CHEMICAL LOG

Managing Insect Outbreaks

By Dr. Mark S. McClure

One of the most difficult tasks facing sports turf managers and golf course superintendents is protecting trees from insect outbreaks. Insect outbreaks come upon trees quickly with little or no warning, and the damaging effects are often immediately apparent and quickly irreversible.

Many of the most damaging insect outbreaks involve species that were accidentally introduced from other areas of the world. Perhaps the most conspicuous and familiar of all introduced insect pests of trees in the Northeast is the gypsy moth. Indeed, outbreaks of this insect, which tend to occur on an eight- to 10-year cycle, are quite dramatic. Substantial economic and aesthetic losses often result in thousands of acres of urban and rural forests and shade trees.

On the positive side, mortality to deciduous trees following a single gypsy moth attack is uncommon. Instead, individual trees generally survive defoliation and subsequently refoliate with little or no lasting ill effects. However, repeated defoliation does greatly increase tree mortality.

Far more destructive and potentially threatening are the less familiar piercing and sucking insects that were accidentally introduced from Asia during this century. They have become destructive pests of hemlock, pine and several other trees in both forest and ornamental settings in the East.

Insects, such as the hemlock woolly adelgid, the elongate hemlock scale and the red pine scale offer unique and difficult challenges because of their persistently high population densities and their sudden and severe impact on their new host plants. Even vigorous hemlocks and pines have shown no resistance to the buildup of injurious adelgid and scale populations. Important natural enemies in Asia have been ineffective in North America.

The **elongate hemlock scale**, *Fiorinia externa*, feeds on the needles of hemlock by sucking cell fluids from the mesophyll. In the United States, its densities often increase rapidly to levels that cause needles to discolor and drop prematurely, resulting in branch dieback. Hemlocks infested with these scales for five years supported only one-third the total foliar biomass, and they produced only half as much new growth as their uninfested counterparts. Five to 10 successive years of this photosynthetic deficiency usually kill the tree.

The **red pine scale**, *Matsucoccus resimosae* and the **hemlock woolly adelgid**, *Adelges tsugae,* feed on the young twigs of pine and hemlock. They suck sap from the phloem parenchyma. The adelgid probably also injects a toxic saliva while feeding. This feeding causes rapid desiccation and drop of needles, dieback of main limbs and usually death of the tree within two to four years.

Effects of Fertilization

Changes in the quality of hemlock and pine feeding sites as a result of the insect damage has been shown to have a profound affect on insect population levels. As the insects injure their host trees by repeated feeding, their performance on these trees decreases. Fewer nymphs survive overwinter and during the growing season. This produces fewer offspring. Reduced performance has been linked to nutrition.

The nutritional quality of food for piercing and sucking insects generally is related to the quantity of organic nitrogen available to nymphs. Extensive studies have demonstrated the importance of nitrogen to the performance of these species on pine and hemlock.

For example, fertilization experiments revealed that nymphs of elongate hemlock scale incurred 13 percent less mortality and each adult produced 45 percent more offspring on hemlocks whose foliar nitrogen concentrations had been elevated only one percent above the unfertilized controls.

The performance of hemlock woolly adelgid also was enhanced by fertilization. Nymphs incurred 48 percent less mortality and each adult produced twice as many offspring on fertilized trees as on unfertilized ones.

Evidence from other studies suggests that fertilization with nitrogen may be of some use in an integrated management program for chewing insects, such as beetles, caterpillars and sawflies. However, piercing and sucking insects, such as adelgids, aphids and scales generally are favored by an increase in the nitrogen concentration of plant sap, thereby aggravating the problem.

Control Options

Although healthy trees are often susceptible to these outbreak insects, populations are generally higher and more destructive on stressed trees. Therefore, maintaining tree vigor is an important component of any pest management program.

Chemical control of many outbreak insects is possible in ornamental settings where you can thoroughly drench the trees with pesticides. This requires early insect detection and quick action. You need to apply controls before trees become severely or irreversibly damaged.

Horticultural oil, insecticidal soap and several petrochemical pesticides, such as diazinon and malathion, are effective in controlling adelgids and scales on hemlock. As yet, there are no effective controls for pine scale.

Spray-applied control is virtually impossible on very large trees or in forested areas because you can't spray the trees thoroughly. Incomplete pesticide spraying usually results in the rapid resurgence of pest populations.

Stem injection of Bidrin and Metasystox and stem implantations of Acephate may provide six months control of adelgids and scales on hemlock. These methods can be impractical when large numbers of trees are involved.

A successful program for managing insect outbreaks may ultimately require the identification or development through genetic manipulation of effective natural enemies and more resistant host trees.

The subject of insect outbreaks remains complex and highly controversial. Entire volumes have been devoted to a discussion about the nature, the causes and the effects of insect outbreaks, including **Insect Outbreaks** by Barbosa and Schultz published in 1987 by Academic Press. This book is recommended for anyone who would like more in-depth information on the general nature of insect outbreaks. ❑

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