PESPWire

The Quarterly e-bulletin of EPA's Pesticide Environmental Stewardship Program Spring 2015

Rising to Meet the Challenge of Spotted Wing Drosophila Management for Michigan Cherries

Silver PESP member, the Michigan Cherry Committee, through its partnership with the Michigan State University (MSU) Fruit Team, has been heavily involved with spotted wing drosophila (SWD) management in Michigan. SWD is a challenging pest for ripening, thin-skinned fruit, and it has become a major late season pest in blueberries, fall red raspberries, and tart cherries since it was first detected in Michigan in 2010. The SWD has significantly increased the number of insecticide applications that must be made to these crops to manage the pest. A fall 2014 survey of Michigan fruit growers showed an overall increase in the number of insecticide applications made to their crops, ranging from 1-3 additional applications and an associated increase in production costs of $35 to $43.25 per acre. In some cases, growers of fall red raspberries gave up on growing this crop and have switched to crops that are not susceptible to the SWD. For blueberry and cherry growers, with greater investments in orchard establishment and equipment used in the production and harvesting of these crops, pulling out of production because of SWD is not a practical solution to the problem.

In response to the increasing challenges the spotted wing drosophila was presenting, in 2010 members of the MSU Fruit Team and the Michigan Cherry Committee initiated a statewide SWD monitoring effort. This proactive effort has been able to alert growers when the pest is active in their region and populations are increasing. A great deal of time and training has gone into this effort, as the SWD are small and difficult to distinguish from other flies frequently caught in the monitoring traps. A weekly report posted on the MSU Extension News for Agriculture website is made available through weekly Fruit & Nut Digest emails during the season.

continued on page 2

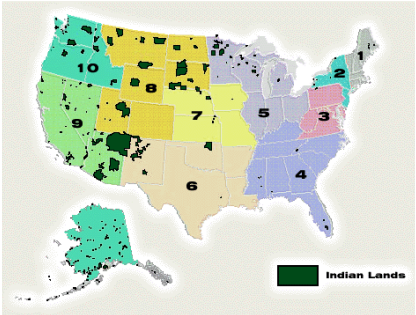
In This Issue:

EPA Promotes Tribal School IPM Nationwide

EPA strives to improve the health of communities across the country by taking action on chemical safety. One important aspect of chemical safety is promoting integrated pest management (IPM) in schools. IPM is a smart, sensible and sustainable approach to managing pests that focuses on addressing the underlying causes that enable pests to thrive. Practicing IPM has many benefits beyond pest management, including water and energy saving. EPA recommends schools implement IPM as a means to reduce the risks of pest and pesticide exposure to children.

Building partnerships with regional and national organizations is one of the strategies that the EPA uses to advance the adoption of IPM in schools. During the summer of 2013, the EPA Center of Expertise for School IPM, EPA Region 10, and the Indian Health Services (IHS) partnered to develop a model project with aims to increase the number of tribal schools with a sustainable school IPM program.

continued on page 9



Tribal lands in EPA regions

continued from page 1

Monitoring is a key component of a successful integrated pest management (IPM) plan, as it allows for preventative pest management, and prevents unnecessary pesticide applications.

Monitoring trap (left), and sticky card filled with flies from the monitoring trap (right)

The 2010 survey also revealed that most respondents (73%) consulted the weekly MSU SWD Statewide Monitoring Report at least once per week, with 76% of respondents saying they altered their insecticide program based on trapping data in their region. Alterations in pest management plans involved either using the report to trigger the initiation of an SWD management program when SWD were found in traps in their region (69%), or the elimination of a planned insecticide application when low or no SWD were reported in traps in their region in a given week (34%). More than half (56%) of respondents increased monitoring efforts on their own farms after SWD trap counts increased in their region.

As populations of SWD have continued to grow within the state, the pest is being found earlier in the season and has started to overlap with ripening tart cherries. Michigan is the largest producer of tart cherries in the U.S., most of which are processed and some of which are exported to markets in Europe and East Asia. These markets often have lower maximum residue limits (MRLs) or tolerances for pesticide residues in agricultural products than the U.S., and cherries have a mandated zero-tolerance for infested fruit. Late-season pests such as SWD are of particular concern to cherry growers both for the risk of rejected fruit if maggots are found in them, and for the potential of pesticide residue detections that might prevent their sale into export markets with lower tolerances.

In response to increasing concerns among growers of the potential impact of SWD on the Michigan cherry industry, an SWD Summit was organized by MSU and held at the Northwest Michigan Horticultural Research Center in Traverse City, Michigan in November 2014. The goals of the meeting were to solicit input from growers, field scouts, and processors on their needs, and to coordinate research and extension efforts regarding SWD management in cherries. More than 65 growers and other industry representatives attended this meeting including the Cherry Marketing Institute, the Michigan Cherry Committee, and the newly formed Michigan Tree Fruit Commission.

