

Verticillium Wilt of Shade Trees

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Verticillium wilt is a serious vascular wilt disease that affects a broad array of shade tree species. The fungi that cause Verticillium wilt, *Verticillium albo-atrum* and *V. dahliae*, are soil-borne and infect through the roots. They can gradually become systemic in the tree. These fungi are capable of attacking over 130 different species of shade and ornamental trees, food and fiber crops, and herbaceous ornamentals. Because these fungi are soil-borne and can infect so many different plant species, Verticillium wilt is difficult to control.

Symptoms

Once the fungus gains entry to the tree through the root system, it generally spreads upward into the trunk through the sapwood and interferes with water movement and other plant functions. It causes a variety of symptoms that may be accentuated by drought, inadequate nutrition, poor drainage, or other conditions that reduce tree vigor.

Wilting, interveinal browning, and leaf drop usually begin on one branch or on a section of the tree and progress throughout the tree. Dead and dying branches, sparseness of the crown, and reduced twig growth are frequently observed (Fig. 1).

Verticillium species cause discolored streaks in the sapwood that run parallel to the grain of the wood and



Fig. 1. Symptoms of Verticillium wilt on maple: the left half of the tree appears diseased, while the right half appears healthy. (Photo by R. J. Stipes)

commonly extend from the roots into the branches. In a slant cut the discoloration appears as spots or partial to complete rings in one or more growth rings (Fig. 2). The discoloration varies with the tree species. In maples and smoketree, it is grayish-green to olive-green; in black locust, it is brown to black; in elm, it is brown; and in northern catalpa, it is purple to bluish brown. Streaking may or may not be found in affected branches, and observation of the wood in or near the root system may be required. Positive confirmation can be made only by laboratory culture of symptomatic wood samples.



Fig. 2. Leaf symptoms and vascular discoloration in sapwood of sugar maple. (Photo by R. J. Stipes)

Control

The fact that Verticillium species are able to attack both herbaceous and woody plants complicates control. Verticillium-susceptible weeds, such as lamb's quarters, amaranth (pigweed), nightshade (horse nettle), and ground cherry, are hosts of the fungus and should be controlled. In nurseries, rotation of susceptible and nonsusceptible species is recommended. Certain plant parasitic nematodes are capable of interacting with Verticillium spp. to increase the incidence and severity

of disease in susceptible shade tree seedlings. Nematode control, therefore, is recommended in nurseries where *Verticillium* wilt is known to occur. Nematode control currently involves use of a preplant nematicide or soil-sterilant and is usually not practical in home landscape situations.

The following disease control measures are recommended for landscape plantings:

- Make a positive laboratory diagnosis.
- Apply a liberal and prompt application of ammonium sulfate fertilizer to trees with mild symptoms. (Studies in Michigan showed that nitrate fertilizers were ineffective.)

- Prune out dead branches to prevent infection by other pathogens.
- Remove and replace severely infected or dead trees with a wilt-resistant species (Table 1).

Susceptible and Resistant Hosts

Maple (*Acer*) species are probably the best known shade tree hosts of *Verticillium* spp. Silver (*A. saccharinum*), Norway (*A. platanoides*), red (*A. rubrum*), Japanese (*A. palmatum*), and sugar (*A. saccharum*) maples are commonly infected. Other woody species reported to be either susceptible, resistant, or immune are reported in Tables 1 and 2.

Table 1.

Species resistant or immune to *Verticillium* wilt

Abies spp. (fir)
Amelanchier spp. (serviceberry)
Betula spp. (birch)
Buxus spp. (boxwood)
Carpinus spp. (ironwood)
Castanea mollissima (Chinese chestnut)
Ceanothus spp. (red-root)
Celtis spp. (hackberry)
Cercidiphyllum japonicum (katsura-tree)
Cornus spp. (dogwood)
Crataegus spp. (hawthorn)
Fagus spp. (beech)
Ficus carica (fig)
Ginkgo biloba (maidenhair tree)
Gleditsia spp. (honey locust)
Ilex spp. (holly)
Juglans spp. (walnut)
Juniperus spp. (juniper)
Larix spp. (larch)
Liquidambar styraciflua (sweet gum)
Malus spp. (apple)
Morus spp. (mulberry)
Nerium oleander (oleander)
Picea spp. (spruce)
Pinus spp. (pine)
Platanus spp. (sycamore)
Pyracantha spp. (fire-thorn)
Pyrus spp. (pear)
Quercus alba (white oak)
Q. falcata (southern red oak)
Q. phellos (willow oak)
Q. virginiana (live oak)
Salix spp. (willow)
Sorbus aucuparia (European mountain-ash)
Taxus spp. (yew)
Zelkova serrata (zelkova)

Table 2.

Species susceptible to *Verticillium* wilt

Acer spp. (maple)
Aesculus hippocastanum (horsechestnut)
Ailanthus altissima (tree-of-heaven)
Catalpa speciosa (northern catalpa)
C. bignonioides (southern catalpa)
Cercis canadensis (redbud)
C. siliquastrum (Judas tree)
Cotinus coggygria (smoketree)
Cydonia oblonga (quince)
Diospyros virginiana (persimmon)
Fraxinus pennsylvanica (ash)
Juglans regia (English walnut)
Koelreuteria paniculata (goldenrain tree)
Liriodendron tulipifera (tulip tree)
Populus tremula (European aspen)
Robinia pseudo-acacia (black locust)
Sassafras variifolium (sassafras)
Ulmus americana (American elm)
U. procera (English elm)
U. rubra (slippery elm)