SOOTY BARK DISEASE DIAGNOSTIC GUIDE

Sooty Bark Disease Overview

Sooty bark disease, caused by the fungus *Cryptostroma corticale*, is an emerging disease that can impact deciduous trees in urban areas. It primarily infects trees in the genus *Acer* (maples). The fungus is believed to be native to the Great Lakes Region of North America (Gregory and Waller 1951) and was first detected in Washington State in Whitman County in 1968 and then Lewis County in 2007 (WSU Herbaria 2021). Beginning around 2020, *C. corticale* was confirmed on numerous dying deciduous trees around Seattle and a few neighboring cities. Since then, *C. corticale* has been recovered from samples of the following species:

- *Acer campestre*, field maple
- *Acer circinatum*, vine maple
- *Acer japonicum*, full moon maple
- *Acer macrophyllum*, bigleaf maple
- *Acer palmatum*, Japanese maple
- *Acer platanoides*, Norway maple
- *Acer pseudoplatanus*, sycamore maple
- *Acer rubrum*, red maple
- *Aesculus hippocastanum*, horse chestnut
- *Prunus cerasifera*, cherry plum
- *Betula occidentalis*, water birch
- *Fagus sylvatica*, European beech

The term “sooty bark disease” refers to the mats of black fungal spores produced by this pathogen within the bark of infected trees.

Certain people may develop hypersensitivity to sooty bark disease and experience negative respiratory conditions. This condition, fortunately rare, is referred to as “maple bark disease.” Individuals who handle infected logs often (such as sawmill workers, wood cutters, or wood turners) are at higher risk of experiencing respiratory symptoms. Visiting or recreating near trees known to be infected with the pathogen is considered low risk (Braun et al. 2021). While occasional and limited exposure to the spores is not a serious health risk for most people, for added safety, an N95 mask or respirator may be worn while examining symptomatic trees or working with infected wood. More information on maple bark disease is available through the Washington State Department of Health.

While there are many unanswered research questions regarding the emergence of sooty bark disease in the Pacific Northwest, the pathogen may behave similarly here as it has elsewhere. In Europe, where this pathogen is non-native, outbreaks of sooty bark disease have been noted to follow years with severe droughts or high summer temperatures (Bencheva 2014; Koukol et al. 2015). Additional studies have indicated *C. corticale* spreads faster within its hosts under drought conditions (Kelnarová et al. 2017; Ogris et al. 2021). European researchers have suggested that urban conditions with higher temperatures and elevated air pollution levels have likely led to increased infection of trees. Based on this information, sooty bark disease has the potential to become more common in Pacific Northwest urban landscapes as climate change results in warmer temperatures and hotter, drier summers.

Identification of Trees with Sooty Bark Disease

Accurate diagnosis is key to understanding the distribution and impact of this disease on trees in the PNW. A combination of approaches is typically used to identify sooty bark disease. These include:

- recording symptoms
- locating fruiting or sporulation structures (signs)
- making laboratory observations
- completing molecular tests

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Knowing what to look for in the field can help identify possibly infected trees.

Symptoms

Sooty bark disease does not generally produce diagnostic symptoms distinct from other diseases, pests, or environmental conditions (Figure 1). However, the typical symptoms of sooty bark disease in Figure 1 should be noted, as they can help identify trees that deserve closer inspection. For example, internal staining from sooty bark disease may be observed after felling symptomatic trees or branches (Figure 2).

Figure 1. Epicormic sprouting on Norway maple (left photo), patchy branch dieback (middle photo), or tree death (right photo). While wilting and branch dieback symptoms can be caused by other factors, such as root disease or a vascular wilt pathogen, trees with these symptoms should be examined further for signs of sooty bark disease. These symptoms are typically more evident during the growing season when healthy trees still have leaves. Photos: Joseph Hulbert (left photo); Dan Omdal (middle photo); Rachel Brooks (right photo).

