

Histological Observations on Needle Colonization by *Cronartium ribicola* in Susceptible and Resistant Seedlings of Whitebark Pine and Limber Pine

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Abstract—Resistance to white pine blister rust based on a hypersensitive response (HR) that is conferred by a dominant gene has been identified as functioning in needles of blister rust-resistant families of sugar pine, western white pine and southwestern white pine. The typical HR response displays a characteristic local necrosis at the site of infection in the needles during the early stages of needle colonization by *Cronartium ribicola*. The localized host cell death early in the infection process is thought to prevent the pathogen from reaching the shoot tissue, thereby preventing further disease development. However, variation in macroscopic symptoms of needle reactions has been observed within and between different pine species and families. Blister rust resistance and variation in needle reactions to infection by *C. ribicola* have been observed in families of whitebark pine and limber pine, but it is not known whether HR type resistance functions in these species. Furthermore, it is not known whether the variation observed

in macroscopic needle reactions reflects intra- and interspecific variation in the HR type reaction, or if different cellular resistance mechanisms are expressed during needle colonization by *C. ribicola*. This study was undertaken to compare the histological details of needle colonization by *C. ribicola* in whitebark pine and limber pine seedlings with those of susceptible and HR reactions in western white pine seedlings. Histological observations and comparisons of needle colonization by *C. ribicola* in blister rust susceptible and resistant limber pine, whitebark pine and western white pine individuals suggests that substantial colonization of resistant phenotype needles occurs, despite the presence of a HR-like response. The presence of large amounts of *C. ribicola* hyphae observed in western white pine individuals displaying HR-like needle reactions was unexpected, and suggests that mechanisms other than HR responses in needles may be involved in blister rust resistance. Further examinations are underway.

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