

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 lack 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 fassinotata*, which feed solely on hemlocks, will be affected.



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Adelges tsugae*

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)

Review: Gabriella (Riella) Zilahi-Balogh, PhD Entomologist/Entomologiste Programme Officer, Plant Health/agent de programme, protection des végétaux Canada

Publication date: 2007-02-09

ALIEN RANGE

[1] CANADA
[1] TAIWAN

[1] INDIA
[28] UNITED STATES

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

[Tsuga canadensis](#) LR/lc

BIBLIOGRAPHY

40 references found for *Adelges tsugae*

Management information

Asaro, C., Berisford, C.W., Montgomery, M.E., Rhea, J. and Hanula, J. 2005. Biological control of the hemlock woolly adelgid in the Southern Appalachians. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Cheah, C.A.S-J., Mayer, M.A., Palmer, D., Scudder, T. and Chianese, R. 2005. Assessments of biological control of hemlock woolly adelgid with *Sasajiscymnus tsugae* in Connecticut and New Jersey. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Conway, H., Culin, J.D. and Hedden, R. 2004. Introduced biological control agents for hemlock woolly adelgid (HWA). Clemson University Entomology Insect Information Series.

Summary: This fact sheet provides information about the biological control agents used for *A. tsugae* in the USA.

Cowles, R.S., Cheah, C. S-J. and Montgomery, M.E. 2005. Comparing systemic imidacloprid application methods for controlling hemlock woolly adelgid. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Cowles, R.S. Soil application of imidacloprid to control hemlock woolly adelgid: best management practices. USDA Forest Service, Hemlock Woolly Adelgid website: Chemical control.

Evans, R.A. 2002. Hemlock ecosystems and Hemlock Woolly Adlegid at Delaware Water Gap National Recreation Area.

Felton, K. and Onken, B. 2006. Life stages of the hemlock woolly adelgid in the northern range. Prepared by USDA Forest Service, Forest Health Protection, Morgantown, West Virginia.

Havill, N.P. 2005. Using mitochondrial DNA to determine the native range of the Hemlock Woolly Adelgid. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Jefts, S. and Orwig, D. 2005. The effects of HWA outbreaks on ecosystem level changes in Southern New England. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Johnson, K., Taylor, G. and Remaley, T. 2005. Managing hemlock woolly adelgid and balsam woolly adelgid at Great Smoky Mountains National Park. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.

Global Invasive Species Database (GISD) 2026. Species profile *Adelges tsugae*. Available from: <https://www.iucngisd.org/gisd/species.php?sc=230> [Accessed 30 June 2026]

