Want to find out more? Contact us today!

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International Collaborations

The scientists of the Crop Bioprotection Research Unit are internationally recognized for their expertise. Scientists from around the world come to visit us to receive guidance and training and to share their knowledge with us.

- **Brazil…**Gabriel Moura-Mascarin is working with Mark Jackson on new methods of culturing insect-killing fungi, and Nilce Kobori is working with Dave Schisler to find new ways that beneficial fungi can be used to control plant diseases. Emiliana Romagnoli is working with Chris Dunlap on characterizing fungi that live in symbiosis with weeds.
- **South Korea…**Soo-Jin Kim is working with Alex Rooney to come up with new ways to identify and track bacteria in the genus *Bacillus* which are important for many different agricultural applications.
- **Pakistan…**Sahdia Khalil is working with Dave Schisler on new ways of culturing beneficial fungi to control plant diseases.
- **Egypt…**Atef Sayed is working with Bob Behle on ways to use insect-killing fungi to control fruit flies and leaf miners that plague tomatoes.

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CBP Scientists

Research Leader

Alejandro P. Rooney, Ph.D. – Supervisory Research Geneticist – microbial biological control agent discovery and development; microbial systematics, taxonomy, and evolution

Principal Investigators

Robert W. Behle, Ph.D. – Research Entomologist – microbial biocontrol agent formulation
Allard Cossé, Ph.D. – Research Entomologist – insect chemical communication and ecology
Patrick Dowd, Ph.D. – Research Entomologist – corn biotechnology and insect resistance
Christopher Dunlap, Ph.D. – Research Chemist – formulation chemistry; microbial genomics
Mark Jackson, Ph.D. – Research Microbiologist – microbial biological control agent fermentation
Eric Johnson, Ph.D. – Research Molecular Biologist – transgenics and RNAi biocontrol applications
David Schisler, Ph.D. – Research Plant Pathologist – phytopathogen biocontrol agent development

Postdoctoral Scientists

Lina Flor-Weiler, Ph.D. – Research Entomologist – microbial biological control agent development

CBP Technical Staff

Support Scientists

Bruce Zilkowski – Entomologist

Greenhouse

Todd Wert – Green House Manager

Laboratory Technicians

Mark Doehring Maggie Hammer
Erica Goett Angela Payne
Dave Lee Heather Walker

Undergraduate Research Assistants

April Balagna Patrick Schneider
Marie Deter Kirsten Zeman

Winter 2014

CBP *e*-Updates

The electronic research informational for the Crop Bioprotection Research Unit

Solutions for 21st Century Agriculture

Research to develop novel biological control agents, products and processes produces new "green" technologies that will help growers increase their yields, and it creates new market opportunities for American companies that want to produce or utilize environmentally friendly products. The Crop Bioprotection Research Unit (CBP) develops novel, performance-competitive biological control technologies that enhance plant health and reduce the use of chemical herbicides, pesticides, and fungicides. CBP conducts research to solve the biggest problems within this field. Specific applications currently being developed by CBP scientists include pheromone-based monitoring systems for the emerald ash borer, novel insect-resistant lines of corn, and living microbial agents to control insect pests, weeds, and fungal diseases of field crops and tree fruits.

Above photo: Florida oranges stricken with citrus greening. Photo courtesy of the USDA-ARS Horticultural Research Laboratory.

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Fighting Citrus Greening Disease

Citrus greening disease, or huanglongbing, is a serious threat to the Florida citrus industry, so much so that the USDA has allocated more than $24 million in research dollars to try and find a solution to the problem.

The disease is spread by the Asian citrus psyllid (ACP), *Diaphorina citri* (see photo below), an invasive insect pest native to Asia first reported in Florida in 2005. It has since spread throughout the primary citrus growing regions of the state. A 2012 University of Florida study estimates that the disease cost the State of Florida more than $4.5 billion in lost revenue between the production years 2006-2007 and 2010-2011 and also estimates that more than 8,250 jobs per year have been lost. Clearly, the importance of finding a solution to this problem cannot be overstated.

Citrus greening is caused by a bacterium known as (*Candidatus*) *Liberobacter asiaticum.* When an ACP carrying this bacterium feeds on a tree, it injects the bacterium into the phloem, the living tissue that transports nutrients through the plant. Once inside, the bacteria begin to grow and eventually clog the phloem, resulting in the accumulation of toxins in the tree and causing starvation of vital systems, such as the roots and leaves. The fruit also becomes discolored and misshapen, and other effects are produced including reduced flavor and size. Left unchecked, the disease can quickly spread throughout a grove.

