

# Woody Ornamental Tips

## Verticillium Wilt of Shade Trees and Woody Ornamentals

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**V**erticillium wilt is a disease that attacks many species of trees, shrubs and woody ornamentals (Table 1). It is caused by the fungus *Verticillium dahliae* Kleb. *Verticillium dahliae* survives in the soil as small fungal bodies called microsclerotia. The microsclerotia may remain dormant in the soil for years. When roots of susceptible woody ornamentals and weeds grow near, the microsclerotia germinate and infect the roots. The fungus grows upward into the water-conducting vessels of the plant and interrupts water movement. The parts of the plant dependent on water conducted by the blocked vessels begin to show symptoms of the disease: wilting, branch dieback and, in some cases, death. If plant roots and other tissues that die of Verticillium wilt are not removed from the soil, numbers of microsclerotia may greatly increase.

### Symptoms

Trees, shrubs and woody ornamentals affected by Verticillium wilt may show both external and internal symptoms of the disease. External symptoms (Fig. 1) may appear as early as May and as late as October and may range from mild to severe. Mild, chronic symptoms are general yellowing of the foliage, leaf scorch, reduction in twig growth, dieback of twigs and branches, sparseness in the crown or an abnormally heavy seed crop. Severe, acute symptoms are rapid defoliation, wilting and dying of leaves on individual branches, death of branches or rapid defoliation of the entire plant. Symptoms often appear in only one branch, one side or one section of the plant. A sudden wilt of the crown and death of the entire plant may occur, especially during hot, dry weather. Recurrence of symptoms the following year is unpredictable. Plants with mild, chronic symptoms one year may show more severe, acute symptoms the next year, may not have

symptoms for several years or may recover completely. About half the plants showing wilt symptoms usually wilt in succeeding years. The extent of branch dieback in the current year is often not related to the previous year's symptoms. A plant may be infected for a long time before it exhibits any symptoms.

The fungus grows from infected roots and branches into main stems and often into shoots and petioles of sprouts on the main stems of infected trees and shrubs. Usually the topmost or outermost twigs of the plant are not invaded by the fungus, despite their symptoms of water stress and dieback.

The internal symptoms of infection (Fig. 2) are streaks or bands of darkly discolored sapwood directly beneath the bark. In most plants, the darkly discolored sapwood may be observed by cutting diagonally across the base of an infected branch. The streaks are usually brown to black but may be green to brown in maple, magnolia and sumac. Ash may have no streaks of discolored sapwood even when severely infected.

The fungus is active only in the sapwood, so we can determine how long a plant has been infected by counting the discolored annual growth rings. The current year's sapwood is discolored in plants showing wilt or necrotic leaf tissue. Plants showing mild symptoms or plants in remission have the discolored streaks confined to the annual rings of the sapwood of previous growing seasons. In trees in remission, the fungus has been found to be alive in annual rings up to three years old. Each winter, vigorous plants can compartmentalize or "lock up" the fungus infection in the previous season's sapwood. This leads to remission of severe symptoms and explains why symptoms can vary from one year to another, depending on tree health. Thus, a tree or shrub that is genetically very susceptible to Verticillium wilt can remain apparently symptomless if the tree is well fertilized and watered and not subject to unfavorable growing conditions.

A new root infection cannot extensively colonize the sapwood of a large tree during one season. Old infec-





**Fig. 1.**  
External symptoms of *Verticillium* wilt in this maple include wilting of foliage, dieback of twigs and sparseness in the crown.



**Fig. 2.**  
Internal symptoms of *Verticillium* wilt are streaks of dark colored sapwood directly beneath the bark. These were taken from diseased maples.

*Photos by Thomas Harpstead*

tions that were successfully compartmentalized in the previous season's sapwood can move into new sapwood only slowly through bud (xylem) traces. If a tree is too weak to have successfully compartmentalized the infection, the tree will become severely diseased as the fungus rapidly and directly penetrates into the new sapwood.

## Treatment or Control

Generally, plants that are severely infected and show symptoms throughout the crown cannot be saved. Plants with less severe symptoms often recover. In landscape plantings, a tree showing symptoms should be watered every 10 to 14 days with the equivalent of 2 inches of rainfall, particularly during dry periods.

Proper fertilization may help diseased trees go into remission and may prevent *Verticillium* wilt in landscape plantings. A fertilizer balanced in nitrogen, phosphorus and potassium (N:P:K) in proportions such as 10:10:10 should be used every year after symptoms appear (see Extension bulletin E-786). High potassium (K) is most important. This nutrient has been found to bring maples affected by *Verticillium* wilt into remission. Generally, soils in Michigan have low levels of available potassium. Using a fertilizer containing nitrogen (N) without high levels of potassium (K) may make *Verticillium* wilt more severe.

