

Whither Plant Disease Epidemiology?

L. V. MADDEN, Department of Plant Pathology, The Ohio State University, Wooster, and P. S. TENG, Department of Plant Pathology, University of Hawaii, Honolulu



Dr. Madden

Dr. Teng

Plant disease epidemiology has advanced greatly since the publication of Vanderplank's famous treatise, *Plant Diseases: Epidemics and Control*, more than 25 years ago. Before 1963, few people realized that epidemiology would consist of anything more than the measurement of weather factors and the association of temperature and other variables with selected disease cycle components such as sporulation. The rich and exciting field that has since evolved, based on theory and experimentation, can be both predictive and explanatory. The science is based on the concept of an epidemic as a process consisting of changes in the populations of pathogen and host in time and space.

On the surface, plant disease epidemiology seems to be in a healthy state. Many departments of plant pathology in the United States have a faculty member specializing in epidemiology instead of a particular commodity or pathogen group. In contrast to the situation of a little more than a decade ago, editors of our journals are eager to publish articles on epidemiological topics, both experimental and theoretical. Many significant papers are published every year. Several books have been or shortly will be published, providing a thorough assessment of the field. These publications make it clear that plant disease epidemiology is a legitimate science with its own set of first principles. Also, the most active epidemiologists gather every few years (Israel in 1986, West Germany in 1990) for international workshops to discuss new methods, theories, and results.

Despite such progress, there are signs that epidemiology is facing some serious problems as we approach the 1990s. Perhaps the most significant omen is the lack of graduate students specializing in plant disease epidemiology. An informal survey of colleagues indicates that only a few departments have one or more Ph.D. students focusing on this area. Ironically, a decade ago, when epidemiologist faculty members were few, more students were specializing in this quantitative (and difficult) field. We do not believe this change is strictly due to the lack of jobs. Both of us have had trouble in the past year finding qualified individuals for postdoctoral positions. Four years ago, there were plenty of qualified candidates for similar jobs. Additionally, some new faculty positions have attracted few acceptable candidates.

Faculty positions in epidemiology (and in some other areas) are under threat from the redirection of phytopathology into biotechnology. This new, exciting, and pioneering field will revolutionize plant pathology in the next decades in ways that are still difficult to imagine but could develop at the expense of other phytopathological disciplines essential for both

theoretical and practical advances. Although we are not aware of any good epidemiologists who could not eventually find a job in their field of choice, this situation could change if departments relegate epidemiology to secondary importance. We already know of some departments that are changing openings in epidemiology to positions in molecular biology. The paucity of qualified candidates for epidemiology positions, because of the low number of students and postdoctoral researchers, may even accelerate the redirection of positions in the 1990s.

Some believe that the lack of funding for epidemiological research is discouraging activity in plant disease epidemiology and hence is resulting in the low number of students. We do not believe that this is any more so for epidemiologists than for other plant pathologists. There are, admittedly, more proposals in the molecular and biochemical areas than in others, and thus more are funded. Having served on competitive grants panels, however, we feel that the proportion of epidemiology-related proposals funded is not significantly different from that of other specialties, including biotechnology.

Epidemiologists, we feel, represent true interdisciplinarians in plant pathology, since our specialty is based on, inter alia, understanding interactions among plants, pathogens, humans, and the environment. The specialty has admittedly gone through a technique-oriented decade, with increasing application of mathematics, statistics, and computer techniques. During this time, many nonquantitative pathologists were wrongly sensitized into considering that epidemiologists are oriented strictly toward statistics or computer applications. Some other scientists consider epidemiology to be a "soft" science in contrast to physiology or molecular biology. In reality, however, many epidemiologists are excellent biologists and ecologists as well as competent mathematicians, statisticians, and systems scientists. Nonappreciation and misappreciation of plant disease epidemiology still persist, and we believe this persistence is harmful to the future role of plant pathology in modern agricultural science. A case in point is the manner in which ecologists with little or no agricultural or phytopathological experience have been consulted at the national level on issues pertaining to planned releases of bioengineered microorganisms for agricultural use. We believe that epidemiologists are better prepared than many other scientists to address the issue of released organisms in the environment.

As modern plant disease epidemiology approaches its fourth decade, we feel it is important to consolidate this specialism into a distinctive and more obvious discipline, one that has its own principles and theory, sometimes separate from those borrowed from animal/human epidemiology or plant ecology. Concurrently, epidemiology needs to further demonstrate its relevance to conventional applications, such as biological control and integrated pest management, and to newer applications, such as assessment of the products and risks of biotechnology. We urge our colleagues to emphasize the biology as well as the statistics in their work, to show how models can capture the essence of biological processes, and to show that their techniques have a rationale and relevance to plant pathology. We urge the Epidemiology Committee and related APS committees to consider a sensitization project to show the role of epidemiology in plant pathology, so that the number of graduate students, postdoctoral researchers, faculty, and research grants in the subject area can increase. So much of the practice of modern disease management is based on epidemiology that our profession cannot afford to see its development slowed. Indeed, APS and the profession need to actively foster this field for the general good of plant pathology and world agriculture.