The program began with a history of the pest and an update on our current knowledge of its biology and management. Members of the MSU Fruit Team involved with cherry pest management followed with presentations on the work that has been done and is underway in Michigan. Participants then formed groups, facilitated by the MSU Fruit Team, to brainstorm research and education priorities. The top priorities to come out of these discussions were 1) a better understanding of when SWD control strategies must be initiated by improving the tools used to monitor for this pest and relating that to potential fruit infestation, 2) improving our understanding of the residual activity of insecticide sprays to guide future management decisions, and 3) knowing which insecticides will work best and the most effective timing for application of these insecticides against SWD in cherry.

As a result of the SWD Summit, MSU campus and field staff collaborated over the winter to write four coordinated research proposals that have been funded by the Michigan Cherry Committee for a total of $49,000.

- Larry Gut will lead a project that will help support the continuing statewide monitoring network for SWD and to develop better management techniques for SWD, including improved monitoring traps and relating trap catch to fruit infestation through mark-and-recapture studies to determine the trap area of influence (*Monitoring and Management of Spotted Wing Drosophila in Michigan Cherries,* $14,000).
- Nikki Rothwell will lead a project to test the efficacy and timing of insecticides against SWD and will evaluate alternate wild host sources of the pest (*Improving management strategies for controlling spotted* wing Drosophila in Michigan cherries, $12,000).
- Matthew Grieshop will lead a project to develop attract-and-kill tactics for managing SWD (*Development of an Attract and Kill Tactic for Spotted Wing Drosophila*, $9,000).
- Mark Whalon will lead a project to evaluate various biopesticides for their ability to control SWD as an alternative to insecticides that may cause problems for cherry exporters (*Late Season Biopesticides as an Alternative to Conventional Pesticides for SWD Control and Avoidance of MRL Violations*, $14,000).

Additional SWD projects that the MSU Fruit Team are involved with include a collaborative project led by Julianna Wilson (*Developing sound IPM strategies for controlling spotted wing drosophila in tart cherries*, $40,000), and a recently submitted pre-proposal for a $7 million USDA-SCRI grant led by North Carolina State on SWD biology and management.

The goal of all of these efforts are to enable Michigan cherry growers to make the best possible management decisions for controlling this new, late-season pest. Through the use of better monitoring tools to aid timing of control strategies, by providing alternatives where possible to broad-spectrum insecticide applications, and by providing growers with regional trapping data to alert them as to when they may need to start considering SWD management strategies on their farms, the Michigan Cherry Committee and the MSU Fruit Team hope to manage SWD while minimizing impacts on the environment from pesticide use.

Is Biocontrol Beating the Bug?

Richard Lehnert
Courtesy of Good Fruit Grower

Brown Marmorated Stink Bug (BMSB)
Photo: TJ Mullinax, Good Fruit Grower

"I have growers who hadn't sprayed a miticide in 15 or 20 years until brown marmorated stinkbug came around," said Dr. David Biddinger, tree fruit research entomologist at Pennsylvania State University's research center in Biglerville.

The arrival of this invasive Asian bug "turned our IPM systems upside down," he said. Growers resorted to more sprays, applied more times and later in the season, and using harsher pesticides, including pyrethoids for the first time. As a result, outbreaks of secondary pests such as European red mite, San Jose scale, and woolly apple aphid began to occur because they were no longer controlled by beneficial insects, themselves victims of new pesticide regimens.

BMSB has increased growers' insecticide/miticide bills from about 8 percent of their production costs to 25 percent, Biddinger said, with control of secondary pests adding $100 or more an acre to the cost.

"This pest not only caused a lot of damage for many growers, but extended our spray season right up through harvest time," he said. "It made us start to look up reentry and preharvest intervals more than we used to, and it brought the first widespread use of pyrethroids to Pennsylvania apple orchards.

"Pyrethroids were always a bad word in Pennsylvania IPM programs because of the negative effects they have on the biological control of secondary pests such as leafrollers, spider mites, woolly apple aphids, and San Jose scale."

BMSB also brought the return of broad-spectrum insecticides like Lannate (methomyl), Thionex (endosulfan), and diazinon. Growers hadn't used those chemicals much since the days when tufted apple bud moth was the main pest of concern, he said.

These days, Biddinger is on a mission to help growers restore IPM practices to their orchards. He's written several articles that were published on Penn State's Fruit Times website, and he speaks frequently at field days and annual horticulture shows, such as the Mid-Atlantic Fruit and Vegetable Convention.

Nature snapping back?

