The IR-4 Project
Pest Management Solutions for Specialty Crops and Specialty Uses

Newsletter

Vol. 49 No.4 Fall 2018

Scientists Spent Years on a Plan to Import this Wasp to Kill Stinkbugs. Then it Showed Up on its Own

— by Kelly Servick

Modified from "Scientists spent years on a plan to import this wasp to kill stinkbugs. Then it showed up on its own" Science August 9, 2018 (doi:10.1126/science.aav0327). Reprinted with permission from AAAS.

In a peach orchard down a rural road in Bridgeton, NJ, an uninvited guest has run amok. The brown marmorated stinkbug (*Halyomorpha halys*) has been gorging on the unripe fruit. The bugs have sunk their needle-sharp stylets into the peaches, creating wounds that ooze a clear, sugary goo; form corky brown blemishes; and leave the trees more vulnerable to infection.

In this orchard, managed by the Rutgers University Agricultural Research and Extension Center, the mottled, shield-shaped stinkbug is a research subject. In surrounding farms and homes, however, it's a despised invasive pest known for its indiscriminate appetite, its tendency to escape cold weather by crowding into homes—sometimes by the thousands—and the pungent, cilantro-like odor it releases when crushed. (Exterminators often recommend that homeowners vacuum up the insects instead.)

Native to Asia, the bug was first spotted in the United States in 1998; it has since reached 43 states and Washington, DC, attacking fruit trees, corn, soybeans, berries, tomatoes, and other crops. Statistics are scarce, but an industry group estimates that Mid-Atlantic apple growers alone lost $37 million to stinkbug damage in 2010.

In the peach orchard, however, another surprise invader also is on the march—and it may prove to be the stinkbug's nemesis.

Like many invasive species, the brown marmorated stinkbug has no major enemies in its new home to keep its population in check. So in 2005, entomologist Kim Hoelmer and his team at the US Department of Agriculture's (USDA's) Agricultural Research Service (ARS) in Newark, DE, turned to a strategy known as classical biological control: they traveled to Asia to find natural enemies of the stinkbug that they might release in the United States.

Fanning out to agricultural fields and botanical gardens, the team searched for the bug's tiny clusters of barrel-shaped eggs. They checked whether any had been invaded by parasitoid wasps, which inject their own eggs into the stinkbug's, leaving larvae that eat the developing bugs before chewing their way out. By far the most pervasive parasite they found was the samurai wasp (*Trissolcus japonicus*), which, despite its fearsome name, is stingerless and smaller than a sesame seed. The ARS team imported several strains of the wasp to a quarantined facility in Newark and began painstaking tests to decide whether it was a good biocontrol candidate.

Then in 2014, Hoelmer got an unexpected phone call. Elijah Talamas, a taxonomist at the Florida Department of Agriculture and Consumer Services in Gainesville, had been helping another ARS team identify native wasps parasitizing stinkbug eggs in Maryland. Talamas, an expert on Trissolcus species, had recognized that some were samurai wasps.

continued on pg 3

Inside...

4 Personalities in the News

6 IR-4 & American Ginseng

8 Safety in IR-4

10 Combined Workshops

11 New Product Corner

13 Holiday Greenery

14 Spotted Lanternfly

15 Measuring Pollinator Attractiveness

Executive Director Notes

Dear Friends

WOW, another year is reaching its conclusion. Though I am not ready to tackle all the year-end reports and documents, (SPOILER ALERT) IR-4 had one of its most successful years in recent memory. The number of new registrations is expected to exceed 1000. I am proud of the IR-4 team in gaining this number of tangible registrations in a challenging regulatory climate. Everyone, including Field Technicians, Field Research Directors, Regional Field Coordinators, Laboratory Staff, Laboratory Research Directors, Study Directors, Quality Assurance, Administrative Support and Management have worked diligently to achieve this milestone. IR-4's partners, including the companies, growers/commodity associations, USDA and EPA continue to provide great support.

One can ask, what did we do differently? I believe the uptick in new registrations is due to many factors. Some of the efficiency moves we have implemented over the past several years are playing out in the number of new registrations. This includes more attention to bundling multiple crops in a submission for an active ingredient. IR-4 has also taken advantage of the larger crop groups associated with the Crop Grouping expansion and enhancement project. Another factor playing a key role in IR-4 success is the reestablishment of the EPA Minor Use Team. The group that manages IR-4's submissions within EPA was sidelined by retirements and reassignments within EPA. The EPA Minor Use Team was stabilized this summer with the appointment of Bo Davis as Minor Use and Emergency Response Branch Chief and Nancy Fitz as Minor Use Officer. With Bo's support, Nancy and the remaining members of the Minor Use Team have been working through the accumulated backlog of IR-4 submissions pending at EPA.

On other fronts, IR-4 continues its aggressive push to eliminate the backlog in its analytical laboratories. I am pleased to share that the IR-4 North Central and Western Region Laboratories have fully eliminated their backlog. Congratulations to Sue Erhardt and Matt Hengel and their teams at the Regional Laboratories at Michigan State and University of California, Davis, respectively. The Southern Region Analytical Laboratory and the USDA-ARS Laboratory in Wapato, WA are on track to report success by March 2019. Unfortunately, the USDA-ARS Laboratory in Tifton, GA will not achieve the backlog reduction goal. Due to USDA rules, the laboratory has not been able to use available resources to solve their backlog. We have requested that USDA-ARS management find ways to expedite the elimination of the backlog.

In September, IR-4 and its stakeholders established research priorities for 2019 at our workshops in St. Louis. If you recall from the last issue's Executive Director's notes, IR-4 was launching our Integrated Solutions program with the workshop serving as a venue to establish the first set of research priorities. It was not always as smooth as expected but MISSION ACCOMPLISHED. Kudos to Dan Kunkel, Krista Coleman as well as other technical leads at IR-4 HQ and in the regions for kicking off the exciting new program with six high priority projects. We see great potential to make a difference for the growers and consumers of specialty crops as a result of this program.

As we wrap up the year, I want to recognize and thank three scientists who are retiring, the first is Marija Arsenovic; she was hired by IR-4 HQ almost 20 years ago as our Weed Science Manager. During her tenure, she was lead biologist in the herbicide management area, helping to facilitate hundreds of herbicide registrations on specialty crops. Also retiring is Dan Botts. Dan has led the Technical Committee of the Minor Crop Farmers Alliance since its establishment in the mid-1990s. He also served on the IR-4 Commodity Liaison Committee. He has produced significant national/international impacts in his career including the development and approval of the Minor Use Title of the 1996 Food Quality Protection Act. Dan will be missed. One more retirement was that of Connie Scarborough, who worked for 30 years in the USDA-ARS Laboratory in Tifton, GA.

Dan Kunkel presenting appreciation plaque to Dan Botts at the Minor Crop Farmer Alliance meeting.

On behalf of my co-workers with the IR-4 Project, we wish everyone a wonderful holiday season. We look forward to keeping the IR-4 success train running at full speed in 2019.

That's all for now,
Jerry

Wasp *continued from pg 1*

"It was stunning news," Hoelmer recalls. He had spent years studying the wasp in the lab to make sure that, if released, it would do its job without harming native species. But the insect was already here. Genetic tests confirmed that the wasps in Maryland hadn't escaped from any of his quarantined strains. Somehow, they had immigrated on their own.

Over the decades, a variety of uninvited biocontrol candidates have popped up on new continents, including a fungus that kills forest-stripping gypsy moths and a beetle that devours allergy-inducing ragweed. "The examples definitely are piling up," says Donald Weber, an ARS entomologist in College Park, Maryland, whose team found the first US samurai wasps. "We've had this mindset that natural enemies would be less likely to establish than invasive pests," he says. "But sometimes, It might be fairly easy."

