Association of *Coriolus versicolor* with a Dieback Disease of Apple Trees in Washington State

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ABSTRACT

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Coriolus versicolor was consistently isolated from the decayed wood of living apple trees with limb dieback and papery bark.

Additional key words: *Malus domestica*, *Polyporus versicolor*

Australian researchers have associated *Coriolus versicolor* (L. ex Fr.) Quél., as *Trametes versicolor* (L. ex Fr.) Lloyd (= *Polyporus versicolor* L. ex Fr.), with a dieback disease of apple trees (*Malus domestica* Borkh.) (1,3,6). Symptoms include dying back of limbs, papery bark, and wood decay of affected branches (1). Wade (6) produced dieback symptoms on greenhouse-propagated apple trees by inoculating artificial wounds with *C. versicolor*, and Darbyshire et al (1) produced dieback symptoms in field trees by inoculation. Koch's postulates have not formally been completed. While surveying wood decay in central Washington apple orchards, we noticed symptoms similar to those described by Darbyshire et al (1).

MATERIALS AND METHODS

Branches from seven trees with dieback symptoms (Fig. 1) were selected for isolations: two Delicious cultivars approximately 25 yr old from an orchard in Wenatchee, four Winesap cultivars about 40 yr old from an orchard near Oroville, and one 3-yr-old Delicious cultivar from an orchard near Othello. Decayed wood basipetal to papery bark was selected for plating from six of the seven trees. A branch of the seventh tree displayed fruiting bodies of *C. versicolor*.

Chips of decayed wood approximately 0.5 × 2.0 cm were cut with a chisel dipped in 75% ethanol before each cut. Each chip was stored in a plastic bag at 5 C; isolations were made within 48 hr of cutting the chips. Flakes approximately 3 × 3 × 2 mm were cut from inside each chip, surface-sterilized in 0.7% NaOCl for 10–20 sec, and rinsed in sterile distilled water for 45 sec. The flakes were plated on malt extract agar, incubated at room temperature, and examined after 7–10 days for fungi. Examinations continued for four more weeks.

Fungi with clamp connections (plus fungi without clamps but suspected of being basidiomycetes because of other morphological characters) were transferred to malt agar plates and incubated at room temperature in the dark (4). Cultures were identified to species with Nobles' key (4) and by comparison with stock cultures from identified sporophores.

