

Assessment of the effect of climate change on the interactions of plant, pathogen and microorganisms

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Plants are challenged by pathogens, among which fungi are important organisms. A plant pathogen that infects plants may either live in balance with the host plant or may gradually cause an infection that ultimately will kill the host plant. The development of a plant disease requires a susceptible host tissue, a compatible pathogen and involves also the natural microflora. The prevalence of suitable environmental conditions can tilt the plant-pathogen relationship into a disease situation. The general objective of our project is to model the effect of climate change on plants and their pathogens, illustrate expected scenarios and suggest adaptive measures.

In the present work, we studied parameters related to key components of the development of *Oidium neolycopersici* on tomato leaves and to the development of tomato powdery mildew that it causes. Changes in microclimatic conditions may affect the behavior of the pathogen on the plant surface (i.e., conidial germination, germ tube growth and appressoria formation) during infection, the growth of the fungus within plant tissue and/or the formation and survival of conidia. Ultimately, all of these factors affect disease severity. The range of microclimatic conditions tested was initially wide (5 to 35°C, 23 to 99% RH and 0 to 5150 lux) and was later narrowed to temperatures of 18-28°C, 70-99% RH and three levels of irradiation. The relationships between the different microclimate parameters and disease severity were studied.

In the growth chamber experiments, temperature changes (in 2°C increments) resulted in significant changes in disease severity. For instance a change from 22 to 24°C resulted in a more than two-fold increase in disease severity and a change from 26 to 28°C caused diminishing of the disease. Reductions in RH were associated with significant reductions in disease severity. The ability of microorganisms and plant extracts to suppress disease was generally more significant at 26 than at 24°C. After finding that these microclimate changes significantly affected disease severity, we tested two climate regimes in commercial greenhouses. In the warmer greenhouse (27-32°C), which was closed during the day, the level of disease severity was significantly lower than in the standard commercial greenhouse (20-28°C).

Disease development is the cumulative effect of the effects of various factors on the host and pathogen. In the present study, various abiotic factors affected different aspects of the tomato powdery mildew disease cycle. It was demonstrated that a slight change in microclimate conditions can affect the outcome of the interaction of plants with a pathogen, as well as the outcome of the interactions of the plant-pathogen relationship with microbial control agents. The effects of climate change may be different in different plant-pathogen systems. Nevertheless, it is clear that such effects will occur and that adaptive measures need to be developed in order to respond to these expected changes.

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