Recently, CBP scientists Mark Jackson, Chris Dunlap, Lina Flor-Weiler, and Alex Rooney have teamed up with other ARS colleagues at Ft. Pierce, Florida and with colleagues at the University of Florida to try and find a solution by developing entomopathogenic (insect-killing) fungi to combat the ACP. The research is still in its early stages but is promising. Check back with us for more updates as the project progresses.

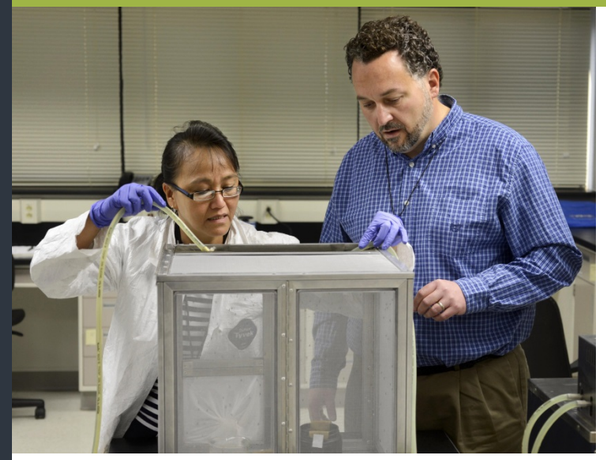
*Below: an adult Asian Citrus Psyllid (*Diaphorina citri*). Photo courtesy of the USDA-ARS Horticultural Research Laboratory.*

USDA Crop Bioprotection Research Unit
Agricultural Research Service
U.S. Department of Agriculture

Holy Guacomole!

California produces about 85% of the nation's $300 million per year avocado industry, and Florida produces another 14%. Recently, avocado production in both states has come under attack by invasive disease-carrying ambrosia beetles.

The Tea Shot Hole Borer , a pest of tea and avocado in Asia, was discovered in Florida, and the closely related Polyphagous Shot Hole Borer (PSHB), also from Asia, were detected in several varieties of avocado (*Lauraceae*) and multiple other tree species in California. These two ambrosia beetles carry different species of mutualistic fungi that females use to feed their young, but the fungi also attack and kill avocado trees and many other species of ornamental landscape trees that the beetles infest. The PSHB beetles are highly polyphagous, and attack over 200 tree species, the top eight of which make up 25% of all landscape trees in southern California. CBP scientist Allard Cossé has started a project to detect and identify possible attractants for these beetles that can be used in detection programs. CBP scientists Alex Rooney, Bob Behle, and Chris Dunlap are working on developing new biological control agents to control these pests.



*Above photo: CBP Research Leader AlexRooney and research entomologist Lina Flor-Weiler prepare to feed pig's blood to a colony of yellow fever (*Aedes *aegypti) mosquitoes. Photo by David Zalaznik, Peoria Journal Star.*

Peoria Ag Lab works to control the world's deadliest animal

Mosquitoes transmit a number of killer diseases

Mosquitoes kill 1 million people each year, according to the World Health Organization, making it the deadliest animal in the world. A Peoria scientist at the Ag Lab is at the forefront of a war against this killer.

Scientist Alejandro Rooney is engaged in new research efforts to battle dangerous mosquito varieties such as the Asian Tiger, yellow fever and floodwater species at the Peoria Ag Lab. "Mosquitoes carry some nasty diseases — like dengue fever, chikungunya and West Nile Virus," said Rooney, the research leader of the crop bioprotection unit at the U.S. Department of Agriculture lab at 1815 N. University St. "There's also the treehole mosquito that can spread encephalitis," he said, adding that mosquitoes also pose a threat to livestock.

It's enough to call off summer and pray for the return of the Polar Vortex.

But Rooney and his team have a battle plan. "We're trying to develop environmentally friendly ways to kill mosquitoes — with fungi," he said. Specifically, the fungi would go after mosquito eggs before they hatch. "The new strategy, the Holy Grail of mosquito control, is to kill them before they hatch," said Rooney.

To battle a pest that has stood its ground for so long, one has to know the enemy — and share that information with the public.

"Make sure you clean out gutters and places where water can collect. Mosquitoes can also breed in empty containers and bird baths," Rooney said

Above: a female Asian tiger mosquito (Aedes albopictus) at rest.

