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Beetle Mania Rocks Northern Arizona Lab

Flagstaff, Ariz. – A phenomenon being dubbed *Beetle Mania* is playing out in northern Arizona. As can be expected, it involves rock music, but instead of screaming fans there are cheering scientists who have found a way to make bark beetles crazy with sound.

In a Northern Arizona University School of Forestry lab, researchers are listening to the sound of western forests under attack, the scratching, scraping, crunching of the *Ips* bark beetle and its cousins chewing the life out of ponderosa, pinyon and lodgepole pines.

Armed with sonic bullets, they are firing back with Rush Limbaugh, Queen, Guns N' Roses and manipulated sounds of the bugs themselves.

"Our interest is to use acoustic sounds, specific only to each species, that make beetles uncomfortable and not want to be in that environment," said NAU Forest Entomology Professor Dr. Richard Hofstetter.

Barely a quarter-of-an-inch long, bark beetles are tiny and powerful killers. When they amass by the thousands, they become a lethal army, tunneling through millions of acres of trees already stressed by drought and overcrowded forest conditions.

"You can get thousands, even tens of thousands of bark beetles colonizing a tree and that tree can die very quickly, within a day or two," he said.

British Columbia Invasion

The evidence for this exists all over the West. In fact, the beetles' British Columbia invasion that ended just last year wiped out some 10 million acres.

Pondering this deadly infestation is truck driver turned research assistant Reagan McGuire. "I read an article in the local paper that bark beetles have killed 74-million trees in Arizona and New Mexico. So I got to thinking, what if we could fight back with sound, what if we could alter their behavior by producing acoustic stress."

After McGuire convinced Hofstetter to look into this kind of research, he quit his truck driving job and joined the lab.

"I thought, 'What would be the nastiest, most offensive sound?' To me, that would be Rush Limbaugh or heavy metal," said McGuire.

Researchers began collecting infested tree trunks in the fall. And because bark beetles live and tunnel through the phloem, or living tissue of the tree just under the bark, they started creating *phloem sandwiches*, slices of infested pine trees encased in Plexiglas, to build ant farms of sorts. Using tiny speakers, like the kind in musical greeting cards, they piped sound in and also recorded sounds coming out, sounds the bugs were making.

Beetle Mania

They blasted the beetles with rock music and Rush Limbaugh commentary played backwards. Discouraged by the results, the scientists started firing the insects' own sounds back at them. They couldn't believe what they saw.

"We could use a particular aggression call that would make the beetles move away from the sound as if they were avoiding another beetle. Or we could make our beetle sounds louder and stronger than that of a male beetle calling to a female, which would make the female beetle reject the male and go toward our speaker," said Hofstetter. "We found we could disrupt mating, tunneling and reproduction. We could even make the beetles turn on each other, which normally they would not do."

Wearing a headset, McGuire would listen and watch the beetles on a computer monitor hooked up to a microscope. "We observed and recorded beetles mating two or three times. Then we'd play the beetle sounds that we manipulated and watch in horror as the male beetle would tear the female apart. This is not normal behavior in the natural world."

Music to their Ears

So in the spotlight and under the microscope are bark beetles and their communication sounds and patterns.

"If we know how they hear and what they hear, we can disrupt that behavior," said NAU forest science doctorate student Kasey Yturralde. "If we can do that, we may be able to stop this mass aggregation and the killing of trees. But right now, we don't even know where the beetles' ears are."

Hearing the need for a better understanding of bark beetle anatomy is University of Arizona Neurobiology Department Professor Dr. Wulfila "Wulfi" Gronenberg. By inserting tiny electrodes and performing what amounts to bark beetle brain surgery, Gronenberg is working to find where and how the sound is perceived.

"Insects can have ears almost anywhere, on their wings, legs, antennas or abdomen. It's important to find out all about the sound these beetles use to communicate. Then we can aim that sound and do something to their brains so they don't respond properly."

Defense against Infestation

Researchers are seeking funding to help them continue looking for the sound, maybe even ultrasound, that can be used strategically to keep beetles from damaging individual or entire stands of trees.

Right now, bark beetles are hibernating in the snow-covered forests, where they will awake to a feast of vulnerable trees. But inside the lab, scientists are waiting to greet the sleepy pests with what they hope will be a rude awakening.

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