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Have you seen pouches stapled to forest trees? They're designed to trick 'tree murderers'

BY JULIE JUNG AUGUST 07, 2023 4:00 AM

Bark beetles are only about the size of a grain of rice. But for such tiny critters, they can take a big bite out of the forest. There are more than 100 species of bark beetles in Idaho, said Gina Davis, entomologist and group leader at the Coeur d'Alene Field Office for the U.S. Forest Service, in a phone interview with the Idaho Statesman. Closely related bark beetle species look very similar. Mountain pine beetle, western pine beetle, and Douglas-fir beetle are all in the same genus (*Dendroctonus* — loosely translated from Greek as “tree murderer”), and you'd be hard pressed to tell them apart. Even different families of insects can sometimes look very similar in the larval stage. But bark beetles are relatively host specific, meaning they'll only attack one or a few species of trees. For instance, Douglas-fir beetles will attack Douglas fir trees; Western pine beetles will attack ponderosa pine trees; and mountain pine beetles can attack a small range of different pine trees. In Idaho in 2022, Douglas-fir beetles caused tree mortality on more than 30,000 acres of land; western pine beetles affected 2,400 acres, and mountain pine beetles caused damage on more than 6,000 acres. TOP VIDEOS Skip in 5s “There are all these different species of bark beetles, and each of those is unique in host type, life cycles and when they are attacking,” said Erika Eidson, a forest health specialist for the Idaho Department of Lands, in a phone interview. Mountain pine beetle killed trees, Salmon National Forest, 2012. Provided by Tom Eckberg, Idaho Department of Lands In part because of these differences, management of bark beetles and the forests that they inhabit is a formidable challenge. Some landowners and forest caretakers, though, are fighting back with science. Little packets of pheromones, when stapled onto trees, can signal to certain beetle species, tricking them into thinking that the host tree is already occupied. “I like to think of it as having a no-vacancy sign on the tree,” Eidson said. This signaling is species-specific, small-scale tree protection, but it's a critical step to combat these devastating infestations, especially in our ongoing era of extreme weather and drought. THE EVOLUTIONARY ARMS RACE BETWEEN BEETLES AND TREES Bark beetles and trees are longstanding evolutionary enemies. Bark beetles and host trees are native to Idaho, “so there has always been this arms race to evolve defenses against the beetles and for the beetles to evolve strategies to overcome the defenses,” Eidson said. The bark beetle life cycle is largely shared among species. First, the pioneering beetle (usually a female) finds a suitable host tree by detecting plant compounds. She then sends a chemical signal to her fellow beetles to attack the tree together. When the beetles (both males and females) follow the chemicals — called aggregation pheromones — and find their host, they bore in and carry out their life cycle, feeding and laying eggs in the phloem, which is the vascular tissue that transports food in the tree. Sawtooth National Recreation Area turns 50 Read the epic story of how Idaho and the nation helped preserve the SNRA READ MORE The trees are not defenseless to bark beetle invasions. They fight back with a toxic resin, which can surround the beetles, either trapping them or flushing them out. A clear sign that a pine could be infested with a bark beetle is popcorn stuck on the bark. Well, not actually popcorn, but popcorn-sized masses of resin called “pitch tubes” that indicate where beetle tunneling began. As the tree oozes resin to “pitch out” invading beetles, those resin globs can dry and turn into brown, pink or white buttons on the outer bark. “It's a battle between the tree and the beetle,” said Anna Webb, forest health and protection entomologist for the U.S. Forest Service, in a phone interview. “If the tree is not super