On the good news side, Biddinger sees signs that biological control is exerting itself against the brown marmorated stinkbug. "There was less stinkbug damage this year, and we don't really know why," he said. It may be the cold winter last year reduced their numbers. It may be, as he likes to say, "native biocontrol agents are getting used to eating Chinese food."

That's a reference to a couple of native species trying to adapt to include the Asian BMSB in their diets. In one study, Biddinger found that 25 percent of BMSB egg masses had been eaten by native predators and the introduced multicolored Asian ladybird beetle.

Much of the added biocontrol is taking place outside of orchards—a good thing, he said, because brown marmorated stinkbugs spend 90 percent of their lives elsewhere. That makes them hard for fruit growers to control, since they continually invade from woodlots and corn and soybean fields. But it may also mean that biological control agents outside of orchards are already at work. "Something is happening out there," he said. "Nature is snapping back."

As growers learn more about the behavior of the stinkbug and researchers develop better monitoring tools, they react with less panic and more forethought.

"The ability to preserve IPM programs seems to have worked better for large growers with larger blocks and farms where damage to fruit in the border rows was only a small fraction of the total volume of apples harvested," Biddinger said. "Most of these growers were able to get by with border sprays of the less disruptive neonicotinoid products—Venom and Scorpion (both with the active ingredient dinotefuran)—to control BMSB without developing secondary pest problems."

"Growers with smaller blocks of fruit and more borders exposed to woodlots or corn and soybean fields could not afford the risk of major crop losses due to BMSB and hit them with everything but the kitchen sink.

"It is our hope that BMSB populations will decline in the near future as some native predator or pathogen decides it likes to eat Asian food as well or that we will be able to import and release Asian Chinese parasitoids that already have a taste for BMSB eggs," Biddinger said. "Then, hopefully our apple IPM programs will return to normal and we will see fewer secondary pest outbreaks as biological control is re-established."

Progress Toward Finding Immediate, Practical Huanglongbing Solutions

Abby Yigzam
Courtesy of Citrograph, published by the Citrus Research Board

The United States Department of Agriculture's (USDA) Huanglongbing Multiagency Coordination (HLB MAC) Group was created in December 2013 in direct response to a request from the citrus industry to the USDA for greater urgency, support and coordination in the fight against HLB. HLB, also known as citrus greening, is a serious disease of citrus spread by the Asian citrus psyllid. During the last 12 months, the HLB MAC Group met each of these goals as it worked to prioritize and allocate $21 million in funding for research and field-trial projects that will soon put promising tools that fight against HLB into the hands of growers.

"From day one, our focus has been on getting growers the help they need now to combat this devastating disease," said Mary Palm, Ph.D., chair of the HLB MAC Group. "We've pushed hard this year to get promising HLB detection, control and management methods out of the labs and into large scale field trials where they can be validated and turned over to growers for use in their groves."

An infested sample of flush is collected for parasitism analysis in a laboratory.

The HLB MAC Group made its first major announcement in May, providing $1.5 million to ramp up the release of the biological control agent, *Tamarixia radiata*, to help suppress populations of Asian citrus psyllid (ACP) in Florida, California and Texas. This also will benefit neighboring citrus-producing states. Through its work to set collective goals and priorities, HLB MAC group members all agreed that scaling up biocontrol, which is a tool that has shown promising results, would be of immediate benefit to the citrus industry.

A field insectary cage being installed over a recently hedged lime tree that is infested with thousands of ACP nymphs and where about 300 Tamarixia radiata will be introduced for mass production.

Part of the $1.5 million was instrumental in the transfer of technology for the production of *Tamarixia radiata* from the Animal and Plant Health Inspection Service's methods development laboratory to the Texas Citrus Pest and Disease Management Corporation, which repurposed Agricultural Research Service greenhouses in Weslaco for biocontrol production.

Then, in June, the HLB MAC Group made the decision to allocate $6.5 million for citrus health research projects that seem the most promising for producing tools and strategies that can help growers in the near future. This funding is supporting the field testing of antimicrobials, such as streptomycin and oxytetracycline, in Florida to gauge their effect on the HLB bacterium.

It also is supporting thermotherapy technology projects, as well as a large demonstration grove in Florida to will help educate growers about best management practices that support citrus production in areas where HLB is present.

A field insectary cage installed over a lime tree where Tamarixia radiata has been introduced and is parasitizing all ACP nymphs present. The mesh screen is removed right before the third generation of parasitoids emerge, often producing about 12,000 parasitoids.

Through these and other efforts in 2014, the HLB MAC Group fostered cooperation and coordination across Federal and State agencies and industry. The MAC team focused on sharing information, making strategic decisions based on shared priorities and reducing duplicative efforts. As one example, the National Institute of Food and Agriculture's coordination with the HLB MAC Group avoided the duplication or overlap of research efforts and ensured that the greatest number of critical projects was funded.