Those unexpected arrivals can unsettle scientists and regulators. Rules aimed at carefully controlling insect releases can seem nonsensical when the species in question is already happily spreading on its own. And the arrival of the samurai wasp has prompted a fresh look at some US regulations.

But unplanned introductions also free researchers from some of the usual constraints, allowing them to explore key questions about a biocontrol agent's impact in field experiments rather than just the lab. The team at the peach orchard, for example, is one of about a dozen US groups now releasing the samurai wasp into fields and orchards to see whether it will be

A samurai wasp emerges from the brown marmorated stinkbug egg in which it hatched. Scientists hope the wasp will reduce populations of the pest in US crops. *Photo by Chris Hedstrom, Oregon Department of Agriculture*

an ally in fighting the exotic stinkbugs—or yet another problematic invader.

Since the samurai wasp's first US appearance in 2014, surveys have turned up at least three genetically distinct populations in areas affected by the brown marmorated stinkbug suggesting multiple introductions.

One night last May, 3600 samurai wasps streamed from mesh cages into the stinkbug-infested New Jersey orchard. A team led by Rutgers entomologist Anne Nielsen and entomologist Kevin Rice of the University of Missouri in Columbia had strung up yellow sticky cards baited with stinkbug egg clusters among the peaches and along the adjacent forest edge. They planned to wait a few days, collect the cards, and count the wasps to see whether they had ventured into the orchard to pursue the peach-destroying bugs.

The insects were descendants of wasps that Nielsen first discovered in a nearby New Jersey orchard in 2017—the first find in a US agricultural crop. Maybe wasp embryos were hiding in stinkbug eggs aboard a cargo ship. An adult wasp may even have hitched a ride with an unsuspecting airline passenger. (While awaiting a flight from New York City to Russia,

Talamas once watched a different parasitoid wasp species, native to the U S, land on a page of his book. "All it had to do was fly down the walkway … next stop: Russia." He trapped the hitchhiker in his contact lens case and, on arrival, preserved it in vodka.

Now that the wasps are in the US, research questions abound, Nielsen says. "In their native range, they parasitize up to 90% of brown marmorated eggs. But will their behavior be different here? Where will they congregate and forage? Will they dramatically reduce stinkbug populations? Could farmers support the wasp by adjusting their practices—for example, not spraying pesticides where the insects are most concentrated?" The chance to probe basic questions about a little-studied exotic species, Rice says, is "fabulously exciting."

For US regulators, however, the wasp's unexpected arrival poses a conundrum. "This is a good chance for us to codify policy and decide, 'How are we going to handle these circumstances?'" says Robert Pfannenstiel, an APHIS entomologist in Riverdale, Maryland, who reviews release applications. "Will we allow changes from our policies and processes that are already in place, or not?"

Studies so far suggest the samurai wasp is a promising biocontrol agent. Although in laboratory tests it has parasitized some eggs laid by native species, it has shown a strong preference for brown marmorated stinkbug eggs. Scientists can release the accidental strains in states where they've already been discovered, but for

continued on pg 4

Wasp

now they can't spread the wasps indiscriminately. APHIS prohibits moving exotic species that haven't been formally cleared for release into new states. (Nielsen and Rice, for example, couldn't legally perform their same experiment if they drove 4 hours north to Connecticut, where samurai wasps haven't been found—so far.)

The wasp needs to go through regulatory review, just like any other candidate, Pfannenstiel says. "The danger, in one case, of saying, 'Oh, we can tell it's not a risk,' and then releasing it [is that] there's pressure to do that repeatedly, and start making judgment calls rather than determinations based on data." Field studies of the accidental strains could speed the evaluation and help the wasp's chances of approval—or reveal new reasons not to release it," he says. "I go into these evaluations with no preconceptions."

Hoelmer's team at ARS is still preparing a petition to APHIS to release one deliberately imported strain, which he hopes could serve as a backup if the accidentally introduced strains spread slowly. He also intends to include the accidentally introduced strains in his release petition, because their biology is so similar to that of the strain he has studied extensively. He plans to submit his petition by the end of this year, and hopes for a decision next year. For now, he says, growers and researchers in states where the wasp hasn't been detected will simply "have to wait until it crosses the border."

The researchers at work in the Rutgers orchard aren't yet endorsing the samurai wasp as a biocontrol agent. First, they'd like more

Rutgers University entomologist Anne Nielsen and graduate student Nick Avila survey a yellow sticky card for samurai wasps to track their dispersal in the peach orchard. *Photo by Dean Polk.*

evidence that it won't harm native species. "They're invasive," Rice says. "They're not in a different bucket from the stinkbugs."
The restrictions on spreading the wasp "can be frustrating, and it can seem arbitrary, but the regulations are there for a reason," Nielsen adds. Still, she says, the wasp "is likely our best hope of controlling the brown marmorated." Examining the sticky cards this summer, her team found a roughly equal distribution of wasps in the peaches and the nearby woods. That finding suggests the wasps are perfectly happy foraging for stinkbug eggs among the fruit, which bodes well for the wasps' ability to control the pests. The team plans to run a similar experiment soon to see how the wasps spread into another crop, soybeans.

Meanwhile, researchers in California have sent Talamas another surprise: a new, accidentally introduced *Trissolcus* parasitoid wasp, this one native to India and Pakistan, which emerged from the egg of another exotic stinkbug pest, *Bagrada hilaris*. "I think that these introductions are happening constantly," Talamas says, but come to light only when taxonomists bother to take a close look. He published the new finding in August 2018, in the *Journal of Hymenoptera Research*.

Such arrivals are "humbling," Weber says—a reminder of the limits that humans face in shaping their environment. "We have less control over things than we think."

Personalities in the News

Herman Waguespack, Jr.

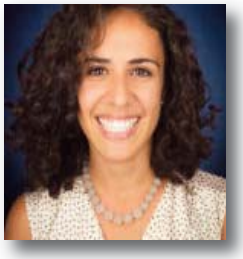
Herman Waguespack, Jr. is the newest IR-4 Commodity Liaison Committee member. Herman earned a B.S. in Agriculture from Nicholls State University. While at Nicholls, he was president of the NSU Ag Club and served as president of Delta Tau Alpha honorary agriculture fraternity. He was named the outstanding AG graduate of 1981 and was a Nicholls Hall of Fame graduate. Upon graduation he worked as a sugarcane farm manager for Caire and Graugnard and for several years worked as a Farm Bureau insurance agent in St. James Parish, LA. In 1985, he began his career as a sugarcane agronomist for the American Sugar Cane League working with researchers and farmers throughout the state to develop new varieties and test new technology for the advancement of the Louisiana sugarcane industry. In 1996, he completed his studies at LSU and graduated with a master's degree in agronomy. Since 1985, he has worked with the Louisiana sugarcane variety development team to release 20 new sugarcane varieties for commercial production. Sugarcane is a unique commodity. It's a tropical crop that has been improved through breeding to withstand the temperate

continued on next pg

environment in Louisiana. Although LA experiences freezing temperatures every year, growers can still successfully produce a sugarcane crop and supply approximately 20% of the domestic sugar (sucrose) supply. Herman recently became involved in the IR-4 program while working with researchers at LSU and USDA to develop a management strategy for a new weed that has been causing major losses in the sugarcane fields. Working with engineers and farmers, the American Sugarcane League agronomists have also conducted studies to help improve mechanical planting and other important tools for the industry.