Trees and shrubs that have shown symptoms of *Verticillium* wilt should be fertilized yearly in the early spring as soon as soil is free from frost. Do not fertilize in the summer or fall. Fertilization in late summer or fall may predispose plants to winter injury. Fertilizer should be applied to the lower soil instead of the soil surface, because P and K do not move well through the lawn and soil and will not reach tree roots beneath a lawn. Dig small, narrow holes about 1 foot deep in circular patterns around the tree, starting at least 3 feet away from the trunk and out to a few feet beyond the drip line of the tree canopy. Holes should be spaced about 2 feet apart. Apply fertilizer to the holes at a rate of 6 lbs N per 1,000 square feet, and refill holes with peat. (For more information on fertilizing trees and shrubs and calculating rates of application, see Extension bulletin E-786.)

Prune out and destroy dead and dying branches, but do not prune out branches showing recent wilting—remission may occur the following growing season. Plants that die of *Verticillium* wilt should be removed, along with as much of the root system as possible. Wood should be disposed of by burning or removing to a dumping area, not by burying. Infected wood should not be chipped—unless it is thoroughly heated as in a compost pile—because the chips will spread *Verticillium* to uninfested soil if used as a mulch. Only resistant plant species should be selected as replacements (see Table 2). *Verticillium* wilt is not known to occur in yews and conifers.

Verticillium wilt has become increasingly common in landscape plantings and nurseries because many homes and nurseries have been established on land where infected agricultural crops once grew. Plowed down residues of these crops greatly increased the numbers of microsclerotia in the soil. Some plants that become infected in nurseries show no symptoms until after transplanting. Plant pathologists have found that approximately 10 percent of symptomless maple trees sold at nurseries are infected with *Verticillium*. In

nurseries, susceptible plants should not be planted on agricultural land where *Verticillium* wilt has been a problem. Weeds should be controlled in and around nursery crops because some weeds act as hosts and greatly increase numbers of microsclerotia in the soil. Soil fumigation is not entirely effective. It is highly recommended that plants used in new landscape plantings be bought only from reputable, disease-free nurseries.

**Table 1. Ornamental plants susceptible to *Verticillium* wilt.**

Amur cork tree  
 Ash (black, blue European and green)  
 Azalea  
 Barberry  
 Boxwood  
 Brambles (blackberry, gooseberry, currant)  
 Catalpa (western, northern and southern)  
 Cherry  
 Dogwood (coral)  
 Elm (all varieties)  
 Goldenrain tree  
 Grape  
 Hibiscus  
 Horsechestnut  
 Honeysuckle (*Lonicera*)  
 Japanese pagoda tree  
 Kentucky coffee tree  
 Lilac  
 Linden (American and little-leaf)  
 Locust (black)  
 Magnolia (saucer and star)  
 Maple (all varieties)  
 Oak (pin and red)  
 Osage orange  
 Peach  
 Pear  
 Peony  
 Plum  
 Poplar, yellow (*Liriodendron*)  
 Privet  
 Quince  
 Redbud  
 Rhododendron  
 Rose daphne  
 Rose, multiflora (most cultivated roses)  
 Russian olive  
 Sassafras  
 Serviceberry  
 Smoke tree  
 Sour gum  
 Spirea  
 Sumac (fragrant, smooth and staghorn)  
 Tree-of-Heaven  
 Tulip tree  
 Viburnum  
 Wiegela  
 Yellowwood

**Table 2. *Verticillium*-resistant replacement species.**

Arborvitae  
 Beech  
 Birch  
 China fir (*Cunninghamia*)  
 Crabapple, flowering  
 Dogwood (flowering)  
 Douglas fir  
 Fir  
 Ginkgo  
 Hackberry  
 Hawthorn  
 Hickory  
 Holly  
 Honeylocust  
 Hop hornbeam  
 Hornbeam  
 Juniper  
 Katsuratree  
 Larch  
 Mountain ash (European)  
 Mulberry  
 Oak (white and bur)  
 Pawpaw (*Asimina*)  
 Pine  
 Planetree, London  
 Poplar (*Populus*)  
 Pyracantha (firethorn)  
 Spruce  
 Sweet gum  
 Sycamore  
 Willow  
 Yew (*Taxus*)  
 Zelkova



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