Final Project Report to the NYS IPM Program, Agricultural IPM 2002-2003

Title:
Evaluation of hemlocks for resistance to hemlock woolly adelgid

Project Leader(s):
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Type of grant:
Pest-resistant crops

Project location(s):
Throughout the eastern U.S.

Abstract:
The hemlock woolly adelgid has become firmly established in the Hudson River Valley and Long Island, and is responsible for the loss of vast acreage of virgin hemlock forests and countless hemlocks in managed landscapes. Replanting with susceptible hemlocks is doomed to failure because these trees will be equally susceptible to the adelgid. We plan to evaluate a number of species of hemlock under two fertility regimes for their susceptibility to *A. tsugae* in hopes of identifying species that might be suitable for replanting trees lost to this invasive exotic pest. Because of the severe drought that existed in eastern NY until this summer, however, transplantation of hemlocks needed to be deferred until conditions were more suitable for plant establishment. The plan of work and budget were modified to reflect this cutback in work planned. Trees will be purchased this winter, and planted in spring of 2003.

Background and justification:
Hemlock woolly adelgid (*Adelges tsugae* Annand) is a devastating pest of eastern hemlock (*Tsuga canadensis*) and has become firmly established in the forests of the eastern U.S. In New York, the insect is found throughout the southern Hudson River Valley and Long Island, and ranges as far north as Columbia County, just south of Albany. The insect itself is quite small, but has extremely long mouthparts that allow it to suck nutrients from the vascular system of its host, trees in the genus *Tsuga*. After several years of infestation, the pest is capable of killing mature trees. Several insecticides have been found to effectively control the pest, but their use is not feasible or desirable in many situations. Biological control has been explored, and a species of coccinelid (*Pseudoscymnus tsugae*) native to the home range of *A. tsugae* (eastern Asia) appears to offer potential. Field evaluation of this natural enemy, however, has not yet been completed, and challenges remain in rearing large enough quantities of the predator. In the meantime, hundreds of acres of hemlocks have been lost to the pest, and the character of the devastated landscapes will be drastically changed if the trees are not replaced. Replanting with susceptible hemlocks (*T. canadensis*) is doomed to failure because these trees will be equally susceptible to the adelgid, which is unlikely to be eradicated from the U.S., at least not in the foreseeable future. If these trees could be replanted with trees similar in botanical form and ecological characteristics to *T. canadensis* with the exception of susceptibility to *A. tsugae*, the original character of these landscapes may be at least partially restored. We propose to evaluate a number of species of hemlock for their susceptibility to *A. tsugae* in hopes of identifying species that might be suitable for replanting trees lost to this exotic pest. Anecdotal reports exist claiming that western species of hemlock (e.g. *T. heterophylla* and *T. mertensiana*)

are resistant to the adelgid, but no scientific reports exist in the literature. In addition, it is known that soil fertility impacts susceptibility of eastern hemlock to the adelgid (McClure 1991); fertilized trees are much more susceptible to the pest. It is not clear whether other species of hemlock are similarly affected.

If susceptible hemlocks could be replaced by resistant ones, then pesticide treatment for the pest in managed landscapes could be greatly reduced and areas once forested with susceptible hemlocks could be restored to a state similar to that existing before the adelgid arrived. The loss of mature hemlocks greatly changes the character of forests since these trees normally provide abundant shade and their roots help stabilize soil. The impact on watersheds following the loss of climax trees like hemlocks could be enormous. Knowing how fertility regimes impact susceptibility of hemlocks to the adelgid could also be very important. For example, if adelgids are found to reproduce more abundantly on trees that are merely tolerant of the pest (as opposed to being completely resistant), this would offer guidance to those wishing to reduce overall numbers of the pest as part of an overall pest management program. If soil fertility had little impact on adelgid numbers, however, then this factor could be largely ignored as far as pest management goes.

Objectives:

The objectives for this project were modified (with approval) because of the severe drought conditions in eastern NY state, where the project was to be conducted. The sole objective was to establish plots of several species of hemlock that are expected to possess resistance to hemlock woolly adelgid. Evaluation of these species will be conducted in the future, when they become established.

Procedures:

Plot establishment. Plots containing representatives of the candidate species were to be established in summer of 2002 in Putnam County, NY, an area already colonized by *A. tsugae*. Because of the extreme drought conditions in most of eastern NY state this past year, however, it was decided to defer planting until April or May of 2003, when soil should conditions should be suitable and nursery operators will resume shipment of young trees from the western U.S., where most of this nursery stock is grown.