"We're finding locations where mosquitoes breed in mass. We're teaming up with mosquito expert Jack Swanson of the Peoria Public Health Department along with experts from the University of Illinois. It's a big team effort," said Rooney.

"May is traditionally a bad time for mosquitoes," said Phil Nixon, an entomologist with University of Illinois Extension, who identifies the specific culprit out of the 176 species of mosquitoes known to exist in the United States. "The inland floodwater mosquito is the one that buzzes your ear and drives you inside on a summer evening as it whines about your head. It has a range of 30 to 60 miles so you're not going to get rid of it," said Nixon.

These mosquitoes hatch in the spring but need water — warm water — with temperatures in the 70s to bring them out, said Nixon, suggesting that spring showers and warming temperatures set the stage. "We can almost always count on their arrival just before the Memorial Day weekend," he said. Other mosquitoes, some that carry diseases, do better in hot, dry weather. Look for them in mid-summer, said Nixon.

The insect's story is one that indicates how little size matters in the animal kingdom. The mosquito, after all, is a tiny creature that weighs just 2.5 milligrams and lives only four to six weeks. But the mosquito has been buzzing around the planet for 400 million years, biting dinosaurs before people. Now that humans have inherited the Earth, the little bug may be mankind's biggest challenge, spreading diseases estimated to have killed billions.

> "We're trying to develop environmentally friendly ways to kill mosquitoes – with fungi"

Left photo: A female woodland mosquito (Aedes stimulans). Woodland mosquitoes are nuisance pests that are commonly encountered during the summer months, in or around forests or smaller wooded areas.

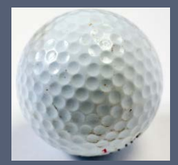
That might explain why a big team effort is needed to counter perennial pests. After all, teams have been organized before. The first effort to form a national organization of mosquito control workers in the United States came in 1903. The Illinois Assembly set up mosquito abatement districts back in 1927.

Rooney said some of the old precautions still make sense. "You want to wear protective clothing, such as a long-sleeve shirt at night," he said. DEET is still an effective repellent and citronella candles help but are not 100 percent effective, said Rooney. Meanwhile, traps are set up and being checked twice a week, said Melissa Goetze, environmental health supervisor at the Tazewell County Health Department. The problem is West Nile Virus, she said. "We have concerns going into this year. We're hoping that a nice cold winter will keep the (mosquito) numbers down. Looking at results after the rainy season will tell the story," said Goetze.

By Steve Tarter, Peoria Journal Star, April 26th, 2014. Steve Tarter is Journal Star business editor. Tarter's phone number is 686-3260, and his email address is starter@pjstar.com. Follow his blog, Minding Business, on pjstar.com and follow him on Twitter @SteveTarter

New Lines of Research

Tough on Turf



There's nothing that irritates a golf course manager more than seeing beautiful fairways marred by the sight of weeds or looking at greens dotted with patches of yellowed turf due to the action of white grubs feeding on the root system. That's where our unit comes in. CBP scientists Chris Dunlap and Bob Behle have started a new project to control weeds and insects on turf. The project is an outgrowth of an extramural project funded by the U.S. Golf Association (USGA) that was awarded to Behle back in 2012. The goal of that project was to identify new agents for controlling grubs on turf. The project's success led to a renewal of funding from the USGA for another 3 years. With their encouragement, this project was transformed into a new 5 year in-house project with two main goals: (1) come up with new controls for black cutworms on turf, one of the most serious pests threatening the golf industry today, and (2) come up with ways to control some of the more problematic species of weeds on turf. We'll keep you posted on developments as they come in!

Outreach

Retirees learn about our unit's efforts to control fungal diseases of wheat and potatoes

In March and August, CBP scientist Dave Schisler spoke to members of the Bradley University Osher Lifelong Learning Institute (OLLI) on the topic of biological control of plant diseases. According to Bradley University, OLLI "is an organization of over 1,000 Peoria-area residents, from age 50-98, who want to stay vital and active as they reach and enjoy retirement". Dr. Schisler spoke to the group about his research on developing new yeast antagonists to control *Fusarium* Head Blight on wheat and for control of potato diseases such as zebra chip. The latter is a disease caused by the bacterium (Candidatus) *Liberibacter solanacearum*, which is vectored by the potato psyllid (*Bactericera cockerelli*). See the article on citrus greening which describes a related psyllid-bacteria disease complex involving a different crop.

Below: potatoes showing signs of zebra chip disease.