

# Survey of Wood Decay and Associated Hymenomycetes in Central Washington Apple Orchards

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## ABSTRACT

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An estimated 3.5% of 200 producing apple trees in central Washington were free from discolored and decayed wood, 52.5% contained discolored wood, and 44% contained decayed wood. Hymenomycetous fructifications of 16 species were observed on the approximately 225 acres of apple trees examined. The most common species were *Flammulina velutipes* and *Coriolus versicolor*. Five species constituted new host-fungus records: *Coltricia perennis*, *F. velutipes*, *Merulius* sp., *Pholiota aurivella*, and *Poria ferruginosa*. Four other species have not been reported on apple trees in Washington: *Naematoloma fasciculare*, *Pleurotus* sp., *Poria* sp., and *Phellinus igniarius*. Other species identified were: *Bjerkandera adusta*, *Coriolus velutinus*, *Fomitopsis pinicola*, *Ganoderma applanatum*, *Pholiota squarrosa*, and *Trametes hispida*. The ascomycete *Daldinia vernicosa* was also reported for the first time on apple trees in Washington.

Additional key words: *Malus domestica*, *M. pumila*, Shigometer

Wood decay of living apple trees (*Malus domestica* Borkh.) in commercial orchards was noted by plant pathologists at least 65 yr ago (11). No publications have dealt specifically with wood decay in central Washington orchards, although Ketchie et al (4) and Covey and Larsen (*personal communication*) noted extensive wood decay on apple trees in the Wenatchee area of central Washington in 1976. We conducted a survey to determine the prevalence of this phenomenon in central Washington and to identify the associated hymenomycetes.

## MATERIALS AND METHODS

From 26 orchards selected on the basis of owner permission from the Yakima Valley to the Oroville area, 200 producing apple trees 10-60 yr old were evaluated for discolored and decayed wood from June through November 1977. Alternate trees in the second and third rows, with respect to a border, were surveyed in each orchard. Trees showing one or more of the following were considered to contain decayed wood: 1) hymenomycetous sporophores; 2) large (> 100 cm<sup>2</sup>), unhealed winter injury scars; 3) large (> 5 cm diam), unhealed pruning wounds; and 4) exposed, decayed wood. The assumption that large, unhealed wounds indicate decay was based on our

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approximately 50% of all unhealed pruning wounds greater than 5 cm in diameter had decay within 0-10 cm. Winter injury wounds result from longitudinal splitting of bark caused by extreme cold, with subsequent exposure of the underlying xylem. Winter injury scars averaged 10 cm in surface diameter. Wood decay was only rarely associated with completely healed wounds. Trees without any of the listed characters were not considered to contain decayed wood and were tested for discolored wood with a Shigometer (8). On the basis of test results, the trees were categorized as containing either discolored wood or only clear (nondiscolored) wood.

In addition, a 5- to 20-acre block of trees in each of the surveyed orchards was inspected for hymenomycete fructifications. Identification to species was based on available reference sources (3,5,6,8-10). Fructifications were also casually observed on apple trees while we

preliminary study of 84 apple trees that were felled and dissected to locate decay and infection courts. In that study we found decay to be most advanced in wood 0-10 cm from unhealed wounds. All unhealed winter injury wounds and

**Table 1.** Incidence of discolored and decayed wood in 200 standing apple trees in central Washington

Wood condition	Tree age group (estimated years)									Total
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50+	
Clear	3	4	0	0	0	0	0	0	0	7
Discolored	13	21	14	15	25	0	2	8	7	105
Decayed	5	5	34	11	10	2	1	14	6	88

**Table 2.** Wood decay fungi sporophores collected on apple trees in central Washington, June through November 1977

Fungus <sup>a</sup>	Trees <sup>b</sup> (no.)	Areas <sup>c</sup>	Reported <sup>d</sup>
<i>Bjerkandera adusta</i> (Willd. ex Fr.) Karst.	2	W	*
<i>Coltricia perennis</i> (L. ex Fr.) Murr.	1	W	***
<i>Coriolus velutinus</i> (Fr.) Quél.	3	W	*
<i>Coriolus versicolor</i> (L. ex Fr.) Quél.	24	E,L,M,O,W,Y	*
<i>Daldinia vernicosa</i> (Schw.) Ces. & de Not.	2	W	**
<i>Flammulina velutipes</i> (Fr.) Karst.	190	E,L,O,W	***
<i>Fomitopsis pinicola</i> (Swartz. ex Fr.) Karst.	7	L,M,O	*
<i>Ganoderma applanatum</i> (Pers. ex Wallr.) Pat.	11	O,W	*
<i>Merulius</i> sp.	1	M	***
<i>Naematoloma fasciculare</i> (Huds. ex Fr.) Karst.	2	L,M	**
<i>Phellinus igniarius</i> (L. ex Fr.) Quél.	7	W,Y	**
<i>Pholiota aurivella</i> (Fr.) Kummer	11	L,M,W	***
<i>Pholiota squarrosa</i> (Müller ex Fr.) Kummer	9	L,O,W,Y	*
<i>Pleurotus</i> sp.	14	M,O,W	**
<i>Poria</i> sp.	1	Y	**
<i>Poria ferruginosa</i> (Schrad. ex Fr.) M. C. Cooke	1	O	***
<i>Trametes hispida</i> Bagl.	2	O,Y	*

<sup>a</sup> All species are hymenomycetes except *D. vernicosa* (Sphaeriales, Ascomycetes).