healthy, then the beetle will probably get through the pitch tube. But if the tree is healthy, typically the beetles will tire themselves out and die.” And according to Eidson, “the tree’s defenses become less important with large populations of beetles” who can work together to overwhelm and kill the tree, typically within one year. But if it’s a cold year, maybe even two, Webb said. When the tree is “tapped,” the beetles release anti-aggregation pheromones to deter more colonization on a fully colonized tree. The beetles recognize the signal and fly off to other host trees. Many succumb to exhaustion or predators if no suitable host tree is around. Bark beetle exit holes in ponderosa pine. Provided by Idaho Department of Lands PHEROMONE PACKETS CAN HELP GIVE TREES A LEG UP Sometimes, humans can play on “team tree” and assist our forest friends with pouches of synthesized anti-aggregation pheromones. Eidson warns that these pheromones are “not a silver bullet.” Rather, they are highly specific to the species of tree and the species of beetle involved. Eidson says that MCH is “close to 100% effective when used correctly” on Douglas fir trees against Douglas-fir beetles. Anti-aggregation pheromones in this species have been synthesized into a liquid that slowly diffuses through a plastic bubble pouch. It creates an invisible repellent pheromone plume that deters more colonization. Erika Eidson, Idaho Department of Lands, applying MCH to a Douglas-fir tree in 2018. Provided by Idaho Department of Lands. You staple either single or double bubble pouches to healthy trees to trick the beetles into thinking they are already fully attacked. Grid application to protect an entire stand costs about \$50 to \$60 per acre. To protect a single tree or log, it costs about \$3.95 for double bubble. Down larch (logs) and recently burned stands of Douglas fir trees are high risk, since they are highly attractive to beetles, which can develop in large logs for one year and then attack nearby standing trees. Piles of Douglas-fir beetle frass on a down Douglas-fir log. Tom Eckberg, Idaho Department of Lands Verbenone is another anti-aggregation pheromone used to trick beetles into thinking healthy trees are already fully attacked, but this pheromone is used to repel mountain pine beetles. Mountain pine beetles attack all pines in Idaho, but prefer large diameter trees and dense lodgepole. The efficacy of Verbenone is more variable compared to MCH. Davis attributes this lower efficacy to the fact that mountain pine beetles can infest multiple pine species and are less specific than Douglas-fir beetles. Thank you for supporting local journalism Your subscription allows us to provide our readers with quality, relevant journalism that makes a difference. We believe a platform for sharing local news is critical to our community – and we're glad you think so, too. Have questions about your subscription? We're happy to help. Contact us Forest caretakers must apply 1-3 pouches per tree for single-tree protection, or 20-60 pouches per acre in a grid pattern for area protection. Each pouch costs about \$8 to \$9. They’re often used to protect areas that are partially burned, and specifically blister rust resistant whitebark pine and western white pine “plus” trees. The “plus” indicates possible rust-free trees that may be used in a rust-resistant breeding program. “We work to protect those specific trees more because their genetics may help them survive that disease in the long run,” Davis explained. And importantly, there are not tools developed for every species. Verbenone and MCH are the only available repellent pheromones, available for mountain pine beetle and Douglas-fir beetle, respectively, and only for one season. A new repellent for spruce beetle called AKB (Acer Kairomone Blend) is in the works. This can potentially be used as a synergist with MCH to help prevent spruce beetle attacks in the future. According to Davis, the Forest Service has been working with the repellent in Southern Idaho and “it was looking very promising.” It is highly effective, but not yet available commercially. BARK BEETLES TARGET STRESSED TREES It’s easy to think of these beetles as the enemy in the evolutionary war between beetle and trees, but these are native beetles. Eidson reminds that “they’re supposed to be here; they’re part of our ecosystem.” Rather than thinking of bark beetles as misbehaving, Eidson likes to think of them as simply “reacting to the conditions

around them.” Beetles tend to choose weakened trees to attack, so certain types of weather events can contribute to outbreaks. For instance, in January 2021, a windstorm swept across North Idaho, blowing down a swath of pines. That wind-swept blow-down was still verdant and fresh for the beetles to infiltrate, but since the tree was not producing the same level of defense as usual, “that’s like a magnet to Douglas-fir beetles,” Eidson said. The Douglas-fir tussock moth is another devastating defoliator that creates outbreaks every seven to 10 years that last about three years. The caterpillars of that native moth species thin the tree’s needles, causing “a lot of tree stress that contributed to Douglas-fir beetle outbreaks around the Cascade area and in Southern Idaho in 2018 and 2019, especially,” Eidson said. According to Eidson, the Idaho Department of Lands is still seeing the aftermath of these outbreaks. Trees severely defoliated by Douglas-fir tussock moth at Craters of the Moon National Monument in 2017. Southern Idaho experienced a Douglas-fir tussock moth outbreak in a number of areas in 2017-2019. Areas that were defoliated are now experiencing higher levels of Douglas-fir beetle activity. Erika Eidson, Idaho Department of Lands Other damage to trees, from drought or fire, can also prime pines for beetle infestation. Trees that are scorched, but not killed completely, are “low-hanging fruit” for beetles, Eidson said. Fire-scorched ponderosa pine and Douglas-fir at Farragut state park in 2017. Ponderosa pine were beginning to be infested with western pine beetle. A major western pine beetle outbreak occurred in this area in the following few years. Erika Eidson, Idaho Dept of Lands “Anytime there has been a fire,” Webb explained, “beetles will always move in.” According to Webb, the beetles pick up on tree volatiles, or carbon-based chemicals similar to pheromones, and swoop in, taking advantage of fire-stressed trees that can’t fight back as well as healthy ones. Since scientists anticipate these stressors may increase in the coming years, we may see corresponding beetle infestations boom in future decades. Davis warns that so far, “we really just seem to pay attention to a handful of species that cause annual damage, but there are a lot of bark beetles that we put in this secondary category that doesn’t necessarily cause annual damage, but may just kill some branches or the tops of trees.” But as the trees get more stressed from drought and fire, Davis and other entomologists are “really starting to pay a little bit more attention to some of these secondary bark beetles,” like the red turpentine beetle, for instance. Pitched out red turpentine beetle, 2018. Red turpentine beetle is not usually a tree killing bark beetle and usually only infests the base of trees. Erika Eidson, Idaho Dept of Lands In an era of climate change, the tides in this evolutionary arms race could turn in an instant, so it’s becoming more important to develop tools for managing tree stress. Julie Jung is writing about science topics for the Idaho Statesman this summer in partnership with the American Association for the Advancement of Science mass media fellowship.

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