Figure 2. Internal staining associated with sooty bark disease in felled sycamore maple trees. Greenish-brown staining can occasionally be observed in cross sections of infected tree wood, though this stain fades after tree death (left, middle, and right photos). Other diseases, insects, and environmental factors can produce similar staining, and staining is not diagnostic for sooty bark disease in the absence of other sooty bark signs. (*Note*: the white arrows in the photo point to sooty bark disease fruiting bodies, while the blue arrows point to normal tree bark). Photos: Rachel Brooks (left photo); Jamilee Kempton (middle photo); Jamilee Kempton (right photo).

Diagnostic Fungal Signs and Structures

To determine if sooty bark disease is present on a tree, look for the characteristic fruiting bodies (mats of fungal material that produce and release spores) of *C. corticale* (Figure 3 through Figure 6). These fruiting bodies develop on dead or dying tissue, where the bark blisters and then the top layer of the bark flakes off and exposes the dark brown, gray, or black fruiting bodies. These discolored patches, which produce spores, may appear dusty (when large numbers of spores are being actively released) or solid and firm. Over time the fruiting bodies can become lighter in color. Figures 3 through 6 display specific sooty bark disease signs to look for.

Figure 3. *Cryptostroma corticale* fruiting bodies in thick bark of bigleaf maple (left and center) and sycamore maple (right). On thick maple bark, the dark-colored fruiting bodies of *C. corticale* can often be clearly seen. From afar these fruiting bodies are visible as black or gray patches, which are often oblong and parallel to the stem. These patches occur on dead portions of the tree. Upon closer inspection, these patches are sunken into the bark (with the top layer of bark flaked off), but do not always grow into the wood. (Note: the white arrows point to sooty bark disease fruiting bodies, while blue arrows point to normal tree bark.) Photos: Joseph Hulbert (left photo); Rachel Brooks (middle photo); Rachel Brooks (right photo).

Figure 4. *Cryptostroma corticale* fruiting bodies in thin bark of bigleaf maple (left) and red maple (center and right). *Cryptostroma corticale* fruiting bodies on maple trees with thin bark are still sunken into the bark but may require a much closer inspection to notice this important characteristic. (*Note*: the white arrows point to sooty bark disease fruiting bodies, while blue arrows point to normal tree bark.) Photos: Rachel Brooks (left photo); Joseph Hulbert (middle photo); Joseph Hulbert (right photo).

Figure 5. *Cryptostroma corticale* fruiting bodies faded in color on bigleaf maple (left and center) and red maple (right). Sooty bark disease signs can fade or turn lighter over time. Additionally, as bark flakes off to expose these fruiting bodies, freshly exposed light-colored bark tissue that is not weathered may be visible adjacent to fruiting bodies (left and right photos). (*Note*: the white arrows point to sooty bark disease fruiting bodies, while blue arrows point to normal tree bark.) Photos: Joseph Hulbert (left photo); Rachel Brooks (middle photo); Joseph Hulbert (right photo).

Figure 6. *Cryptostroma corticale* fruiting bodies in bark of bigleaf maple trees. *Cryptostroma corticale* fruiting bodies may sometimes be found only on a portion of a tree, such as only one stem of a multiple stem tree (left photo) or just on one side or portion of a stem (middle and right photos). These fruiting bodies can be found throughout the tree (from ground level out to the branches) and are usually observed on dead tissues. (*Note*: the white arrows point to sooty bark disease fruiting bodies, while blue arrows point to normal tree bark.) Photos: Rachel Brooks (left photo); Rachel Brooks (middle photo); Rachel Brooks (right photo).

Please note, signs and symptoms may appear differently on other tree host species. The potential role of this fungus in other tree health issues should be considered, especially when the signs or symptoms noted above are observed in the same site.

