Abstract of the Dissertation
Ecological and Genetic Factors Influencing a Natural Plant-Pathogen Interaction

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Little is known about the ecological and genetic factors that influence plant-pathogen interactions in nature, although theories about the importance of pathogens assume that certain factors are paramount. The idea that pathogens regulate host population size assumes that pathogens respond strongly to host plant density. The idea that pathogens favor sexual reproduction in plants assumes that they respond strongly to host plant genotypes. As microscopic organisms, it is possible that plant pathogens are most affected by local environmental factors.

In this dissertation, the influences of some potentially important factors were examined in a three-year spatial study of a Long Island pine barrens population of the perennial rush *Juncus dichotomus* naturally infected by the smut fungus *Cintractia junci*, and in three multifactorial field experiments. For the spatial study, the relationships between disease and host plant density, nonhost

plant density, soil water content, and host genetic variation were examined by comparing surface plots and spatial autocorrelations, and/or by calculating partial Mantel-test correlations. The experiments consisted of plantings and inoculations of propagated replicates of uninfected plants that were collected from the natural population and genotyped electrophoretically. One experiment tested the effects of host density, pathogen density, host genotype, and block heterogeneity; another tested the effects of heterospecific neighbors, host genotype, and block heterogeneity; the last tested the effect of soil water, host genotype, and block heterogeneity.

In the natural population, disease had stable spatial pattern, and disease and host density were positively correlated, with disease appearing to thin the population in a density-dependent manner. No associations were detected between disease and the other factors. Experiments showed that plants exposed to higher pathogen loads were more likely to be infected, that plants grown at high host density or in a dense stand of heterospecifics were smaller and less likely to become infected, that plant genotypes were variable for infection, that genotype X environment interactions were evident, and that environmental heterogeneity influenced infection.