

Stem injections: In this systemic treatment, imidacloprid is injected into the trunk of the tree. This application is normally recommended for trees growing in very rocky soils where soil treatments cannot be made. Stem injection treatments require specialized equipment and are usually made by professional arborists. The higher cost and tree wounding associated with stem injections should be considered before using this method.

Biological Control



Because HWA is not native to the eastern U.S., few predators exist to limit its population growth. Survival of the hemlock species is dependent on the establishment of biological agents to keep the HWA population in check. Researchers are now using four kinds of predacious beetles to fight HWA. Two species of beetles native to Asia, *Scymnus sinuanodulus* and *Sasajiscymnus tsugae*, and two species native to the Pacific NW, *Laricobius nigrinus* and *Scymnus coniferarum*, are currently being released in Georgia (Figures 6, 7, 8 & 9). These beetles are mass reared in labs in Georgia and surrounding states and collected from hemlock in the Pacific northwest. Research is ongoing into other predatory insects and diseases that can control HWA.

Figures 6, 7, 8 & 9 - Predator beetles being used to control HWA. From top: *Scymnus sinuanodulus*, *Sasajiscymnus tsugae*, *Laricobius nigrinus*, and *Scymnus coniferarum*.



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The Hemlock Woolly Adelgid in Georgia

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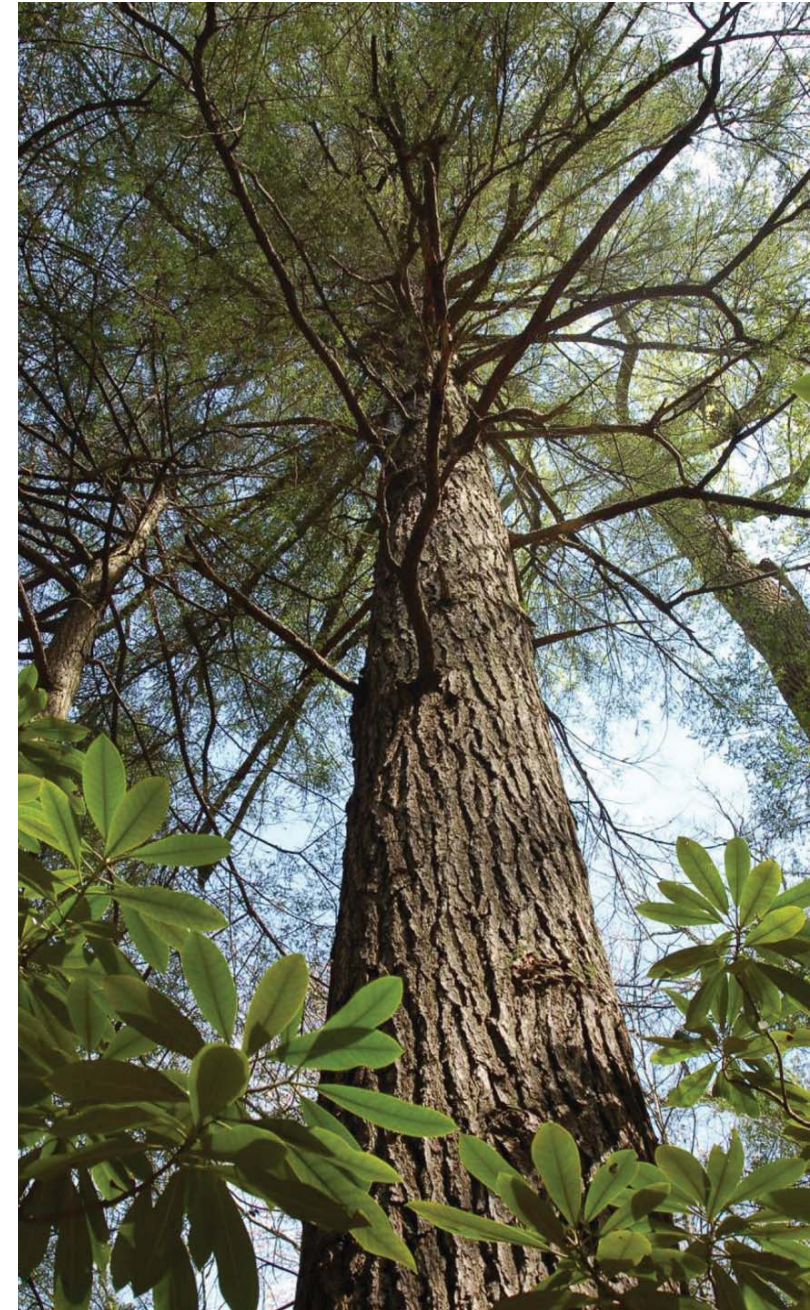
Figure 8 - Guangyu Li, Chinese Academy of Forestry

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References: Jefferey S. Ward, Michael E. Montgomery, Carole A.S.J. Cheab, Brad P. Onken, and Richard S. Cowles 2004. *Eastern Hemlock Forests: Guidelines to Minimize the Impacts of Hemlock Woolly Adelgid.*

Funds for this publication are provided by the USDA Forest Service.