The Group also coordinated regular communications, including weekly conference calls, among State, Federal and academic biocontrol practitioners from across the United States. These calls not only help to facilitate vital information sharing, they also are enabling rapid advances in the development and use of biological control technologies for ACP. To date, the practitioners have developed common standards to measure the efficacy of biological control of ACP so that programs in different states can compare results, share information about best production and release practices and identify alternative biological control strategies, in addition to *Tamarixia radiata*, which are near the implementation stage.

"As we look ahead to 2015, we want to continue the progress we started last year and build on it to fund more projects that will get us closer to our goal of effectively battling ACP and HLB," said Palm. "We want to help the citrus industry gain the advantage as quickly as possible."

As part of the HLB MAC Group's efforts to help the citrus industry gain that advantage, the group cast a wide net to receive project suggestions from industry, academic, State and Federal researchers. The project suggestions selected will be funded in 2015 and focus on four critical areas:

- early detection, such as standardizing antibody-based detection methods, developing high throughput diagnostics using root samples and training canines to detect HLB;
- sustainable citrus production practices, such as the treatment of bicarbonates in irrigation water and soil, rapid propagation and widespread field testing of HLB-tolerant rootstocks and the establishment of several more demonstration groves to help showcase effective integrated management approaches;
- treatments for infected trees, such as field-level thermotherapy delivery systems to heat trees, kill the HLB bacteria and restore productivity; and
- vector management, such as a lure to attract and kill the ACP, release and establishment of several alternative biocontrol agents and new methods to increase production of the biocontrol agent, *Tamarixia radiata*.

It has been an exciting and busy year for the HLB MAC, as the group has worked toward funding near-term solutions for fighting HLB. These near-term investments will pay dividends as longer-term research continues. And it's just the start. More information on the MAC Group's efforts and announcements can be found at http://usda.gov/citrus.

Abby Yigzaw is the acting assistant trade director and trade correspondence manager of the USDA's Animal and Plant Health Inspection Service.

School IPM Success in the Midwest

Children's health is paramount to the EPA, and it's Office of Chemical Safety and Pollution Prevention (OCSPP) promotes school IPM as an effective approach to protecting children from exposure to pests and pesticides. "Children are among the most vulnerable members of our society, and it's EPA's job to protect them from harmful chemicals," said Jim Jones, OCSPP Assistant Administrator. "We aim to help schools implement sustainable pest management practices to create a healthier environment for our children and teachers."

Since 2012, the Agency has committed over $1.9 million to improving children's health through school IPM grants, impacting over 4.5 million children nationwide. Improving Kids' Environment, Inc. (IKE), one of the recipients of the grant funds, partnered with school IPM experts to ensure a safer and healthier learning environment for children in Indiana and Ohio through training programs, coalition building and demonstration programs.

With $250,000, IKE sought to increase school IPM implementation in Ohio and Indiana through a multi-pronged approach that included demonstration schools, coalition building, training, and information sharing. Ten demonstration schools, representing nine school districts, were chosen to serve as the catalysts towards developing healthier environments for children. A coalition within Indiana was expanded, and one within Ohio developed, to ensure dissemination of information and support. Trainings and information sharing ensured the creation of a knowledge base in both states, making school IPM dissemination possible.

Franklin Township Community School Corporation in Indianapolis, Indiana saw a 70% reduction in amount of pesticides applied and 75% drop in pest complaints through the implementation of IPM. This district had previously participated in a school IPM event hosted by IKE. After learning the basic principles of school IPM, the implementation team within Franklin Township believed they were well prepared to move further down the IPM road to a more advanced and verifiable IPM program. This suburban community school district provided an excellent model as to what other local school districts can accomplish with a comprehensive IPM program in their school systems.

Rick Hunter, Franklin Township supervisor of buildings & grounds, and his staff demonstrated their commitment to this progressive program by adopting the approach: "Pest Management is People Management". Methods in "people management" include distributing Pest Press newsletters regularly as reminders of IPM, posting Pest Sighting Logs in clear view, and holding regular discussions with staff about pest prevention by keeping classrooms clutter-free, properly storing food, and quickly reporting pests or pest-conducive conditions.

All demonstration schools saw an average of 62% reduction in both pesticide use and pest complaints. Out of the nine districts, seven adopted IPM techniques across their district after seeing the successes in their demonstration schools, including in Columbus City School District, which contains 111 schools. In addition, IKE and partners developed school IPM websites specific to Ohio and Indiana, over a dozen newsletters, multiple posters and presentations, and five videos. One school district, Western Reserve in Collins, Ohio, achieved the prestigious IPM STAR Certification. In the end, the health of over 75,000 children was positively impacted through the work of Improving Kid's Environment, Inc, and their partners. EPA will continue to work with partners and stakeholders to advance school IPM nationwide.

