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Hardy Hemlocks and Salty Pines©

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HARDY HEMLOCKS

Hemlock woolly adelgid (*Adelges tsugae*) is an aphid-like insect that feeds on several species of hemlock in Asia, its homeland, and in North America, where it was introduced early in the last century. Damage occurs from feeding on needles, and can result in death of the tree in as little as 4 years (McClure, 1996). Adelgids are readily distributed by mammals, birds, and wind; and with multiple generations each year, populations can increase dramatically. For the most part, populations of hemlock woolly adelgid cannot be managed effectively. Integrated pest management (IPM) of hemlock adelgid utilizes pest monitoring, cultural practices that enhance tree vigor, and mechanical, chemical, or biological control.

Within its native range, hemlock woolly adelgid feeds harmlessly on several hemlock species: *Tsuga chinensis* in Taiwan, and *T. diversifolia* and *T. sieboldii* in Japan. The adelgid also has been innocuous on Western hemlock (*T. heterophylla*) and mountain hemlock (*T. mertensiana*) during the 80 years it has had a foothold in the Pacific Northwest. However, in Eastern North America, where it was discovered about 50 years ago, hemlock wooly adelgid has caused extensive damage to forests and ornamental plantings of both Eastern (*T. canadensis*) and Carolina hemlock (*T. caroliniana*).

Both the Japanese and the two western North American hemlock species are much more resistant to hemlock woolly adelgid than their Eastern North American counterparts. Although adelgids do survive on these resistant species, they seldom reach densities high enough to cause injury. Planting resistant Japanese and western hemlocks in eastern landscapes should reduce the impact of the adelgid. Of all these species, Western hemlock is the most similar to Eastern hemlock in appearance and utility.

A stumbling block to the use of Western hemlock as a sustainable landscape substitute is cold hardiness. Most commercially available Western hemlock is grown from coastal seed sources that are cold hardy only to USDA Zone 6b (0 to -5°F). The native range of Western hemlock extends from northern California to Alaska, and east to the western slopes of the Rocky Mountains in Montana. Research on the cold hardiness of western hemlock seedlings (Kuser andChing, 1980) has shown that seed collected from northern latitudes and higher elevations are much hardier than those from coastal and low elevation accessions. However, no cold hardy selections of Western hemlock are available in the nursery trade today. Since 1999, URI researchers have collected seed of Western hemlock from the hardiest reaches of its native range. These seed are being grown in Rhode Island and by Western Maine Nurseries in Frieburg, Maine. Lawyer's Nursery of Plains, Montana, also has been collecting "hardy" seed for liner production. Over the next 5 to 10 years, putative cold-hardy accessions of Western hemlock will be grown out in various locations in the northeast for evaluation of cold hardiness. Selected foliar samples also will be evaluated for acclimation and deacclimation to cold temperatures. Promising cold-hardy selections will be propagated by graftage and cuttage for release to the trade.

Recent studies at the University of Rhode Island and around the northeast (Desanto, 2001; McClure and Chea, 1999) are evaluating the biological control of hemlock woolly adelgid using a predatory beetle, *Pseudoscymnus tsugae*, first discovered in Honshu, Japan, in 1992. By combining biological control with the selection of resistant hemlock species it is hoped that, in the future, hemlock woolly adelgid will cease to be a threat to landscape hemlocks.

Another species similar to Eastern hemlock in form and function is the western red cedar (*Thuja plicata*). The native range of this species is similar to that of western hemlock. Like hemlock, it holds its lower branches, making an effective screen or hedge. It is adaptable to northeastern climates, and hardy as far north as central Massachusetts (USDA Zone 5). However, like commercially available Western hemlock, western red cedar are primarily grown from coastal seed sources. We also have collected and germinated seed of Western red cedar from northern Idaho, and will be working with collectors to locate even hardier stock from the Canadian Rockies.

