Adelges tsugae 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Homoptera	Adelgidae

Common name hemlock woolly adelgid (English)

Synonym

Similar species

Summary Adelges tsugae is a small, aphid-like insect that has become a serious pest of eastern hemlock and Carolina hemlock. The most obvious sign of infestation is the presence of white, woolly egg masses on the underside of hemlock needles. Infested eastern North American hemlocks defoliate prematurely and will eventually die if left untreated. A. tsugae is a difficult insect to control as the white waxy secretion protects it from pesticides. It is dispersed to new habitats through the nursery trade and locally by wind, birds, mammals and humans. Hemlock trees provide important habitats for many wildlife species and A. tsugae has severe adverse ecological impacts which will become more severe as its distribution expands.

view this species on IUCN Red List

Species Description

Adelges tsugae is a small (0.74mm), reddish-purple, aphid-like insect that covers itself with a white, waxy secretion. Both winged and wingless forms are present. Their mouthparts are thread-like and about 1.5mm long and used to suck sap. Eggs are brownish-orange but darken as the embryo matures. When the eggs hatch, reddish-brown crawlers move about actively in search of a suitable site to settle. The tiny crawlers can only be seen with a hand lens as they are barely visible to the naked eye. Once the crawlers settle, they insert their mouthparts into the plant at the base of the hemlock needles and remain in the same place for the duration of their life. Dormant first instar nymphs are black with a white fringe around the edge and down the center of the back. The developing nymphs produce white, cottony, waxy tufts that cover their bodies. The white masses are 3mm or more in diameter. The presence of these masses on the twigs and bark of hemlock is a sure sign of *A. tsugae*.

Notes

Some of the adults produced during the spring generation are winged individuals that are unable to reproduce on hemlock, therefore they leave the hemlock tree in search of spruce, the alternate host. But because no suitable spruce host is available in North America, they soon die. Hemlocks growing in poor conditions (compacted soils, ledgy soils, poor drainage, drought prone, etc.) are much more likely to succumb within 3-5 years from invasion. Hemlocks growing under better growing conditions have been shown to withstand infestations longer.

Lifecycle Stages
Spring generation adults lay numerous eggs within large, white, woolly sacs. The eggs hatch and crawlers from the second generation move to attach themselves to new needles. Once they find a site, they settle and become dormant (no feeding) until fall (autumn). At that time, they end their dormancy and begin to feed and develop through the fall and winter. *A. tsugae* is atypical of most insect species in that it is inactive for much of the growing season and very active throughout the winter.

Habitat Description
The secondary host of *Adelges tsugae* is hemlock (where the asexual cycle occurs), and spruce is the primary host where the sexual cycle occurs. Experts hope that an aversion to cold weather will slow or stop its northern movement. In New Jersey and Connecticut, a large population of *Adelges tsugae* died as a result of a cold period in the winter of 2000.

Reproduction
Adelges tsugae has both sexual and asexual (parthenogenic) reproduction. The asexual cycle occurs on hemlock while the sexual stage occurs on spruce. *A. tsugae* has two asexual generations per year on hemlock. Each adult can produce between 50-300 eggs within its lifetime. *A. tsugae*'s reproductive output, and its lacks of natural enemies has caused populations to explode in North America.

Nutrition
Adelges tsugae utilises hemlock as its secondary host, where the asexual cycle occurs and spruce as its primary host, where the sexual cycle occurs. In North America the sexual cycle has not been previously recorded. Young twigs are the preferred feeding sites. Immature nymphs and adults feed on trees by sucking sap from the twigs. They attach themselves just below the base (abscission layer) of newly developed needles and feed on xylem parenchyma cells (tissue that manufactures and stores plant food).

General Impacts
Adelges tsugae is damaging hemlock ecosystems in eastern North America where both eastern hemlock (see *Tsuga canadensis* in IUCN Red List of Threatened Species) and Carolina hemlock (*T. caroliniana*) serve as hosts. To date, approximately 25% of the 1.3 million hectares of host type has been infested. The entire range of eastern hemlock is at risk within the next 20 to 30 years. Immature nymphs as well as adults damage trees by sucking sap from the twigs. The trees lose vigour and prematurely drop their needles, to the point of defoliation, which may lead to death. If left uncontrolled, the adelgids can kill a tree within three to four years. Trees of all sizes and ages are attacked, but natural stands of hemlock are at greatest risk for death. The value of ornamental hemlocks is reduced by the presence of the dirty, white woolly masses attached to the twigs or base of needles. Eastern hemlock is economically important in several areas of the eastern United States. The nursery industry in North Carolina and Tennessee currently maintains approximately $34 million in hemlock growing stock. This industry is feeling the effects of *A. tsugae* in reduced sales of native hemlock for ornamental use. The impact of *A. piceae* on the wood products industry of the north-eastern U.S. could be substantial. Hemlock trees are ecologically important and provide a unique environment. The lifespan of an eastern hemlock can reach 900 years and this tree is a component of many old growth communities. The hemlock forest also provides nesting sites and a foraging habitat for neotropical migratory bird species. Several threatened or endangered species of flora and fauna require hemlock forests to survive. These forests are normally stable and resistant to plant invasions, so the loss of hemlocks from such forests will greatly affect the microclimate and soil conditions. Large-scale hemlock die-offs will affect species diversity, vegetation structure, stand environmental conditions and ecosystem processes. For example, lepidopterans, like *Semiothisa fissinotata*, which feed solely on hemlocks, will be affected.

Management Info
The USDA Forest Service has produced a handbook which summarises current scientific knowledge of the impact of *Adelges tsugae* on eastern hemlock forests. It is designed to help resource managers make informed decisions in preparing management plans to deal with the hemlock woolly adelgid. For more details on management of *Adelges tsugae*, please follow this link *Adelges tsugae management compiled by the ISSG*

Pathway
Adelges tsugae was inadvertently shipped to Maine from Connecticut on untreated nursery stock in 1999.*Adelges tsugae* was accidentally introduced to the North American continent earlier this century (McClure 1987).

Principal source: USDA Forest Service - Hemlock Woolly Adelgid website. Northeastern Area Forest Health Protection

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

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ALIEN RANGE

[1] CANADA
[1] TAIWAN
[1] INDIA
[28] UNITED STATES

Red List assessed species 1: LR/lc = 1;

Tsuga canadensis **LR/lc**

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