Want to find out more? Contact us today!

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On the Horizon

Highlights from our forthcoming issue

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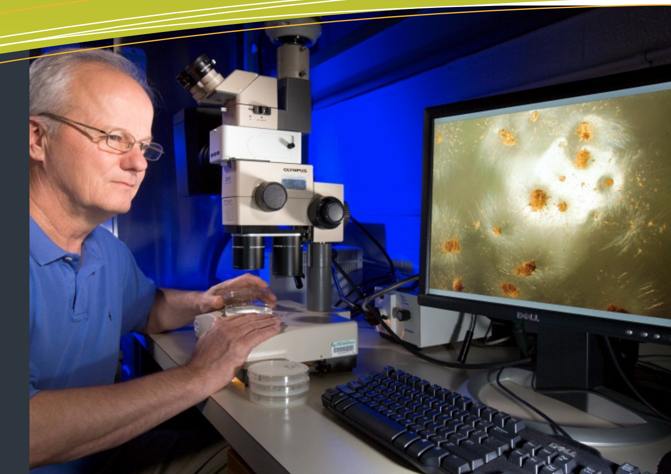
CBP News

Solutions for a New Economy

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.



this issue

Invasive pests threaten the U.S. avocado industry

Peoria, Illinois lies about 1,370 miles from Homestead, Florida and about 1,920 miles from Riverside, California. But that hasn't stopped Agricultural Research Service (ARS) scientists in the Crop Bioprotection Research Unit (CBP) from teaming up with scientists at the University of Florida (UF) and the University of California-Riverside (UCR) to devise a way to prevent invasive wood-boring beetles known as ambrosia beetles from destroying the U.S. avocado industry, valued at $322.1 million in 2010.

The CBP team is led by geneticist Alejandro (Alex) Rooney, who also heads up the CBP unit, and consists of microbiologist Mark Jackson, chemist Chris Dunlap, and entomologist Bob Behle. The team is working with UF professor Jorge Peña and UF professor and tropical fruit specialist Jonathan Crane to tackle the Florida problem. On the California side, the team is working with UCR extension specialist Akif Eskalen.

Although avocado production areas in both states are being simultaneously attacked, the species and fungal diseases they carry are different. In Florida, it's the redbay ambrosia beetle (*Xyleborus glabratus*) that carries the pathogen (*Rafaellea lauricola*) which causes laurel wilt disease. This devastating disease also kills native redbay and swampbay trees. Already it has spread to over 100 counties in the Southeast. In May of 2012, the disease was found in the primary Florida avocado production area, which lies in Miami-Dade County.

In California, the polyphagous shothole borer (*Euwallacea sp.*) carries a *Fusarium*fungus that causes *Fuarium* dieback in avocado and a number of ornamental trees including coastal live oak and box elder. As of the summer of 2012, the disease has been found in Los Angeles and Orange Counties and continues to spread rapidly.

The team is working to adapt a unique foam technology first developed by CBP to control subterranean termites attacking wooden structures in New Orleans, Louisiana. Rather than deliver a slow-acting insecticide, as do other foam products now sold, the formulation exposes the insects to spores of the fungus *Isaria fumosoroseus.* On contact, the fungus sends threadlike filaments called "hyphae" into the insects' bodies and starts to feed and grow, killing its victims within a few days. It's a gruesome end, but one not likely to earn the sympathy of avocado growers.

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

Waging war on the Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*) is a voracious beetle taking its toll on Midwestern and Northeastern forests. CBP entomologist Allard Cossé is working with a team of scientists from ARS, the Animal and Plant Health Inspection Service (APHIS), and the Forest Service (FS) to identify naturally occurring chemicals that the ash borer simply cannot resist.

Early success came with the identification by APHIS and FS colleagues of several compounds emitted from the bark and leaves of girdled ash trees. These compounds, which are sensed by the antennae of adult ash borers, led to the development of traps baited with manuka oil—a less expensive proxy. These traps are now used to detect infestations of ash borer and support the establishment of new quarantine areas.

Cossé and colleagues have also discovered components of the ash borer's chemical attractant, or pheromone, and synthesized it for use in traps—either alone or combined with attractants derived from ash trees. Their target is a compound that adult female ash borers emit while feeding. This compound's role as a sex attractant for adult male borers has recently been determined in large-scale field tests in the USA and Canada.

-This story was first published in Agricultural Research magazine by Dennis O'Brien and Jan Suzkiw, ARS Information Staff.

Got tick problems? Here's what you need to know.

CBP entomologist Bob Behle is taking-on the terrible tick and developing new technology for delivering "green" killing agents.

Derived from essential oils of plants such as grapefruit, vetiver grass, and Alaskan yellow cedar, as well as by chemical synthesis methods, nootkatone is commonly used in foods, cosmetics, and pharmaceuticals. But scientists have also demonstrated nootkatone's potential to kill ants, termites, mosquitoes, cockroaches, and ticks, including deer, or blacklegged, ticks (*Ixodes scapularis*), whose bite can transmit bacteria that cause Lyme disease in humans and other animals.

According to the Centers for Disease Control and Prevention (CDC), there were 29,959 confirmed cases of Lyme disease in 2009—the latest year for which statistics are available. Afflicted individuals experience fever, headache, fatigue, and skin rashes. Left untreated, Lyme disease can affect the joints, heart, and nervous system.

