

Spread of Infection Within Tanoak (*Lithocarpus densiflorus*) Trees Inoculated With *Phytophthora ramorum*¹

Jennifer Parke,^{2,3} Bradley Collins,³ Gerri Buckles,² Everett
Hansen,³ and Barb Lachenbruch⁴

Abstract

In an experiment with mature naturally infected tanoak trees, *Phytophthora ramorum* was observed in sapwood and appeared to interfere with stem water transport (Parke and others 2007). We postulated that colonization of the xylem could contribute to rapid spread within the tree and lead to development of crown mortality symptomatic of sudden oak death. In this field experiment, we compared the initial spread of *P. ramorum* within xylem and phloem of tanoak trees inoculated at specific locations in the bole, basal sprouts, and belowground tissues. We determined hydraulic conductivity of sapwood from inoculated vs. wounded boles and investigated the spatial and temporal development of tyloses in response to infection.

The experiment was conducted in a redwood-tanoak stand at El Corte de Madera Open Space Preserve in the Midpeninsula Regional Open Space District in San Mateo Co., California. Boles of understory tanoak trees (10-15 cm DBH) were inoculated in May 2006 with mycelial plugs of *P. ramorum* placed at the cambium. Bole controls received agar plugs without the pathogen. Twigs of basal sprouts and belowground tissue were inoculated similarly. There were twelve replicate trees for each of the four treatments (bole wounded control, bole-inoculated, sprout-inoculated and root-inoculated). Half of the trees were harvested in September 2006 and the remaining trees were harvested in 2007. Sapwood samples were excised for hydraulic conductivity assays, and adjacent sapwood and phloem tissues were used for pathogen isolation, diagnostic PCR, and microscopy to determine the extent and location of *P. ramorum* infection.

For both sampling times, inoculated boles with xylem infections had significantly more tyloses compared to wounded, non-inoculated boles (Collins, 2008). In addition, the increase in tyloses was associated with a decrease in specific hydraulic conductivity, suggesting that tyloses induced by infection with *P. ramorum* could interfere with stem sap flow. Over time, tylosis development increased in tissues further away from the inoculation site, preceding the vertical spread of infection. Results suggest that infected sapwood contains numerous tyloses which could significantly impede stem water transport. This is consistent with the hypothesis that tanoak mortality associated with *P. ramorum* infection results, at least in part, from impaired hydraulic conductivity (Collins and others, *submitted*). In this study, infections did not spread from inoculated basal sprouts to the boles, nor did they spread from inoculated belowground tissues to aboveground tissues.

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² Department of Crop and Soil Science, 3017 Agriculture and Life Sciences Building, Oregon State University, Corvallis, OR 97331, USA.

³ Department of Botany and Plant Pathology, 2082 Cordley Hall, Oregon State University, Corvallis, OR 97331, USA.

⁴ Department of Wood Science and Engineering, 118 Richardson Hall, Oregon State University, Corvallis 97331, USA.

Corresponding author: Jennifer.Parke@oregonstate.edu.

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