

Effects of *Phytophthora ramorum* Infection on Hydraulic Conductivity and Tylosis Formation in Tanoak Sapwood¹

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Abstract

Tanoak (*Lithocarpus densiflorus*) is highly susceptible to sudden oak death caused by *Phytophthora ramorum*. Symptoms include dying crowns, bleeding cankers, and, eventually, death of infected trees. The cause of mortality is not well understood, but we showed previously that naturally infected mature trees have reduced sap flow and reduced hydraulic conductivity. One possible mechanism for this is the presence of tyloses in xylem vessels formed in response to *P. ramorum* infection.

In this study, we examined the development of tyloses in relation to hydraulic conductivity of *P. ramorum*-infected sapwood. Boles of understory tanoak trees (6 to 12 cm DBH) were inoculated with mycelial plugs of *P. ramorum* placed at the cambium. Wounded non-inoculated controls received agar plugs without the pathogen. Trees were felled at one of two sampling dates (4 months or 14 months after inoculation) and boles were cut into subsections. Three subsections (0 to 12 cm and 12 to 24 cm above the inoculation point, and 12 to 24 cm below the inoculation point) were used for assessment of specific conductivity and observation of tyloses. Specific conductivity was measured in the lab on 1 cm x 1 cm x 10 cm pieces of wood chiseled from the sections. Sapwood was viewed in cross-section at 100 x, and the proportion of vessel lumens with tyloses was determined.

At both sampling dates, inoculated trees with xylem infections had significantly more tyloses as compared to wounded controls. At 14 months after inoculation, for all three bole sections combined, the proportion of vessel cross-sections with tyloses was 29.1 percent for diseased trees and 0.4 percent for wounded control trees ($p < 0.001$). Tylosis frequency was strongly associated with a decrease in specific conductivity of sapwood tissue ($p < 0.0001$, $r^2 = 0.24$). Over time, tylosis development increased in tissues further away from the inoculation site in advance of the vertical spread of infection. Results suggest that *P. ramorum*-infected sapwood contains numerous tyloses that could significantly impede stem water transport.

Results from this work are reported in more detail in: **Collins, B.R.; Parke, J.L.; Lachenbruch, B. and Hansen, E.M. 2009.** The effects of *Phytophthora ramorum* infection on hydraulic conductivity and tylosis formation in tanoak sapwood. *Canadian Journal of Forest Research*. 39(9) 1766–1776.

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