The Plant Doctor's LANDSCAPE TIPS

By David L. Roberts, Ph.D., *Senior Academic Specialist, College of Agriculture and Natural Resources, Michigan State University*

HWA: HERE TO STAY

INTRODUCTION:

The Hemlock Wooly Adelgid (*Adelges tsugae*) is an invasive, introduced pest that probably originated from Japan or other parts of Asia (Photo 1). It was first found on the West Coast of the U.S. in the 1920s, but it is somewhat disputed whether it was introduced there or is simply a native population. The insect was first detected on the East Coast in the early 1950s near Richmond, Virginia. By 2005 the HWA had become established in 16 states ranging from Maine to Georgia.

While the insect in not considered to be particularly troublesome on the West Coast, it is highly destructive to Eastern Hemlock (*Tsuga canadensis*), a.k.a. Canadian hemlock, and Carolina Hemlock (*Tsuga caroliniana*) on the East Coast (Photo 2). Since the 1950s, the pest has migrated throughout many of the eastern states and into the Appalachian/Smokey Mountain regions (Fig 1).

HWA has been introduced into Michigan on several occasions in the last couple of decades. With these prior introductions, the pest was detected relatively early and successfully eradicated by the use of "slash and burn" techniques, employed by the various state departments (MDARD, DNR, etc.). A new infestation was detected on Michigan's west coast (Lake Michigan) during 2016. This new infestation was evaluated for possible eradication; it was determined that the HWA could not be easily eliminated due to its widespread distribution. Hence, the HWA is here to stay.

Photo 1: The Hemlock Wooly Adelgid (HWA) is an introduced, invasive, lethal pest of hemlock, most easily recognizable by its white, waxy, fluffy appearance. In 2016, the pest was discovered in a rather widely distributed area in Western Michigan; it is unlikely that the HWA can be eradicated and with time will likely spread throughout Michigan. (Photo credit: Connecticut Agricultural Experiment Station, Bugwood.org).

PEST BIOLOGY AND CYCLE:

The HWA is a small, aphid-like insect, approximately 1/16 inch long; it is most easily recognizable when it produces a waxy, cottony coating around its body (Photo 1). Underneath that waxy coating, the insect ranges in coloration from dark reddish brown to dark purple (Photo 3). The insect reproduces by parthenogenesis (asexually), which means that young are produced by females without traditional fertilization by males. All HWA are females. The

Continued on page 10

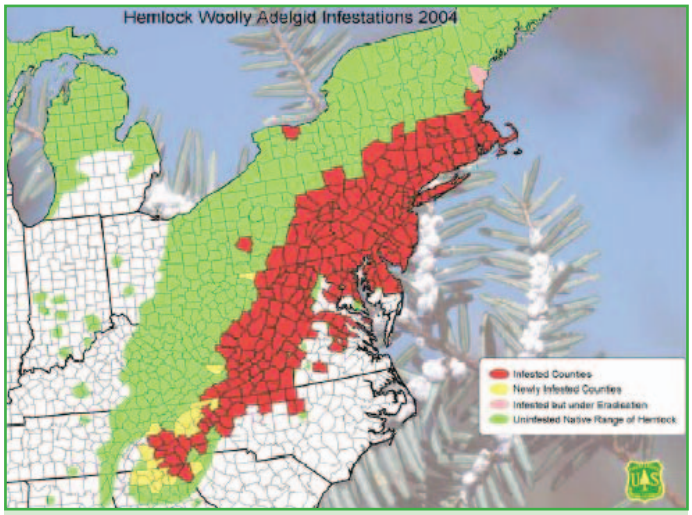

Figure 1: A map of the distribution of Hemlocks and the HWA as of 2004. (Credit: USDA Forest Service).

Photo 2: Destruction of Hemlock trees is very evident throughout many eastern states. (Photo credit: USDA Forest Service).

Photos 3: Nymphs of the HWA without the waxy coating. (Photo credit: USDA Forest Service).

The Plant Doctor's LANDSCAPE TIPS

HWA: HERE TO STAY

Continued from page 9

insects develop from an egg stage, through four nymphal instar stages, to an adult. As the insects mature, they produce filaments of wax that protect the eggs, nymphs and adults from desiccation and predation. These waxy coatings, known as "ovisacs," are most easily observed during the late fall to early summer on the undersides and tips of hemlock twigs (Photo 1 & Photo 4).

