GROWING KNOWLEDGE

Series content is coordinated by Dr. Lloyd Nackley, associate professor of nursery production and greenhouse management at Oregon State University in Corvallis, Oregon.

Oregon State University USDA

An ongoing series provided by Oregon State University in collaboration with the United States Department of Agriculture and in partnership with the Oregon Association of Nurseries

A beautiful threat

Update on flatheaded borer management in specialty tree crops

Adult flatheaded borer beetle with bright colored underbody exposed. Adults may cue into bright colors like this during flight. PHOTO COURTESY OF OREGON STATE UNIVERSITY

BY KARLA ADDESSO

FLATHEADED BORERS in the genus *Chrysobothris* are beetles native to North America and found across the United States. Within the genus, common pest species in the western U.S. include Pacific flatheaded borer (*C. mali*) and flatheaded apple tree borer (*C. femorata*).

The threat

The larvae of flatheaded borers cause aesthetic damage and economic crop losses to many nursery, nut, and orchard tree species.

The Oregon Hazelnut Commission recently ranked Pacific flatheaded borer as the number one priority pest in young hazelnut orchards. About half of the acreage in Oregon consists of trees less than 11 years old.

In August 2018, Pacific flatheaded borers were also found attacking smaller limbs and branches of walnut trees in California. By 2019, 90–100% of the newly planted walnut trees in two walnut orchards covering 300 acres had visible flatheaded borer damage.

Other species of flatheaded borers are important pest of arborvitae and juniper in western nurseries. In the southeast, flatheaded borer losses routinely exceed 40% of some nursery tree species (Oliver et al. 2010).

In 2018, Hurricane Michael severely damaged about 17% of Georgia's pecan acreage, affecting more than 700,000 trees. In August 2019, new replacement pecan transplants began to show flatheaded borer damage (Acebes-Doria, pers. comm.).

Chrysobothris species have also emerged as a threat to Florida blueberry production, where damage to blueberry canes results in production of fewer marketable fruits.

A team effort

In 2020, a multi-state research project led by Drs. Karla Addesso and Jason Oliver of Tennessee State University was funded by the USDA-Specialty Crop Research Initiative to

Damaged tree stem indicative of flatheaded borer beetle larve feeding. PHOTO COURTESY OREGON STATE UNIVERSITY

Flatheaded borer emerging from a stem of tree. PHOTO COURTESY OREGON STATE UNIVERSITY

coordinate research on this pest group.

The team includes Drs. Lloyd Nackley and Nik Wiman of Oregon State University, focusing on the needs of growers in the Northwest, as well as contributors from California, Texas, Alabama, Tennessee, Georgia, Florida, North Carolina, and South Carolina.

With the support of grower collaborators and industry representatives, the research team has focused on six areas of investigation:

- Reliable borer identification methods,
- Phenology and spatial relationships,
- Trapping,
- Production practices,
- Chemical and biological management and
- Economic impacts.

The following are some insights gained from the work of our team.

Identification

Proper identification of these beetles is the first step to managing them.

This has been a challenge because *Chrysobothris* species are similar in appearance, even to experts. A pictorial guide to identification of key pest species has been developed to assist diagnosticians with microscope identification of specimens.

New molecular data has been assembled of 20 common species of *Chrysobothris*. The data will allow non-experts to identify adult and larval specimens through molecular techniques.

We are also evaluating whether sawdust from old damage can be used to identify the borer species after it has emerged and flown away. Research is also underway to determine whether species can be identified by spectral analysis (ultraviolet and color readings) of their body parts and the wax compounds on their body surface.

Phenology

Understanding the timing of pest activity is critical for developing management recommendations. We are reviewing historic museum collection data for these beetles as well as the dates from our current trapping and field projects to better understand when the different species emerge.

We have found slight differences in activity patterns for different species. In the Pacific Northwest, *C. mali* and *C. femorata* activity overlaps, however, *C. mali* has a narrower period of activity compared to *C. femorata*.

Trapping

Traps can be used as a tool for monitoring borer population activity or to reduce populations in the field.

Experiments have exposed the challenge of trapping borers in different pro-

duction systems. We have found that tall, narrow purple traps ("pole traps") coated in glue and placed on the ground to mimic a young tree trunk are the most effective means of trapping *Chrysobothris* beetles in nursery production systems.