<sup>b</sup> Number of trees on which sporophore was observed.

<sup>c</sup> E = Entiat, L = Leavenworth, M = Mt. Adams, O = Oroville, W = Wenatchee, Y = Yakima.

<sup>d</sup> \* = Previously reported on apple trees in Washington; \*\* = not previously reported on apple trees in Washington; \*\*\* = not previously reported on apple trees (1,7,12).

walked to and from the survey sites and in an orchard near Mt. Adams in southwest Washington. Approximately 5,000 trees were checked in this manner.

## RESULTS

Seven (3.5%) of the 200 trees contained only clear wood, 105 (52.5%) contained discolored wood, and 88 (44%) contained decayed wood (Table 1). Fifty-two (26%) trees showed sporophores of lignicolous hymenomycetes.

Sporophores of 17 species of wood decay fungi were identified on apple trees in central Washington (Table 2). The most common species, *Flammulina velutipes*, was found on 190 trees. The second most common species, *Coriolus versicolor*, was found on 24 trees. *F. velutipes* was found in all areas except Mt. Adams and Yakima; *C. versicolor* was found in all areas. An ascomycete, *Daldinia vernicosa*, was found in Wenatchee.

## DISCUSSION

The high incidence of decay in central Washington apple trees is not surprising, as many of these trees have been exposed to severe winter temperatures (4). Eide and Christensen (2) reported that winter injury was a predisposing factor in wood decay of apple trees in Minnesota. Many orchards were surveyed before certain hymenomycete species, most notably *F. velutipes*, had fruited for the season. One orchard surveyed in August and estimated to have 6% decayed trees was informally surveyed again in October. At that time, *F. velutipes* was observed fruiting from

the limb junctions in approximately 60% of the trees surveyed in August. That our estimates of decay are probably conservative is illustrated by the 10-fold increase in *F. velutipes* sightings between the August and September surveys. Ephemeral sporophores of *F. velutipes*, *Naematoloma fasciculare*, *Pholiota* spp., and *Pleurotus* spp. may be overlooked during surveys conducted when such species are not fruiting. Older trees may be expected to have a higher decay incidence than younger ones. Correlating these factors is difficult because in most central Washington orchards the cold-damaged trees were removed after the severe winter of 1968-1969. The trees that were left showed little winter injury or apparent decay.

Of the fungi listed in Table 2, the following species have not previously been reported on apple trees (1,7,12): *Coltricia perennis*, *F. velutipes*, *Merulius* sp., *Pholiota aurivella*, and *Poria ferruginosa*. The following species have been reported on apple trees but constitute new host-fungus records for the state of Washington (7): *N. fasciculare*, *Phellinus igniarius*, *Pleurotus* sp., and *Poria* sp. Although two *Pleurotus* spp. have been reported on apple trees in Washington, the descriptions of those two species, *P. serotinus* Fr. and *P. subareolatus* Peck., do not adequately match the characters of the species we collected on apple trees.

It is interesting to note that *F. velutipes*, the most common species, has not been reported previously on apple trees. This may be due to the ephemeral

nature of the sporocarp. In our survey we noted most fruiting bodies from late October to early December (occasionally throughout the winter and early spring); they were decomposed by April.

## LITERATURE CITED

1. ANONYMOUS. 1964. Index of plant diseases of the United States (Part 5). United States Department of Agriculture, Division of Mycology and Disease Survey. 950 pp.
2. EIDE, J. A., and C. M. CHRISTENSEN. 1940. Wood decay in apple trees in Minnesota. *Phytopathology* 30:936-944.
3. FARR, E. R., O. K. MILLER, and D. F. FARR. 1977. Bio-systematic studies of the genus *Pholiota*, stirps *adiposa*. *Can. J. Bot.* 55:1167-1180.
4. KETCHIE, D. O., R. D. BARTRAM, and C. H. BEEMAN. 1976. Evaluation of winter injury occurring during 1968-1979 in northcentral Washington. *Wash. Agric. Exp. Stn. Bull.* 826. 14 pp.
5. MILLER, O. K. 1973. *Mushrooms of North America*. E. P. Dutton & Co., New York. 360 pp.
6. OVERHOLTS, L. O. 1953. *The Polyporaceae of the United States, Alaska and Canada*. University of Washington Press, Seattle. 466 pp.
7. SHAW, C. G. 1973. Host fungus index for the Pacific Northwest. I. Hosts. *Wash. Agric. Exp. Stn. Bull.* 765. 121 pp.
8. SHIGO, A. L., and P. BERRY. 1975. A new tool for detecting decay associated with *Fomes annosus* in trunks of *Pinus resinosa*. *Plant Dis. Rep.* 59:739-742.
9. SMITH, A. H. 1963. *The Mushroom Hunter's Field Guide*. Rev. University of Michigan Press, Ann Arbor. 264 pp.
10. SMITH, A. H. 1973. Agaricales and related secotioid Gasteromycetes. Pages 451-478 in: G. C. Ainsworth, F. K. Sparrow, and A. S. Sussman, eds. *The Fungi*. Vol. IVB. Academic Press, New York. 504 pp.
11. WEIR, J. R. 1914. An unusual host of *Fomes fomentarius* Fries. *Phytopathology* 4:339.
12. WILTSHIRE, S. P., ed. 1968. Review of Applied Mycology. Plant host-pathogen index to volumes 1-40. *Commonw. Mycol. Inst., New, Surrey, England*. 820 pp.