Air Pollution Injury to Landscape Plants

Identification and Treatment

E. Thomas Smiley, Ph. D., Plant Pathologist

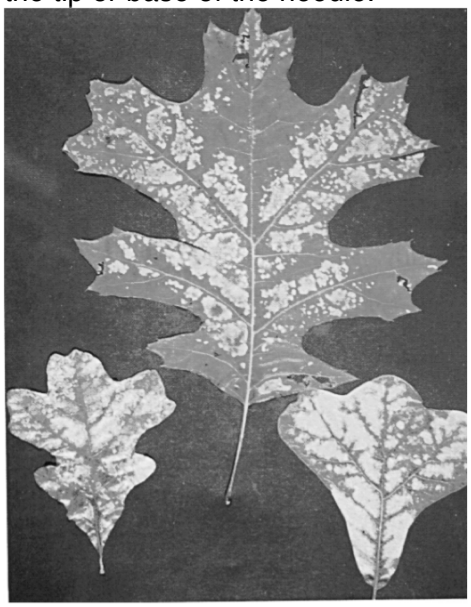
Air pollution injury occurs when certain air pollutants reach levels that cause health problems for plants and people. They are commonly associated with a late spring and summer high pressure weather pattern during which the temperature and humidity frequently exceed 90°F and 90% respectively. They are also associated with temperature inversions when a band of warm air forms in the normally cool upper level of air. This prevents the upper movement of pollutants and concentrates them close to the earth surface. During these episodes, **sulfur dioxide** (SO_2) and **ozon**e (0_3) can accumulate to concentrations in the air that will damage plants including trees and shrubs. A number of other air contaminants such as **fluoride, ethylene and chlorine** can damage plants, but this happens infrequently and is usually localized.

Sulfur dioxide originates primarily from fossil fuel combustion for the generation of electricity, refining and ore smelting. Ozone is a photochemical (requires light for its formation) pollutant formed by a reaction between nitrogen oxides and hydrocarbons coming largely from car exhaust and industries. Typical injury patterns can be seen in many parts of the country.

SYMPTOMS

OZONE (O_3) - Mottled green and yellow patches or yellow bands of tissue on the needle surface usually indicate chronic O_3 damage on conifers, occurring when concentration of O_3 is low or the tree is fairly resistant. Injury is first seen at the tips but can eventually cover the entire needle. The yellow patches or bands can coalesce forming a completely yellow tip while more yellow patches form closer to the base of the needle. Frequently, some needles on a branch will be entirely covered with chlorotic blotches while others are green with only a slight yellowing at the tip. Last seasons needles can prematurely drop from the tree during the summer. If O_3 concentrations are high or if the plant is particularly sensitive, the tip or the entire needle will turn brown and die. This is classed as acute damage. Symptoms on broadleaves are typically very small yellow flecks or stipples smaller than the size of a pinhead on the upper surface. Ozone seldom damages the lower surface. These distinct flecks can coalesce to form large yellow, tan or reddish areas covering a good portion of the leaf. Leaves frequently drop prematurely. Leaves, which develop after an ozone episode, will not be symptomatic. This can help in diagnosing injury especially in the spring and early summer during active growth.

SO_2 - Sulfur dioxide enters plants along with normal air components moving into the leaves and reacts with cells in the inside of the leaf. Symptom expression can take as little as one day to develop. On conifers injury may be shown as yellowing of scattered needles with occasional brown needles, or in more severe episodes, a tan to reddish-brown discoloration indicating death of all or a portion of the needle. The injured portion may at first be restricted to the tip or base of the needle.



Sulfur dioxide damage on oaks.

On broadleaved trees injury is seen as an intervienal or marginal chlorosis or necrosis similar to leaf scorch. The veins frequently remain green.

MIMICKING SYMPTOMS

Many factors in the environment cause plant symptoms, which mimic those caused by specific air pollutants. High temperatures and dry soil cause leaf scorch, symptoms which resemble fluoride or SO_2 damage. Winter injury on broadleaf evergreens is displayed as marginal chlorosis and necrosis, which also resemble SO_2 or fluoride injury. Drought injury on conifers may resemble needle browning caused by various pollutants. Some nutrient deficiency symptoms show up as chlorosis between the veins whereas other deficiencies appear as a general leaf chlorosis, similar to symptoms of low level, chronic exposure to an air pollutant. Insects such as mites, aphids and leafhoppers cause leaf symptoms nearly identical to those due to O_3. Also, pesticides used to control fungi or insects may themselves cause injury to plants, which resemble air pollution damage.

RELATIVE TOLERANCES

Tree species, varieties, cultivators and individuals within a species react differently to a given air pollutant. White pine, for instance, is blacklisted as being highly sensitive to O_3 and SO_2 pollution, and yet there are individual trees, which are more resistant than supposed pollution resistant species. Therefore, several pines on a piece of property may show symptoms whereas one or two may not. This would be true of other species as well.

Some of the more sensitive species to ozone injury which are damaged by concentrations typically found in the Northeast each summer include big-leaf linden, fastigiate English oak, 'Imperial' honeylocust, Kentucky coffee tree, London plane 'Bloodgood', sycamore, zelkova and white pine. Maples, birches, oaks and honeylocust varieties are generally quite tolerant of ambient O_3 concentrations.

PREVENTION AND CONTROL

Remedies for needles and leaves already damaged by pollution is very simple - there is none! However, fertilizing trees can make them less susceptible to further injury from SO_2 and O_3. In areas with chronic high concentrations of pollutants, consider planting species, which are tolerant to those pollutants, which are problems in your area.