

THE EMBATTLED HEMLOCK: BAD GUYS AND HEROS By Morgan R. Mellette

The Hemlock Woolly Adelgid(HWA) is a forest pest that is threatening to significantly destroy, if not completely eradicate, hemlock trees found along the eastern United States from Maine to Georgia. The HWA is a tiny insect that feeds on stored nutrients from young twigs of hemlocks. This results in the loss of needles and new shoots that can seriously affect tree health. The tree dies after about four years, as the needles and branches gradually die and fall off the tree.



*The Bad Guys: Hemlock Woolly Adelgid Infestation.
Photo courtesy of Connecticut Agricultural Experiment
Station Archives, Bugwood.org*

The HWA is an invasive insect that originated in Asia. It is native to Japan, India, southwestern China, and Taiwan. Surprisingly, the insect is harmless in its native area, as well

as in the western U. S., where it ranges from northern California to southeastern Alaska. Foresters first observed the HWA in the eastern U. S. around 1950, near Richmond Virginia. It has since spread into 16 states along the eastern seaboard, from northeast Georgia to southeastern Maine. Over the past 15 years, the main infestation has spread at a rate of roughly 15 – 20 miles per year.

Eastern hemlock is an important component of northeastern and Appalachian forests, often forming nearly pure stands. It grows on almost 19 million acres of forest in the Eastern United States and is the predominant species on 2.3

million acres. The range of eastern hemlock extends from Nova Scotia to Georgia and westward to Minnesota. The other hemlock growing in the East, Carolina hemlock, is limited to the Blue Ridge Mountains of the Southern Appalachians. Eastern hemlock is a large, majestic tree that can live for 800 years or more. A mature tree reaching over 175 feet tall with a diameter of more than 6 feet is among the largest specimens recorded. Although similar in appearance, mature Carolina hemlock is typically smaller, reaching heights of 55 feet and 2 to 3 feet in diameter on larger specimens. The HWA threatens both of these hemlock species.

Eastern hemlock grows on a wide range of sites from ridge tops to swamps. Like all hemlock species, it is intolerant of drought and typically occurs where soil is constantly moist. The dense, evergreen canopy associated with mature hemlock forests creates a unique environment that is a critical habitat for many animal and plant species. Hemlock forests also provide thermal cover and forage for a variety of mammals, including porcupines and white-tailed deer. Nearly 90 species of birds thrive in hemlock forests. Several species are significantly associated with hemlock forests, including the black-throated green warbler, Blackburnian warbler, and Acadian flycatcher. A wide variety of aquatic species, brook trout for example, is more likely to live in streams sheltered by hemlock than streams sheltered by hardwoods. Hemlock maintains aquatic habitat integrity by regulating stream flow and moderating water temperature. Hemlock-shaded streams have lower summer temperatures and are less likely to dry up. Loss of existing stands of hemlocks will result in a significant change to the forest ecosystem.

How can we stop the spread of this voracious invader that threatens the beautiful hemlock forests in the eastern United States? Foresters are learning to control HWA by three different means: cultural, chemical, and biological.

Cultural control includes management techniques that will insure healthy hemlock trees. Mulching and irrigating ornamental trees during prolonged droughts; quarantines that limit the movement of logs, firewood and seedlings from infected areas; and removing isolated infested trees are simple cultural controls that will help to reduce the spread of the HWA. Bird feeders should not be placed near hemlocks because birds have been known to transport both egg masses and crawlers for long distances.



Soil Drenching. Photo courtesy of Great Smokey Mountains National Park Resource Management Archives, USDI National Park Service, Bugwood.org

The high cost of insecticides limits chemical controls to individual high-value trees. Chemical treatment is not a permanent solution, so repeated applications at intervals ranging from several months to a few years will be necessary. The most effective chemical control is imidachlorpid injected into the soil next to the tree or into the tree itself. Imidacloprid is a relatively

new pesticide developed by the Bayer Corporation that is available to landscapers, arborists and nursery managers; some homeowner formulations

are also available at garden centers. Some of the trademark common names for Imidacloprid products include Merit, Marathon, Grub-ex, and Imicide Soil injections and soil drenching appear to last longer and do not harm the trunk as tree injections can. However, there is not much information available as to the effect soil injected imidachlorprid can have on aquatic and soil organisms. Therefore, trunk injections may be better suited for locations where there may be concern about releasing imidachlorprid into the soil environment.

