Dwarf Mistletoe as a Host for Brown Felt Blight in California

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ABSTRACT

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The brown felt blight fungus (*Herpotrichia juniperi*) was found colonizing shoots of dwarf mistletoe (*Arceuthobium abietinum* f. sp. *magnificae*) growing on *Abies magnificae* in the higher elevations of the southern Cascades in California. The fungus was found only where deep snowpacks persist for a long time. Except for this report and one on *Primula* sp., the fungus is known to colonize only coniferous species.

Herpotrichia juniperi (Duby) Petrak (*H. nigra*) (1) and *Neopeckia coulteri* (Pk.) Sacc. are fungi that cause a disease of conifer foliage commonly called "brown felt blight" or "snow mold." In North America, *H. juniperi* was thought to occur only on conifers other than pines, and *N. coulteri*, only on pines (4,9); however, Shope (7) reported *H. juniperi* on pines and other conifer species in Colorado. In only one instance has brown felt blight been reported on a species other than a conifer. Boyce (2) reported that Meinecke found *H. juniperi* on both primrose (*Primula* sp.) and foxtail pine (*Pinus balfourianai* Grev. & Balf.) in the same area in the southern Sierra Nevada.

Brown felt blight fungi are unusual in that they develop on foliage under the snow and only in areas where the snowpack persists for a long time (8). In California, for example, brown felt blight has been found on most conifers in the higher elevations of the Sierra Nevada and southern Cascades. In many of these areas, the snowpack often reaches a depth of 3 m or more. Throughout much of the winter, small trees and lower branches of larger trees are covered with snow for extended periods, creating conditions ideal for brown felt blight.

The way in which these fungi damage trees is not fully known. Boyce (3) reported that the organisms parasitize and kill needles and smother the foliage with their dense brown to black mycelium. Tubeuf and Smith (10) suggest that lower branches and small trees pressed to the ground by the snow become infected by the fungi growing in litter. Simms (8) found infection much higher in trees and showed that branch litter deposited in the snowpack also serves as a mode of infection when the melting snow deposits the infected litter on foliage-bearing branches. Apparently, only needles are initially infected, and penetration occurs through stomata (6,8). After death of the foliage, the fungus apparently is then able to enter and kill twigs through needle scars (8). Mature fruiting bodies develop on dead twigs and needles under the snow two winters after they have fallen from the tree.

In August 1983, brown felt blight was observed on several red firs (*Abies magnifica* A. Murr.) in Latour State Forest in Northern California. The firs examined were 3–10 m tall, growing at an elevation of about 1,950 m. Above-normal precipitation occurred during the 1982 winter, and the snow in the area reached depths of 3–5 m. During that winter, many of the smaller trees and lower crowns of the larger ones were covered with snow.

This study reports the occurrence of brown felt blight on another nonconiferous host, red fir dwarf mistletoe (*Arceuthobium abietinum* Engelm. ex Munz f. sp. *magnificae* Hawks. & Wiens). Observations showed that many of the dwarf mistletoe plants on smaller trees or on lower branches of larger trees were colonized by brown felt blight. The study also describes the damage that can occur to dwarf mistletoe shoots from brown felt blight.

MATERIALS AND METHODS

In July of 1984, a study was undertaken to determine the extent to which brown felt blight had colonized and defoliated dwarf mistletoe plants in a stand of red firs on the Latour State Forest. Thirteen open-growing, dwarf mistletoe-infected red firs 2.5–8 m tall were selected for study. The trees were felled and all dwarf mistletoe infections examined. Data collected on the dwarf mistletoe infections included height within the tree, number of shoots (none, sparse = one to 10, and abundant = more than 10), and presence of brown felt blight (none, light = fewer than half of the shoots blighted, and heavy = more than half of the shoots blighted).

Other conditions that may have been responsible for the presence or absence of dwarf mistletoe shoots also were recorded. A total of 1,114 dwarf mistletoe infections were examined.

RESULTS

The fungus was identified as *H. juniperi* by ascocarp morphology and by ascospore shape, color, and septation (1). All trees contained some dwarf mistletoe plants with brown felt blight. Plants with blight most often were found within 1.5 m of the ground, but a few occurred between 3.1 and 4.5 m (Table 1). No blight was observed above 4.5 m. In most instances, the fungus was not abundant and not all shoots were affected, but when abundant, nearly all shoots were dead (Fig. 1). In some instances, the brown fungus mycelium remained on the portion of an infected branch where shoots had died and fallen. Some fir foliage also was killed by the fungus, but there was no indication that the fungus had spread from the foliage to dwarf mistletoe shoots.

The percentage of dwarf mistletoe plants with shoots was smaller in the lower portions of fir crowns than in the

Table 1. Percentage of dwarf mistletoe plants with brown felt blight at different heights above the ground

Brown felt blight[a]	Height above ground (m)			
	0–1.5	1.6–3.0	3.1–4.5	>4.5
None	70	84	97	100
Light	18	13	3	0
Heavy	12	3	0	0

[a] Light = fewer than half and heavy = more than half of the shoots blighted.

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Table 2. Percentage of dwarf mistletoe plants bearing shoots at different heights above the ground

Shoots[a]	Height above ground (m)			
	0–1.5	1.6–3.0	3.1–4.5	>4.5
None	72	51	28	25
Sparse	27	47	64	69
Abundant	1	2	8	6

[a] Sparse = one to 10 shoots and abundant = more than 10 shoots.

tops (Table 2). The blight fungus was found in only 20% of the cases where shoots were missing.

Another fungus, *Colletotrichum gloeosporioides* Penz. sensu von Arx, also was found infecting dwarf mistletoe shoots and undoubtedly was responsible for some shoot mortality and loss, particularly in the lower crown (5). However, most of the shoots infected by *Colletotrichum* were on plants in the middle to upper portions of the crowns. Of 556 plants with shoots, 219 (39%) had one or more shoots infected by *Colletotrichum*. Therefore, both brown felt blight and *Colletotrichum* may contribute to the reduction in dwarf mistletoe shoots.

DISCUSSION

Although pathogenicity tests were not conducted, field evidence strongly suggested that the brown felt blight fungus (*H. juniperi*) can colonize and kill shoots of red fir dwarf mistletoe. The only other reported colonization of a non-conifer host (2) may have occurred when infected lower branches of foxtail pine came in contact with primrose growing under the tree. Colonization of dwarf mistletoes apparently occurs directly, without the fungus having to initiate infection on red fir foliage. The mechanism by which the organism damages dwarf mistletoe plants is not known.

Deep, persistent snowpacks seem to favor the disease. The Latour State Forest manager estimated that the snowpack in winter of 1982–1983 reached depths of about 3 m or more in the study area; nearly all blighted plants were within about 3 m of the ground. During years of shallower snowpacks, one would expect diseased plants to be closer to the ground.

Most dwarf mistletoe plants examined in the study were devoid of shoots and only basal shoot scars remained, but not all shoot loss could be attributed to brown felt blight or *Colletotrichum*. Other factors, including breakage by wind or snow or natural abscission, may have contributed to the loss of shoots.

The extent to which brown felt blight operates as a biological control agent is not known, but during years when snow conditions favor colonization, the fungus probably reduces fruit production and population buildup of red fir dwarf mistletoe.

Fig. 1. Dead shoots of red fir dwarf mistletoe covered with the mycelium of the brown felt blight fungus (*Herpotrichia juniperi*).

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