



EDITOR'S
FILE COPY

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR

Research Note



Number 114

Portland, Oregon

April 1955

NEEDLE BLIGHT OF PONDEROSA PINE

By

EDITOR'S
FILE COPY

T. W. Childs, Pathologist
Pacific Northwest Forest and Range Experiment Station

This progress report describes the appearance and behavior of needle blight of ponderosa pine as it has been observed in central and eastern Oregon since 1945. Sorts and extent of damage are briefly discussed, results to date are presented from continuing studies, and timber marking and improvement practices are recommended for infected stands.

The current outbreak of blight is the worst on record but it is not the first. In 1913 the disease was observed in many localities. Then, as now, damage was more severe in Oregon than in Washington, Idaho, or Montana. Several small outbreaks have since occurred, but until recently none was extensive or destructive enough to attract much attention.

The needle blight fungus, Elytroderma deformans (Weir) Darker, is a native of western United States, occurring from California to British Columbia and east to Colorado. It has also been found in two localities in eastern North America. It is most destructive to ponderosa pine but sometimes attacks other 2- and 3-needled pines. Outbreaks usually start in thickets of reproduction, or in the lower crowns of larger trees, in stream bottoms and other sheltered situations where fog is more common and foliage is wet for longer periods than in the surrounding area. The blight then spreads into the middle and upper crowns and into more

exposed parts of the stand. Large trees are usually infected most heavily on the north to northwest sides and in the interiors of crowded groups. This suggests that fluctuations in abundance of the disease may be governed largely by moisture conditions, at least during the early stages of outbreaks.

DESCRIPTION

In spring and early summer, groups of infected needles are conspicuously red. These "flags" gradually fade so that by late summer it is almost impossible to distinguish them, at a distance, from the older needles that have faded preliminary to normal fall defoliation.

The characteristic dark, slender fruiting bodies of the blight fungus first appear during early June as faint lines on the outer (convex) surfaces of the red needles, and become plainly visible within the next few weeks. When these fruiting bodies are present the blight can easily be distinguished from winter or drought injury and from other, less destructive, diseases that occur on ponderosa pine foliage (fig. 1). Most of the spores ripen in the fall and are ejected when the foliage is wet. Practically all of the killed needles then drop, but a few old bleached ones occasionally remain attached to the twigs, sometimes for 2 or 3 years, with the sooty, ragged remnants of the fruiting bodies still visible upon them.

On a twig that has once borne blighted foliage, the year-old foliage is usually destroyed each year until, within a few years, the twig dies.

EFFECT ON THE TREE

Ponderosa pine needles normally live for 3 or 4 years, but when infected by the blight they die near the end of their first year. In crowns that have been very severely infected for 2 or 3 years, the foliage consists mostly of needles produced during the preceding spring, and even these die shortly before the next year's growth appears. New needles are stunted and yellow, and never attain full size or good color. Deprived of the foliage necessary for its existence, the tree soon dies. Trees killed rapidly in this way are not attractive to the western pine beetle.

Where blight is less severe, few if any trees are killed outright, but many have their crowns drastically thinned by the disease (fig. 2) and are correspondingly reduced in vigor and in ability to resist attacks by other enemies. Such trees

are attractive to both mountain and western pine beetles, and produce large broods. Fairly vigorous trees that have been lightly to moderately infected for a few years usually produce compact, globose witches' brooms (fig. 3).

EFFECT ON THE STAND

The current outbreak probably started in the early 1940's. In the few localities where the disease first became abundant, most of the trees on areas of about 40 to several hundred acres were soon killed.

Where blight has become abundant more recently, damage has usually been slower and less severe. On 6 plots, which have been under observation for 3 to 5 years, mortality from blight has occurred principally among trees with "D" crowns according to the Keen classification and with a large majority (usually more than 80 percent) of the twigs bearing blighted foliage when the plots were established. Results from these plots are summarized in table 1. The figures in this table do not indicate the destructive power of the disease as it was evident on a few of the first and worst outbreak areas, but they do indicate the extent of the killing that the disease has caused during the past few years in most of the stands where it has been abundant. Mortality from root rot, beetles, and windthrow has equalled that from blight on these plots but has been much more uniformly distributed among the various crown and infection classes. Most of the moderately to severely infected trees have survived considerable defoliation for several years and show no signs of dying in the near future. However, these trees and thousands like them have been transformed by needle blight from good mortality risks into poor ones.

Damage is not confined to timber of merchantable size. On some areas, practically all pine reproduction from sapling to small-pole size has been killed in patches of several acres. These losses are counterbalanced to only a small extent by the thinning that the disease has caused in stagnated thickets.

Although the disease is sometimes very destructive in ponderosa pine stands, its effects are often greatly overestimated because of the marked contrast between infected and healthy foliage in the spring. At this season a moderately infected stand looks as though many of the trees will die within a year or so. In reality the potential damage may consist entirely of reduction in growth rate and gradual increase in mortality as some of the weakened trees are attacked by other parasites. Fall estimates, on the other hand, are likely to be too conservative because the killed foliage has faded so much that it is relatively inconspicuous.

