ROLE OF MAJOR GENES FOR RESISTANCE IN THE LOBLOLLY PINE-FUSIFORM RUST FOREST PATHOSYSTEM

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Abstract. The genetic basis of disease resistance in forest trees is poorly understood, but for long-lived trees to survive the resistance must be durable. Forest tree disease resistance traditionally has been viewed as polygenic (controlled by many genes each with small effect), and most tree breeding programs have used quantitative approaches to define disease resistance. In contrast to this, examples of host-pathogen specificity in some forest pathosystems suggest that major resistance genes play a role, but convincing evidence for Mendelian inheritance of major gene resistance in forest trees is rare. In studying the loblolly pine-fusiform rust *(Pinus taeda-Cronartium quercuum* f.sp. *fusiforme [Cep* pathosystem, we recently identified and mapped with RAPD markers a major gene for fusiform rust disease resistance in a pedigree of loblolly pine family 10-5 across three generations. While inheritance of this resistance gene appears to be simple, disease expression is a complex trait which is environmentally modulated. A new approach of complex trait dissection with molecular markers has allowed us to quantify an environmental component of disease phenotype which confounded previous analyses. Existing phenotypic data suggest that other major genes for fusiform rust resistance are present among various loblolly pine families. We hypothesize that fusiform rust disease resistance in loblolly pine is controlled by major resistance genes, that resistance gene and corresponding virulence gene frequencies are low and that resistance genes have an associated resistance cost. We propose to use molecular (RAPD) markers and a complex-trait approach to determine the extent and role of major resistance genes in the endemic loblolly pine-fusiform rust forest pathosystem by addressing each of these hypotheses. Demonstration of a role for major genes in forest tree disease resistance will advance basic understanding of forest pathosystems for both the pathology and the ecology communities. Fusiform rust disease is the most economically damaging forest tree disease in the southern US, and this research will directly impact and probably redefine tree breeding efforts against this disease.