Prevent Moles, Voles, and Pocket Gophers from Ruining Your Spring

It's Springtime. Time to get outside and enjoy your lawn, sports fields, or golf course you manage. As you assess your spring maintenance routines, you notice something has created a maze of tunnels, in every direction in that once-beautiful turf.

Voles and moles are the most common culprit. But which is it and how do you tell the difference? How do you discourage them from living on your turf and convince them to take up residence elsewhere? Moles are often blamed for the damage caused by voles or pocket gophers. Moles and voles are entirely different pests that have little in common beyond a name that rhymes.

The biggest differences between moles and voles are their diet and the type of damage they cause. Once you understand their differences it becomes rather easy to tell them apart and develop a prevention strategy.

Voles are rodents who look much like mice, only with shorter tails. Voles usually do not invade homes and should not be confused with the common house mouse. Voles are plant-eaters, feeding on the stems and blades of lawn grass, perennial-flower roots, seeds and bulbs. In winter when their main sources of food are scarce, they'll even chew into the stems and trunks trees and shrubs, damaging and sometimes killing them.

Pocket gophers, also rodents, are powerful diggers and have front paws with large claws. Pocket gophers eat grasses, herbaceous plants, shrubs, and even small trees. They mainly feed on the roots they encounter when digging. Sometimes they pull the vegetation into their tunnel from below.

In comparison, the primary diet of moles is earthworms, with a few grubs and insects tossed in as appetizers.

Their landscape demolition is the incidental damage of tunnels and runways dug in lawns while on the never-ending search for more worms. According to Ohio State, a 5 ounce mole will consume 45-50 pounds of worms and insects each year. So, unlike voles or gophers, they pose no direct threat to your turf.

Damage

Moles, voles, and pocket gophers cause noticeably different types of damage. Moles make raised burrows in your lawn, ground cover, and shrub areas as they search for worms and grubs to eat, and their tunneling activity raises the soil into ridges. However, when voles tunnel in search of roots, they do not create raised ridges. Pocket gopher mounds are clustered and fan-shaped.

Voles create quarter-sized entry holes in their tunnels along walls and in mulched beds, leaving minimal mounds behind.

Vole surface runways result from the voles eating the grass blades, and beating a path through the grass. Their tunnels are at or near the surface and are most noticeable in early spring, just after the snow melts.

Is it a Mole, a Vole, or a Pocket Gopher?

Moles

Photo: Stanislaw Szyalo, creative commons.org

Insectivores who eat earthworms, grubs, and insects

Mole Damage
Photo: Steven Vantassel

Voles

Photo: Jack Kelly Clark, UC Davis

Rodents who eat plants grass, roots, seeds and bulbs

Vole Damage
Photo: Steven Vantassel

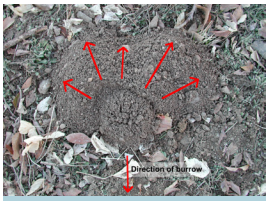
Pocket Gopher

Photo: Jack Kelly Clark, UC Davis

Rodents who eat herbaceous plants, shrubs, and small trees

Pocket Gopher Damage
Photo: Steven Vantassel

Moles, on the other hand, are built for tunneling, with paddle-like front paws that make quick work of soil. Moles prefers well-drained, moist, loose, sandy or loamy soil, and are often drawn to manicured lawns, parks and golf courses. They are constantly tunneling in search of meals, pushing up mini mountain ranges all over the lawn, and creating volcanoes of soil in random spots. Moles produce two types of elaborate tunnels; feeding tunnels just beneath the surface that appear as raised ridges running across your lawn, and deep tunnels that enable moles to retreat up to 5 feet below the surface as the weather cools.



Pocket Gopher Mound
Photo: University of Arizona Cooperative Extension

Pocket gopher mounds are characterized by a kidney-like fan shape, and are often clustered. The plugged entry hole is off to one side of the mound. Pocket gopher burrows consist of a main burrow between 4 to 18 inches below ground, with a variable number of lateral burrows. Like moles, some parts of their tunnel system may be as deep as 5 or 6 feet. A single pocket gopher can construct as many as 300 soil mounds while moving over 4 tons of soil a year.

To deter these landscape pests, be prepared to alter their environment. Preventing pest problems through foresight, is the #1 rule of Integrated Pest Management (IPM). IPM is both beneficial both to your health and to the health of the environment.

