parent in the majority of cases, and only in trees with limited infections. It is likely to be most effective where light infections can be pruned out at an early stage.

4. More intensive research is needed: 1) to find new chemicals that will destroy the pathogen in elm tissue without serious toxicity to the elms; 2) to enhance more uniform distribution of the chemical in small twigs; and 3) to detect and evaluate probabilities for vigorous growth and healing of wounds.

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EASTERN WHITE PINE IRON DEFICIENCY

by Elton M. Smith and Cynthia D. Mitchell

Eastern White Pine yellows is manifested by a general light green or yellow cast to the foliage, shorter needles, and reduced growth of branches. Growth of white pines seems most affected when trees are located in poorly drained, alkaline soil regions.

A research program was initiated at The Ohio State University in 1974 to determine if the limiting factor in the growth of Eastern White Pine (*Pinus strobus*) was pH-induced iron chlorosis. Knowing that high pH was detrimental to a number of trees including many Oaks, a number of trees were treated with an iron compounds. The pH of the clay-loam soil in the area of the trees ranged from 6.9 to 7.4.

Capsules, marketed as Iron Medicaps and containing ferric ammonium citrate, were implanted in a spiral pattern into the trunks of the pines during the last week of March in 1974 and 1975. All trees were between 5 and 8 inches in diamter, measured 1 foot from the soil line, and received between three to six capsules/tree. Although pine resin exuded from the implantation sites, all the ½-inch wounds healed completely by the following September.

Periodic examinations of the treated trees during both years indicated a positive response to the iron implantations. Vegetative growth of treated pines was improved, needle length increased, and curling of needles was no longer evident. The most dramatic difference, however, was in the change in overall tree foliage color from a yellow-green to a more normal medium green as noted in Table 1. Laboratory studies have indicated that both the foliage iron level and total chlorophyll content were increased in treated trees.

TABLE 1. The Effect of Trunk Implantations of Ferric Ammonium Citrate Capsules into Eastern White Pine Trees. Implantations in March and Evaluations in September 1975. Figures Represent Averages from Six Trees.

	Untreated pines	Treated pines
Foliage color*	4.5	8.0
Total chlorophyll content of foliage	156 mg./g.	225 mg./g.
Foliage iron level	331 p.p.m.	461 p.p.m.

*Values based on visual scale of 1-10 with 10 a dark green.

These findings suggest that Eastern White Pines may become yellow or light green due to iron deficiency caused by alkaline soils. Since changing the pH of soils under landscape trees is somewhat difficult, if not impossible, supplying iron to the trees is a logical control measure. Previous work by the authors with ferric ammonium citrate capsules in Oaks has indicated that visual effects can be noted for 3 or more years from the initial application. The improved foliage color of white pines treated in 1974 was markedly visible as of July 1976 indicating a similar pattern.

Not all yellow or chlorotic trees should be treated with iron compounds as injury may occur. However, in most instances, chlorotic oaks and yellow Eastern White Pines will respond to iron treatments. A foliar analysis and soil test are recommended for verification of the nutrient condition of plant materials.

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ABSTRACTS

Sterner, T.E. 1976. **Dutch elm disease vector populations are low within Fredericton, N.B. sanitation area.** Bi-Monthly Research Notes 32(4): 20.

Sanitation, the annual removal of potential elm bark beetle breeding material (newly dead elm wood) is the basic recommendation to municipalities for control of Dutch elm disease. Little effort has been made to monitor beetle populations, and consequently, information on beetle density within sanitation areas is lacking. Fredericton was deemed an ideal location to obtain such information about the native elm bark beetle because a 24-year sanitation program has left the City with a healthy elm population, while up to 75% of the elms in the surrounding areas are dead or infected. In Fredericton, beetle catches per unit trap area were significantly lower (t-test, .05 level) than in the outside areas, indicating that sanitation has restricted the beetle population. Ninety-five percent of all beetles collected were trapped after July 25, and 83% of these were on the upper portion of the trap, indicating that the beetles were moving downward. The largest catches were made on eight elms outside Fredericton that became infected during the season. This suggests that infected and dying trees are more attractive to the beetles than healthy trees.

Nault, L.R., M.E. Montgomery, and W.S. Bowers. 1976. **Aphid alarm pheromone role in ant-aphid association.** Ohio Report 61(5): 77-79.

Aphids are small, soft-bodied insects that feed on plants. Their sedentary, gregarious habits make them particularly vulnerable to predator attack. Aphids have countered this threat by evolving a dual, self-serving, and altruistic defensive system involving the aphid's cornicle secretion. When attacked by predators, aphids secrete cornicle droplets. These "sticky" droplets can impede an attacking predator and result in the release of aphid prey. The droplets also contain hydrocarbons which serve as alarm pheromones that inform nearby aphids of impending danger. Aphids then fall, jump, or walk away to escape. It was suspected that ant-associated aphids may depend more on ants for protection than on their own dispersive powers. This hypothesis was tested under controlled conditions in the laboratory and a marked difference was found in alarm behavior between ant-associated and nonant-associated aphids.