THE OFTEN CONFUSED ETIOLOGY OF

STRESS DISEASES

Diagnosis of an abiotic disease is often every bit as difficult

as the diagnosis of a biotic disease. When combinations

of single or multiple abiotic and biotic diseases

occur on the same plant or in an entire area, however,

the diagnosis of the diseases and the determination of

the relative importance of each become extremely difficult

and often impossible.

When plants are adversely affected by an environmental

factor, such as low moisture, nutrient deficiency,

air pollution, or freezing, they are generally and concurrently

weakened and predisposed to infection by one

or more weakly parasitic pathogens. For example, all

the conditions mentioned earlier predispose annual

plants to infection by the fungus *Alternaria* and many

perennial plants to infection by canker-causing fungi

such as *Leucostoma* (*Cytospora*) and *Botryosphaeria*. A

late blossom frost is often followed by infection with

*Botrytis*, *Alternaria*, or *Pseudomonas*. Herbicide injury

is likely to be followed by root rots caused by *Fusarium*

and *Rhizoctonia*. Flooding injury is often followed by

*Pythium* root infections.

Obviously, many of the stresses discussed in this

chapter are often complicated by biotic diseases that

follow. As a matter of fact, many epidemic disease problems,

such as stalk rot of corn, tree declines, and stand

depletions in forage legumes, although thought of as

being caused by one or more biotic agents, they are in

reality set off by one or another of the environmental

factors discussed in this chapter. Thus, stalk rot of corn,

although caused by one of several common fungi (*Fusarium,*

*Diplodia, Gibberella*), actually occurs or becomes

important only under conditions of low potassium and

low moisture stress in early season. Similarly, the additional

stress caused by some herbicides on soybean,

sugar beet, and cotton seedlings increases the susceptibility

of these crops to the *Thielaviopsis basicola* and

*Rhizoctonia* root rots and damping off.

A striking example of the often confused etiology of

stress diseases was developed in the last 30 years in

Europe, where many different forest tree species, shrubs,

and herbs have been exhibiting various degrees of yellowing,

reduced growth, defoliation, abnormal growth,

decline, and eventually death. This widespread general

decline of forests (called *waldsterben*) occurred and

spread over large areas of central Europe after about

1980. Such declines seem to be triggered by the stress

caused by atmospheric depositions of toxic or growthaltering

air pollutants that are subsequently aggravated

by additional abiotic and biotic predisposing or stressinducing

factors. The air pollutants themselves, such as

ozone, cause some direct injury and reduction in photosynthesis,

but the mixture of deposited acidic pollutants

may also cause the acidification of soils. This may

result in leaching out and therefore deficiency in certain

elements, such as magnesium, or in increases in the solubility

of certain toxic elements, such as aluminum,

thereby causing aluminum toxicity in plants. The latter

then causes necrosis of fine roots, which leads to

increased moisture or nutrient stress and eventual drying

out and death of trees, particularly during dry periods.

In addition to the effects caused by these abiotic factors,

affected trees show increased susceptibility to insects

and to foliage and root pathogens such as *Lophodermium*,

*Phytophthora*, and *Armillaria*, which further

increase the moisture and water stress and reduce photosynthesis

in the plant.