The basis of IPM consist of the following fundamental principles.
1) Take preventive steps to preclude a pest problem instead of taking a purely reactive approach by waiting for pests to arrive.
2) Determine tolerance levels ahead of time. How much of an infestation can you tolerate before eradication measures need to be taken?
3) Know your pest. That knowledge will give you key clues for management strategies.
4) Determine the optimal time of the year, weather conditions, or time of day to control your pests.
5) Implement cultural, maintenance and mechanical best practices necessary for control.
6) Use chemical controls judiciously, as they are are also a part of the IPM toolbox.

Cultural and biological controls

For moles, regulating at least some of their food supply will make your lawn less appealing to them. Since moles are fond of beetle grubs in the lawn, you can begin by controlling these grubs. The three primary solutions are milky spore, beneficial nematodes, and neem oil products. An annual lawn application of bacterial-based milky spore disease granules can help, but killing every last grub won't necessarily solve the mole problem immediately. Milky spore takes two to three years to inoculate, and it doesn't work in colder climates. Neem has been used as an insecticide for centuries in India and is available in oil or powder. However, as long as there are plenty of worms or ants in your lawn, you may still have a mole problem and may wish to resort to other measures.

For voles and pocket gophers, you need to modify your yard to make it less appealing. Be particularly careful about applying mulch too close to trees and shrubs. Voles easily tunnel through the mulch and it provides them with an insulated pathway under snow, ice and frozen ground in the winter. Get rid of autumn leaves, twigs and other debris that can also make inviting pathways and remove ground cover that can hide voles. Bare soil makes them more vulnerable to predation. Consider placing wire cages around individual plants. This can be very effective, especially for your favorite plants, but it is also very time consuming, thus making it impractical for large-scale implementation.

Wrap hardware cloth around the base of the young tree and shrub trunks to keep them from being gnawed. Be sure to bury the screen at least 4 to 5 inches deep and go up the trunks at least 2 feet.

Keep your garden weeded and avoid planting dense ground covers. Tilling gardens and fields can add to deterrents for voles and pocket gophers. Also, keep your lawn short if voles are a problem in your neighborhood.

Repellents

For moles and gophers, the most widely used repellent is castor oil – whether it's a homemade treatment or commercial product made from ground corn cobs and castor oil.

For voles, some commercial repellents are formulated from hot-pepper sauce, while the fungicide thiram is made with urine from predators such as coyotes that is repulsive to voles. These repellants are effective at keeping voles from eating live plants and bulbs. Their draw back is that they need to be re-applied frequently because most dissipate with the rain. Voles may also become acclimated to the smell and come back. Therefore, a varied approach works best with repellents.

Other repellents such as fumigants, ultrasonic repellers, and noise or vibration makers are not effective against voles, moles, or pocket gophers.

Trapping or Lethal Action

Trapping moles, voles, or pocket gophers is an effective long-term strategy. Check your state's regulations before turning to trapping or lethal action, as there may be restrictions. Snap traps manufactured mainly for mice also are effective at catching voles. Place the mouse traps into the widest vole runways. They are indicative of heavy traffic and offer the best results. A mix of peanut butter and oatmeal or small apple slices are effective vole bait.

Numerous pesticides are available for moles, voles and pocket gophers including zinc phosphide and warfarin-based products. These products are regulated by the EPA. Remember to read and follow all label directions. A serious vole or pocket gopher problem may require a pest management professional who has access to more effective technologies and pesticides ingredients than the homeowner.

Scientists Discover How Bollworm Becomes Resistant to *Bt* Crops

Reprinted with permission from Entomology Today

Bt crops are plants that have been genetically-engineered to produce proteins that are harmless to humans but are toxic to some devastating insect pests. The proteins are produced by genes from the bacterium *Bacillus thuringiensis* (*Bt*) that have been inserted into the crops. These same *Bt* proteins have been used by organic farmers for more than 50 years in a spray formulation.

Bt crops were introduced in 1996 and have helped reduce the use of insecticides in corn and cotton fields around the world. In Arizona alone, cotton growers have reduced spraying broad-spectrum insecticides, which kill beneficial insects along with pests, by 80 percent.

The *Bt* protein works by binding to receptors in certain insects' guts — which makes it harmful to targeted insects but safe for others.

As Dr. Bruce Tabashnik (University of Arizona) once explained it, the idea behind *Bt* crops "can be explained with a lock-and-key analogy … The lock on the door is the receptor protein in the insect's gut, and the key is the *Bt* toxin that binds to that receptor. To be able to kill the insect, the toxin must fit the lock to open the door and get inside." Several insect pests have evolved resistance to *Bt* crops, one of which is called the pink bollworm (Pectinophora gossypiella), and Dr. Jeff Fabrick, a USDA-ARS entomologist, and his collaborators from the University of Arizona have unraveled the genetic mechanism by which it occurs. Their findings are described in the journal *PLOS ONE*.