Incases where HWA have infested larger forested areas, the best control strategy is biological. In 1992, foresters with the USDA Forest Service Forest Health Technology Team discovered a lady beetle in Japan that is the natural enemy of the HWA. Both the larvae (young stage) and the adult beetle



The Heroes: Japanese Lady Beetle that is being Used for Biological Control of the Hemlock Woolly Adelgid. Photo courtesy of Carol Chea, Agricultural Experiment Station, Bugwood.org

feed on all of the growth stages of the HWA. In fact, researchers found that the predator beetle had effectively consumed 86% - 99% of all of the HWA in 24 of 74 infested forests and ornamental hemlocks that they studied in Japan. This potential hero of the hemlock forest is such an effective control mechanism for several reasons:

- It is adapted to a wide range of climate conditions
- It strongly prefers to feed on the HWA
- It has at least two generations per year
- Its life cycle is synchronized with that of the HWA
- It has a high searching efficiency and dispersal ability

Forest researchers have since discovered several other natural predators, some of which are native to North America.

The USDA Forest Service has developed a HWA Working Group to develop and implement plans to stop the spread of the HWA. Their Hemlock Woolly Adelgid Newsletter, August 2006, states, “Our focus is to develop and implement management tools that minimize the impact of HWA in the Eastern United States. More than \$5.7 million was provided by USDA Forest Service State and Private Forestry (\$3.3 million) and Research and Development (\$2.4 million) to support this effort in 2006. ... Nearly 75 percent of the funding is directed toward developing and implementing biological and chemical control strategies. Here’s a brief overview of biological ... control activities:

- 1) exploration in China, Japan, and the Western United States to find new natural enemies;
- 2) learning how to rear predators on artificial diets;
- 3) accurately and quickly screening newly discovered predators to ensure their desirability and safety; and

4) releasing and establishing HWA predators and evaluating their impact on HWA and hemlock health. This year, more than 260,000 *Sasajiscymnus tsugae* beetles were reared and released (mostly in the South), and more than 5,000 each of *Laricobius nigrinus* and *Scymnus sinuanodulus* beetles were released at sites from Connecticut to Georgia.”

Clemson University in South Carolina has been raising and releasing two different species of predator beetles since 2003. In 2003-2004, they released over 105,000 beetles at 41 sites in North Carolina, South Carolina, and Georgia. In 2004-2005, they released over 211,000 at over 110 sites located throughout the tri-state region. In mid May of 2005, forest researchers at Clemson University began an experimental release of beetle eggs that has proven to be quite promising. And the war against the HWA continues across the eastern United States, as over 1.5 million beetles have been released from staging areas being located at Forest Service and university extension service research labs in 15 states.

From the Hemlock Woolly Adelgid Newsletter, August 2006, “*Are the predators being released working?* The impact of these predators is extremely difficult to measure and may take decades before we really know. Our goal is to establish a complex of natural enemies that will self perpetuate and prevent HWA outbreaks. Each predator is unique in its dispersal, reproductive potential, feeding behavior, and suitable climate regimes. But they all share two important traits—they are very host specific and have a voracious appetite for HWA.”

Contact Mellette Forestry Group at (770) 718-9954, or morgan@melletteforestry.com, for more information about identifying and controlling the Hemlock Woolly Adelgid on your property.

We have taken information from the following publications for this article:

1. Ward, Jeffrey, et al. "Eastern Hemlock Forests: Guidelines to Minimize the Impacts of Hemlock Woolly Adelgid." The Connecticut Agricultural Experiment Station; USDA Forest Service, Northeastern Research Station; USDA Forest Service, Northeastern Area State and Private Forestry. May 2004.
2. McClure, Mark. "Biological Control of Hemlock Woolly Adelgid in the Eastern United States." Forest Health Technology Team. January 2001.
3. Onken, Brad, and Souto, Dennis. "Hemlock Woolly Adelgid Newsletter, Issue No. 7." USDA Forest Service Northeastern Area State and Private Forestry, *Forest Health Protection*. August 2006.