Genetic Variation in *Pinus taeda* L. Populations for Fusiform Rust Disease Incidence from Artificial Inoculations and Correspondence to Field Trials

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Fusiform rust, caused by the fungus *Cronartium quercuum* f. sp. *fusiforme*, is the most damaging disease affecting the health and productivity of loblolly pine (*Pinus taeda* L.), the most commercially important pine in the United States. Planting genetically improved stock is the only efficient way to mitigate disease incidence. Artificial inoculation of seedlings and progeny testing can be used to select genetically resistance germplasm in loblolly pine breeding populations in the Southeastern U.S. This study was conducted in a loblolly pine population to assess genetic variation for resistance to fusiform rust disease. In this study, 24 loblolly pine parents were mated to produce 76 full-sib crosses using a three disconnected eight-parent diallel mating design. Approximately 120 full-sib seedlings of each cross was challenged with 50,000 spores per milliliter of a broad-based inoculum from across the expected deployment region. The overall disease incidence from the artificial inoculation was 48%. The narrow-sense heritability of full-sib family means was 0.90, suggesting strong genetic control of the disease incidence on the family level. For further testing, all seedlings with fusiform rust galls and 25 entire crosses with high disease incidence were discarded. The remaining 2362 seedling progeny of the 51 crosses were clonally propagated via rooted cuttings. One genetically identical copy of each clone (ramet) was planted at eight test sites across the Southeastern U.S. The disease mean from the field tests was 5.3% while the nonscreened seedling checklot family had a mean of 23%. Narrow-sense clone mean heritability for disease incidence was 0.47 while broad-sense clone mean heritability was 0.69. The correlation between the disease incidence from the artificial inoculation and field trials was 0.44 for the full- sib families, while correlation was 0.74 for half-sib families (not truncated during artificial inoculation or cloned for the disease when tested in the field trials).