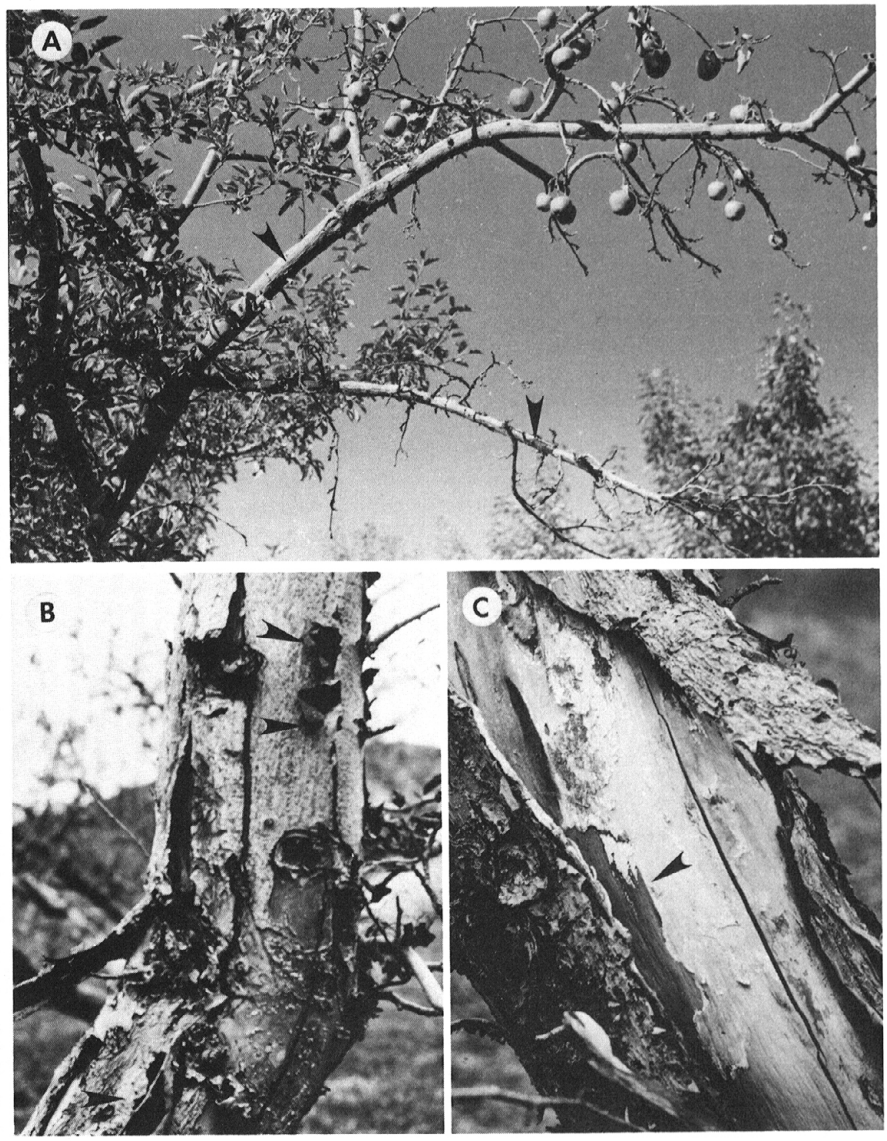

Fig. 1. Apple trees from central Washington with signs and symptoms of a dieback disease: **(A)** Branch of Delicious cultivar. Note papery bark (arrows). **(B)** Papery bark (arrows) on Winesap cultivar. **(C)** Bark necrosis and mycelium of *Coriolus versicolor* (arrow) on branch in B.

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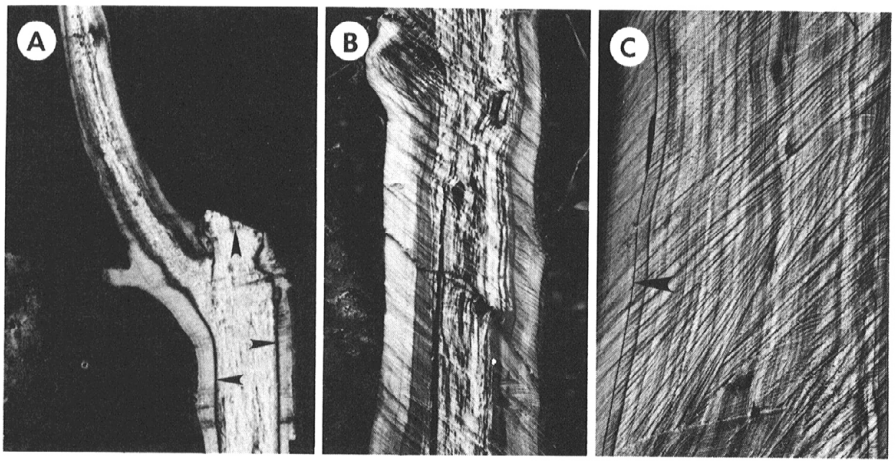

Fig. 2. Longitudinal sections of branches from central Washington apple trees with dieback symptoms: **(A)** Branch and trunk intersection from 3-yr-old Delicious cultivar. *Coriolus versicolor* was isolated from the central column of decayed wood. The pruning wound (top arrow) is the suspected infection court. Note the "barrier zone" (bottom arrows) surrounding the column of decayed wood. **(B)** Acropetal section of branch from old (about 40 yr) Winesap cultivar. *C. versicolor* was isolated from the central column of decayed wood. **(C)** Basipetal section of branch in B. A "barrier zone" (arrow) appears to surround the decayed wood.

RESULTS

C. versicolor was isolated from each branch with dieback symptoms; *Flammulina velutipes* (Fr.) Karst. was also isolated from one branch. *C. versicolor* is relatively difficult to identify in vitro because it shares many macroscopic and microscopic characteristics with at least 15 other basidiomycetes (4). Of this group of fungi, only *C. versicolor* sporophores have been observed on apple trees in central Washington (M. A. Dilley, *unpublished*). This fungus does not fruit in culture, although some isolates develop a pore layer on malt agar plates.

The Othello tree did not have papery bark, but the trunk displayed a central column of decayed wood surrounded by a thin (5 mm) layer of presumably healthy sapwood separated from white-rotted wood by a thin, dark, hard "barrier zone" (5) (Fig. 2A). A dead branch acropetal to this area was brown inside, with mottled areas of decay near the pith. The point of infection appeared to be a small, unhealed pruning wound 2 cm acropetal to the point of intersection of the dead branch and the trunk (Fig. 2A).

A similar condition was observed when a large (30-cm diam) branch of a Winesap cultivar with dieback was split in half with a chain saw along its 3-m length (Fig. 2B–C). This branch apparently died early in the growing season—small, dead leaves and fruit were still hanging from it in the fall. In addition, white mycelium was observed beneath the papery bark.

DISCUSSION

C. versicolor appears to be associated with this dieback disease of apple trees in Washington. The evidence presented here, plus other research studies reported above, suggest that *C. versicolor* is the causal agent of the disease, although other organisms may cause the dieback and papery bark symptoms. Shigo and Hillis (5) reported that wood decay fungi usually follow a succession of xylophilous bacteria and nonhymenomycetous fungi in the decay process. Perhaps a primary invader such as *Cytospora* sp. causes the dieback and papery bark, and *C. versicolor* follows, producing the wood decay. Significantly, however, of 16 species of wood decay fungi observed on apple trees in central Washington (2), only *C. versicolor* was consistently associated with dieback symptoms.

C. versicolor has not previously been linked with dieback on apple trees in the United States, although D. L. Coyier (*personal communication*) observed similar symptoms on apple trees in Oregon.

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