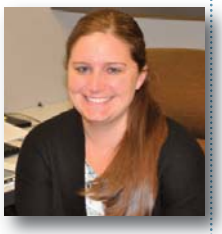
His hobbies include hunting, fishing, guitar, woodworking, gardening and anything Cajun (especially the food). He and his wife Lisa, enjoy living in Thibodaux, LA.

Carolina Simao Roe-Raymond
Dr. Carolina joined IR-4 as a Program Assistant in 2018. Carolina assists with managing the Protecting Pollinators project within the Environ. Hort. Program.



This project brings together scientists from various institutions to research how to protect bees within ornamental horticulture. In her role, she also conducts field work associated with the project, helps develop outreach content, maintains the Protecting Bees website, and contributes to the pollinator-attractiveness database. In her spare time, Carolina enjoys dancing salsa, traveling, and spending time with her family.

Chelsea Bonetti
Chelsea Bonetti has joined IR-4 as a Research Coordinator and Study Director. Her strong analytical chemistry background and robust knowledge of Good Laboratory Practices brings much needed support for the Food Use Program. Chelsea has seven years of experience in the agroscience industry, which includes working as an Assistant Laboratory Director, Research Scientist and Analytical Chemist for Eurofins Agroscience Services. She also worked as a Research Intern at the Princeton Institute for the Science and Technology of Materials (PRISM) and the Princeton Center for Complex Materials (PCCM). Chelsea has a Masters of Chemistry in Analytical Chemistry from Illinois Institute of Technology and a Bachelor of Science, from the College of Saint Elizabeth.



New Beginnings for Retirees
HQ will miss **Marija Arsenovic** who retired on Nov. 1, 2018. Marija had been with IR-4 for almost 20 years. She was the Lead Weed Science Biologist and was responsible for managing the Weed Science registrations.

Marija is looking forward to spending more time with her family. Thank you Marija for your service to IR-4!

Connie Scarborough retired on October 8, 2018 after 30 years of service with USDA-ARS. Connie spent her entire career as a laboratory technician at the Crop Protection and Management Research Laboratory in Tifton, GA where she conducted food residue assays in support of the IR-4 Project.

The IR-4 Newsletter, Vol. 49 No.4 Fall 2018
The IR-4 Newsletter is published quarterly for distribution to cooperators in our partner State/Federal/Industry research units, State and Federal officials, commodity groups, and private citizens. Material from the IR-4 Newsletter may be reproduced with credit to the New Jersey Agricultural Experiment Station Publication No.P-27200-18-04. This material is based upon work that is supported by the National Institute of Food and Agriculture, US Department of Agriculture, under award number 2017-34383-27100 and the Hatch Multistate project accession number 1008823 through the New Jersey Agricultural Experiment Station Hatch Multistate project NJ27202, with substantial cooperation and support from other State Agricultural Experiment Stations, USDA-ARS, and USDA-FAS. In accordance with Federal Law and US Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age or disability.

Editor: Sherrilynn Novack
IR-4 Public Relations and Communication Manager, 732.932.9575 x 4632, novack@njaes.rutgers.edu

Newsletter Committee:
North Central Regional Director, **John Wise,** 517.432.2668.

Western Regional Assistant Field Coordinator, **Stephen Flanagan,** 541.688.3155.

Southern Region
USDA-ARS Interim Minor Use Coordinator, **Alvin Simmons** 843.402.5307

Commodity Liaison Committee member, **Mike Bledsoe,** 407-493-3933, Village Farms.

IR-4 HQ, 732.932.9575
Integrated Solutions Program Assistant, **Krista Coleman** x 4631
Research Coordinator & Study Director, **Thomas Pike** x 4628
Associate Director, **Dan Kunkel** x 4616
Environmental Horticulture Manager, and Technical Copy Editor **Cristi Palmer** x 4629
Research Coordinator & Study Director, **Ken Samoil** x 4614
Assistant Director, **Van Starner** x 4621

The IR-4 Project and American Ginseng: Like Two Peas in a Pod

— by Kathryn Homa, IR-4 Project, Dr. Mary K. Hausbeck and Blair Harlan, Michigan State University

The collaboration between the IR-4 Project and growers of American ginseng (*Panax quinquefolius*) is an example of a perfect relationship. Both share a strong passion for success of this specialty crop, they communicate well with each other, and support each other in times of need. This excellent working relationship has led to many accomplishments including the registration of many beneficial chemical compounds to increase the quality of the crop and bolster the success of the American ginseng industry. Without these registered products, growers could lose an estimated 80-100% of their crop. Through IR-4 research, more than 14 products have been labeled for ginseng disease control since 2002.

Growers share a special relationship with American ginseng. This perennial herb is an expensive and time-consuming crop to grow. A minimum of three years is needed to obtain a marketable root. Native to woodlots, many growers commercially cultivate the crop by covering raised plant beds with a thick layer of straw and maintaining artificial shade structures (see picture). This high value crop must be monitored for wild turkeys, plant pathogens, weeds, and insects. After harvest, the roots are cooled in a monitored refrigerated unit for 10 to 20 days and then washed and sorted to remove soil and field debris. Roots are dried in a specially designed ginseng dryer for 14 days, where they are closely monitored. Following drying, roots are trimmed, and sorted again according to size, shape and quality before they are sold.

Traditional Cultivated Ginseng Field

Cultivation of American ginseng has a long, rich history of more than 100 years in Wisconsin that dates back to the 1870s. The first cultivated ginseng was grown by the Fromm Brothers of Hamburg, Wisconsin during World War II. Revenue from ginseng funded their fox fur business.

Today, 95% of the total cultivated American ginseng production in the US occurs in Central Wisconsin, specifically, Marathon County. This area provides optimal conditions for ginseng production including cool summers, rolling hills, and unique soils. Currently, there are approximately 150-200 growers in Wisconsin who farm approximately 1,500 acres, producing 500,000-600,000 pounds of root. Annually, the revenue is approximately $15 million USD, depending on price and international trade conditions. American ginseng is widely used in Western cultures as a dietary supplement and has been used in traditional Chinese medicine for centuries. In a recent clinical trial, Wisconsin ginseng was found to improve overall energy levels in cancer patients undergoing chemotherapy. American ginseng (*Panax quinquefolius*) and Asian ginseng (*Panax ginseng*) are both consumed for health benefits including antioxidant and anti-inflammatory properties, improvement in memory, behavior and mood, strengthening of the immune system, lowering of blood sugar, and anti-cancer properties. The active compounds include ginsenosides and gintonin, which are thought to complement each other to provide health benefits.

