

# Tapping the Senses To Catch Asian Longhorned Beetles



An adult Asian longhorned beetle feeds on the bark of a sentinel tree. Sentinel tree species are those known to attract the beetles and are treated with insecticides that will kill the beetle after it lands on or feeds on the tree.

MICHAEL SMITH (K11033-1)

A neighborhood maple tree, prized for its brilliant fall color, must be cut down and burned. Raw stumps border a city street where leafy shade trees once stood.

These are the effects of a black beetle whose white spots, bluish feet, and 1- to 2-inch-long antennae would make it seem, at worst, a funny-looking garden guest. But this bug's not getting many laughs. The Asian longhorned beetle (ALB) from China is one of the country's most formidable invasive insects. On its hit list? Deciduous trees in city parks, suburbs, and forests across the eastern United States.

Coming to the aid of regulatory agencies trying to eradicate the coleopteran pest is Agricultural Research Service (ARS) scientist Michael T. Smith. Smith is an insect behaviorist at the Beneficial Insects Introduction Research Unit (BIIR) in Newark, Delaware. His latest tactics to quash the beetle rely

on smells and sounds. Specifically, he's developing strategies based on tree smells that are irresistible to the beetle and on acoustics technology that can detect the sounds of ALB larvae feeding in infested trees.

Novel methods are needed to detect and manage the beetle, in part because of its cryptic nature. "The beetle doesn't make leaves fall off a tree or turn them brown—the usual signs of bad health or insect attack," says Smith. It spends most of its life cycle as a developing larva hidden deep within a tree, feeding on and tunneling through the plant's vital tissues. Like fingerprints left at a crime scene, sawdust, sap, and nicks in tree bark produced by the beetle serve as small clues for those tasked with finding infested trees. But a tree may suffer repeat ALB invasions over several years before the problem is ever noticed.

## Sentinel Trees Stand on Guard

How do you entice an insect? Give it its favorite food. Many insects choose certain tree species—for feeding and laying eggs—based on aromatic chemicals, called volatiles, that the trees produce. But a few years ago, little or nothing was known about how longhorned beetles find their desired tree hosts. With the hope of developing new ways to conquer ALB and other longhorned beetle pests, Smith set out to understand this process.

Smith first examined the role of vision in the beetles' orientation to trees. He documented them flying to vertical objects, including both host and nonhost trees. "I thought, if they're using vision, they may also be using odors to discriminate among tree species," he says. After 3 years of investigating ALB's response to different tree species and their odors, Smith says the beetles are using the two senses in tandem. "They appear to use vision to orient to the vertical silhouette of a tree from a distance and then use the tree's odors to guide them at close range."

The beetles' affinity for certain trees, like maples, poplars, willows, and elms, is significant because such attractive species may be used as sentinel trees. The strategy? A tree known to attract ALB is set out in an area so that survey crews can detect the pests as they fly to it. Smith has found highly attractive tree species that work effectively, but he's still confirming which species produce the most alluring beetle scents.

Sentinel trees can also be used to capture and destroy ALB. When treated with insecticides, the trees become an attract-and-kill system. "The potted tree is sprayed or injected with an insecticide—inside a greenhouse or warehouse—and then transported to an area believed to be infested," says Smith.

Another tool being readied for the beetle battle are lures that contain tree-odor attractants, which can then be deployed with traps in potentially infested areas. Chemist Aijun Ahang, of ARS's Chemicals Affecting Insect Behavior Laboratory in Beltsville, Maryland, collected volatiles from two attractive tree species to formulate the special blends. Smith is investigating which of the blends' compounds are the key attractants in field studies in China. Once refined, the blends can be passed on to industry partners.

The scientists ran a unique laboratory test to find out which of the volatile compounds the beetles were

truly "smelling." Smith describes it: "Insects smell volatile odors with their antennae. So we attached electrodes to the beetles' antennae, then puffed air containing the tree volatiles across them. When the antennae nerves fired, we'd see a blip on the screen. Something in the puff of air was causing the nerves to fire." With a gas chromatograph-mass spectrometer, Aijun was able to identify the volatile compounds causing the neural firings. These compounds are in the special blends.

## Unwitting Beetles Get "Bugged"

Smith is sitting beneath a leafy tree and wearing earphones. He's listening to beetles. Not the groovy tunes of John, Paul, George, and Ringo, but rather the noises made by hungry beetle larvae munching their way through the tree's inner tissues.

For nearly 5 years, Smith and BIIR biological technician Joseph Tropp have been eavesdropping on longhorned beetles in an effort to develop a tool that gives away the insects' destructive feeding. The scientists are working in collaboration with the State University of New York and Pryor Knowledge Systems, Inc., of Detroit, Michigan. Still being fine-tuned, their detection tool is simple—and 80 percent efficient at distinguishing ALB sounds from background noises. Visual detection, the method currently used to find infested trees, is only about 30 to 60 percent effective.

"We envision a scenario in which a sensor is attached to a tree and the vibrations picked up by the sensor are fed into a portable device that determines the likelihood that an ALB larva is chewing inside the tree," says Smith.

And what do munching larvae sound like? "They make a variety of feeding noises, including one that sounds like someone chewing on cornflakes," Tropp says.

More work is needed to determine the sensitivity of the current sensor and the best way to use it. The researchers also plan to develop improved sensors that can detect ALB feeding vibrations from even greater distances.—By **Erin K. Peabody**, ARS.

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**Sentinel trees (in pots) are placed to attract Asian longhorned beetles in areas believed to be infested.**