The University of Vermont

UNIVERSITY COMMUNICATIONS

Forest Fungus Factory

Narrator: In Townshend State Park in southern Vermont, tall hemlock trees soar. One of the most common and important trees in the Eastern United States, hemlock trees provide shade for picnickers, cover for deer in winter, and cool streams for fish in summer. Dozens of bird species depend on the hemlock's dense branches. But hemlock trees from Georgia to New England are dying by the millions.

SC: Well, a Hemlock Woolly Adelgid is an insect that invaded the United States from Japan in the early 1950s and it's been destroying Hemlock trees ever since. What we are trying to find out today is: Can we control this HWA through ground applications? Are we going to be able to use fungi to suppress this invasive pest?

We can. A fungus called *Lecanicillium muscarium* is actually a registered product that comes from the Netherlands and used in a number of different countries. But it's also ubiquitous throughout the world and already found in HWA ecosystem so it's not novel fungus that's coming in. It's an insect killing fungus. What it does is: When the insect comes in contact with the fungus the fungus germinates, just like a seed, penetrates the insect and then proliferates and then kills it. Then reemerges and releases more spores into the environment to kill other insects. The hope is that we have major disease outbreaks that suppress the HWA populations.

We have a special technology that is licensed from the University of Vermont that was developed in my laboratory there. It's called whey-based micro-factory technology and it's very unique. What we do is we allow the fungus to grow in this special formulation after it's released into the environment so you get a lot more bang for your buck essentially.

And it's been a really big problem trying to use fungi to control insects and diseases and other applications because they cost a little too much to use and it takes a little bit too much to really be effective. And so what we do now is we take the mass production, the growing of the fungus, out of the factory, the bricks and mortar factory, and we transfer that out into the field. So it's basically a formulation additive. We call it Micromax and we mix the fungus, a registered bio-pesticide, with this natural formulation additive based on sweet whey, which comes from cheese production (it's a bi-product) and once they get out into the environment under suitable conditions of nice relative humidity and warmer temperatures the fungus grows and it mass produces out in the field.

So we have an experiment: We spray ten trees, we leave ten trees unsprayed and we come back in a month and then in the winter and see if we had control taking place.

Narrator: Back on campus several months later, Costa continues his experiment, looking to see if the fungus knocked back the adelgid.

SC: So now what I'll have to do is go through a lot of samples. I have twenty different trees that we collected foliage from and five branches from each tree and I'll go and I'll examine five twigs, preferably of new growth, and I'll do that microscopically. I'll go through and I'll determine the number of alive and dead adelgid and I'll do that by puncturing each of the hundreds and hundreds of adelgids that I see.

So what we are looking at is small part of a Hemlock branch and there is a stem with Hemlock needles on them and I see at least a dozen adelgid there.

And I go through and I squish it... and these are pretty dry... ooop - that one was juicy. The juice was a pretty dark color though. It was more brownish than pinkish and that indicates that it's about to die. Has to be a nice reddish pink color. Mmhm. That one's dead. Lot of dead here. Those that do survive will go on each individual with reproduce 100 to 150 of its own offspring and each of those will reproduce 100-150 of their offspring in one year. And so each individual ultimately results in about 10,000 adelgid. And that's why we see these explosive population outbreaks.

We want to make the trees look like the one over here. You can see the new growth. It's a light color. Each stem has new growth coming up on it. Here, this is last year's growth. There's no new growth here at all. The tree is being suppressed by the adelgid.

Narrator: The adelgid has devastated hemlock forests in the Appalachians. With no natural predators in the United States, it is rapidly marching north.

Last year Costa tested his fungal factory in large forest plots in Tennessee, spraying the fungus from helicopters. But would it work in Vermont on single trees sprayed from the ground?

SC: What we discovered is that we can use fungi to control HWA populations. We had a successful experiment. We took fungi, we sprayed them out there and the insect population where the fungi were stopped growing whereas our control, where no fungi was sprayed, the HWA population continued to grow. There were almost three times as many insects on the controls, the untreated branches, as there were on those that received the fungus. So the experiment was a success.

Link to the video:

iframe width="560" height="349" src="http://www.youtube.com/embed/RHcIthbBMVQ?rel=0" frameborder="0" allowfullscreen></iframe

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