

Canker diseases on ornamental woody plants

Canker disease mostly occurs on ornamental woody plants, forest trees, and some fruit trees such as apple, peach, and pear, etc. It causes dieback of twigs and branches, reduces tree growth, affects lumber quality, and causes significant yield losses on fruit trees. Sometimes, it kills the entire tree if the canker girdles the trunk of a tree.

1. General Symptoms

Canker by definition means a definite and localized area that is usually dry and dead, often discolored, sunken or raised, sometimes cracked on a stem, trunk, branch, or even twig. Not all cankers have these characteristics at the same time, and expression of canker symptoms is very variable depending on the type of host plants, pathogen species, environment and stage of disease development. In the early stage of the infection, abnormal appearance may not be visible or identifiable on the bark surface. However, when the surface tissue is scraped off, significant discoloration may be seen inside the bark tissue. As a defensive response, tree plants may exude gum from bark at the site of infection or injury. Bleeding is another sign of infection. In most cases, bacterial infection causes bleeding cankers, however, some fungi such as *Phytophthora* also cause bleeding symptom. When a fungus invades and kills a large area of bark tissue, a distinct color change occurs on infected bark (Fig. 1). Some trees form callus tissue in response to injury or infection, so it is very common to see callus tissue on canker area. Bark killed by fungi may be cracked. Some cankered bark may look sooty such as sooty bark canker on trembling aspen trees. As a result of bark canker, the younger branches or twigs may dieback. Sometimes, an entire tree will die if the canker girdles the major stem of a tree. In most cases, fruiting bodies of the fungal pathogen are very evident and visible on dead or seriously infected bark. The most common fruiting bodies are stromata, sporodochia, and acervuli (Fig. 1).



Fig. 1. Left: Discoloration of bark on a popular trunk infected by the *Cytospora* fungus (Picture by Bill Carlos). Right: *Cytospora* fruiting bodies (stromata) on the bark of eastern hemlock (Cited from “*Diseases of trees and shrubs*”).

2. Etiology

Generally speaking, canker disease always occurs on trees that are predisposed by other factors. There are numerous factors that can hurt or stress the tree in Nevada, for example, lightning damage, cold and freezing injury, sun scalds, drought, poor soil, nutrient deficiency, improper pruning, other fungal diseases, wild animal damage, and bark borer insects.

Many fungi cause canker diseases on a variety of trees and shrubs. They are opportunistic pathogens and like to attack those stressed or injured trees. The most common canker-causing fungi are listed in Table 1.

Table 1. The common canker-causing fungi

Botryosphaeria dothidea
Ceratocystis fimbriata
Cryodiaporthe populea
Cryphonectria parasitica
Dibotryon morbosum
Eutypa armeniaca
Eutypella parasitica
Gremmeniella abietina
Hypoxyton mammatum
Leucostoma sp.
Nectria galligena
Urnula craterium

3. Disease cycle

Most canker-causing fungi overwinter in dead or infected bark tissue in which fungal fruiting bodies, spores or mycelia are present. In the spring, fungal spores are transmitted by wind, rain, water, or pruning tools to other trees or other parts of the same tree. If spores reach a stressed or injured tree and find desirable infection sites (usually those injured spots or natural holes on the bark), they germinate immediately and then penetrate into the bark tissue. Once the fungus is established in the bark tissue, it kills bark cells and reproduces asexual or sexual fruiting structures there. During summer time, the fungus usually produces conidia spores (asexual state) that can be spread to other trees and start another cycle of infection. This cycle may occur many times during the growing season. When winter is approaching, the fungus will turn into sexual reproduction and produce ascospores. Ascospores infect trees in the next spring, resulting in primary infection.

4. *Cytospora* canker

Cytospora canker is named after the fungal genus *Cytospora* that cause canker diseases. Due to the presence of both sexual and asexual states, there are different genus names for this group of fungi. In sexual state, its current name is *Leucostoma*, previously *Valsa*. In asexual state, it is named as *Cytospora*. So *Cytospora* canker is also called as *Leucostoma* canker or *Valsa* canker. Numerous *Cytospora* species cause cankers on approximately 70 species of fruit trees, hardwood forest trees, shade trees, shrubs, and conifers.

Cytospora canker is one of the most serious diseases on fruit trees such as apple, peach, and pear. It can destroy an entire orchard if it is not managed well. Naturally, the fungus cannot penetrate healthy bark or buds, but it can penetrate through injured sites or pruning cuts, or dead tissue. The first visible symptom is the exudation of gum at the site

of infection, which is defensive response of the plant to the infection. The fungus then grows inside the bark tissue, and the canker begins to show, usually enlarges along the branch in oval to elongate shape. When the canker gets old, callus ring forms. Callus production is a mechanism used by the plant to prevent fungal spreading in the tissue. Unless some borer insects break the callus ring, callus is very effective to prevent canker from expanding.

5. Other canker diseases

Although *Cytospora* canker is a major canker disease, there are many other types of canker diseases, which cause significant damages to specific ornamental trees. The common ones are black knot canker, *Phomopsis* canker, *Hypoxylon* canker, *Dothichiza* canker, *Cryphonectria* canker, *Endothia* canker, *Thyronectria* canker, *Tubercularia* canker, *Fusarium* canker, *Botryosphaeria* canker and Sooty-bark canker. These cankers are caused by fungi and most of them are named after the fungal genus names. Besides these fungi, some bacteria also cause bark canker on some trees.

6. Detection and identification

The first step to detect a canker disease is to look for symptoms. The most common symptom caused by canker disease is dieback. Check the tree to see if any twigs or branches are dead or not growing well (for example, buds are not open, or leaves are dead, etc.). If no dieback is found, check trunk and all branches for discolored and dead bark, cracks, sunken appearance, callus or bleeding. Sometimes, a knife is used to scrape off bark surface during examination. If a canker area is found, examine bark surface for pathogen signs such as stromata, sporodochia, perithecia, pynidia, acerculi, or sootiness by using magnifying lens.

Accurate identification of the pathogen is very critical for determining which canker disease the case belongs to. Usually, a microscope is enough to make identification on fungi, but it is not always easy to make a complete identification of those canker fungi because the identification is based on morphology of either sexual or asexual structures. If no fruiting bodies can be found on canker tissue, it is probably difficult to determine which fungus causes the problem.

7. Management

Management of canker diseases should be based on integrated pest management (IPM) principles. As most of the canker fungi are opportunistic and like to attack those weakened trees, keeping tree's growth vigor is very critical to lower the chance of infection. Avoiding wounding or severe pruning also will reduce opportunities for fungi to attack. Removing cankers and treating with a disinfectant will prevent further expanding of the canker area. Burning or burying all cankered or dead branches or twigs will eliminate the infection sources. Always spray some protective fungicides after pruning and before rain.