

Phytophthora Root Rot of Raspberry

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Phytophthora root rot is caused by several related species of soilborne fungi belonging to the genus *Phytophthora*. To date, *P. megasperma*, *P. cryptogea*, *P. citriicola*, *P. cactorum*, and at least two additional unidentified *Phytophthora* species have been implicated in this disease. The disease occurs on red, black, and purple raspberries, although in the Northeastern United States, it has been documented most commonly on red raspberries. The disease has been reported to occur on blackberries in Kentucky. *Phytophthora* root rot can be an extremely destructive disease on susceptible cultivars where conditions favor its development. Infected plants become weak

and stunted and are particularly susceptible to winter injury; seriously infected plants commonly collapse and die (Figures 1 and 2).

Symptoms

The disease is most commonly associated with heavy soils or portions of the planting that are the slowest to drain (lower ends of rows, dips in the field, etc.). In fact, most declining plants that are considered to be suffering from “wet feet” may be suffering from *Phytophthora* root rot. Symptoms include a general lack of vigor and a sparse plant stand. Apparently healthy canes may suddenly decline and collapse during the late spring or summer. In such cases, leaves may initially take on a yellow, red, or orange color or may begin scorching along the edges. As the disease progresses, affected canes wilt and die. Infected plants frequently occur in patches, which may spread along the row if conditions remain favorable for disease development.



Figure 1. Above-ground symptoms of *Phytophthora* root rot on a red raspberry primocane.



Figure 2. Above-ground symptoms of *Phytophthora* root rot on Heritage red raspberries.

Because wilting and collapsing plants may be caused by other factors (winter injury, cane borers, etc.), it is necessary to examine the root system of infected plants to diagnose the disease. Suspect plants should be dug up and the epidermis (outer surface) scraped off the main roots and crown. On healthy plants, the tissue just beneath the epidermis will be white; on plants with *Phytophthora* root rot, this tissue will be a characteristic brick red (eventually turning dark brown as the tissue decays). Sometimes a distinct line can be seen between infected and healthy tissue, especially on the below-ground portion of the crown (Figure 3).



Figure 3. Below-ground symptoms of *Phytophthora* root rot on crown and roots of red raspberry plant. Note the sharp line of demarcation between healthy (white) and infected (reddish brown) tissues.

In many fields, plants that are dying and declining because of *Phytophthora* root rot had previously been diagnosed as suffering from winter injury or “wet feet.” One major difference in distinguishing between root rot and winter injury is that plants infected with *Phytophthora* root rot will continue to decline as time goes on and will not produce healthy primocanes, whereas winter-injured plants will usually send up healthy primocanes the year following the damaging winter.

Disease Development

The fungi persist primarily as mycelium in infected roots or as dormant resting spores in the soil. When the soil is

moist, reproductive structures (sporangia) are formed upon the infected tissue or by germinating resting spores (oospores) in the soil. Within each of these structures, a number of individual spores called zoospores are formed. These zoospores are expelled into the soil during periods when the soil is saturated with water. The zoospores have “tails” (flagella) that allow them to swim through the water-filled soil pores to reach new plant parts. Upon reaching a plant root or crown, the zoospores become attached and begin the infective process. As water remains standing and oxygen is depleted from the root zone, the plant is progressively less capable of resisting the fungus’s attempts at invasion, and infection becomes more likely and severe.

Each new infection site is a potential source of additional resting spores and zoospores, allowing for epidemic disease development in sites that are subjected to repeated periods of standing water. Although the optimum season for infection is not known for certain, it is likely that spring and fall are particularly favorable periods. However, it is assumed that infection can occur throughout the growing season if soil moisture conditions are favorable.

Control

There is no one simple “cure” for this disease. However, there are a number of different practices or methods that growers can use to avoid or minimize losses. Because no single method is completely effective by itself, the best strategy is to develop an integrated disease management program, where as many control practices as possible are used within an integrated approach. The following methods should be considered and used:

1. Exclusion.

Avoid introducing the *Phytophthora* fungi if you are planting into an uninfested site, especially one that has not previously contained fruit crops. Circumstantial evidence suggests that symptomless nursery plants may be an important means of initially introducing this pathogen into a grower’s field. Fortunately, it is now possible to buy many different raspberry cultivars that have been propagated through tissue culture techniques in a laboratory and greenhouse, without ever coming into contact with field soil. Such plants pose little risk of introducing *Phytophthora* fungi into the field. To minimize your risk of setting out contaminated plants, use only those that come directly from the laboratory or greenhouse and have not been grown out in nursery fields before sale.

2. Drainage.

Any practice that will prevent water from collecting around plants will reduce the incidence and severity of Phytophthora root rot. This includes both good planting-site selection and site modification when necessary. Included in site modification are the placement of tile drains and growing plants on raised beds. Using a raised-bed planting system can provide substantial control of Phytophthora root rot of raspberry.

3. Resistance.

One of the best techniques for controlling any disease is the planting of resistant varieties and the avoidance of highly susceptible varieties. Phytophthora root rot is most serious on red raspberries and some of the hybrids. The black raspberry varieties ‘Cumberland’ and ‘Munger’ are reported to be susceptible. The cultivars ‘Bristol,’ ‘Dundee,’ and ‘Jewel’ appear to be moderately to highly resistant.

Among red raspberry cultivars, none are immune to the disease, but cultivars do differ greatly in their level of susceptibility. Among varieties grown in the Midwest and Northeast, ‘Titan’ and ‘Hilton’ are extremely susceptible, with ‘Festival,’ ‘Heritage,’ ‘Reveille,’ and

‘Taylor’ moderately to highly susceptible. ‘Newburgh’ is somewhat resistant, and ‘Latham,’ ‘Boyne,’ ‘Killarney,’ and ‘Nordic’ are considered to be fairly resistant.

4. Fungicide.

Phytophthora root rot of raspberry can be partially controlled with the soil-applied fungicide Ridomil Gold. Although Ridomil is effective for control of Phytophthora root rot, it should be remembered that it is merely an additional disease-management tool. It will give you the best results only when the other disease management practices that have been discussed are also followed. For the most current fungicide use recommendations, growers are referred to Bulletin 506-B2, *Midwest Commercial Small Fruit and Grape Spray Guide*. This publication can be obtained through your county Extension educator or the Extension Publications Office, The Ohio State University, 216 Kottman Hall, 2021 Coffey Road, Columbus, Ohio 43210-1044.

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