Research Plots

Despite the historical significance and economic value of American ginseng, the industry was not well known to registrants and others. As a result, very few pesticide labels

continued on next pg

Alternaria Blight

included ginseng, and the crop's yield and quality were suffering. That all changed about twelve years ago when the industry partnered with the IR-4 Project. Dr. Mary K. Hausbeck, from Michigan State University was working with the small ginseng industry in northern lower and upper peninsulas of Michigan and began a regional effort to secure Section 18 labels for needed fungicides. This regional effort across Wisconsin and Michigan, with strong support from the IR-4 Project, has resulted in many key pesticide registrations that have greatly enhanced the yield and limited root rot which was decimating the industry. Every year, the Ginseng Board of Wisconsin in cooperation with Michigan State University and the IR-4 Project host a summer Ginseng Field Day. This full-day program provides an important opportunity to showcase research plots established with grower cooperators, answer specific questions about the crop, assist with diagnosis, and discuss new pesticides and management strategies. Growers communicate their need for future research to be conducted in upcoming years. This system works well as grower cooperators open their ginseng gardens to allow the research work to be conducted and the results can be shared with other growers. Ginseng Field Day was held on Thursday, August 9, 2018 with over 100 participants that included growers, researchers, and industry and state representatives. The day focused on examining the efficacy and crop safety of both registered and experimental conventional and bio-fungicides. Research field stops also included plots that consisted of tank mixes and alternations of fungicides. These plots are important, since they replicate an example of how a grower would use these products in the field. Important diseases of focus included *Alternaria panax*, *Botrytis cinerea*, root rot caused by *Phytophthora cactorum*, root and stem rot caused by *Rhizoctonia solani*, and root rot caused by *Cylindrocarpon destructans*. Also included in this year's field day were plant growth regulator strip trials to de-bud the crop to limit seed production and promote large roots. Herbicides are also tested for crop safety and efficacy against the commonly occurring weeds. These trials are important, as growers currently rely on hand labor to weed and de-bud.

Throughout the Field Day, growers and researchers shared their knowledge with one another about successes and issues that they were encountering over the last growing year. The IR-4 Project's Kathryn Homa was a featured speaker and discussed with growers the fungicides that have been submitted to EPA for review and other GLP residue projects that are ongoing. Many growers were excited to hear about the pipeline of new products that will be registered over the next few years.

Opportunities such as the annual Ginseng Field Day provide valuable information that aid growers in producing a successful crop by reducing the risk of pest damage. This meeting also strengthens the relationships between growers, industry. researchers, and the IR-4 Project.

Dr. Mary Hausbeck (in blue shirt) provides valuable information regarding the trial.

Safety

— by Stephen Flanagan, WSR Assistant

Safety is key in many aspects of our IR-4 work. While from a field perspective, our field research personnel have the most direct safety risks, the reality is that all IR-4 personnel are impacted by safety. Whether in the field, the lab or commuting to and from home and work we are all exposed to safety risks. Let's take some time to consider how field, lab and driving safety can be addressed and improved in our IR-4 workplace.

Field Safety

The first culprit might be fairly obvious, that is our work is related to pesticides, compounds designed to kill. For all of us involved in the direct handling and application of pesticides we are the benefactors of decades of scientific progress. This progress means we're spraying remarkably fewer organophosphate and carbamate materials and we're testing biorational materials (compounds that are effective on the pest but relatively innocuous to beneficial insects and humans) with greatly reduced mammalian toxicity. In simple terms we're spraying compounds such as insect growth regulators (IGRs) and synthetic mushroom byproducts (strobilurins) which are effective at controlling agricultural pests with the added benefit of being safer for humans and non-target organisms.

I'm a father and grandfather with over three decades of agricultural field experience and a few stories garnered from the miles. I can tell you about an early morning bike ride alongside an alfalfa field where I was sprayed by an AgCat airplane applying an insecticide that left me retching at the end of the field. I can tell you about following my boss into a California vineyard that we both knew had been sprayed with dimethoate and how we laughed off the headaches and nausea we experienced later. In another vineyard event my whole crew was staring fixedly at an injection pump which blew a hose and proceeded to spray us all with a carbofuran solution. That last event ended up with a late night emergency run.

Why the stories? I'm not interested in anyone experiencing the fear and physical effects of being poisoned with acutely toxic pesticides. One of the aspects of our work is that we serve a critical role in bringing safer and more effective tools into the agricultural environment. Our work is the slow, detailed and progressive science that helps bring safer pest control materials to the farm. In our program, field research directors are the front line workers who directly handle and apply these pesticides.

How do we mitigate handling risks for our field researchers? I'd suggest this is a two-fold responsibility. First off as an organization we need to hold ourselves to prioritizing work on safer, biorational materials from the beginning. Secondly we need to avoid the contempt that inevitably comes with time. Training and reminding ourselves that even relatively safe (say category III: Caution) materials are still pesticides with acute and chronic health effects and therefore deserve respect. I'm always impressed when I visit a field site and observe the careful attention to detail and use of PPE (personal protective equipment) by our field researchers.

I'm now in my seventeenth year of working in the Western Region and participating in field studies. These studies have been as diverse as aerial mosquito applications, oysterbed spike wheel injectors, and a plethora of airblast, hand boom and injection systems as well. Since coming to IR-4 I've never been directly exposed or poisoned in this work. In fact I'm not aware of any "accidents" or "events" with our research activities related to pesticide poisoning. This is a remarkable fact and speaks to the quality and care exhibited by our field research directors and also serves as a reminder to continually strive for a safe work environment.

Some of you reading this article may have met or interacted with our Idaho field researcher Will Meeks. At the time of this writing I queried Will about how he approaches safety in his field activities. I caught Will on his way to an eight day deer hunt in northern Idaho. "Regardless of whether it's Roundup ® or Paraquat ® it's all the same to me." Will works alone as an FRD and travels long distances across Idaho to conduct his IR-4 trials. "Field work is the same as hiking or camping, if you're alone the risk is higher and requires extra caution."

Will Meeks in Tyvek suit.

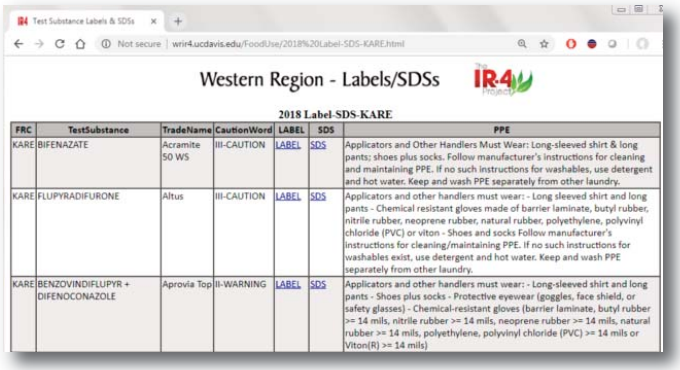
I've observed Will's pesticide applications for many years and it's remarkable whether it's been in the dark at 5 am or late in the day under blazing sun, Will is consistently suited in full mask

in IR-4

RFC and Matt Hengel, WSR Lab Director

respirator, Tyvek suit and rubber boots. Will practices what he preaches and sets an impeccable standard in personal protection.

To specifically aid FRDs in the Western Region the field office provides each Field Research Center with a comprehensive web page with links to important pesticide safety documents. Most of us are familiar with MSDS (Material Safety Data Sheets) which are now called SDS internationally. During the protocol review process we confirm the exact test substance formulations and label and generate a web page which lists each study and the corresponding SDS and label. In addition, this website has the material's hazard category (III-Caution, II-Warning, or I-Danger) and protective equipment requirements. If the material is not labeled, the label link will have an entry of "No Data" as a reminder that the material is new and has limited documents. The web page serves as a central location for safety documents and a reminder of important safety requirements associated with a particular test substance.