For people in regions of the Northeast and Midwest where deer tick populations are endemic, the threat of Lyme disease necessitates sharp-eyed vigilance and a willingness to take preventive measures. These include wearing light clothing to reveal crawling ticks, removing leaf litter where they might hide, creating mulch barriers, spraying insecticides, and using repellents.

Biobased Pesticide

For some folks, though, concerns about environmental or personal exposure to chemicals make spraying a measure of last resort. Interest in alternatives has prompted research on natural tick controls.

> "…the threat of Lyme disease necessitates a sharp-eyed vigilance…"

Although low doses of nootkatone have proven effective against different tick species in the laboratory, the essential oil rapidly turns to vapor when applied in the field. And while nootkatone is environmentally benign and nontoxic to humans, early formulations caused discoloration or other signs of toxicity in plants.

Now, however, a solution to both of these problems could be at hand.

As part of a 3-year cooperative project awarded by the CDC, entomologists Kirby Stafford (of the Connecticut Ag Experiment Station) and Bob Behle are testing a spray-dry procedure that encapsulates nootkatone in lignin. In nature lignin serves a kind of mortar that holds together the cell walls of plants.

In this case, the researchers used lignin as a semi-permeable packaging in which to extend nootkatone's residual activity and slow its environmental loss.

The lignin-encapsulation technology was originally developed and patented for use with other pest-control agents. Investigations by Behle and colleagues at ARS's Crop Bioprotection Research Unit in Peoria, Illinois, determined that the technology could similarly protect nootkatone, improving its effectiveness as a tick control.

-This story was first published in Agricultural Research magazine by Jan Suzkiw, ARS Information Staff.

New Sources of Insect Resistance for Corn

The perennial herb soapwort, *Saponaria officinalis,* owes its prized cleansing foam to detergent-like compounds called "saponins." But soapwort isn't the only plant that produces the compounds; nor are their properties limited to removing dirt and grime.

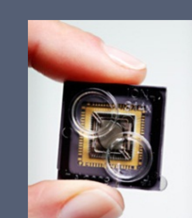
CBP scientists are spiking laboratory diets fed to corn earworm and fall armyworm with saponins from soybeans, switchgrass, yerba maté, and other sources to determine what effects the compounds have on the caterpillar pests' growth and survival.

CBP entomologist Pat Dowd says the studies are an integral part of a broader effort at Peoria to identify novel sources of resistance that can be put into corn—either through traditional plant breeding or biotechnological means. Ultimately, this could usher in new corn varieties that sustain less damage from caterpillars, are less prone to infection by toxin-making molds, or require fewer pesticide applications. Another potential benefit is staving off the ability of pests like corn earworms to build tolerance to existing sources of resistance—such as that endowed by insecticidal proteins from the soil bacterium *Bacillus thuringiensis,* which is used in about 63 percent of U.S. corn, according to USDA's Economic Research Service. "Looking for natural methods of controlling pathogens and pests is a win-win situation for the environment, for businesses who want to grow their efforts in green technologies, and ultimately for the U.S. taxpayer, who benefits from a cleaner environment and a thriving economy," remarks Alejandro Rooney, who leads the CBP Research Unit.

-This story was first published in Agricultural Research magazine by Jan Suzkiw, ARS Information Staff.

Agricultural Security and Biodefense

State-of-the-Art Technology Drives New Research Efforts



Earlier this year the CBP unit acquired the latest advance in genomics technology. The Ion PGM™ Sequencer uses semiconductor chips that employ a massively parallel array of semiconductor sensors to directly translate genetic information (DNA) to digital information (DNA sequence).

So what are we doing with it? CBP chemist Chris Dunlap is using it to discover antibacterial production genes in bacteria strains used for controlling *Fusarium* head blight in wheat, a project being conducted in collaboration with CBP plant pathologist Dave Schisler. CBP unit leader and geneticist Alex Rooney is using the technology to sequence the genomes of "uncultivable" bacteria and fungi (those that can't be grown in the lab) that cause diseases important to agricultural security and biodefense. He hopes to unlock the secrets hidden in their genomes, which he believes are the keys to determine how to grow them. Being able to grow them in the lab is the first step to controlling them. Why? We need to be able to work with them in order to conduct the experiments to figure out how to control them.

EYE ON IT
Control of Potato Diseases

Dry rot, late blight and pink rot are crucially important storage diseases of potatoes worldwide that combined can cause losses of 50% or more of the total harvest in storage. CBP plant pathologist Dave Schisler, in collaboration with scientists at the University of Idaho, have developed microbial antagonist strains that are effective against several maladies of potatoes in storage. The team has witnessed reductions in Late Blight from 20 to 90% over six years of trials. In addition, a 40% reduction in dry rot severity and new infections of pink rot were also noted. Proven biocontrol consistency and breadth of efficacy against four important potato storage problems (*Fusarium* Dry Rot, Pink Rot, Late Blight, and Sprouting), combined with recent breakthroughs in three-strain co-culturing protocols and drying-tolerant variants, has strengthened product marketability and benefit to farmers. Patents are available for licensing.

Biocontrol of Pink Rot in Storage

Pathogen only — **Antagonist plus pathogen**