SALTY PINES

As development along the Eastern seaboard has increased, so has the need for salt-tolerant landscape plants, particularly evergreens. Particularly popular are two very salt-tolerant evergreens, Japanese black pine and Austrian pine (*Pinus thunbergii* and *P. nigra*, respectively). Yet, over the past decade these species have undergone a major decline due to the combined effects of turpentine beetle (*Dendroctonus terebrans*) and bluestain fungus (*Leptographium* spp.). Affected pines turn yellow and die, often within the 1st year of infestation. An equally lethal

Table 1. Pine taxa under evaluation in the University Rhode Island Sustainable Landscapes Program.

Taxon (*Pinus*)	Common name	Origin	Notes
banksiana	Jack pine	North America	fast growing, grows well in sand, drought tolerant; salt sensitive?
cembra	Swiss stone pine	Eurasia	long, dark green, waxy needles like Austrian pine; salt sensitive?
heldreichii	Bosnian pine	S. Europe	Dense growth, thick needles like black pines; very slow growing.
peuce	Macedonian pine	Balkans	Similar to *P. cembra*; salt sensitive?
ponderosa	ponderosa pine	Western U.S.A.	Very salt tolerant; fast growing and tolerant of poor soils. Selections?
rigida	pitch pine	Eastern U.S.A.	Salt and sand tolerant native pine; less attractive — selections?
strobiformis	south western white pine	South Western U.S.A.	Salt tolerant 5-needled pine; fast growing, attractive.
virginiana	scrub pine	Eastern U.S.A.	Stress tolerant native pine; less attractive.

pest of Japanese black pine is pinewood nematode, transmitted by certain long-horned borers which feed on healthy trees and breed in logs or dying trees. Furthermore, Austrian pines are susceptible to diplodia tip blight (*Sphaeropsis sapinea*), and other two-needled pines in southern New England are experiencing heavy pest pressure, due to red pine scale and other stressors.

The greatest attraction to Japanese black and Austrian pines in the northeast lies in their superior salt tolerance. Heroic efforts are often made to salvage declining trees, typically through the use of potent insecticides; yet most are doomed. Alternate evergreen plant species that will survive and grow in sandy soil and salt-impacted coastal areas are sorely needed.

Only a few studies have evaluated the salt-tolerance and culture of conifers in coastal landscapes. Locating substitutes for these pines is a top research priority of the URI Sustainable Landscapes Program, which presently is working with a range of pine taxa (Table 1). While the salt tolerance, culture and use of these species needs to be studied in more detail, several represent hopeful alternative species to Japanese black and Austrian pines.

Salt tolerance research by Townsend and Kwolek (1987) found several of these species to be acceptably salt tolerant. In particular, ponderosa and south western white pines survived 2 to 4 years of salt exposure with significantly less damage and mortality than nine other pine taxa. Although no formal studies of diseases of *P. strobiformis* have been conducted, it appears that it is susceptible to pine shoot weevil. Like other five-needled pines, it is not susceptible to turpentine beetle, pinewood nematode, or diplodia. Like the Japanese black pine, *P. strobiformis* is tolerant of high ozone levels, which occur several times each year in the Northeast.

Over the next 5 years URI researchers will evaluate the salt tolerance of these pines as possible substitutes for pest-prone salt-tolerant evergreens that are used in coastal areas and along roadsides in the northeast. To achieve this objective we will obtain and grow liner stock and collect provenance seed of many of these pines. Container-grown plants will undergo preliminary screening for damage from salt spray. Salt damage will be assessed as visible injury, reduction in growth, and winter survival. Taxa and individual plants exhibiting the greatest salt tolerance will be grown on for additional testing and selection. At the same time we will work with cooperating nurseries and landscapers to plant and evaluate test blocks of pines in coastal locations.

The most salt-tolerant seedlings and clones will be propagated vegetatively, by grafting and rooting of cuttings, and be evaluated further. Over the long term, trial blocks will be evaluated for host plant tolerance of salt spray and soil salt, as well as resistance to associated pest complexes.

CONCLUSION

The best landscape plants are those that suffer from no major insect or disease problems. The goal of the URI Sustainable Landscapes Program is the identification, evaluation, release and promotion of pest-free substitutes for the most severely affected landscape taxa. In combination with effective biological control, sustainable landscapes will become the standard.

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