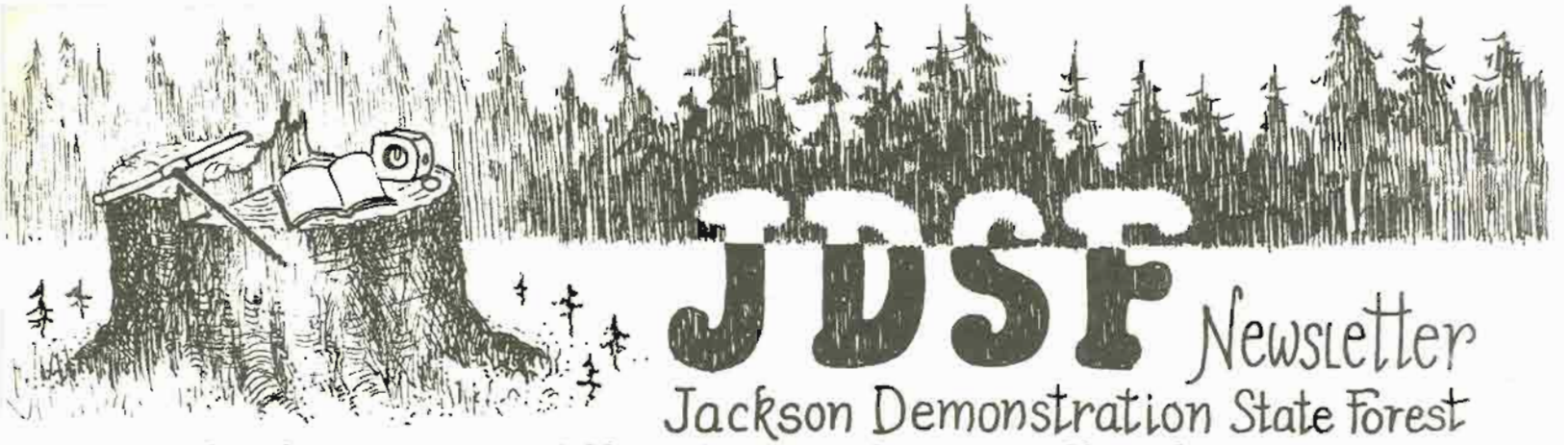

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AN INTRODUCTION TO BLACK STAIN ROOT DISEASE ON JACKSON DEMONSTRATION STATE FOREST

David Adams[1/]

Introduction

Present and potential pest impact should be considered in any forest management plan. Black stain root disease presents a potential crop loss impact which is not easily estimated through pre-harvest survey. Dead and dying trees can be marked for felling; but less obviously diseased trees are much more difficult to detect, even by the experienced observer. Suspect trees usually cannot be examined for black stain without severely damaging phloem, cambium and sapwood tissues around the butt during the search to confirm black stain infection.

In the past two years, Jackson Demonstration State Forest foresters have become increasingly concerned about the presence of black stain root disease in young growth Douglas-fir stands. Following the selection harvest of timber on the Hare Creek 1979 Timber Sale, the author conducted a disease assessment survey. It was obvious that some infected Douglas-firs had been marked for harvest while others had not, a fact that demonstrated the difficulty of identifying the disease in living trees. A primary objective of this survey and ongoing studies is to develop a more accurate method of pre-harvest indentification of infected trees so that stands containing black stain can be more effectively managed.

The purpose of this article is to describe the pathogen and symptoms associated with its occurrence. A future article will discuss the biology and control of the fungus.

The Pathogen

Black stain root disease caused by Verticicladiella wageneriii Kend. is a fungus found on roots of Douglas-fir and many species of pine. The common name has been derived from the fact that the woody tissue (tracheids) colonized by the fungus become very dark colored. Microscopic examination of the dark colored wood reveals hyphae of the fungus within and passing through the tracheid walls.

Sapwood alone is attacked by the fungus. Occasionally, however, black stain may be found in the stump well into the heartwood. This is not a deeper infection, but is probably due to an old infection that did not kill the tree and was overgrown as the tree grew in diameter.

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Small roots are killed during decline of the tree. Infected seedlings and saplings are quickly killed, while larger trees may not die for several to many years, or even survive an attack.

There is no wood decay associated with this disease, although bole wood may be downgraded because of stain. Conks are not produced; the fruiting bodies developed by this fungus are too small to be seen by the unaided eye. Host hypersensitivity to fungal toxins may be involved in tree decline. Certain root-feeding bark beetles or weevils may serve as vectors to move the fungus locally or over longer distances. Tree-to-tree spread through root grafts may occur but this has not yet been documented.

The Symptoms

External

Black stain infected trees are difficult to detect with any certainty prior to the time the disease has severely weakened the tree. Noticeably infected trees are off-color, have reduced growth, and often produce a stress cone crop. Excessive needle drop may occur throughout the tree, giving the foliage crown a "thin" appearance when compared with nearby healthy trees (figure 1).

Pitch flow from the lower bole as an indicator of black stain is quite variable in occurrence. In general, pitching is expressed as a late symptom of infection and is much more prevalent in coastal forests as opposed to those forests further inland. However, pitching may be due to other causes; e.g., Armillaria root rot or wounding, and cannot be assumed to always indicate black stain infection without further confirmation of each occurrence. Pitching caused by black stain is usually bluish-grey and flows copiously, often dripping onto adjacent shrub foliage or forming little mounds on the ground. Pitch flow originates between nodes and should not be confused with pitch flowing from a wound.

