

Toe Talk: Beetles save needles

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Dr. Richard McDonald / Symbiont Biological Pest Control



Dr. Richard McDonald has been involved in nearly every *Laricobius nigrinus* beetle release on non-federal land in NC. He received the first release of *L. nigrinus* in NC in 2003; this was the eighth release of beetles in the US at the time. He has been collecting beetles for local and university research programs and commercial clients since 2005. Dr. McDonald is the only person with the regulatory permits to be allowed to ship interstate hemlock predatory beetles into North Carolina from the PNW at this time.

Back around the year 1950, a shipment of trees from Japan came into an arboretum in Richmond, Va. The trees were weeping hemlocks (*Tsuga diversifolia*) and they happened to have an insect on them called the hemlock woolly adelgid (*Adelges tsugae* Annand) or HWA. Adelgids are 'tree aphids' and makes a woolly mass to hide in, much like woolly apple aphids do.

In its native lands, the HWA has a spotty distribution and does not kill trees. Studies in Japan showed that native predatory insects ate on the adelgids and held their numbers below levels that damaged the trees. So the hemlock trees in the forest in Japan had adelgids, but the HWA never was at damaging levels. The hemlock trees, adelgids, and predator beetles were in balance and got along fine.

In Virginia, nobody originally noticed that this adelgid had jumped from the Japanese weeping hemlocks to nearby native eastern and Carolina hemlocks ... until the cat was out of the bag. People first noticed this pest in the early 1980s and didn't think it would kill hemlocks. They were wrong. This insect had a 30-year head start on us before anything was done.

Freed from the natural enemies that held the HWA in check where it was native, the adelgid began to ravage the hemlock forests of the East Coast of the US. More than 80 percent of the hemlocks in the nearby Shenandoah National forest were killed by the HWA. The same thing is happening to hemlocks in all the states south of the Mason-Dixon line. North of that line, weather holds the HWA in check compared to the hemlock death down south. About 50 percent of the hemlocks are dead in southwestern NC at this point.

The HWA has two generations a year. Basically, it has a 'winter' generation that becomes active in October and lasts until May and a short 'summer' generation that lasts from May into June or so. The summer progeny of the HWA settle on needles and wait for cooler weather in the fall before feeding. The 'winter' generation of HWA is the one that does the damage to the trees, because that is when hemlocks get most of their food for growth. Hemlocks depend upon winter sun to be able to grow underneath other trees in the summer. The adelgid knows this too, and is trying to intercept the food that the hemlock is making during the winter.

In Japan, the first studies on predatory insects feeding on the HWA in Japan by the US Forest Service during the late 1980s and early 1990s showed a small predatory beetle called *Sasajiscymnus tsugae* was a main predator of the HWA's 'summer' generation. This predator has been mass reared by the millions and released in many places. Claims have been made that this predator has helped the hemlocks, but nobody can recover any meaningful number of these beetles after their release. Trees were still dying by the millions even in the presence of this beetle.

2006 — Hemlock Woolly Adelgid turns out to be native to Pacific Northwest!

A shocking discovery (to us, anyway) was made in 2006 by researchers with the Forest Service. Using DNA analysis, the scientist Dr. Nathan Havill discovered that the HWA was native to the Pacific Northwest of the US! A small group of folks including Stan Steury of the Blue Ridge Resource Conservation and Development (BRRC&D) and DrMcBug understood the significance of this finding.

It meant, just like in Asia, we had NATIVE summer and winter predators of our very own that we could collect and ship back east to control the HWA. It was time for us mountain folks to take care of our own. And this happened because of a premium we place on education and organizations like BRRC&D and our regional universities. If it wasn't for the discoveries by the Forest Service and work done by Profs. Scott Salom and Loke Kok of Virginia Tech, none of this would have happened. Knowledge is what saved the trees, and not just hemlocks.

The winter predator *Laricobius nigrinus* is the key for saving hemlocks from HWA

The big breakthrough came from a Canadian researcher named Lee Humble in the early 1990s — he told us about a 'winter' adelgid predator beetle they knew. The beetle was controlling the HWA in hemlock seed orchards on Vancouver Island. It was

named *Laricobius nigrinus* (Lari for short). This beetle's life cycle perfectly follows the damaging winter generation of the HWA. Studies showed the Lari beetles only ate adelgids; they ate about 97 percent of all the HWA in a particular area. Previous studies totally missed this beetle, because nobody thought there would be an insect out roaming around in the winter! Boy, do we still have a lot to learn about the forest.

The Lari beetles emerge from underneath hemlocks in mid-October, right when the HWA is becoming active. The adults live until April and they eat six to eight HWA every day for more than two months before they begin laying eggs in late January. The eggs are laid one at a time inside (!) the HWA's woolly egg sack, and the female marks the sack with a scent, so no other beetle bothers it. The Lari larva hatches inside the egg sack and eats about 250 HWA eggs or crawlers to complete development. Each Lari female can lay between 200 to 400 eggs and egg laying goes from January to April. Reminds me of ladybugs and aphids ... these are serious HWA predators! They are the key that keeps these big hemlock trees with HWA healthy and alive.

The feeding and predation by the Lari beetles and their larvae reduce the HWA population levels below 30 percent of infested needles. Once a hemlock has less than this percent of needles infested, it grows even better than normal. Below this 30 percent level, the low levels of adelgids actually don't hurt, but stimulate the tree, because everything is back in balance. The trees are able to store the winter sun carbohydrates again, rather than the HWA getting them, and their regrowth shows it.

Not guessing anymore, but a game of numbers initially

By 2006, we KNEW Lari beetles worked, but we had to get enough of them into our trees as fast as possible to save them. The BRRC&D, along with cooperators at Virginia Tech and the USDA Forest Service, began to field collect and ship 1000s of these native Lari beetles back from the Pacific Northwest, and making releases. The oldest Lari beetle releases (2003) were made by the Forest Service in Big Ivy, Middle Fork (Mt. Mitchell), and by Dr. McDonald at Hemlock Hill in Banner Elk.

Several local communities were also early participants, and have reaped the reward of watching their hemlocks regrow for the past 6 years (since about 2009). The Celo Community got Lari beetles back in 2008, and there are beetles present all the way to Mars Hill and Burnsville from this area. Local folks in areas like Pensacola, NC; Lickskillet Road on 19E, and The Lodge at Big Ivy also bought and released beetles. Grandfather Golf and Country Club in Linville released more than 14,000 of these beetles from 2008 to 2014, and their beetles have spread about 70 miles in every direction.

Our green is our gold — we want YOU to put the beetles to the needles!

When people think of the Appalachian mountains, they think of clear running streams full of trout and other game fish. Blue herons are present, birds are calling and the trees that overhang the streams and cool them are hemlocks. No other tree cools the streams and mountains like hemlocks. There is no replacement for this tree — we can't lose this ecosystem and now, if we organize and act quickly as a group, we won't. Our mountains would never be the same without Carolina and eastern hemlocks and all the creatures that depend on them.

Through efforts by the North Carolina Department of Agriculture and Consumer Services, USDA Forest Service, and USDA Animal and Plant Health Inspection Service (APHIS), money is being made available to spread these *Laricobius nigrinus* beetles into every watershed in western North Carolina with hemlocks. A "Beetles Save Needles" guidesheet has been prepared and is being distributed to interested folks, and classes on survey and detection are being held locally. If you have hemlocks, you should find out if the beetles are already in your area. Communities are especially encouraged to participate.

For more information contact the Blue Ridge Resource Conservation and Development Council at jhartsell@blueridgercd.org. Remember, our green is our gold.

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