

## Integrated Blueberry Disease Management

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This discussion will concern diseases of highbush blueberry (*Vaccinium corymbosi*), although some of these pathogens can also infect lowbush blueberry (*V. angustifolium* and *V. myrtilloides*). Fungal diseases will be exclusively discussed, including mummy berry, Botrytis blight, Phomopsis twig blight, Fusicoccum (Godronia) canker, anthracnose, Phytophthora root rot, witches' broom and black shadow. Important virus diseases (scorch, shock and possibly red ringspot) will be discussed by Dr. Peter Oudemans in the afternoon session.

**Mummy berry:** This is the most important disease in terms of its widespread occurrence in New England and because it has the potential of causing the most economic crop loss. 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. Management of the disease consists of several strategies: resistant or less susceptible cultivars; removal of the mummies from the field by raking them or covering them with 1-2 inches of soil or mulch to prevent spore release; application of urea to the exposed mummies in the spring; pruning canes to allow for good air circulation; application of fungicides during the period between green tip and the end of bloom; and protection of tissue after frost events.

**Botrytis blight:** This is normally uncommon in blueberry fields, but there are occasional outbreaks of the disease when the weather is cool and rainy during bloom when it is difficult 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. Symptoms are usually confined to the flowers, but 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 or scorch. 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. Management of the disease consists of creating an open canopy to reduce moisture and increase fungicide penetration; pruning out

diseased canes and destroying them to remove inoculum; removing wetness duration by watering in the early morning; and application of fungicides from green tip through bloom.

**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. Management of the disease is achieved through the use of resistant cultivars; removal of infected canes or those injured by cold temperatures; avoidance of wounding the canes; irrigation to avoid drought stress; creation of a good air circulation around the bush; and application of fungicides from green tip through petal fall and as a dormant treatment in the late winter/early spring.

**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 pynidia (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. Disease management is achieved through the use of resistant cultivars; pruning out infected canes; and application of fungicides from green tip through the end of bloom.

**Anthraco**: This disease has increased its incidence in New England during the past decade. The fungus *Colletotrichum acutatum* 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. Management of the disease consists of planting resistant cultivars; removal of older canes that harbor the fungal inoculum; irrigation during the early morning hours to avoid long wetness periods; creation of an open canopy to provide good air circulation; fungicide applications from green tip through the first blue coloration in the berries; and refrigeration of the berries after harvest if the disease is a problem.

**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 can be an important source of inoculum. Rhododendrons, azaleas and other Ericaceous plants in the landscape can also serve as inoculum sources. Management of the disease consists of planting in a well-drained field and improving the drainage if low spots develop; planting tolerant cultivars; preventing spread of inoculum on footwear or equipment from infested to non-infested fields; and fungicide applications in the spring and fall.

**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. The disease can be avoided by removing fir trees within 1,500 feet of the field and removing infected bushes; fungicide applications do not usually warrant the expense.

**Black shadow**: This disease was initially described in New Jersey, but I have seen it in several blueberry fields in Massachusetts and I suspect it is present throughout New England blueberry fields. Symptoms are usually confined to 1-2 year old stems and appear as black mycelium on the surface. Affected bushes may eventually decline and suffer reduced yields. All cultivars appear to be susceptible to the fungus *Aureobasidium pullulans* (although molecular analyses indicate that the pathogen may be in another genus of fungi). Because there is a very weak relationship between disease incidence and effects on crop production, management strategies are not presently warranted.