Fabrick and his colleagues have spent more than a decade studying how insects adapt to *Bt* crops. They produced *Bt* resistance in pink bollworm in the laboratory and determined that the resistance is caused by changes to a gut protein called cadherin. In susceptible insects, cadherin binds to the *Bt* toxin, eventually leading to the death of the insect. When mutations in the gene encoding cadherin block this binding, the insect becomes resistant.

The scientists compared the cadherin gene in their lab-raised resistant insects with that same gene in resistant pink bollworm found in India. They discovered that the resistant pink bollworm from India had different changes and many more changes to that gene. In total, 19 unique mutations were found in just eight resistant pink bollworms from India. By comparison, the scientists found just four cadherin mutations in several laboratory-raised resistant strains from the U.S.

The researchers found that the pink bollworm from India uses a novel genetic mechanism to develop resistance. Known as alternative splicing, it enables a single DNA sequence to produce many variants of a protein. The diversity of mutations and the novel mechanism that gives rise to that diversity show that a variety of molecular mechanisms could be important in how insects develop *Bt* resistance.

More work is still needed to determine how widespread resistance due to alternative splicing is in other pests.

EPA's Biopesticides and Pollution Prevention Division (BPPD) in the Office of Pesticide Programs, is responsible for all regulatory activities associated with biologically-based pesticides. Biopesticides include naturally occurring substances that control pests (biochemical pesticides), microorganisms that control pests (microbial pesticides), and pesticidal substances produced by plants containing added genetic material (plant-incorporated protectants, or PIPs).

The use of genetically modified PIP crops, such those expressing the Bt protein, are an effective method of insect control. Such crops greatly reduce the need for topical pesticides, thereby protecting the environment and human health. Biopesticides, including PIPs, are usually inherently less toxic than conventional pesticides, and generally only affect the target pests.

It is essential that these crops are properly managed to remain effective over the long-term. EPA is committed to maintaining effective oversight of these products to prevent the target pests from developing resistance to the natural proteins being expressed. As part of this effort, BPPD is interested in new research exploring how insects can develop resistance to PIPs. In the article above, researchers from USDA and the University of Arizona have discovered that changes to a gut protein called cadherin can lead to resistance in bollworms, a common pest of Bt cotton. This research may help scientists develop new strategies to maintain the effectiveness of these exciting innovations in biotechnology.

Promoting Tribal School IPM Nationwide

continued from page 1

IHS is an agency within the Department of Health and Human Services, and is responsible for providing federal health services to American Indians and Alaska Natives.

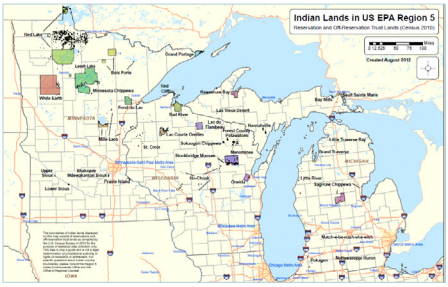
Both EPA and IHS recognized that providing training to IHS environmental health and safety officers (EHOs) was an efficient and effective way to assess schools within Indian Country. EHOs already visit many of these schools on a regular basis to conduct environmental health and safety walkthroughs. The EHOs would be trained on how to use an IPM checklist to identify pest conducive conditions and pest and pesticide hazards. They would also be trained on how to provide limited IPM technical assistance to a school contact.

EPA Region 10

The training took place in Oregon in December 2013, reaching five IHS Portland Area EHOs. Both EPA and IHS presented and led a school IPM walkthrough. These EHOs now integrate IPM inspections into their environmental health and safety walkthroughs when visiting tribal schools within the states of Washington, Oregon and Idaho.

In 2013 and 2014, IHS provided ten schools with an IPM assessment, specifically looking at the schools' pest issues, pesticide risks, prevention and control practices, and administrative practices related to pest management. Based off these initial assessments, IHS has started to develop IPM action plans for interested schools.

Through the success and lessons learned from the Portland area, EPA Region 5 School IPM Coordinator, Seth Dibblee, and IHS decided to continue the exemplary efforts started in the IHS Portland area, and offered the training to its tribal partners. On April 7-8, Mr. Dibblee presented at the annual training event in Duluth, MN for the Indian Health Service Bemidji Area.



Expanding on the pilots efforts in Portland, the EHOs participated in a one-day training workshop on School IPM for tribal schools and Headstart programs.

The interactive workshop included information on IPM principles and pest prevention practices, and a presentation on pest biology from Dr. Stephen Kells from the University of Minnesota Extension. Workshop participants also were able to perform a two-hour "walk-through" of the Fond du Lac Ojibwe School in Cloquet, MN identifying potential areas of concern and apply common sense strategies.

