Root Diseases of Blueberries

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By and large, root diseases are not a big issue for blueberry growers in the Northeast. Most of the diseases that occur affect flowers, fruits, stems or leaves. This will discuss the one disease of economic importance (Phytophthora root rot), four diseases of sporadic occurrence and minor importance (Armillaria root rot, Crown gall, Cylindrocladium rot and parasitic nematodes) and two diseases that have only been recently described (Pythium root rot and Bacterial wilt). Growers should be aware of the latter two newly diagnosed diseases as potential future problems.

Phytophthora root rot. The earliest symptoms are dark lesions on the root tissues, followed by eventual rot. The root systems of infected plants become reduced and younger plants can be easily pulled out of the ground. The crown may become discolored which leads to death of the plant. Above-ground symptoms include early leaf discoloration and marginal burn with new leaves being small and premature defoliation is likely. The plants are more susceptible to drought stress because of the reduced root system. The disease often appears in poorly drained sections of the field and in heavier soils. It can sometimes be misdiagnosed as “wet feet”. Management of Phytophthora root rot in blueberry depends on an integrated approach. First and foremost, only clean planting stock should be used. Propagation beds should not be watered excessively and should not be irrigated with surface water. When planting, fields should be well drained and if needed, ditches or drainage tiles can be installed to remove excessive surface water or raised beds can be employed. Infected plants may be treated with a fungicide applied to soil or leaves.

Armillaria root rot. Infected bushes may display a range of symptoms. Plants may slowly decline in vitality over several years. Infected plants have small, chlorotic leaves and may be more susceptible to drought stress and winter injury than healthy plants. Branches may wilt suddenly, and the entire plant may die within a short time period. The disease may be confined to one area of a field or it may be interspersed throughout the field. The fungus *Armillaria mellea* produces white mycelial fans between the bark and the hardwood, and rhizomorphs (black, rootlike structures that also resemble shoestrings) may be attached to the roots or trunk. The fungus may produce mushroom fruiting bodies at the base of affected plants in late summer. When a forested location is to be used for planting, the soil should be thoroughly disked, and as many root fragments as possible should be removed. The area should be left fallow for at least three years so that inoculum of *Armillaria* is significantly reduced. Infected bushes should be removed and burned. Soil fumigation of areas where infected bushes have been removed helps to prevent

recurrence of the disease in replanted areas. Most cultivars are probably highly susceptible to the fungus.

Crown gall. Galls are most common at the base of canes or on major roots and are rare on smaller lateral roots. Occasionally, galls form on branches higher in the bush, especially in fields where flooding has occurred. Young galls are cream-colored to light brown; they turn dark brown to black and become rough and hard as they age. Galled areas on canes may appear elongated because several smaller adjacent galls are growing together. Galls vary in size, with a few becoming large. Infected plants may be stunted or weak compared to healthy ones. When older plants (two to five years old) are affected, the foliage discolors prematurely in the summer. Very young plants may be killed outright. All blueberry cultivars are apparently susceptible to crown gall. Thus, the most effective means of control is to establish plantings in uninfested soil with pathogen-free planting stock. Fields where the previous crop was infected should be avoided for two or three years or more. A nonhost crop, such as grasses (grains or pasture) or vegetables, should be grown during this period to significantly reduce the population of the pathogen. Soil fumigation has generally been ineffective in eliminating the bacterial pathogen *Agrobacterium tumefaciens* from field soil. Good cultural practices, including sanitation, minimize the risk of introducing the pathogen into disease-free plantings. All nursery stock should be carefully inspected, and all plants with crown gall symptoms should be removed from the site and discarded. Minimization of wounding of plant tissues is beneficial.