Western Region - Labels/SDSs

2018 Label-SDS-KARE

FRC	TestSubstance	TradeName	CautionWord	LABEL	SDS	PPE
KARE	BIFENAZATE	Acramite 50 WS	III-CAUTION	LABEL	SDS	Applicators and Other Handlers Must Wear: Long-sleeved shirt & long pants; shoes plus socks. Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.
KARE	FLUPYRADIFURONE	Altus	III-CAUTION	LABEL	SDS	Applicators and other handlers must wear: - Long sleeved shirt and long pants - Chemical resistant gloves made of barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, natural rubber, polyethylene, polyvinyl chloride (PVC) or viton - Shoes and socks Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.
KARE	BENZOVINDIFLUPYR + DIFENOCONAZOLE	Aprovia Top	II-WARNING	LABEL	SDS	Applicators and other handlers must wear: - Long-sleeved shirt and long pants - Shoes plus socks - Protective eyewear (goggles, face shield, or safety glasses) - Chemical-resistant gloves (barrier laminate, butyl rubber >= 14 mils, nitrile rubber >= 14 mils, neoprene rubber >= 14 mils, natural rubber >= 14 mils, polyethylene, polyvinyl chloride (PVC) >= 14 mils or Viton(R) >= 14 mils)

A sample of the Kearney Agricultural Center's Label and SDS page

Lab Safety

As with the field, the lab faces very similar safety concerns. Not only does the lab need to handle the purified pesticide (>95% purity), but they are faced with concentrated acids and bases, powerful oxidizing agents and cancer-causing organic solvents. In some cases, the reagents are far more toxic than the pesticide of interest. To mitigate the risk using these chemicals, UC Davis has gone to great lengths to provide training and access to free PPE (lab coats and eye protection). In addition, the lab has gone through a major shift in attitude towards personal safety. Long ago, it wasn't uncommon to find certain analysts wearing shorts (cough cough, Matt) without a lab coat or eye protection, or to see a cup of coffee warming on top of a hot gas chromatograph right next to the beaker of hexane for washing the injection syringe. Currently, many of the sample extractions, which used to simply occur on the bench, are now conducted in a fume hood or in sealed tubes to minimize exposure to organic solvents. And where possible, the overall amount of organic solvent has been reduced from approximately 400 mL per sample to 40 mL. This reduction helps us in two ways; first we reduce the exposure during sample analysis and second, we minimize the amount of solvent that must be handled for waste disposal.

Julie Coughlin, Guy Kyser, and Michelle Mitchell using safety precautions in the lab.

Driving Safety

The safety aspects of handling pesticides and laboratory reagents are specific to our field and lab personnel. A universal safety topic for all of us at IR-4 is driving. We all get behind the wheel. We all push ourselves and end up fatigued behind the wheel. It might be on the New Jersey Turnpike, I-85 in the Carolinas, Highway 99 in the San Joaquin Valley, or innumerable interstates and rural two lane roads. Regardless of our professional role or where we live, we all are exposed and at risk when we are driving. According to the Center for Disease Control the effects of drowsy driving are akin to drunk driving (1). We're all keenly aware of the dangers of driving under the influence, but do we have the same awareness around lack of sleep? The above mentioned CDC article states that staying awake for 18 hours is equivalent to a blood alcohol content (BAC) of .05% and staying awake for 24 hours is comparable to a BAC of .10%.

"Drowsy driving is estimated to be a factor in 20 percent of fatal crashes. A new study from AAA states that drivers who skimp on the seven hours of sleep experts recommend increase their risk of a crash exponentially. Missing one to two hours of sleep doubles a driver's crash risk, while foregoing two or three hours increases the risk of a crash by 400 percent, according to the AAA Foundation for Traffic Safety study." (2)

Long field days, delayed travel plans and snarling commutes all translate

continued on pg 10

Safety & Workshops

continued from pg 9

into fatigue and the potential to become a drowsy driver. As Will Meeks said to me on the phone today "It's about not doing something stupid that means you end up dead." In my years before IR-4 life I consulted and conducted research studies throughout California. In those years I estimate that I drove over 750,000 miles and can relate to several of the "Drowsy Driving" warning signs listed below.

Drowsy Driving Warning Signs

- Yawning or blinking frequently
- Difficulty remembering the past few miles driven
- Missing your exit
- Drifting from your lane
- Hitting a rumble strip

Take some extra time to get where you're going, slow down, pull over and take a nap when you start to feel drowsy. Most of us have experienced these symptoms, but let's remind ourselves of the dangers and take steps to mitigate the risks.

In Summary

So what do we do? Maybe I'm finally at the age where slowing down a bit actually seems beneficial. The work will get done. As Matt Hengel mentioned in the lab section, we can ensure that PPE is provided and used as well as revising our procedures to minimize exposure. Do your field personnel have adequate PPE? Are they using it? Have you reviewed your MSDS and label safety documents? Have you reviewed your facility procedures with an eye toward safety? These are all questions worth examining to improve safety.

The riskier aspects of our work in handling pesticides and driving long distances can be mitigated with thought and some planning ahead. In our western region webinars, we emphasize safety reminders, but ultimately individual safety is a personal responsibility. We have significant experience and a record of safety in our organization, but let's keep in mind that the work has its dangers and requires us all to be careful out there.

(1)www.cdc.gov/sleep/about_sleep/drowsy_driving.html
(2)cars.usnews.com/cars-trucks/best-cars-blog/2016/12/drowsy-driving-worse-than-drunk-driving

Combined Workshops

— by IR-4 HQ Personnel: Michael Braverman, Krista Coleman, Thomas Pike & Van Starner

From September 19th to the 21st, over 175 IR-4 commodity/grower stakeholders, industry representatives, and regulatory colleagues from North America and beyond gathered in St. Louis, MO for the Food Use/Integrated Solutions/Biopesticide Workshops. There, just a few of the hundreds of project requests received from grower stakeholders would be selected as priority research projects for the upcoming year. With this being perhaps the most important meeting of the year for IR-4, a tremendous amount of planning was done leading up to the event. Planning was especially crucial with the incorporation of the first ever Integrated Solutions Workshop.

Wednesday began with a short introduction by IR-4 Exec. Director Jerry Baron before jumping right into the Food Use project prioritization process. Review and discussion was focused on a list of about 180 project requests that received "A" priority nominations from stakeholders online Aug. 23-Sept. 6. Workshop participants were tasked with determining the 46 most critical "A" priority residue and 8 most important "H+" product performance projects from this list. After only a few passes through the requests, the target was achieved. These "A" and "H+" priorities, including various insecticide, fungicide and herbicide needs, represent about two-thirds of the IR-4 Food Use research plan for 2019. Kudos to the stakeholders who were extremely cooperative when it came to sacrificing certain favored projects to allow more critical ones to make the cut and achieve the target number of priorities. Also, a special thanks goes to Bo Davis and Nancy Fitz from the EPA Minor Use and Emergency Response Branch, who provided an update on various regulatory topics of special importance to IR-4 stakeholders.

Thursday morning was focused on various presentations, including "The State of IR-4," updates from CAST and the IR-4 Commodity Liaison Committee, Minor Use Activities in Australia, and a thank you from IR-4 colleagues in Puerto Rico for support through the devastating 2017 hurricane season they endured. Industry representatives then had an opportunity to present new

continued on next pg

IR-4's Executive Director, Jerry Baron (far right) delivers the "State of IR-4" presentation at the Workshop.

conventional and biopesticide products that are coming down the pipeline, as well as updates on existing products.

Next up was the Integrated Solutions priority setting workshop, which included many of the same needs as the Biopesticide Workshop due to 2018 being a transition year. High-priority projects selected for research in 2019 include bacterial disease control in onions, parasitic weed control in processing tomato, cucumber beetle control in watermelon, wireworm control in sweet potato, verticillium wilt control in eggplant and nematode control to avoid tuber decay in yam. These priorities were derived from a sorting process similar to the Food Use Workshop. For next year, a pre-workshop on-line project nomination process is being considered to facilitate more concise discussion at the workshop. IR-4 believes that this Integrated Solutions approach, being a hybrid of the Food Use Pest Problems Without Solutions (PPWS) research and elements of the traditional Biopesticide research program, will better service the needs of IR-4 stakeholders.