At best, reasonably dependable estimates can be made only of the damage that will result from infection visible at the time of estimate. Fluctuations in prevalence of the disease cannot be predicted until more is known about the conditions that permit infection to occur, but it can be assumed from past experience that periods of abundance and locally severe damage will alternate with periods when the disease is not common enough to cause appreciable damage. The blight is simply one of the normal, although intermittent, hazards to which ponderosa pine stands are subject. On a long-term average, risk of loss from needle blight is probably smaller than risk of loss from fire.

RECOMMENDED PRACTICES

Acceleration of logging in blight areas is necessary not only to salvage values that will otherwise be lost but also to prevent buildup of beetle populations.

During clear weather in spring and early summer, timber markers can anticipate the effects of blight by assuming that twigs with blighted foliage will die within a few years, and making cut-or-leave decisions accordingly. On cloudy days and at other seasons the extent of the disease within the crowns of large trees cannot be determined from the ground. Markers working in infected stands should make a special effort to relieve crowding of crowns, particularly in groups of three or more trees. They should keep constantly in mind the fact that the disease is most injurious to trees with poor crowns even though it is most conspicuous in good crowns.

Presence of needle blight should not be allowed to prevent stand improvement work except perhaps where infection is exceedingly severe. Risk of loss of the investment is not excessive, since the disease is, in general, less destructive to young stands than are porcupines or dwarfmistletoe. Even where infection is fairly severe, its effects on potential crop trees will usually be limited to moderate reductions in growth rate and in density of stocking. There is reason to believe that thinning will somewhat reduce the subsequent spread of infection.

Although investigations of the disease are continuing, control by spraying or other direct methods is not likely to be practicable within the foreseeable future.

Table 1.--Ponderosa pine mortality from needle blight on six plots^{1/}

Keen	Trees alive at time of plot establishment					Trees killed by needle blight since plot establishment				
	Un- infected	Lightly infected	Moder- ately infected	Severely infected	Very severely infected	Un- infected	Lightly infected	Moder- ately infected	Severely infected	Very severely infected
Class	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
1 A	1	2	2	2	--	0	0	0	0	--
B	--	2	--	1	--	--	0	--	0	--
C	--	--	--	--	--	--	--	--	--	--
D	--	--	1	--	1	--	--	0	--	0
2 A	3	11	17	5	--	0	0	0	0	--
B	10	16	25	21	2	0	0	0	0	0
C	14	18	16	30	5	0	0	0	1	1
D	2	--	2	13	10	0	--	0	2	3
3 A	8	15	8	3	--	0	0	0	0	--
B	50	93	28	12	--	0	0	0	0	--
C	82	144	48	19	6	0	0	0	0	2
D	12	9	5	9	8	0	0	2	2	6
4 A	2	4	--	--	--	0	0	--	--	--
B	14	13	1	--	--	0	0	0	--	--
C	15	20	5	5	--	0	0	0	0	--
D	5	2	2	4	--	0	0	0	1	--

^{1/} These plots were established in cooperation with the Ochoco, Malheur, and Whitman National Forests, in stands where infection was so abundant that severe damage was expected. Crown and infection classes shown in this table are as of the date of plot establishment. The unusually large percentage of "D" crowns is probably a result of blight injury before the plots were established. Infection classes were defined as follows, on the basis of percentages of twigs bearing infected foliage: Uninfected--less than 1%; Lightly infected--1 to 20%; Moderately infected--21 to 50%; Severely infected--51 to 80%; Very severely infected--81 to 100%.

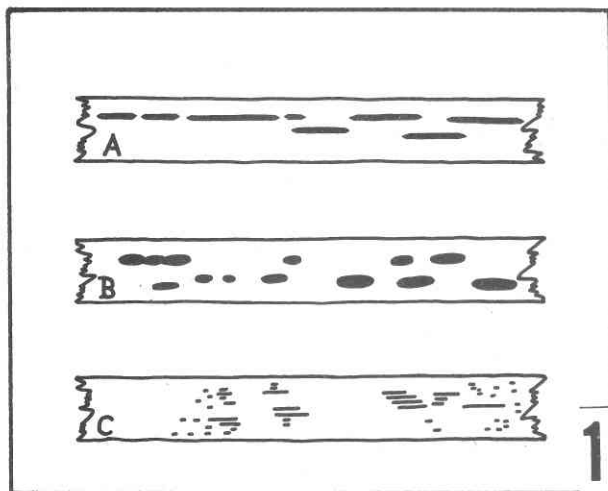


Figure 1. Shape and distribution of fruiting bodies of 3 fungi common on ponderosa pine needles (x6). A. Elytroderma deformans (needle blight) usually fruits on 1-year-old needles. B. Hypodermella medusa, a close but much less damaging relative of the blight, is usually restricted to 3- or 4-year-old needles. Fruiting bodies are wider, and usually shorter, than those of the blight. C. Leptostroma decipiens often occurs on 1-year-old needles but apparently causes little or no damage. It is sometimes abundant on foliage of twigs weakened by previous attacks of blight. Fruiting bodies are much smaller and more closely crowded together than are those of Elytroderma.

Figure 2. Ponderosa pines with crowns thinned by blight. The tallest tree at the left has been very severely infected, and the others have been moderately to severely infected, for at least 5 years.



Figure 3. Witches' brooms caused by blight. These differ in both shape and density from brooms caused by dwarfmistletoe.