Thanks to Dr. Tom Coleman and UGA for review of this publication.



What is the Hemlock Woolly Adelgid?

The hemlock woolly adelgid (HWA) is a tiny pest posing a giant threat to hemlock trees in Georgia. It is an aphid-like insect that feeds on the sap of eastern and carolina hemlock trees and is capable of causing tree death within four to ten years of infestation.

History of Spread

HWA was accidentally introduced into Virginia in the 1950s. The insect is native to Japan, China, and the United States' Pacific Northwest region. HWA was first discovered in Georgia in 2003 near the Ellicott Rock area of Rabun County and can now be found in all Georgia counties where native hemlock occurs. The Georgia Forestry Commission conducts annual surveys to find newly infested areas. The adelgid is dispersed by wind, birds, and human activity. It has spread at an alarming rate.

Identification

The hemlock woolly adelgid is a tiny insect measuring approximately 1/16 of an inch long. As the adelgid matures, it produces and covers itself and its eggs with a white, waxy filament (Figure 1). This waxy covering provides protection from predators and from drying out. The adelgid is most conspicuous from late fall to early summer when the "woolly" covering is present. Adelgids are found primarily on the underside of branches at the base of needles on the newest growth.



Figure 1 - Mature HWA and ovisacs in late winter.

Life Cycle in Georgia

HWA completes two generations a year, a winter and spring generation, which are both all-female and wingless. Adults of the winter generation are capable of laying up to 300 eggs. These eggs, which are the beginning of the spring generation, will begin to hatch during the month of March. Crawlers, the first nymphal stage and dispersal phase, move out in search of suitable feeding locations. The crawler

settles at the base of a needle, then inserts a long feeding tube called a stylet. The developing adelgid will remain here until reaching maturity in May to early June. If tree health is very poor, a portion of the spring generation will form into winged adults that fly off in search of a spruce tree. However, no suitable species of spruce is found in North America, resulting in the death of the winged adelgids. The spring generation adults that remain on the tree lay 20-75 eggs each, beginning the winter generation. Crawlers hatch from the eggs in late June to early July and disperse to settle



Figure 2 - HWA nymphs in summer dormancy.

on the newest hemlock growth. Once attached, the nymphs go dormant for the summer and no wool is produced during this time (Figure 2). In early October the nymphs break dormancy and begin to feed and produce their woolly covering. The nymphs become mature adults by mid February to mid March.

Damage



Figure 3 - Hemlock tree in serious decline due to HWA infestation.

All ages and sizes of hemlocks can be attacked by the HWA. The pest causes damage to the tree by feeding on the starch it produces. This inhibits the tree's ability to produce new growth. Trees that have been infested for a couple of years will show visible signs of decline. Unhealthy hemlocks will appear a dull green to gray color, possess premature needle loss, and exhibit branch die-back (Figure 3). Tree mortality usually occurs after four to ten years of infestation.

Chemical Control Recommendations

Several options are available for chemical control of HWA. Because tree death from HWA is not sudden, it is recommended that treatment options only be used when HWA is present on the

tree or is known to be in your immediate area. Always follow the product label when applying chemicals. The following describes three basic treatments for controlling the hemlock woolly adelgid. More detailed information on HWA control can be found at GaTrees.org.

Soil Treatments: In this systemic treatment, an approved insecticide is applied to the soil around the base of the tree and is taken up by the root system. There are several products that are labeled for this type of application. This includes products that contain the active ingredient, imidacloprid, such as Bayer Advanced Tree & Shrub Insect Control®, Merit®, Imidipro®, Touchstone®, Zenith®, Quali-Pro®, and Lesco®. A product called Safari 20 SG®, containing the active ingredient



Figure 4 - Insecticide being applied by using a soil injector to inject the chemical into the ground.



Figure 5 - Insecticide being applied to the soil by mixing the chemical with water and pouring around the tree.

is also effective. Bayer Advanced Tree & Shrub Insect Control® can be purchased at most hardware stores and the other products can be purchased from pesticide distributors or some farm supply stores. The application is made by mixing the chemical with water and injecting or pouring it into the soil around the base of the tree (Figures 4 & 5). Soil applications are best made in the spring (March to early June) or fall (mid-September to mid-November) when adequate soil moisture is present. Avoid applications to frozen or waterlogged soil. One application can provide protection for two to three years. Soil injection is currently the most effective approach for treating HWA.