Verticillium Wilt of Chile Peppers

Guide H-250

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Verticillium wilt is a serious disease of a large number of diverse plants. The causal agents, *Verticillium albo-atrum* (Reinke & Berthold) and *V. dahliae* (Kelb), are ubiquitous, soilborne pathogens. The disease incidence and severity vary from year to year and from one location to another. The disease significance also varies with host susceptibility, pathogen virulence, soil type, and environmental conditions.

The first symptoms on chile peppers are stunting and a slight yellowing of the lower foliage (Figure 1). As the disease progresses, excessive yellowing and shedding of leaves may occur (Figure 2). Symptom severity depends highly on soil and air temperatures and nutrient availability. The fungus invades the xylem elements and disrupts water transport. As the disease develops, varying degrees of vascular discoloration may occur, and the plant begins to wilt as a result of water stress (Figure 3). Infected plants may recover at night for a few days before permanent wilting and death occur.

Verticillium dahliae and *V. albo-atrum* are incredibly versatile fungi in their ability to cause disease on a wide range of diverse plant species over a large geographic area. However, these fungi exist in different races or strains, which vary in virulence and host range. Most isolates of both species can infect a number of different crop plants and weeds, but a few isolates of *V. dahliae*, including the isolates from chile peppers, are largely host-specific or have unique host ranges. Conversely, isolates from bell pepper generally are able to infect a large number of different hosts. The only *Verticillium* isolates that are consistently unable to infect chile pepper are those from cotton and cabbage, but chile pepper isolates can infect cotton. Strains isolated from the same host may vary in their abilities to cause disease in the host (pathogenicity). For example, some isolates from tomato infect peppers, while others do not. Additionally, isolates from the same host may vary in pathogenicity on the originating host.

Figure 1. **Early symptoms of Verticillium wilt in chile peppers.**

Verticillium survives in soil and crop debris as mycelium or microsclerotia. Microsclerotia tolerate a wide range of environmental conditions. The majority of the microsclerotia in soil die within two to four years; however, even small populations can cause significant crop losses. Microsclerotia can colonize plant debris, which may increase the number of sclerotia in the soil over time. Additionally, *V. dahliae* produces microsclerotia on non-host plants. This means that the survival and subsequent population increase probably allow the fungus to persist in soil indefinitely.

Environmental conditions that favor disease are similar for both *Verticillium* spp., although *V. dahliae* is a somewhat warmer-temperature pathogen (optimum 77°F) than *V. albo-atrum* (optimum 70°F). The chile pepper isolate, specifically, is favored by soil temperatures of 85 to 95°F. Both pathogens require moisture for growth and development, but *V. dahliae* appears to tolerate dry conditions better than *V. albo-atrum*. When temperature and moisture are favorable for pathogen growth, root exudates of susceptible plants stimulate microsclerotia to germinate. The fungus then directly penetrates the root and subsequently moves through the root cortex to the xylem vessels. The xylem vessels become plugged with the fungus, resulting in impaired water and nutrient transport that ultimately leads to aboveground disease symptoms.

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Figure 2. **Defoliation caused by *Verticillium*.**

Figure 3. **Vascular discoloration exhibited by chile pepper infected with *Verticillium*.**

At present, there are no known adequate control measures once Verticillium wilt occurs in a field. Management strategies targeted at avoiding the disease are most effective. Crop rotations that include three to four years out of chile peppers are recommended. However, designing rotations is complicated by the pathogenic variation among isolates. Additionally, more than one isolate may be present in a field at one time. In these fields, selection of virulent strains for some crops is a concern, although genetic changes in *Verticillium* strains appear to be slow.

Regardless of rotation length, some fungus propagules will likely persist due to their ability to survive on dead plant debris, their ability to reproduce on non-hosts, and the potential for weed species to serve as hosts. Nevertheless, consistent or frequent cropping to chile pepper is guaranteed to increase propagules in the soil, and may lead to increased virulence within the pathogen population.

Soil fumigants containing chloropicrin have controlled Verticillium wilt effectively in many crops. Soil solarization is also effective for reducing the soil population. Combining fumigation with soil solarization may increase the propagule death rate. Although chile pepper cultivars vary in their susceptibility to *Verticillium*, no resistant commercial cultivars are currently available.

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