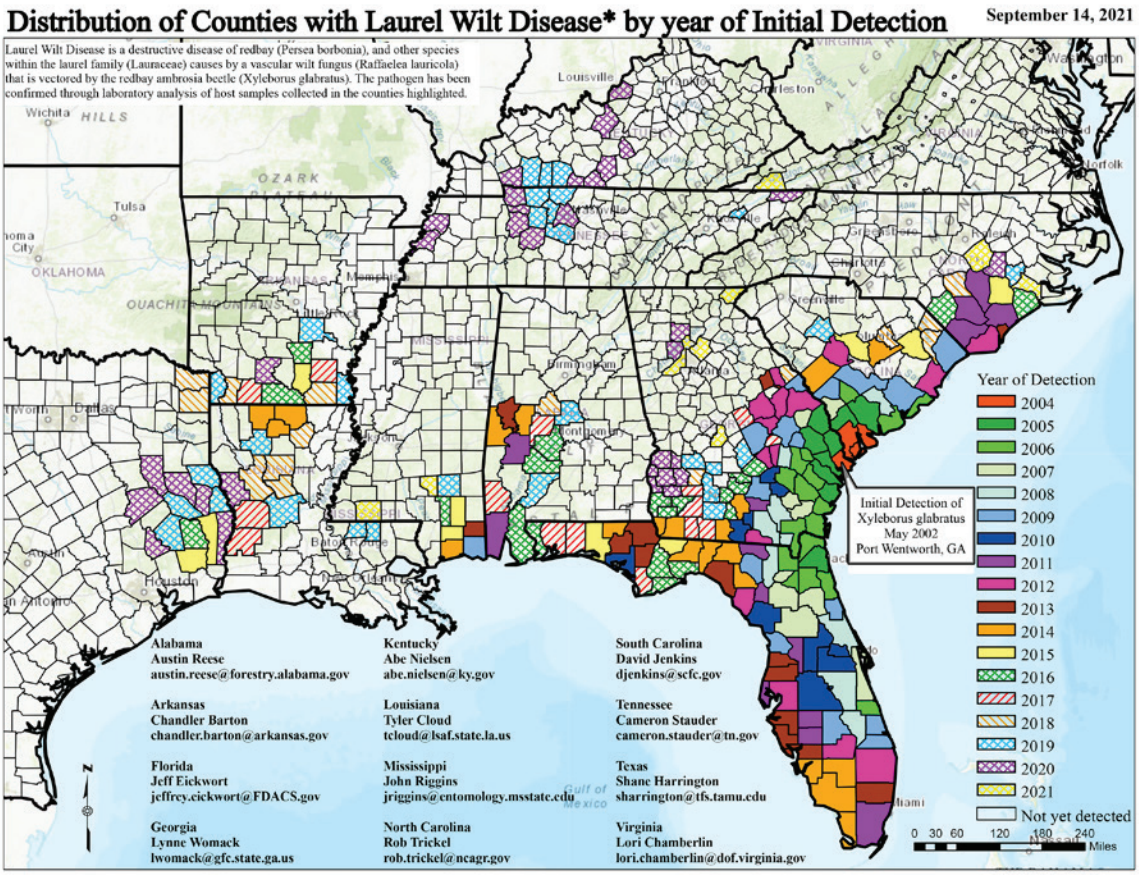
**F.**

**G.**

**H.**

**What's This Answer Key**

A: Adult antlion
B: Beech bark disease
C: Bacterial leaf scorch
D: Introduced pine sawflies
E: Wheel bugs
F: Bark lice
G: Emerald ash borer
H: Bagworms

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