Editorial

The Future of Phytopathological Diagnostics

LARRY W. BARNES, Extension Plant Pathologist, Texas A&M University, College Station

As plant pathologists, we are often called on to make definitive diagnoses of plant diseases. We who are responsible for authoritatively identifying pathogens feel no small amount of frustration when techniques for providing conclusive diagnoses do not exist. Most diagnostic laboratories still use routine pathogen isolation techniques for the more common pathogens, and some have also adopted more sophisticated techniques when time, money, and expertise permit. It has been said, however, that compared with human disease diagnostics, plant disease diagnostics is in the Dark Ages. Medical diagnostic laboratories, from which we have borrowed many techniques and against which we sometimes measure our activities, seem to have a laboratory procedure for almost every disease. The differences between medical and phytopathological diagnostic laboratories are obvious, and there are certainly technological and economic reasons why phytopathological diagnostics lags behind medical diagnostics.

While we continue to borrow techniques from other disciplines, we should also be developing specific techniques within and for our own discipline. A commitment to interdisciplinary cooperation among plant pathologists, plant physiologists, biochemists, molecular biologists, and other scientists in allied fields is necessary if we are to understand some of the complexities of plant disease that might ultimately result in new diagnostic techniques.

Further, we need a commitment to and respect for efforts to develop specific diagnostic techniques. Training of plant pathologists should include course work emphasizing both the traditional and the new diagnostic techniques. Encouraging graduate student research in specific areas of plant disease diagnostics could provide a much needed thrust into developing unique state-of-the-art diagnostic procedures.

Although we still speak in terms of wilts, rots, stunts, and spots—analogous, suggests David J. Padwa, president of the Colorado plant biotechnology firm Agrigenetics Corp., to using the terms humors, vapors, spirits, and colors for human diseases—there are bright spots on the horizon of phytopathological diagnostics. Serology and associated techniques, relatively new to the scene considering the age of the discipline, are borrowed methods that have paid and will continue to pay diagnostic dividends. Rapid and accurate virus identification by the use of immuno-double diffusion, immunospecific electron microscopy (ISEM), and enzyme-linked immunosorbent assay (ELISA) is a diagnostic reality. Such modifications of serology as fluorescent antibody techniques now provide for rapid and precise identification of certain pathogens, e.g., the bacterium causing Pierce's disease of grape. Fluorescent antibody techniques enable identification within host tissue of a number of pathogens, saving the time and money spent obtaining a pure culture of the pathogen for diagnostic testing.

Fluorescence microscopes can be used for direct fluorescence detection (DFD) of certain pathogens as well as for fluorescent antibody work. DFD relies on specific fluorescence changes within infected tissue and approximates some human disease diagnostic techniques involving histological evaluations. This developing technique appears to be applicable to detecting certain viruses and mycoplasmas responsible for the difficult-to-diagnose "yellows diseases." An added advantage is minimal sample preparation; plant pathologists using DFD report that simple freehand sections obtained with a sharp razor blade suffice for evaluation.

Perhaps most significant to the field of phytopathological diagnostics is the impact of biotechnological advances that can increase the effectiveness and utility of serology in pathogen identification. The highly specific nature of monoclonal antibodies should enhance serological diagnostic techniques, and the mass production capabilities of monoclonal antibodies should help reduce costs so that their routine use becomes a reality. Several companies are producing monoclonal antibodies to certain viral, bacterial, and fungal pathogens, and laboratory and field test kits using this innovative technology are available for selected pathogens.

Central to the widespread adoption and use of advanced diagnostic techniques is readily available in-service training. Such training could be provided in intensive workshops offering hands-on experience. It is most appropriate for laboratories with facilities and expertise in specific areas of pathogen identification to continue to develop pertinent workshops. Equally important is a perception by university administrations of the importance of encouraging faculty and staff to participate in workshops that would broaden their diagnostic expertise.

Communication among research scientists, diagnosticians, and others involved in the development and utilization of new diagnostic techniques is absolutely mandatory to staying current and progressive in this rapidly developing area. The development of a "standard methods" approach to phytopathological diagnosis would have merit, as such methods could standardize laboratory diagnostic techniques and enable laboratories and plant pathologists to communicate with each other on a more meaningful basis than currently exists.

Perhaps one of the most effective forums for such communication is the *Plant Diagnostician's Quarterly*. This publication encourages interchange of ideas and techniques among diagnosticians and will continue to be an important source of diagnostic information. Of similar importance is the new Spotlight on Diagnosis section in PLANT DISEASE. An expressed purpose of this section is to emphasize superior diagnostic methods and, hopefully, provide for some level of technique standardization.

There is little doubt that many of the traditional diagnostic methods will be the mainstay of phytopathological diagnostics. They should be. Pathogen isolation from infected host tissue, moist chamber incubation to induce fungal sporulation, selective media for isolating fungal and bacterial pathogens, biochemical tests to identify bacteria, leaf quick-dips and embedding and sectioning to identify viruses, and nematode extraction and identification procedures obviously provide the foundation for diagnostics for the foreseeable future. And the highly trained, peceptive, experienced diagnostician will bridge the diagnostic gap between infected plant material and the use of appropriate diagnostic techniques. It is critical that phytopathological diagnostics exploit to the maximum extent the currently available technology and the wealth of new, sophisticated techniques that are sure to develop.