

Blueberry Diseases

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This presentation (in Blueberry I) will be the first part of a two-part discussion on blueberry diseases and their management. The focus of this article will be a series of short synopses on the diseases, their symptoms, the causal agents and some specifics on the epidemiology. In the second part (in Blueberry II), Dr. Annemiek Schilder will focus on the management of the diseases most important to the region. The emphasis will be on highbush blueberry (*Vaccinium corymbosi*), although many of these diseases can also affect lowbush blueberry (*V. angustifolium* and *V. myrtilloides*). Diseases with a fungus as the causal agent are mummy berry, Botrytis blight, Phomopsis twig blight, Fusicoccum (Godronia) canker, anthracnose, powdery mildew, Phytophthora root rot, Armillaria root rot, and witches' broom. Diseases with a virus as the causal agent are scorch and tomato ringspot. A phytoplasma is the causal agent of stunt. At this point, there are no diseases of economic importance in the region caused by a bacterium or a nematode.

Mummy berry: This is probably the most important disease in terms of its widespread occurrence and because it has the potential of causing the most economic crop losses. It occurs sporadically and is at its highest incidence during cool, wet springs. There are two phases of the disease, a leaf and stem blight and a flower blight which results in the formation of the mummified berries. The disease is caused by the fungus *Monilinia vaccinii-corymbosi*. The fungus overwinters in the fallen mummies on the ground as mycelium. When temperatures are favorable, an apothecium (the perfect or sexual stage) forms and ascospores are released. These spores are the primary inoculum of the fungus and these infect the emerging leaves and young shoots, resulting in blighted tissue. Eventually, the fungus sporulates on this tissue, producing conidia (the imperfect or asexual stage). These conidia infect the flowers, but the symptoms are not apparent until the berries begin to ripen. Infected berries are initially tan or pink and as they harden and shrivel, they eventually turn gray and fall to the ground. The majority of the mummy consists of fungus tissue.

Botrytis blight: This is normally uncommon in blueberry fields, but in 2003 there were severe outbreaks of the disease because the weather was cool and rainy when the plants were in bloom and because it was very difficult for growers to apply protectant fungicides. The fungus *Botrytis cinerea* overwinters on blueberry stems or on a variety of other plant hosts and produces conidia that infect the flowers, resulting in blossom blight. The fungus produces a second crop of conidia on the blighted flower, resulting in the 'gray mold' phase of the disease. These conidia can cause a second round of infections, resulting in further damage to the plants, or infecting other later blooming blueberry cultivars. Normally, symptoms are confined to the flowers. However, in severe epidemics infected twigs are blighted and turn brown or black and later bleach tan or gray. This symptom can be confused with winter injury. Infected leaves may also show blackened areas of dead tissue. If wet weather persists into berry development, the fungus can also infect the fruit, resulting in gray mold symptoms on the berries. These conidia can infect other nearby fruit.

Phomopsis twig blight: This disease can be found in most fields every year. Its incidence tends to be linked to stresses on the bush such as winter injury or drought injury. The fungus *Phomopsis vaccinii* overwinters in the cankered stems in the blueberry field or in neighboring cranberry beds or on lowbush blueberry in the uplands. Conidia (or possibly ascospores although the perfect stage is very rare in nature) infect the emerging new growth in the spring into the mid-summer, resulting in blighted stems. The infection may advance downward on the stem and reach the main stem. There may be multiple infected twigs on a single bush. Entire canes may eventually be killed, as the fungus enters the vascular tissue of the stems and blocks water transport. There is a fruit rot phase of the disease, but this is not observed in New England.

Fusicoccum (Godronia) canker: This canker disease is much less common than *Phomopsis* twig blight. It tends to be confined to the more northerly climates. The fungus *Fusicoccum putrefaciens* overwinters as mycelium on infected wood. Conidia produced from these old cankers infect newly produced tissue, resulting in blighted twigs similar to those caused by *Phomopsis*. A unique difference between the two cankers, however, is a red-maroon-brown lesion centered around a leaf scar for this disease. As the lesion enlarges, a bulls-eye pattern results. The center of this lesion dries out, turns gray, and the fungus will produce numerous black pyrenidia (asexual stage) on the stems. The infected twigs may suddenly wilt and die during especially hot and dry periods. This fungus can also overwinter in cranberry or lowbush blueberry stems.

Anthraxnose: This disease has increased its incidence in New England during the past ten years. The fungus *Colletotrichum gloeosporioides* causes tremendous losses in New Jersey in certain growing seasons. The pathogen primarily damages fruit but may also infect twigs and leaves if environmental conditions are favorable. Symptoms may initially be observed as blossom blight, but normally symptoms are not seen until the berries mature. The fungus develops within the green ripening berry as a latent pathogen. At maturation, the blossom end of the berry becomes soft and sunken and masses of salmon-colored conidia appear on the fruit exterior. One sporulating infected berry can spread the disease very quickly to other berries in a cluster on the bush or to other berries in post-harvest containers. Losses are most serious when long periods of warm and wet weather occur during bloom and/or just prior to harvest.

