Rust Resistance in Seedling Families of *Pinus albicaulis* and *Pinus strobiformis* and Implications for Restoration

Abstract

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Abstract—Infection and mortality levels from *Cronartium ribicola*, the fungus causing white pine blister rust, are very high in parts of the geographic range of *Pinus albicaulis* (whitebark pine) and *P. strobiformis* (Southwestern white pine). Genetic resistance to this non-native fungus will be one of the key factors in maintaining or restoring populations of these species in areas of high blister rust incidence. Trials at Dorena Genetic Resource Center (Dorena GRC), OR, for blister rust resistance evaluation of seedling progenies of *P. albicaulis* from Oregon and Washington populations began in 2001; the first seedling rust resistance trial of *P. strobiformis* from New Mexico selections have been underway since 2002. Over 350 seedlots of whitebark pine have been inoculated with rust, and hundreds more are available for testing in the future. Ten seedlots of *P. strobiformis* have been tested to date at Dorena GRC, and the level of resistance in all 10 of these canker-free phenotypic selections from a highly infected stand is very encouraging. Forty-three additional *P. strobiformis* seedlots, from three national forests in New Mexico, were inoculated in September 2010, and will be evaluated over the next five years. In both species, seedling screening has identified several types of resistant responses, including a hypersensitive type needle spot that results in canker-free seedlings in several *P. strobiformis* families and bark reactions in other *P. strobiformis* families. Compared to *P. monticola* and *P. lambertiana* controls, *P. strobiformis* had a higher percent of seedlings with no needle spots, fewer needle spots per seedling, fewer seedlings with stem infections, fewer stem infections per tree, a higher percentage of seedlings alive with stem infections and higher overall survival. In some tests, the canker-free proportion in *P. albicaulis* has ranged from 0 to >80 percent for the different seedling families. The first tests suggest a possible geographic trend in rust resistance in *P. albicaulis* in Oregon and Washington, with lower frequency of resistance in southern populations. If the current tests confirm this trend, it would suggest that more trees would need to be tested in some parts of the species range than in others to provide a diverse genetic base within each breeding zone. Current results also suggest that the resistance in *P. albicaulis* is effective at both low and higher inoculum densities and to several geographic sources of blister rust. Monitoring of parent trees identified as resistant (based on rust testing of their progeny) will be useful in helping to detect potential changes in pathogen virulence or aggressiveness. Collection of cones from parent trees identified as resistant can be used immediately to facilitate restoration efforts. For greater levels of resistance, seed orchards can be established, but seed would not likely be available for a decade or more.

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