Photo 4: Although HWA is most easily recognizable during the late fall to early summer period, when waxy coatings are fresh (Photo 1), it may also be observed at other times of the year, even though the waxy coatings may have disintegrated somewhat.

Photo 5: Other issues may kill hemlocks or stress the trees to induce greater susceptibility to the HWA. In the author's experience, *Armillaria* root rot is not uncommon on hemlocks. Note white latex paint-like fungal mycelium beneath the bark (shown here on arborvitae).

The insect typically completes two (overlapping) generations per year. Unusual for this type of pest, hot summer temperatures can induce dormancy; cooler periods cause a resumption of feeding and development.

In regards to HWA spread, the insect's first instar is a crawler stage that may move locally on a tree branch or longer distances by wind dissemination. This and other stages may also be picked up and dispersed greater distances by birds and animals. And, of course, the HWA may be transported on nursery transplants, perhaps even on tree parts.

The HWA kills trees by literally "sucking the life" out of the trees. The insect is particularly interested in feeding on the host tree's starches, which are critical for the tree's health and long term survival. Initial symptoms include needle browning and branch death. Tree death usually occurs within 4-10 years after initial infestation. Hemlocks are more readily killed when the HWA attacks trees already stressed by such factors as drought, poor growing sites, spruce spider mites, various scales including the elongate hemlock scale, spruce budworm, gypsy moth, hemlock sawfly ,fir flat-headed borers, needle rust and Armillaria root rot (Photo 5), among others.

HWA MANAGEMENT:

In Michigan forest situations, gaging by the experiences of eastern states, HWA attacks on hemlocks will be highly destructive to populations of trees. This widespread destruction of forest hemlock will also likely have collateral adverse impacts on other plant and animal life.

Fortunately, for landscape trees, or perhaps even small, well managed woodlands, hemlock trees can easily be saved from HWA infestations and subsequent destruction by employing some rather simple practices (Photo 6).

Cultural Management: Unlike most conifers, hemlocks tolerate shade and are often used as understory trees as diffuse screens. They also tolerate full sun. Also unusual when compared to many other conifers, this specie tolerates high pH/calcareous soils. Hemlock prefers rich, well drained soils but will thrive on sandy sites. Heavy clay soils and poor drainage will likely result in the decline and death of hemlock. The author has noted that hemlock can be temperamental in landscape sites with poor soils and excessive irrigation. Avoiding conditions that stress hemlock will enable the tree to better resist attack by the HWA, especially when combined with insecticidal treatment.

Biological Management: Various predators and parasites have been studied to thwart the activities of the HWA. Some have been introduced from Asia. With this ongoing research, biological

control of the HWA has generally not reduced the pest's attack on hemlock trees to below threshold levels that permit tree survival.

Chemical Management: The HWA can be managed by applications of various chemicals. The theory behind chemical treatment is to "knock back" the populations of the HWA on Hemlock trees every so often to preclude debilitating feeding injury and subsequent death of the tree. Generally, innocuous chemical cover sprays such as with insecticidal soaps and oils can be effective. Traditional insecticidal sprays can also be very effective. For treatments that might be considered more environmentally friendly, trunk injections or soil injections can be administered without as much threat to pollinators (Photos 7 & 8) when compared to traditional, broad-ranging, cover sprays. Possibly the easiest and most efficacious treatment is to simply inject Imidacloprid into the soil beneath hemlocks every year or two.

When applying pesticides, be sure to follow label directions. The author does not endorse any particular products or company. For more information or if anyone has questions or comments, please feel free to contact the author at robertsd@msu.edu or at (248) 320-7124.

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Photo 6: These landscape trees are infested with the HWA (see Photo 4). Saving Hemlock trees is a relatively simple proposition, provided they are not too advanced in decline from HWA.

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Photo 7: Trunk injections of an insecticide, in this case Pointer by the Wedgle Direct-Inject System, should be efficacious.

Photo 8: Possibly the easiest as well as highly effective treatment is to inject a systemic insecticide (example: Imidacloprid) into the soil beneath the hemlock tree every year or two. This is the E-Z-Ject soil injector from Arborsystems, Inc.