If pitch flow is present on the base of a tree (figure 2), black stain attack can usually be quickly confirmed by removing a wedge of wood below the point of pitching (figure 3). Most frequently however, crown symptoms may be present but pitch flow is absent. In this situation, if black stain is present in the tree, internal stain may not be near enough to the cambium to allow detection by taking wedges from the stem. It is better in this situation to cut down the tree and examine the stump surface. Even there, actual black stain may not be present and excavation and sectioning of roots may be necessary to confirm disease presence.

Internal

Internal disease appearance is best observed in a freshly cut cross-section of the tree near the soil. Black stain tissue varies in appearance on the stump surface depending on the amount of infection and the health of the tree at the time of harvest.

Undiluted bleach (i.e., Clorox, etc.) sprayed onto the freshly cut stump surface often aids in finding black stain infections. Black stain infected sapwood or "pathological heartwood," has been killed in the presence of the fungus and now looks like heartwood. The bleach reacts with the sapwood and heartwood (both natural and pathological) to visually separate these two distinctive woods.

(Cont'd. pg. 4.)

Photos courtesy of
Calif. Dept. of Food and Agriculture

Fig. 1. Thinning, chlorotic crown of infected tree in final decline. Note normally foliaged trees in background.
Fig. 2. Pitch flowing down bark (white points) may be present on infected trees.
Fig. 3. Diagnostic black staining of xylem (black point).
Fig. 4. Hyphae of V. wagnerii in trachieds of Douglas fir.

("Black Stain" Cont'd.)

In some infected trees actual black stain hyphae may not be present at stump level; pathological heartwood alone may be present. In other trees black stain hyphae can be observed in the dark area at the outermost edge of the pathological heartwood (arrow, figure 4). Occasionally, an area of pathological heartwood may be entirely separate from true heartwood. A small black area, if present, will contain hyphae of the black stain root disease fungus (figure 4).

In heavily infected trees usually most of the sapwood has become pathological heartwood. Actual black stain fungal hyphae may be found as remnants of earlier infection scattered within the pathological heartwood, but also can be found near or into cambial tissue. Annual rings may be compressed where black stain has approached the cambium.

Care must be taken not to confuse the non-pathological blue stain fungus of the sapwood with black stain. Blue stained areas are not surrounded or associated with formation of pathological heartwood. Blue stain colored areas of the sapwood do not look like the smaller, more sharply defined black stain infection, and blue stain comes into the tree or stump only after the tree has died.

Inquiries and/or requests for field visits should be directed by mail or phone to Department of Forestry's Forest Pathologist, Dr. David Adams (916-322-0126). His responsibilities include disease evaluations on State and private lands in California.

SUPER-SPAN GIVES SUPER STREAM PROTECTION

Craig E. Anthony[2/]

Times are changing on Jackson Demonstration State Forest. It is with a touch of sadness that the demise of the old Highway 20 bridge, located twenty miles east of Fort Bragg, is witnessed. Its 24-inch handhewn beams are gone.

Time has also weakened a classic redwood log bridge located one mile upstream from the old highway bridge. As the 35-ton crane strained to remove the six old-growth logs spanning the 50-foot stream crossing, those present could only marvel at the engineering feat required to construct this log bridge so many years ago.

Both bridges demonstrated a principle for stream crossings that in recent years has become very important. They allowed the natural streambed to co-exist with a stream crossing. These streams find their way into the Big River estuary. As in all northern California rivers, the importance of water quality and fish passage is a high priority. Anadromous fish need clean gravel for the incubation of eggs and fry. Also, significant inter-gravel water flow is needed to deliver oxygen and remove waste products from incubating embryos. Thus, it is essential to minimize streambed disturbance.

Time has claimed these existing bridges, but it cannot claim the concept of streambed protection. While the term "multi-plate arch" does not have the romantic ring of "handhewn beams," it does insure the continual protection of the natural streambed.

Masonite Corporation has replaced these bridges with multi-plate arches, commonly known as Super-Spans, trade name of Armco Incorporated. Replacement of these stream crossings is part of the two timber sales that were purchased by Masonite Corporation last year.

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A Super-Span is made of prefabricated steel plates, each weighing between 350 and 450 pounds. When the plates are assembled they form an arch over the streambed. Each side of the arch is fastened to a cement footing that runs the length of the arch on both sides of the stream. This results in the spanning of the stream without the installation of an artificial streambed which allows the unimpeded passage of anadromous fish species.

The watershed at the log bridge site empties 4,000 acres. This would have required the water passing capacity of a round pipe 14 feet in diameter. Large full round and multi-plate structures have been constructed with river run rock placed in the pipe to simulate a natural streambed; however, their costs approach or exceed that of a Super-Span. The existing road surface is only 13 feet above the streambed so a low profile Super-Span was selected. The arch height is 8 feet, with a width of 24 feet and a length of 62 feet. Five feet of fill was required at the center of the span.

The old highway bridge required an arch with an even larger water carrying capacity. The size of the watershed served by this arch is 4,500 acres. This calculates to a roll pipe equivalent of 15 feet in diameter. The road surface is 27 feet above the streambed and the engineers had to contend with a restricted stream width caused by rock walls on both sides of the stream. The selected arch for this location is 12 feet high, 18 feet wide, and 100 feet long.

The State Forest now has four Super-Spans. These are the only known Super-Spans in Mendocino County. It is anticipated that the economical and ecological benefits of the arch will result in increased use in the coastal region.

A California Forestry Note is being prepared detailing the cost analysis and technical descriptions of the two Super-Spans installed on the State Forest. It should be published in early 1982.

Super-Span Used to
Replace Old Log Bridge