

## **FOREST AND SHADE TREE PESTS**

### **Pine Chlorosis & Decline in Florida Landscapes**

#### **SIGNIFICANCE**

Throughout much of Florida, pines in urban landscapes continue to fall victim to an insidious and problematic chlorosis (yellowing of foliage) and decline. Affected pines are very common in southern peninsular Florida, especially in intensively maintained landscapes such as golf courses, upscale developments, etc. While saving chlorotic/declining pines is possible and sometimes achieved, remedial treatments are often costly, time consuming, and futile once decline symptoms appear and are recognized. Accordingly, affected trees do little to enhance their surrounding landscapes; with time they usually die, creating eyesores, safety hazards, expensive removal projects and undesirable voids in the landscape canopy. Death is often hastened or “caused” by the action of one or more insect pests (e.g., bark beetles) which characteristically attack declining or stressed pines.

#### **RECOGNITION**

Foliar chlorosis on affected pines is typically a gradual process. To the novice, the initial phases of chlorosis are often imperceptible, and not until the problem is well developed is it noticed or recognized. Over time, chlorosis progresses from a faint off-color or pale green (Fig. 1) to yellow-green and sometimes a brilliant yellowing of all or most of the foliage on an affected pine (Fig. 2), depending upon local environmental conditions and the nature of the factors causing the chlorosis.

In advanced stages, chlorosis may be accompanied by a measure of crown thinning (loss of foliage) and/or dieback (death of upper branches). Some dieback may be a result of opportunistic insect infestations and/or pitch canker infections (pitch canker is a fungus infection which typically kills affected branches). A rapid change of foliage color to orange or red-brown is a sign of impending death, due frequently to secondary and opportunistic insect infestations (esp. bark beetles).



**Fig. 1.** Early chlorosis (tree at right).



**Fig. 2.** Advanced chlorosis.

## THE CAUSES OF PINE CHLOROSIS

Simply (but certainly not exhaustively) stated, pine chlorosis is a complex physiological malady often related to deficiencies in the essential plant nutrients iron (Fe) and manganese (Mn). Plants and trees can develop deficiencies in these nutrients when grown in soils naturally low in these elements. More commonly, however, deficiencies occur when the supply of these elements is restricted by excessively high soil pH values (i.e., soil reaction is too alkaline). As soil pH values rise, the solubilities of Fe and Mn decrease and therefore the availability of these elements for plant/tree root uptake is limited, resulting in nutrient deficiencies, the accompanying symptomatic chlorosis, and declining plant/tree vigor. High soil pH values also adversely affect the occurrence and function of certain highly specialized and beneficial mycorrhizal fungi associated with the roots of pines. Mycorrhizal fungi are integrally involved in the uptake of mineral nutrients by pine roots, and conditions which negatively impact these delicate fungus-root relationships contribute to nutrient deficiencies and associated decline syndromes. Pines, like azaleas, blueberries, and camellias, prefer soils with an acid reaction (optimum pH for pines ca. 4.5-6.0).

Florida's native pines are too frequently and often unknowingly provided with the "benefits" of urban sprawl, landscape development, and the attending tender loving care afforded intensively managed landscapes. Such benefits are often lethal to pines. Disregarding the obvious, yet unquantified, adverse effects of associated site disturbances (injured roots, habitat alterations, etc.), ill-advised fertilization and excessive irrigation are two of the worst things that can be done to/for Florida pines. Fertilization of pines is usually unnecessary and often excessive, resulting in nutritional imbalances or luxuriance. Such conditions predispose pines to debilitating pitch canker infections. Similarly, irrigation of established pines is unnecessary and often deleterious. Most irrigation water in Florida is heavily laden with minerals (esp. calcium) which, over time, "drive" soil pH values well above 7.0 to values as high or higher than 8.0; values clearly inappropriate for and harmful to acid-loving pines.

## PREVENTION AND MANAGEMENT OF PINE CHLOROSIS

Prevention of pine chlorosis and decline is less expensive, more effective, and generally better for pine than remedial treatments *ex post facto*. Preventive measures include 1) avoiding or minimizing site disturbance and tree injury during construction and landscape activities, 2) avoiding the deposit/accumulation of limerock fill (associated with driveways, roads, parking lots, etc.) in the root zones of pines, 3) minimizing or preferably eliminating the fertilizing and irrigation of existing pines, 4) fertilizing and irrigating pines only if necessary, and then only on a carefully determined prescriptive basis, 5) discouraging the development of lush, water and fertilizer-demanding turf in the root zones of pines, and 6) applying and maintaining a 3-4 inch layer of natural, acid-forming mulches (pine bark, pine needles, etc.) above the root zones of pines.

Remedial treatments of pines exhibiting chlorosis involve approaches including soil acidification, foliar feeding and/or fertilizing with specific corrective fertilizers or micronutrient formulations (including tree injections), retroactive sod/turf removal and replacement with appropriate ground covers or mulches above the root zones of affected pines, and retroactive re-design of irrigation systems. The benefits of such *ex post facto* remedies are variable and often short-lived, and the associated effort and costs can be discouraging.

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