Friday was the Biopesticide workshop. IR-4 has a long history with biopesticides, starting with expanding the registration of *Bacillus thuringiensis* in the mid-1970s. Since the 1980's, the program has focused on registration of these important tools for growers. In 1995, the program expanded to include product performance on both food and non-food crops. Notable achievements include the EPA registration of bacteriophage, biotechnology based resistance to plum pox and papaya ringspot viruses, aflatoxin control, Varroa mite management in honey bees, attract and kill systems, codling moth granulosis virus, and many others. At the workshop, attendees utilized breakout group sessions based on discipline (entomology, plant pathology, and weed science) to discuss pest management priorities and cast their votes. The resulting top priorities to be researched in 2019 include: spotted-wing drosophila, organic basil downy mildew, screening of bioherbicides, and pepino mosaic virus on greenhouse tomato. A top priority in both workshops was damping-off in hemp, which will receive its funding through the Integrated Solutions program since the potential solutions include conventional treatments. Though there will not be separate Biopesticide workshops in the future, this is not a farewell, but a testament to the program's success. In the coming years, biopesticides will receive more attention in the Food Use program through Integrated Solutions.

Ultimately, the 2018 combination of workshops successfully developed an IR-4 roadmap for both residue and product performance research in 2019, addressing the pest management needs of the grower community, and adding more tools to their pest control toolbox.

View from the interior of the famous St. Louis Gateway Arch.

New Product Corner

AFIDOPYROPEN (Inscalis® insecticide – BASF)

Introduction: Registration for BASF's new active ingredient (AI) afidopyropen (Inscalis®) was granted by the EPA Sept. 10, 2018. BASF had submitted for joint review with US-EPA, CAN-PMRA and Mexico COFEPRIS, the latter two agencies still under review. The AI was discovered by Meiji Seika Pharma Co. Ltd and the Kitasato Institute, and was developed by BASF. Registration of afidopyropen provides growers with an alternative mode of action from a novel chemical class, the pyropenes, providing an essential tool to farmers for use in resistance and integrated pest management programs on a wide range of crops such as vegetables, fruits, row crops and ornamentals to control piercing-sucking insect pests. The AI is derived from the natural product Pyripyropene A, and has a favorable toxicological and environmental profile, and low acute toxicity to important beneficial arthropods and pollinators (no pollinator restrictions on labels). With a quick onset of action it stops insect feeding, reducing nutrient loss and vectoring of viral/bacterial pathogens. Afidopyropen is classified by the Insecticide Resistance Action Committee (IRAC) as a Group 9 insecticide, in the new Subgroup 9D, Pyropenes.

Other global registrations: BASF received the first global registrations in Australia and India for the new insecticide Inscalis (afidopyropen). Registrations are

continued on pg 12

continued from pg 11

expected in additional countries and regions in the future.

US trade names/formulations /labeled crops: Versys® Inscalis® Insecticide (a 0.83 lb AI/gal dispersible concentrate) – for uses on leafy vegetables, crop group 4-16; Brassica head/stem vegetables, crop group 5-16; pome fruit, crop group 11-10; stone fruit, crop group 12-12; and leaf petioles subgroup 22B; Sefina® Inscalis® Insecticide (a 0.42 lb AI/gal dispersible concentrate) – for uses on cotton and soybeans; fruiting vegetables, crop group 8-10; cucurbit vegetables, crop group 9; and citrus fruit, crop group 10-10; see labels for specific crops, use patterns and other general directions for use.

Labeled pest spectrum: piercing-sucking insect pests, including homoptera such as aphids, whiteflies, psyllids, scales and leafhoppers

Completed IR-4 residue projects (PR#): 2016 – GH cucumber (11675)/GH tomato (11677)/GH pepper (11676)/GH strawberry (11680) – all joint with Canada, and final reports are signed and ready for submission.

Other IR-4 database requests (PR#): GH eggplant (11796) – should be covered by GH tomato/GH pepper; GH lettuce (11695) - IR-4 to consider submission of Canadian GH lettuce data from ongoing study.

Environmental horticulture: Ventigra® was registered Sept. 2018 for the control of piercing and sucking insects on environmental horticulture crops and vegetable transplants for retail sale to consumers. Specific pests include aphids, whiteflies, mealybugs, and scale suppression. IR-4 contributed to this registration with crop safety studies on numerous crops including Aster, Begonia, Chrysanthemum, Dianthus, Echinacea, Foxglove, Ivy, Larkspur, Poppy, Sedum, Veronica, Yew, and Zinnia. Most crops exhibited no injury or growth reduction at up to 4X the recommended rate. Please view the label for more details on crop safety. Studies are ongoing to broaden Ventigra for additional scale and mealybugs.

PYDIFLUMETOFEN (Adepidyn® Fungicide – Syngenta Crop Protection, LLC)

Introduction: Registration for Syngenta's new active ingredient pydiflumetofen (Adepidyn®) was granted by the EPA May 23, 2018, for various row crop and specialty crop uses. Formulated in products under the Miravis® brand family, Adepidyn fungicide is being broadly made available in the U.S. in late 2018 and 2019, subject to state approvals. Registration of Adepidyn provides growers with a new carboxamide fungicide (SDHI mode of action) and a broad disease control spectrum. Pydiflumetofen is the first member of a new chemical group N-methoxy-(phenyl-ethyl) -pyrazole-carboxamide, and has been classified by the Fungicide Resistance Action Committee (FRAC) as a Group 7 fungicide.

Other global registrations: The first registration of a product based on Adepidyn was in Argentina in late 2016, when Miravis® Duo, a combination of Adepidyn and difenoconazole, was approved by SENASA (the regulatory authority in Argentina), for use on soybeans for late season disease control. Adepidyn based products are also currently available in Australia and New Zealand.

US trade names/formulations/crops: the Miravis line of products will be offered to growers in a wide range of crops through five distinct brands: Miravis® SC (1.67 lb pydiflumetofen/gal) for peanuts; Miravis® Ace (a combination of pydiflumetofen + propiconazole) for wheat/cereal grains; Miravis® Top SC (0.63 lb pydiflumetofen + 1.04 lb difenoconazole/gal) for soybeans and certain pulse crops; Miravis® Neo SE (a suspoemulsion formulation containing 0.63 lb pydiflumetofen, 0.83 lb azoxystrobin and 1.04 lb propiconazole/gal) for corn and soybeans; Miravis® Prime SC (1.25 lb pydiflumetofen + 2.09 lb fludioxonil/gal) for specialty and vegetable crops (potatoes and crop subgroup 1C; specific leafy vegetables in crop subgroup 4-16A; crop group 8-10, fruiting vegetables; crop group 9, cucurbit vegetables; grapes and crop subgroup 13-07F; and specific leaf petiole vegetables in crop subgroup 22B); see labels for specific crops, use patterns and other general directions for use.

Labeled pest spectrum: a broad disease control spectrum that includes leaf spots, powdery mildew, fusarium head blight, *Botrytis*, *Sclerotinia*, *Corynespora* and various other diseases.