IHS has plans to offer similar workshops nationwide at a minimum of four times per year, in coordination with other EPA Regions. These trainings are an important step towards providing tribal schools with information on how to advance their level of IPM.

EPA Leadership Promotes School IPM

Jim Jones, Assistant Administrator for EPA's Office of Chemical Safety and Pollution Prevention, is an advocate for IPM in our nation's schools. Having the Agency's School IPM program under his purview provides Mr. Jones opportunities to see firsthand the benefits schools have realized after implementing smart, sensible, and sustainable pest control programs. He noted that, "many schools are stuck on a treadmill of never-ending pesticide applications, without addressing the underlying issues that make schools attractive to pests. If we can make it so pests aren't attracted in the first place, the need for pesticides in schools would be greatly reduced."

Since 2014, Mr. Jones has visited schools in New Orleans, Louisiana; Phoenix, Arizona; Indianapolis, Indiana; Norfolk, Virginia; and Salt Lake City, Utah.

While each school and school district is unique and presents its own challenges, all have made the commitment to IPM and are pleased with the results.


Mr. Louis Cuffee (center), building supervisor, describes Booker T. Washington's pest monitoring program to EPA's Jim Jones (left), GCA Services representatives, and the assistant principal.

In mid-March, Jones visited, in conjunction with EPA's Environmental Justice (EJ) month, two Norfolk (Virginia) Public Schools with strong IPM programs. The healthier learning environments provided by school IPM are particularly relevant during EJ month. Asthma rates are often disproportionately high in EJ communities due in part to exposure to allergens including those from pests.

Mr. Jones saw firsthand that Campostella Elementary, Booker T. Washington High, and Norfolk Public Schools as a whole were committed to IPM and providing their students with an environment in which they can thrive. The Norfolk Public Schools' IPM program is provided through a contract with GCA Services Group, which trains and oversees the districts' custodial staff and empowers them to be a large part of the IPM solution.

Most recently in late March, Mr. Jones visited Salt Lake City and toured Riley Elementary School. The Agency took the opportunity to present certificates of appreciation to both the school and to the district's custodial supervisor, Ricardo Zubiate, for their dedication to using IPM practices to keep schools free of pests and limit pesticide use.

Salt Lake City Awardees with AA Jim Jones

The Salt Lake City School District has received grants from the EPA, and the district has been recognized for its participation in the IPM Star Certification program. Riley Elementary is an excellent example of a successful and effective IPM program that is managed by district staff. In the last ten years, there has been only one application of pesticide at the school to control a nest of wasps. Other than that, the school's custodians and staff have kept their building pest-free by using common sense strategies to reduce their sources of food, water and shelter.

Through events like these, EPA is able to recognize school districts that have made a commitment to IPM, and hopes to motivate other to move their schools farther down the IPM road.

Upcoming Events

National Assocation of School Nurses Conference
June 24-27
Philadelphia, PA

National Environmental Health Association Conference
July 13-15
Orlando, FL

National Pest Management Association Academy
July 15-17
Las Vegas, NV

National Pest Management Association Mid-Atlantic Summer Conference
July 29-Aug 1
Myrtle Beach, SC

Biopesticide Industry Alliance Fall Semi-Annual Meeting
Sept 16-18
Arlington, VA

Biopesticide Industry Alliance 2015 Global Minor Use Priority Setting Workshop
Sept 20-22
Chicago, IL

Entomological Society of America Annual Meeting
Nov 15-18
Minneapolis, MN

Grant Opportunities

EPA National Farmworker Training Due June 8

EPA is soliciting applications for a cooperative agreement that supports national farmworker training aimed at reducing exposure to pesticides for agricultural workers, their families and the agricultural community. This training will help ensure that farmworkers are aware of the strengthened protections they are afforded under the final worker protection standards that EPA expects to release in September 2015. To implement the program, EPA expects to provide up to $500,000 annually, depending on the Agency's budget, for a total of five years.

EPA must receive proposals through Grants.gov no later than June 8, 2015. Additional information on this soliciation is available under Funding Opportunity Announcement EPA-OPP-2015-001.

Agronomic Science Foundation Sustainable Research Program Due June 1

The Agronomic Science Foundation (ASF) is seeking proposals by June 1 for its competitive Sustainable Research Program with up to $120,000 in grants awarded for research projects involving cover crops and related management practices in the United States.

They invite new and continuing proposals to be submitted as online applications for 2015-2016 funding by June 1, 2015. The ASF Sustainable Research Program Technical Advisory Committee will evaluate proposals and anticipates releasing funds on July 15, 2015.