This trap design is less effective in fully grown orchard settings of walnut or hazelnut. We have tested several different attractants to try and enhance borer trapping. None have consistently performed better than the trap alone.

Production

Common production practices may unknowingly contribute to borer susceptibility.

We have found that post-emergent herbicide drift can induce borer attacks if the herbicide contacts the trunk or foliage. Even with a shielded sprayer, there is a chance that dying weeds at the base of the trees can attract borers or transfer herbicide to the trunk.

Early season management of plant rows with pre-emergent herbicides can reduce the chance of attacks. However, clean rows pose a problem of their own.

Borers prefer to lay eggs on the sunny side of exposed tree trunks. If the plant is not protected with insecticide, it is vulnerable.

Winter cover crop plantings within the tree rows can protect trees from borer damage in their first-year post-transplant, however, there is a reduction in tree growth due to competition.

Irrigating newly transplanted trees is another method for reducing borer incidence. Supplemental watering of older trees under drought conditions may also help prevent attacks on established trees.

Some cultivars, such as 'Autumn Blaze' freeman maples, are resistant to *Chrysobothris* borers. A specific mechanism for resistance has not yet been determined, however, this plant is faster growing and more drought tolerant compared to popular red maples.

In cage studies, female beetles did feed on 'Autumn Blaze' and laid eggs on it, even in the presence of susceptible red maples. It is therefore likely that 'Autumn Blaze' is preventing newly hatched borers from entering the trunk and establishing, rather than causing the females to reject the tree.

Selecting cultivars of plants with greater drought tolerance should also be considered if no other management options are available.

Management

The most consistent method of protecting trees from *Chrysobothris* bor-

ers is a soil application of imidacloprid, which can last up to three years.

This treatment poses some problems in terms of time, labor and per acre active-ingredient limits as well as non-target impacts to beneficial insects and pollinators. Other active ingrediets are being tested to protect trees as trunk spray applications.

The timing of these sprays is crucial to ensure protection and may require monthly or bi-weekly sprays during the flight period in susceptible crops. Some promising a.i.s include bifenthrin, cyantraniliprole, and a new active ingredient under review.

Targeted sprays of trunks with intelligent spray technology can minimize off-target impacts and environmental residues. Predators and parasitoids of *Chrysobothris* have been captured and reared from borers in nursery systems. The extent to which they contribute to control of borers may depend on the presence of nectar resources and pesticide residue levels in the field. In additional to conventional chemical controls, some organic and nematode products have shown success in organic orchard production where chemical applications are not possible.

Economics

Consumer surveys have shown that the public has some awareness of borer damage on trees, and they are willing to pay more for fresh fruit if they are grown with pollinator-friendly production practices.

This is more important to consumers when purchasing fresh fruit, rather than an ornamental tree for their yard. After new management tools are identified, cost comparisons of different treatment options will be provided to aid growers in the selection of management options for their specific needs.

Research on *Chrysobothris* management is ongoing and will continued to be shared through Extension activities as we learn more. We are eager to learn from growers and landscape professionals who have experienced past losses, or who are actively working to minimize the effects of ongoing flatheaded borer activity at their production operations, orchards, and client landscapes.

Flatheaded borer larvae on a petri dish full of sawdust. Notice the relatively large flat head, from which the borer gets its name. PHOTO COURTESY OREGON STATE UNIVERSITY

Experimental nursery field planted with cover crops testing whether or not covering the stems of the trees may reduce borer attack. PHOTO COURTESY OREGON STATE UNIVERSITY

How to help

For more information, or to participate in the team's research efforts, contact Dr. Lloyd Nackley at **Lloyd.Nackley@OregonState.edu.** Additional information will also be presented at the Southern Integrated Pest Management Flatheaded Borer Working Group site: **TinyURL.com/FlatheadBorer.**

Dr. Lloyd Nackley is a plant physiological ecologist at the Oregon State University North Willamette Research and Extension Center (NWREC) in Aurora, Oregon. He can be reached at **Lloyd.Nackley@OregonState.edu**. *Dr. Karla Addesso is associate professor, department of agricultural and environmental sciences, Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee. Reach her at* **KAddesso@TNState.edu**.