Completed IR-4 residue projects (PR#): 2013 – cantaloupe (11158)/cucumber (11156)/summer squash (11157) – data submitted as part of Syngenta 1st tier, and all are registered; 2015 – strawberry (11159 – joint study w/Canada), and 2016 – blueberry (11763 – with data from Syngenta Canada, covers high and low bush) - data submitted as part of Syngenta 2nd tier, with PRIA date 9/16/2019

Ongoing IR-4 residue projects (PR#): 2016 – cherry (11812 – joint, w/Canada as Sponsor/Study Director); 2017 – caneberry (11794, joint with Canada); 2018 – ginseng (11912)/hops (12342) – joint, w/Canada as Sponsor/Study Director.

continued on next pg

Holiday Greenery

— by Cristi Palmer, IR-4 EnvironHort Manager

Plant Information

The smell of cedar, pine and other evergreens are synonymous with the winter holidays. Whether wreaths or boughs hung inside or out, this greenery visually signals the start of the US holiday season, and its aroma brings back childhood memories of home. The tradition of using evergreen plants to decorate in the winter originated thousands of years ago within many cultures celebrating the winter solstice: Egyptians celebrating the return of Ra, Celtic druids symbolizing eternal rebirth, Romans desiring a good harvest year at the feast of Saturnalia (Saturn, the god of agriculture), and Vikings warding off evil spirits. Some of the traditional evergreens (fir, hemlock, holly, juniper, mistletoe, pine, spruce) have been joined by arborvitae, cypress, eucalyptus, mountain pepper, podocarpus, rosemary and others. Any plants with evergreen foliage that can provide interesting colors and textures can be incorporated into wreaths, boughs, and other displays.

Sources of these evergreens are varied. The vast majority come from trimmings from public and private forestlands and Christmas tree producers. For example, trees produced for wood often have side branches removed to limit the formation of knots. Other sources include prunings from nursery producers, or in the case of eucalyptus, deliberate production of cuts for floral displays year-round.

Main Disease Problems

Each of the different crop species have different disease complexes. The conifers tend to have similar root problems (*Pythium*, *Phytophthora*, *Rhizoctonia*, *Fusarium*, *Cylindrocladium*) as other crops, but they also have some unique ones Rhizosphaera Needle Cast (multiple), Cytospora canker (spruce), Cedar Apple rust (juniper), Phomopsis tip blight (juniper), Diplodia tip blight (pines and others). Boxwood is affected by boxwood blight, volutella blight, Macrophoma leaf spot, Fusarium, Phytophthora, and nematodes.

Main Insect Problems

Each of the different crop species have different pest complexes. Generally, they are impacted by adelgids (Hemlock Woolly Adelgid), aphids, bagworms, borers and beetles (Emerald Ash Borer, Southern Pine Beetle), sawflies, and scale (Juniper Scale). Boxwood is affected by leafminer, psyllid, mites and several other less impactful pests.

IR-4 Research

IR-4 has studied several diseases and pests of conifers since 2000: Elongate Hemlock Scale, *Phytophthora ramorum*, *Phytophthora cinnamomi*, *Phytophtora cryptogea*, Oriental Beetle, Black Vine Weevil, Pine Needle Scale, Botrytis Gary Mold, *Fusarium commune*, Tarnished Plant Bugs, Swiss Needle Cast, *Pythium dissotocum*, *Pythium irregulare*, *Pythium ultimum*, *Pythium vipa*, Fletcher Scale. In addition, IR-4 has sponsored more than 850 conifer crop safety trials on 81 products. IR-4 also worked with a team of researchers investigating Boxwood Blight.

Picture Source: Monrovia (https://growbeautifully.monrovia.com/winter-decorating-with-evergreen-clippings/)

continued from pg 12

Other IR-4 Food Use database requests (PR#): broccoli (11826)/cabbage (11827)/mustard greens (11825) – all are Mfg. submitted; GH eggplant (12012)/GH lettuce (11880)/GH pepper (11879)/GH strawberry (11881)/GH tomato (11878) – all are researchable (IR-4 to consider submission of Canadian GH lettuce, GH pepper and GH tomato data from ongoing studies [which should cover GH eggplant].

Environmental horticulture: The pydiflumetofen registration, May 2018, covers environmental horticulture crops and vegetable plants for retail sale to consumers for control of various pathogens causing gray mold, leaf spots, flower blights, powdery mildews and stem rot caused by *Phoma*. The registration also covers soil drench application for *Fusarium* and *Sclerotinia* root diseases. IR-4 contributed to this registration with crop safety studies on Alyssum, Begonia, *Calibrachoa*, Chrysanthemum, *Coreopsis*, *Dianthus*, Geranium, Gerbera, Impatiens (Garden and New Guinea), Lupine, *Osteospermum*, Pansy, Petunia, Poinsettia, Salvia, Snapdragon, and Verbena. No injury or growth reduction was observed at up to 4X the recommended rate. Efficacy studies are ongoing for *Botrytis* and *Thielaviopsis*.

Spotted Lanternfly

This information reprinted with permission from Heather Leach, Pennsylvania State University. Visit www.psu.edu/ spotted-lanternfly for more information, and more FAQs.

Lycorma delicatula, commonly known as the Spotted Lanternfly (SLF), is a new invasive insect that has spread throughout southeastern Pennsylvania since its discovery in Berks County in 2014. SLF presents a significant threat to Pennsylvania agriculture, including the grape, tree-fruit, hardwood and nursery industries, which collectively are worth nearly $18 billion to the state's economy.

Signs & Symptoms

The SLF attacks fruit trees, but not the fruit itself. It uses its piercing-sucking mouthparts to feed on the sap in trunks, branches, twigs and leaves. These oozing wounds will leave a greyish or black trail along the bark of the plant.

As it digests the sap, the insect excretes a substance known as honeydew that, along with sap from these weeping wounds, can attract bees and other insects. There may be a buildup of this sticky fluid on infested plants and on the ground below. The honeydew and sap also provide a medium for growth of fungi, such as sooty mold, which can cover leaf surfaces and stunt growth. Plants with heavy infestations may not survive.

Some SLF Frequently Asked Questions

Get the answers to the most frequently asked questions about spotted lanternfly, including their damage to plants, how to manage them on your property, and what you can do to help! If you have more questions, check out the other resources available on the website: extension.psu.edu/ spotted-lanternfly or contact your local extension agent.

Q. What is a SLF? Where did it come from?

A. The SLF is an invasive planthopper (a type of insect) in the US It is native to certain parts of Southeast Asia.

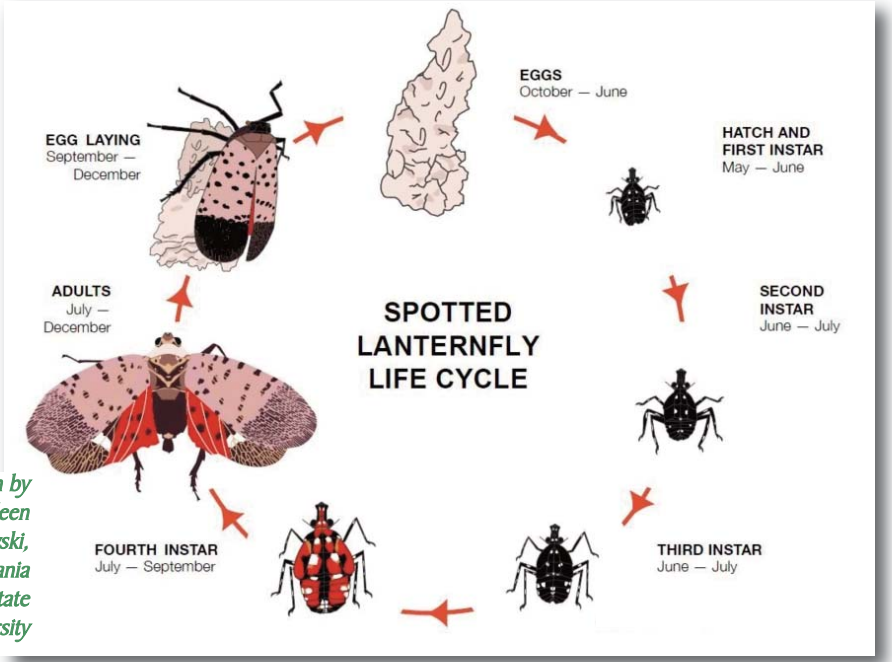


Illustration by Colleen Witkowski, Pennsylvania State University

Q. Are they a threat here?

A. SLF feed on the sap of a plant and when there are high populations of them, they can cause significant damage. They feed on over 70+ plants, including important forestry and agricultural crops. SLF was first discovered in the United States in Berks County, PA in 2014. It has since spread throughout 13 counties in southeastern Pennsylvania, which the Pennsylvania Department of Agriculture has designated as a SLF quarantine zone. In 2017, SLF was also found in Frederick County in Virginia. In 2018, three New Jersey counties (Mercer, Warren, and Hunterdon) were quarantined for SLF.