Powdery mildew: This disease is more of a problem in lowbush blueberry fields in New England. The disease is uncommon in highbush blueberry, and symptoms normally occur in mid-summer, sometimes after fruit have been harvested. The fungus *Microsphaera vaccinii* grows all over the exterior of the leaves, producing the white powdery appearance on the foliage. In rare instances, the fungus may also be found on the stems and berries. The disease is worst during periods of warm, dry weather when the relative humidity is high, but when there is no free water on the plant surface. In severe infections, defoliation may occur.

Phytophthora root rot: This disease normally occurs in the poorly drained areas of a field where water puddles for an extended period of time. The fungus *Phytophthora cinnamomi* is soil-borne, and infects the fine absorbing roots of the plant. The root systems will have many dead roots that are discolored or black. Above-ground symptoms include stunting, reddening or yellowing of the foliage, poor fruit production and death of the plant in some instances. The

fungus overwinters as chlamydospores in the soil or in the infected plant's root system. These spores germinate in the spring and infect the fine rootlets where water is abundant. Water movement within a field can spread the pathogen to other uninfected plants. The fungus is a major pathogen of cranberry plants, and consequently, cranberry beds are an important source of inoculum. Rhododendrons, azaleas and other Ericaceous plants in the landscape can serve as inoculum sources.

Armillaria root rot: This disease is uncommon, usually occurring in fields that were recently pine/oak woods. The fungus *Armillaria mellea* is a Basidiomycete that infects a wide diversity of different plant hosts. The fungus colonizes the roots of many oak and pine species, but usually causes little mortality in these plants. When the trees in these woods are cut and removed, root pieces of these hosts remain in the soil, and this is the inoculum source for this disease. The fungus primarily overwinters as rhizomorphs in these pieces, and hyphae growing from the rhizomorphs infects the blueberry roots. The fungus slowly colonizes the root system and eventually grows to the crown of the plant. The symptoms of the disease are not clear-cut. The vigor of the plant slowly declines over several years, fruiting less each year and the plant shows symptoms very typical of nutrient deficiency. Eventually, canes may die or the entire bush may die, particularly during periods of dry and hot weather. The fungus may produce basidiocarps (mushrooms) at the base of an infected bush. Excavating the roots of the plant will also reveal the rhizomorphs tightly attached to the root system and the base of the crown. The fungus can move to neighboring uninfected bushes via root grafts.

Witches' broom: This disease is more common in lowbush fields, but may occasionally be found on a single highbush plant. Affected plants have broom-like masses of swollen shoots, and no fruit will be produced on the affected canes. There may be several brooms on a single plant. The rust fungus *Pucciniastrum goeppertianum* carries out its life cycle on two hosts, blueberry and several species of fir. Spores produced on fir are spread to blueberry via wind/rain in the summer and infect the leaves and stems. It takes one year after infection for the first appearance of symptoms. Eventually the fungus in the broom will sporulate and these spores will infect fir trees, thus completing the life cycle. Brooms will continue to serve as inoculum sources for several years, if they are not removed.

Scorch: This disease (originally called Sheep Pen Hill Disease) is a serious problem in New Jersey, and was recently diagnosed in fields in Massachusetts and Connecticut. The disease is caused by a carlavirus and vectored by different aphid species. There is a wide array of symptoms produced in infected bushes, the most prominent being a blossom and leaf blight very similar to that produced by *Botrytis*. The necrosis in this phase may occur on one or several canes, and may lead to death of the bush. In some cultivars, the blight may be lacking but the bush may have declining yield and vigor. Later in the season, a distinctive line pattern may be observed in the leaves of certain cultivars. After introduction of the virus, it may take two years for symptoms to be displayed.

Tomato ringspot: This disease was detected in a blueberry field in Massachusetts in 2003, although it is seldom observed in New England. Occurrence and intensity of symptoms of the disease vary according to the cultivar. Infected leaves are cupped and malformed, and smaller in size. Young leaves may be chlorotic and misshapen. Necrotic spots may occur on the leaves or

stems. Defoliation may occur, and fruit production may be severely affected due to reduced vigor of the plant. The disease may predispose the plants to winter injury. The causal agent is a nepovirus that is vectored by the dagger nematode *Xiphinema* spp. The disease occurs in 'hot spots' in a field, and spread of the disease is very slow from these areas.

Stunt: The disease regularly occurs in New Jersey, but is infrequently encountered in New England. The primary symptom is a general dwarfing of the bush. Leaves may be cupped downward and smaller in size and chlorosis may occur between the veins. Plants will be excessively branched and foliage will turn brilliant red prematurely in the late summer. The causal agent is a phytoplasma which is vectored by the sharp-nosed leafhopper. The leafhopper can survive on several woody plants outside a blueberry field.