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Verticillium wilt

The *Verticillium dahliae* fungus causes this vascular wilt disease on hundreds of woody plants.

Host plants:
Common woody ornamentals infected by Verticillium wilt include ash (*Fraxinus*), catalpa, Kentucky coffee tree (*Gymnocladus dioicus*), elm (*Ulmus*), magnolia, maple (*Acer*), Russian olive (*Elaeagnus angustifolia*), redbud (*Cercis*), smoketree (*Cotinus*), tuliptree (*Liriodendron*), and viburnum.

Description:
Leaf wilt and branch dieback caused by Verticillium wilt look like those caused by root damage, water shortage, or stem canker infections because there is a disruption of water and mineral transport to the affected branches and leaves. Acute symptoms include wilting, drying, premature loss, and marginal and interveinal discoloration of leaves on one branch or on one side of the tree. These symptoms appear at any time during the growing season.

Vascular discoloration/staining on maple

Marginal leaf browning and early loss on green ash

Photos: (left) J. W. Pscheidt, (right) C. L. Ash, *Diseases of Woody Ornamentals and Trees*. APS Press.

In addition, there are chronic symptoms that resemble a tree in decline with stunted growth, marginal leaf scorch, smaller than normal and sparse foliage, larger than normal seed production, and branch dieback. Finally, there may be visible streaks in the vascular cambium xylem sapwood, which varies from green to black on maple, yellow to green on smoketree, tan to absent on ash, and is not seen in the early stages of infection. However, vascular discoloration is a good field symptom that can then be followed up for confirmation by a plant diagnostic lab.

Disease cycle:
Factors that damage roots, including wounding and water shortage favor the development of Verticillium wilt. *Verticillium* is a fungus that survives well in soil. It forms small black resting structures that survive for years after the diseased plant material dies and decomposes. The resting structures are stimulated to grow when plant roots grow near them. The fungus infects plant roots through wounds and in some cases directly penetrates fibrous feeder roots. *Verticillium* also is transmitted from plant to plant by grafting, budding and the splash of infested soil onto basal stem wounds. Once in the vascular tissue of the roots or stem the fungus produces spores that move upward in the plant through the xylem sapwood. Spores caught up in a vessel germinate and fungal growth extends the infection into nearby wood. When Verticillium wilt kills sapwood, it stops conducting water and minerals beyond that point and the upper/outer ends of affected branches are not directly invaded by the fungus. As parts of the tree fall or die, *Verticillium* returns to the soil, and the resistant fungal structures form.

Management strategies:
The impact of Verticillium wilt depends on the inherent susceptibility of the tree, environmental stress (especially water shortage and root damage), and the aggressiveness of the fungus. Maintain tree vitality. Transplant trees properly, provide a regular soaking irrigation during extended dry periods, fertilize as needed, and apply 2-3 inches of mulch over as much of the root zone as possible. These activities do not cure the disease but they can enhance the tree's ability to resist infections to a limited extent. Improve the appearance of infected trees by removing dead branches, however this does not eliminate *Verticillium* since infections enter it from the roots. Furthermore, fungicides are not an effective treatment of this disease. Use resistant or immune trees to replace those infected with Verticillium wilt such as crabapple (*Malus*), mountain ash (*Sorbus aucuparia*), beech (*Fagus*), birch (*Betula*), chestnut (*Castanea*), hawthorn (*Crataegus*), holly (*Ilex*), honeylocust (*Gleditsia triacanthos*), katsuratree (*Cercidiphyllum*), larch (*Larix*), oak (*Quercus*), pear (*Pyrus*), London planetree (*Platanus x orientalis*) and sycamore (*Platanus*), pine (*Pinus*), spruce (Picea), sweetgum (*Liquidambar*), walnut (*Juglans nigra*), willow (*Salix*), yew (*Taxus*), and zelkova. Resistant selections of red maple (*Acer rubrum*) cultivars include 'Armstrong', 'Autumn Flame', 'Bowhall', 'October Glory', 'Red Sunset', 'Scarlet' and 'Schlessinger'.

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