Q. How do I identify a SLF if I see one? What do I look for?

A. SLFs go through five stages of growth after hatching from eggs (see illustration). The first four stages are called nymphs, which are incapable of flight. The young nymphs are black with bright white spots and are roughly the size of a pencil eraser. The next stages of growth are similar, but the nymphs become larger. The fourth stage of SLFs, prior to adulthood, is vibrantly red with distinct patches of black and equally distinct bright white spots. The adult SLF is a leafhopper with wings about 1" long. Adults have grey wings with black spots. When the SLF opens its wings, it reveals a bright red underwing. SLFs live through the winter only as eggs. Adults lay eggs in masses in the late fall on trees, under bark, posts, lawn furniture, cars, trailers, outdoor grills, and on many other surfaces.

Q. Do SLFs kill trees and plants?

A. In Korea, SLFs have had a major destructive impact on grapes, and grape-products such as wine. SLFs

continued on next pg

Measuring Pollinator Attractiveness of Environmental Horticulture Plants

Pollinator Research under IR-4's Environmental Horticulture Program —by Carolina Simao Roe-Raymond

Over time, environmental (aka ornamental) horticulture flowers have been bred to appeal to consumers. Although this breeding makes flowers more desirable to humans, it can simultaneously make flowers less desirable to bees. Many cultivars have been bred to reduce or eliminate pollen or to have showy double petals which reduce or remove a pollinator's access to pollen and nectar.

Since there is very little data on which environmental horticulture plants remain attractive to bees, we began a research project to measure the pollinator attractiveness level of various crops and their cultivars. Determining pollinator attractiveness is no easy task, as attractiveness can change depending on various factors, such as how many flowers are present, the total area of the floral display, or how many other flowers or nesting locations are available in the landscape.

Researchers selected their study plants from the list of Top 25 Annuals and Herbaceous Perennials by wholesale value from the USDA NASS 2014 Census of Horticulture. During 2017 and 2018, scientists in five locations throughout the United States planted their selected annuals, herbaceous perennials, and some cultivars. They recorded pollinator visits throughout the summer and early fall, and they are in the midst of analyzing this data. Cross-site results will be available in 2019.

For more about this research and our broader project examining relationships between environmental horticulture crops, pollinators, and pesticides, please visit the website: protectingbees.njaes.rutgers.edu.

Experimental sites with top-selling annual ornamental plants established in San Diego Botanic Garden and Palomar Community College in California. *Photo by Lea Corkidi*

Pollinator attractiveness observations underway at the experimental site established at Michigan State University. *Photo by Erica Hotchkiss*

have also reduced yields on important fruit-bearing trees and other plants. The SLF feeds on more than 70 types of plants, including crops such as grapes, apples, hops, walnuts and other hardwood trees.

Q. Do SLFs infest Christmas trees?
A. Real trees are part of an outdoor ecosystem, thus there is always a chance that insects may be brought indoors with a tree. With the SLF currently an issue of concern, questions have been raised regarding the possibility of SLFs being carried into homes. Although unlikely SLF eggs will be on Christmas trees, if they were to hatch indoors the nymphs pose no threat to humans or animals, and will die quickly. Christmas Tree growers follow integrated pest management practices to minimize such threats. If consumers are concerned they are encouraged to inspect the tree prior to purchase. SLF egg masses are visible on the bark if present and can be easily removed. Purchasing real Christmas trees benefits local growers and the local economy. They are also an environmentally friendly choice as Christmas trees are a renewable resource and can be easily recycled, unlike artificial trees. For those living inside the quarantine zone, we encourage trees to be disposed of by recycling programs where they will be shredded and composted or burned (if allowed by the municipality) and should not be transported out of the quarantine zone.

More FAQs can be found at www.psu.edu/spotted-lanternfly.

Tolerance Successes Aug. - Oct. 2018 (There were no tolerances in Aug.)

The trade names listed here are provided as a means to identify the chemical for which a tolerance has been established. A trade name listed here may not be the name of the product on which the new food use(s) will be registered. Only labeled products may be used on a food crop. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical.

Federal Register: Sept.11, 2018
Cloquintocet-mexyl
Trade Name: Gold Sky
Crops: Teff
PR#: 10807

Federal Register: Oct. 5, 2018
Flumioxazin
Trade Name: Fierce, Valor
Crops: Grass
PR#: 10885

Federal Register: Oct. 15, 2018
Etoxazole
Trade Name: Zeal
Crops: Sweet corn, Pome fruit group 11-10, Tree nut group 14-12, Cherry subgroup 12-12A, Peach subgroup 12-12B, Plum subgroup 12-12C, Cottonseed subgroup 20C
PR#: 11099, 12111, 12112, 12113, 12114

Pyraclostrobin
Trade Name: Pageant, Pristine
Crops: Leafy greens subgroup 4-16A, Brassica leafy greens subgroup 4-16B except watercress, Celtuce, Florence fennel, Kohlrabi, Leaf petiole subgroup 22B, Head and stem brassica vegetable subgroup 5-16
PR#: 11750, 12120, 12121, 12122, 12123, 12124, 12125

Federal Register: Oct. 19, 2018
Boscalid
Trade Name: Endura, Pageant, Pristine
Crops: Leafy greens subgroup 4-16A, Brassica leafy greens subgroup 4-16B except watercress, Celtuce, Florence fennel, Kohlrabi, Leaf petiole subgroup 22B, Head and stem brassica vegetable subgroup 5-16, Succulent shelled pea and bean subgroup 6B, Dried shelled pea and bean subgroup 6C, Root vegetable except sugar beet subgroup 1B
PR#: 11750, 12120, 12121, 12122, 12123, 12124, 12125, 12126, 12127, 12128

Federal Register: Oct. 29, 2018
Pyroxasulfone
Trade Name: Zidua
Crops: Mint, Grass, Edamame, Leaf petiole subgroup 22B, Cottonseed subgroup 20C
PR#: 10792, 10885, 11133, 11324, 12130

The IR-4 Project
IR-4 Headquarters,
Rutgers, The State University
of New Jersey
500 College Road East
Suite 201 W
Princeton, NJ 08540

USDA United States Department of Agriculture
National Institute of Food and Agriculture
ars Agricultural Research Service

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-34383-23710 with substantial cooperation and support from the State Agricultural Experiment Stations, USDA-ARS and USDA-FAS In accordance with Federal Law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age or disability.

NON-PROFIT
US POSTAGE
PAID
NEW BRUNSWICK, NJ
PERMIT NO. 157