Aphid-munching beetle could help save hemlock forests

By Gabriel PopkinJan. 15, 2020 , 4:20 PM

An introduced beetle that eats the eggs of the hemlock woolly adelgid is showing promise. ROBBIE FLOWERS/VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

A potential ally for one of North America's most embattled trees has passed its first big test. A tiny predatory beetle that researchers have been rearing and releasing into forests appears to be doing damage to an aphidlike pest that poses a deadly threat to ecologically important eastern hemlock trees, a 5-year study has found. The result marks a rare success for forest scientists aiming to use introduced insects to battle pests, a strategy called biocontrol. Researchers caution that hemlocks are far from safe, however, because it is unlikely the beetle alone can defeat the pest. But the news "gives some cause for encouragement," says Aaron Ellison, an ecologist at the Harvard Forest, who is not involved in the work.Sometimes called the redwood of the east, eastern hemlock (*Tsuga canadensis*) is an evergreen giant inhabiting forests in eastern North America from Alabama to southern Canada. Its dense shade cools mountain streams, and its leaves and branches host hundreds of insects

and other arthropods. It can form almost pure stands in the forests of the northern United States and Canada, making it a foundational species.

Since the 1980s, however, hemlocks have come under an ever-widening assault from the hemlock woolly adelgid, a tiny insect native to Japan **that sucks sugars** from hemlock needles, killing trees. The adelgid has left ghost forests throughout the Appalachian Mountains and southern New England. It recently showed up in Michigan, putting hundreds of millions of trees in the upper Midwest at risk. To save the hemlock, many scientists have placed their bets on biocontrol: introducing one or more species to reduce adelgid populations. In the 1990s, investigators in British Columbia in Canada found that a black beetle named *Laricobius nigrinus*, about the size of a grain of rice, munches on adelgid eggs, larvae, and nymphs. Scientists have since reared and released more than 400,000 of the beetles at sites throughout the eastern hemlock's range and watched some populations take hold.

To see whether the beetles were actually harming the adelgid, a team led by entomologist Scott Salom of Virginia Polytechnic Institute and State University traveled to nine sites, from northern Georgia to New Jersey, where beetles were well established. The researchers placed mesh bags around some adelgid-infested hemlock branches to keep predators away. They then monitored the bagged branches, as well as unprotected branches, from 2014 to 2018. One indicator, the number of adelgid egg sacs showing signs of beetle attack, was "about as good a start as we could have hoped for," Salom says. Overall, beetles appear to have snacked on 30% to 40% of egg sacs on unbagged branches, the researchers reported last month in *Biological Control.*

Still, Salom and other researchers are hardly doing a victory lap. The beetle is not yet eating enough adelgids to reduce total populations, they found. The pest produces two generations per year, one in winter and one in spring. But the beetles only go after adelgids in winter. That means the adelgids can rebound to high numbers in spring and summer, when the beetles burrow into the soil and go dormant. In addition, the beetle has not become well established in the northern forests that are now on the front lines of the adelgid invasion, says entomologist Mark Whitmore of Cornell University. Whitmore and others are working to establish two species of insects from western North America, called silverflies, which are known to eat adelgids in spring and summer. If successfully established in eastern forests, silverflies could become "one of the most important [adelgid] predators in the north," Whitmore says. In combination with beetles, the flies could also help control

the adelgid's spring generation farther south, Salom adds. Despite the headwinds facing the beetle project, Ellison says success could help set a precedent. Most efforts to control invasive insects have relied on parasites and parasitoids, which lay eggs and complete their life cycles in or on the target species. If Salom's team can build on its result to show that the beetles can really save trees, it would mark a rare example of successful biocontrol using a predatory insect. Before biocontrol agents are deployed on a large scale, researchers typically conduct studies **evaluating the potential risks and benefits**. And Salom says his team rigorously vetted the beetle in the lab before releasing it. Still, releasing alien species in an ecosystem can have unforeseen consequences, Ellison notes. Introduced *L. nigrinus* beetles, for example, are now mating with related beetles native to eastern forests; about 2% of the beetles Salom's team recovered were such hybrids. That low rate suggests hybridization is likely "of little long-term concern," says Lynne Rieske-Kinney, an entomologist at the University of Kentucky. Researchers are planning a follow-up study to determine whether the beetles are actually improving hemlock health, Salom says. For now, however, he's savoring a morsel of success. "I've been working on this for 22 years," he says. "It really feels good to have some positive data."

Source: https://www.sciencemag.org/news/2020/01/aphid-munching-beetle-could-help-save-hemlock-forests