- Mark S. McClure. 1998. Hemlock Woolly Adelgid, *Adelges tsugae* (Annand), The Connecticut Agricultural Experiment Station.
Summary: Detailed report on description, distribution, symptoms of attack, effect on the host, and control.
- Mark S. McClure. Managing Hemlock Woolly Adelgid, *City Trees - The Journal of The Society of Municipal Arborists*, Vol 33, Number 6 November/December 1997.
Summary: Detailed report on description, distribution, symptoms of attack, effect on the host, and control.
- McClure, M.S. 1997. Managing Hemlock Woolly Adelgid. *City Trees - The Journal of The Society of Municipal Arborists*. 33 (6) November/December 1997.
Summary: Detailed report on description, distribution, symptoms of attack, effect on the host, and control.
- McClure, M., Salom, S., Shields, K. 2001. Hemlock woolly adelgid. FHTET-2001-03.
Summary: Includes information on native range of hemlock, and range of hemlock woolly adelgid, the importance of hemlocks in eastern forest ecosystems, and on hosts, life cycle, control and population trends of the hemlock woolly adelgid.
- McClure, M.S. Undated. Hemlock Woolly Adelgid, *Adelges tsugae* (Annand). The Connecticut Agricultural Experiment Station.
Summary: Detailed report on description, distribution, symptoms of attack, effect on the host, and control.
[Michigan Department of Agriculture. 2001. Hemlock woolly adelgid quarantine. Pesticide and Plant Pest Management Division.](#)
- Summary:** This document outlines the quarantine measures undertaken to prevent the spread of *A. tsugae* into Michigan.
Available from: <http://na.fs.fed.us/fhp/hwa/pdfs/miquar.pdf> [Accessed 5 October 2006]
- Morisawa, T., 2003. Hemlock Woolly Adelgid: *Adelges tsugae* Annand, University of California, Davis, The Nature Conservancy.
Summary: Detailed report on description and management of the pest.
- Morisawa, T. 22 March 2000. Hemlock Woolly Adelgid: *Adelges tsugae* Annand, University of California, Davis, The Nature Conservancy.
Summary: Detailed report on description and management of the pest.
- New Hampshire Division of Forests and Lands. 2001. *Hemlock Woolly Adelgid*. Concord, New Hampshire: Department of Resources and Economic Development.
Summary: Brief report on description, distribution, symptoms of attack, effect on the host, and control.
- New Hampshire Division of Forests and Lands. 2001. *Hemlock Woolly Adelgid*. Concord, New Hampshire: Department of Resources and Economic Development.
Summary: Brief report on description, distribution, symptoms of attack, effect on the host, and control.
- Onken, B.P. 2002. Hemlock Woolly Adelgid - a race in time. USDA Forest Service.
- Orwig, D.A. and Kittredge, D. 2005. Silvicultural options for managing hemlock forests threatened by hemlock woolly adelgid. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.
- Pais, R.C. and Polster, K.M. Undated. Strategies for Managing Hemlock Woolly Adelgid (*Adelges tsugae*) in Forests. EcoScientific Solutions LLC, 930 Meadow Avenue, Suite 2B, Scranton, PA 18505.
Summary: A detailed report on methods and management strategies.
- Plant Pest Surveillance Unit. 2005. Canadian Food Inspection Agency website. *Adelges tsugae* (Annand) - hemlock woolly adelgid.
- Rabaglia, R.J. 2005. The Maryland hemlock woolly adelgid management plan. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005
- Salom, S.M. 1999. Hemlock Woolly Adelgid: A Major Threat to Eastern Hemlock. *Virginia Forest Landowner Update*. Spring 1999. 13 (2). Virginia Tech Department of Entomology.
Summary: Report on description, hosts and distribution, symptoms of attack, effect on the host, life history and behavior, and control.
- Salom, S. M., 1999. Virginia Tech Department of Entomology. Hemlock Woolly Adelgid: A Major Threat to Eastern Hemlock, Virginia Forest Landowner Update. Spring 1999 -- Volume 13, No. 2 .
Summary: Report on description, hosts and distribution, symptoms of attack, effect on the host, life history and behavior, and control.
- Snyder, C.D., Young, J.A., Ross, R.M. and Smith, D.R. 2005. Long-term effects of hemlock forest decline on headwater stream communities. In: Onken, B. and Reardon, R. (Compilers). 2005. Third Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, North Carolina. February 1-3, 2005.
- Strategies for Managing Hemlock Woolly Adelgid (*Adelges tsugae*) in Forests Richard C. Pais and Kathleen M. Polster EcoScientific Solutions LLC 930 Meadow Avenue, Suite 2B, Scranton, PA 18505
Summary: A detailed report on methods and management strategies.
- USDA. 3 June 2002, Hemlock Woolly Adelgid Management, USDA Forest Service - Northeastern Area.
Summary: Brief report on key issues and budget history of management strategies.
[USDA Forest Service. 2004. Biological control of hemlock woolly adelgid. USDA Forest Service FHTET-2004-04.](#)
Summary: The Invasive.org website provides detailed information about the biological control of *A. tsugae*.
Available from: <http://www.invasive.org/hwa/index.cfm> [Accessed 5 October 2006]
- USDA Forest Service. 2004. Number of beetles released and release sites by state.
- USDA Forest Service. 2006. List of state and counties with known Hemlock Woolly Adelgid infestations. Prepared by USDA Forest Service, Forest Health Protection, Morgantown, West Virginia.
[USDA Forest Service. 2006. Northeastern area. Hemlock woolly adelgid](#)
Summary: USDA Forest Service website. Provides up to date information on distribution of HWA, management, image gallery, contacts etc.
Available from: <http://na.fs.fed.us/fhp/hwa/> [Accessed 5 September 2006]
- [USDA Forest Service., 2008. Hemlock Woolly Adelgid website. Northeastern Area Forest Health Protection](#)
Summary: USDA Forest Service website. Provides up to date information on distribution of HWA, management, image gallery, contacts etc.
Available from: <http://www.na.fs.fed.us/fhp/hwa/> [Accessed 6 October 2006]
- [USDA National Agricultural Library., 2006. National Invasive Species Information Centre Species profiles Hemlock woolly adelgid.](#)
Summary: This webpage provides extensive links to Federal and State government, University and Internal resources of information on the Hemlock woolly adelgid.
Available from: <http://www.invasivespeciesinfo.gov/animals/hwa.shtml> [Accessed September 2006]
-



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Adelges tsugae*

Ward, J.S., Montgomery, M.E., Cheah, C.A.S-J., Onken, B.P. and Cowles, R.S. 2004. Eastern hemlock forests: Guidelines to minimize the impacts of hemlock woolly adelgid. USDA Forest Service, Northeastern Area State and Private Forestry, Morgantown, West Virginia.
Webb, R.E., Frank, J.R. and Raupp, M.J. 2003. Eastern hemlock recovery from Hemlock Woolly Adelgid damage following imidacloprid therapy. *Journal of Arboriculture*. 29 (5): 298-302.

General information

Salom, S.M., McClure, M.S., Montgomery, M.E., Zilahi-Balogh, G., and Kok, L.T. 2001. Hemlock woolly adelgid in the United States: status of on-going biological control efforts. pp. 87-97. In: IUFRO World Series Vol. 11. Protection of world forests from insect pests: advances in research. Proceedings of the XXI IUFRO World Congress 7-12 August 2000, Kuala Lumpur, Malaysia

Summary: Detailed up to date report on biological control research and field applications.

Available from: The IUFRO Secretariat Seckendorff-Gudent-Weg 8 , A1130 Vienna, Austria: email: iufro@forvie.ac.at: website: <http://iufro.boku.ac.at>

Salom, S.M., M.S. McClure, M.E. Montgomery, G. Zilahi-Balogh, L.T. Kok 2001. Hemlock woolly adelgid in the United States: status of on-going biological control efforts.

Summary: Pages 87-97. In: IUFRO World Series Vol. 11. Protection of world forests from insect pests: advances in research. Proceedings of the XXI IUFRO World Congress 7-12 August 2000, Kuala Lumpur, Malaysia. Available from: The IUFRO Secretariat Seckendorff-Gudent-Weg 8 , A1130 Vienna, Austria: email: iufro@forvie.ac.at: website: <http://iufro.boku.ac.at> Detailed up to date report on biological control research and field applications.