Some Recent Highlights From A White Pine Blister Rust Resistance Program For Western White Pine And Sugar Pine

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Introduction: In Oregon and Washington (USDA Forest Service, Region 6), there has been a white pine blister rust resistance program for over 40 years. Artificial inoculation at Dorena Tree Improvement Center, and subsequent evaluation of resistance mechanisms of both sugar pine (*Pinus lambertiana*) and western white pine (*Pinus monticola*) seedlings with white pine blister rust (*Cronartium ribicola*) has been a major component of this program. Only recently has there been a strong emphasis on out planting some of the resistant seedlots to evaluate their performance under field conditions. This presentation presents preliminary results from recent inoculations and field plantings of western white pine and sugar pine.

Artificial Inoculations: Western white pine (WWP) and sugar pine (SP) seedling families sown in 1994 and 1996 provided an opportunity to assess several things, including performance of checklots from: (a) the Idado WWP resistance program (USDA Forest Service, Region 1), (b) the California SP program (USDA Forest Service, Region 5), as well as previously identified 'slow rusting' and major gene resistance (MGR) families from the Dorena program and seed orchard bulk lots. Two 'strains' of rust were used in inoculations, with some replications being inoculated with 'wild' type (presumably no 'Champion Mine' strain present), and some replications being inoculated with 'Champion Mine' strain (which 'overcomes' the major gene resistance in WWP);

Results through the third inspection (two years after inoculation) indicate that the high resistant Dorena WWP 'MGR' families have relatively low cankering with 'wild' type strain of the rust (in fact, as expected, the highest incidence of canker-free of all tested seedlots), but showed a very high frequency of cankering when inoculated with 'Champion Mine' strain. Sugar pine families with major gene resistance (for the hypersensitive reaction in the needles) appear to be unaffected by the 'Champion Mine' strain.

Other results to date show that:

(1) the two homozygous dominant 'MGR' sugar pine seedlots both unexpectedly showed low levels of stem infection with both strains of rust
(2) 'slow rusting' resistance seem to be more common in WWP than in SP
(3) the five Idaho control cross seedlots had a incidence of cankering and 'slow rusting' similar to some of the Region 6 open-pollinated 'slow rusting' seedlots
(4) the 'slow rusting' families appeared to not be adversely affected by the 'Champion Mine' strain
(5) in at least some geographic areas there was a positive family correlation between needle lesion frequency and percent cankering

(6) on a family mean basis, some of the better 'slow rusting' families were also relatively highly rated for canker-free.

Three years of assessments are remaining on the 1996 sowing, and there some of the 'slow rusting' families have started to show increased mortality (but delayed over the 'non-resistant' families).

Field Testing: Seedlings from 12 sugar pine and 13 western white pine families were planted at Happy Camp, California in 1996, for field validation of families artificially screened for white pine blister rust. Container stock (1-0) from a mixture of resistant and non-resistant families was planted in 12 blocks in a randomized complete block design. An initial assessment was done in early summer 1999, in which height, number and type of cankers (normal, bark reaction, partial bark reaction or blight) was recorded. These results indicated moderate levels of blister rust infection, with sugar pine having a significantly higher percentage of trees infected (both active and inactive cankers) and significantly more stem infections per infected tree than western white pine (based on all trees, including healthy). Height differed significantly between species, and among families within a species, but the number of cankers per tree was not significantly different between families at this age. An unexpected result from this assessment is the very high percentage of infections that are bark reactions (completely inactivated infections), despite the fact that only some of the families of both species were selected for this mechanism. The reason for this high level of bark reaction is unknown at this time. A subsequent assessment took place in July 2000 to track the progression of blister rust infection in the individual families, and contrast differences in infection, and subsequent mortality between the two species. In addition, it will show whether the observed bark reactions have remained inactive, and the current status of infection scored in 1999 as partial bark reaction.

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