



Hemlock Woolly Adelgid

Adelges tsugae Annand (Hemiptera: Adelgidae)

Introduction:

The Hemlock Woolly Adelgid (HWA) is an invasive, aphid-like insect from Asia believed to have been accidentally introduced into North America on imported nursery plants. HWA were first reported on the west coast in the 1920's, then near Richmond, VA, around 1950. It is now a serious pest of eastern hemlock (*Tsuga canadensis*) in the U.S. Eastern hemlocks are critical in providing a unique habitat for wildlife and in maintaining forest stream ecosystems. There is not an ecologically equivalent tree species that can take the place of eastern hemlock.

North American Distribution/Spread:

In the Pacific Northwest, HWA is found in relatively low numbers from northern California to southeastern Alaska. The eastern distribution of HWA ranges through at least 17 states, including all the New England states, south to Georgia, and west to Tennessee. Nearly half the hemlock range in the eastern U.S. is infested with HWA, and the entire range is at risk. The average rate of spread over the past decade has been about 15 miles/year, but it can be more explosive when conditions are right.

Local spread of HWA occurs primarily from 1st instar crawlers and cottony ovisacs being carried by wind, birds or forest animals. Long-distance movement of HWA occurs when people transport infested nursery stock, accidentally spreading HWA to uninfested areas. State quarantines require inspection of hemlock nursery stock and restrict the movement of infested materials into uninfested areas.

Host Plants:

In the Pacific Northwest, HWA is found on western and mountain hemlocks but has little impact on these resistant species. In the eastern U.S., however, HWA are highly destructive on eastern hemlock (*Tsuga Canadensis*, also known as Canadian hemlock and Hemlock Spruce) and Carolina hemlock (*Tsuga caroliniana*).

Biology and Damage:

HWA is parthenogenetic (all individuals are females) and completes two generations (progreddiens and sistens) a year, each having six stages of development: egg, four nymphal instars, and adult. The two generations differ in notable ways. The progreddiens, or spring generation, hatch in early spring (March) from eggs laid in late winter and live about 3 months. There are two nymphal forms: a winged form, which soon dies, and wingless crawlers which settle permanently at the base of hemlock needles, begin feeding, and secrete a protective woolly covering. Progreddiens complete nymphal development stages by early summer (June), after which the new adults will each lay 20-75 eggs in cottony masses attached to twigs.



Severe HWA infestation on hemlock twig. Connecticut Agricultural Experiment Station Archive, Bugwood.org

The sistens, or winter generation, hatch from progreddien eggs as wingless crawlers (1st instar nymphs) in June and July, and live about 9 months. The crawler stage is not protected by a woolly covering, and is the only life stage of HWA able to move about. Within days sisten crawlers attach at the base of hemlock needles, and soon after aestivate (enter dormancy) for the hot summer months, an unusual characteristic of HWA. During aestivation, nymphs have only a tiny halo of white woolly wax outlining their bodies. When cool fall weather arrives, sisten nymphs break aestivation, resume feeding, secrete a woolly covering, and develop throughout the winter, maturing in early spring. In March, sisten adults each lay up to 300 eggs in protective cottony ovisacs, which give rise to a new progreddiens generation. The two generations may overlap in mid to late-spring.

Identification:

- Adult HWA are tiny (~ 1/16" or 1-2 mm), oval shaped aphid-like insects, dark reddish-brown to purplish-black in color.
- Eggs are brownish-orange, darken as they mature, and are covered with white, woolly filaments.



Close-up of HWA adult and eggs inside cottony ovisac. Michael Montgomery, USDA Forest Service, Bugwood.org

- Flat, naked reddish-brown crawlers (nymphs) hatch out and move about actively.
- Once crawlers settle, they turn black with a white halo of fringe outlining their body.
- The wingless nymphs resemble adults but are smaller.
- As HWA mature, they produce a covering of fluffy, white wool-like wax filaments.
- Woolly masses are ~ 1/8" (3 mm) in diameter and are most conspicuous late-fall to early- summer at the base of needles on the underside of the outermost twigs of hemlock trees.



HWA crawlers emerging from ovisacs: PA Dept. of Conservation and Natural Resources, Bugwood.org. Inset: 1st instar nymph with halo, Scott Salom, Va Tech

What to Look For:

HWA infest and kill hemlocks of all sizes and ages, under all growing conditions, by sucking up the tree's sap and feeding on stored starch reserves.

Symptoms of HWA infestation include:

- Heavily infested hemlocks look grayish/green (not yellow/brown) within a few months as needles desiccate and die.
- Needles drop and most buds are killed, so that little or no new foliage is produced.
- HWA are easily recognized on infested branches by their white, fluffy, wool-like coverings.

- Dieback of major limbs, progressing from the bottom to the top of the tree.



Infested hemlock needles turn grayish/green. James Johnson, Georgia Forestry Commission, Bugwood.org

- Foliage is usually sparse at branch tips and in the top of the crown.
- Weakened trees are often attacked by other diseases and insects, and easily broken by wind.
- A tree may defoliate and die within 4-10 years of infestation in the northern range of HWA, or as little as 3-6 years in its southern range.

How to Report a Possible Sighting/Infestation

In Maryland:

University of Maryland Cooperative Extension Exotic Pest Threats Website: <http://hgic.umd.edu/faq/sendAQuestion.cfm>

Maryland Department of Agriculture: call 410-841-5920 to report suspect pests; visit http://www.mda.state.md.us/plants-pests/invasive_species.php for information.

Nationally: USDA-Animal and Plant Health Inspection Service (APHIS) at http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml

**HWA Woolly Mass
Actual Size:**



Where to Get More Information:

UMD Cooperative Extension Exotic Pest Threats Website: <http://www.PestThreats.umd.edu/index.cfm>

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