Cylindrocladium rot. This is primarily a disease affecting the root systems of blueberry cuttings and nursery plants. Initial disease symptoms are browning or blackening of the stem near the soil line followed by wilting and death of plants. Brown leaf spots and stem lesions with reddish borders may also be observed. Lesions can girdle the stem, killing all tissue above the girdled area. Root lesions and root rot are also commonly observed. Orange-colored perithecia develop on infected tissues under humid conditions. The disease can spread rapidly in a rooting bed. Dead plants are often found in a circular pattern, with disease spreading radially from a point source. Spores of the fungus *Cylindrocladium parasiticum* or *C. calhounii* may infect leaves and stems, and eventually kill entire plants. The root system is often the last healthy part remaining. Sanitation is a key to managing this disease, starting with a new, clean, rooting medium. Frames, trays, and pots should be cleaned before reusing them. No cultivars are known to be resistant to the disease. Moisture should be managed to reduce relative humidity and water splash as much as possible. Diseased cuttings or plantlets should be removed as quickly as possible and remaining plants should be treated with an effective fungicide.

Parasitic nematodes. The majority of plant-parasitic nematodes associated with blueberry are ectoparasites, which use their stylets to feed on root epidermal and cortical cells, but do not enter roots. Most ectoparasites preferentially feed on root tips, thereby disrupting root elongation, causing ‘stubby’ roots or witches-broom symptoms, and reducing overall root growth without necessarily causing noticeable lesions or necrotic areas. Sheath nematodes (*Hemicycliophora*

spp.) can cause terminal root swellings or galls on the roots. Lesion nematodes (*Pratylenchus* spp.) are endoparasites that use their stylets to perforate cell walls and completely enter fine roots, causing localized lesions that can become infection courts for opportunistic fungal pathogens. When roots have become infected by many nematodes, lesions coalesce, causing girdling and dieback of fine roots. Root-knot nematodes are endoparasites which enter roots and establish permanent feeding sites. As the female nematodes mature, they become enlarged and root tissue around them swells, resulting in formation of the characteristic galls or 'root-knots'. *Meloidogyne carolinensis* is the only root-knot nematode known to infect blueberry. The ultimate effect of all plant-pathogenic nematodes is impaired root functioning, and above-ground symptoms of nematode damage are usually non-specific and manifested only as patchy areas of poor growth that are difficult to distinguish observationally from the effects of poor nutrition or water availability. Plant-parasitic nematodes alone generally do not cause plant death. Because there are no obvious aboveground symptoms of nematode damage, diagnosing the possible role of nematodes in plant disease depends entirely on analyzing soil and root samples for the presence of plant-pathogenic species. Damage to roots in one year may not be manifest as reduced growth or yield until several years later, or after additional stresses such as drought are imposed upon the crop. Some nematode species (*Xiphinema* spp.) are capable of vectoring viruses that infect blueberry. Only the preplant fumigants are currently labeled for nematode control in blueberries.

Pythium root rot. This disease was found in a field in Michigan in 2009. Affected plants were stunted with yellow leaves and defoliated. Plants had declined in productivity over several years and some plants died. Roots in these plants were shown to have decay and necrosis, and roots systems were reduced in volume. The fungal pathogen, *Pythium sterilum*, had previously been found in infected plants in Georgia, Oregon and British Columbia. Very little is known about the disease, which can very easily be confused with Phytophthora root rot. Control strategies would likely be very similar to the latter disease.

Bacterial wilt. This disease was only discovered in New Jersey in one field in 2012, but it is worth reporting because it is a potentially devastating disease wherever it may occur in the future. The field of 'Bluetta' plants exhibited symptoms of wilting and rapid cane death. Entire bushes died in a short time period. Leaves exhibited marginal leaf necrosis. The bacterial pathogen, *Ralstonia* (formerly *Pseudomonas*) *solanacearum* was present in the vascular tissue and systemic in the plants. This bacterium is an effective soil colonizer and can survive for many years in the absence of a host plant, and it has a wide host range. No chemical controls are available and very little is known about the disease in blueberry. The plants in the affected field were immediately removed and burned and sanitation was employed to prevent any spread of the bacterium.