Sooty Bark Disease Look-alikes

Other fungal fruiting bodies may be confused with sooty bark disease. One common look-alike includes *Kretzschmaria deusta*. This pathogen produces thick, rough, and lumpy fruiting bodies on the surface of the bark or wood, usually near ground level. Bark surface stains can also look black and be confused with sooty bark disease. For example, some insects that feed on a tree's sap produce a sugar-containing excretion that can coat a tree's surface, providing a food source for fungi. Similarly, bacterial infections of the tree's wood can cause slime flux or wet wood from increased pressure within a tree that forces sap out. The black surficial molds and similar organisms growing on these sugary liquids do not cause disease. If the discoloration only occurs on the natural bark surface and not just in areas where a layer of bark has flaked off, it is not indicative of sooty bark disease. Figures 7 and 8 show some common look-alikes to be aware of.

Figure 7. *Kretzschmaria deusta* fruiting bodies on bigleaf maple. *Kretzschmaria deusta*, also known as brittle cinder fungus, is a broadleaf tree pathogen that may be confused with sooty bark disease. Though these fruiting bodies are clearly white and light gray when fresh (left photo), they turn dark black and crumbly as they age and appear almost burnt looking (middle and right photo). Unlike sooty bark disease fruiting bodies, *K. deusta* fruiting bodies are visibly thick and are clearly on top of the wood or bark—not sunken into the bark. (*Note*: the black arrows point to sooty bark disease look-alikes, while blue arrows point to tree bark). Photos: Rachel Brooks (left photo); Rachel Brooks (middle photo); Dan Omdal (right photo).

Figure 8. Maple tree with a bark surface stain. Bark of living maple trees can appear darker in patches when sap is released. The sap provides a food source for black molds and similar organisms, which then grow on the surface of the bark. Mechanical injury, infection, or insect feeding can cause sap to be released from a tree. (*Note*: the black arrows point to sooty bark disease look-alikes, while blue arrows point to tree bark). Photos: Joseph Hulbert (left photo); Rachel Brooks (right photo).

It is important to note that the presence of look-alikes does not necessarily indicate an absence of sooty bark disease. More research is needed to identify the possible interaction between *C. corticale* and other plant pathogens such as *K. deusta*.

Diagnostic Confirmation

To confirm an uncertain field diagnosis, samples with suspected fungal mats (e.g., bark sections) should be submitted to a plant diagnostic laboratory. Three laboratory approaches are

commonly used to confirm the presence of *C. corticale*. Diagnosticians can examine the samples microscopically to view structures and spores, isolate, grow and identify the fungus from culture, or use molecular approaches (such as DNA extraction for amplification with diagnostic PCR) to confirm the presence of this pathogen's genetic material (Figure 9).

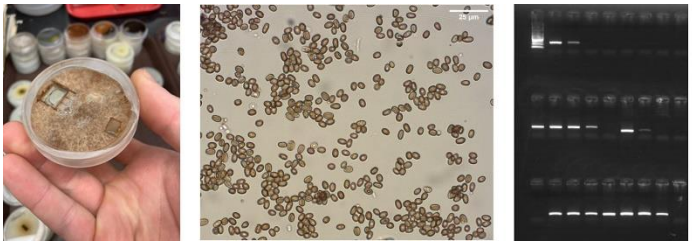

Figure 9. Culture of *C. corticale* growing on potato dextrose agar (left photo). Sooty bark disease spores viewed in a compound microscope (middle photo). Agarose gel photo showing samples that tested positive (illuminated bands) and negative (no bands) for *Cryptostroma corticale* genetic material using diagnostic PCR (right photo). Photos: Joseph Hulbert (left photo); Marianne Elliott (middle photo); Marianne Elliott (right photo).

Additional Sources of Information

Research relating to the development and spread of sooty bark disease in the Pacific Northwest is ongoing. To find out the latest information about this disease, human health impacts, and recommendations on what you should do if you identify diseased trees, please check the following resources:

WSU Puyallup Research and Extension Center: Sooty Bark Disease

Forest Pathology: Sooty-Bark Disease of Maple

Forest Health Watch: Watch Out for Sooty Bark Disease on Maples

Pacific Northwest Pest Management Handbooks: Maple (*Acer* spp.)—Sooty Bark Disease

Washington State Department of Health: Maple Bark Disease

References

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