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Commentary

Molecular Methods in Plant Pathology

Jason Foster*

Department of Plant Pathology, North Carolina State University, North Carolina, USA

ABOUT THE STUDY

Molecular methods in plant pathology include methods in plant pathology at the molecular level, including PCR techniques, electron microscopy, tissue culture, and cloning of disease-resistant genes. Plant pathogenic fungal species can cause significant losses in crop yield quantity and quality, which is a major economic problem in the global agricultural sector. Accurate as well as rapid detection and identification of fungi that infect plants is essential to enable effective treatment of diseases. These molecular-based detection techniques are effective in detecting symptomatic and asymptomatic diseases of both culturable and unculturable fungal pathogens in single and co-infections.

Even with the recent significant expansion of molecular diagnostic approaches, the development and application of molecular diagnostics in plant diseases still has a long way to go. Molecular techniques for diagnosing plant diseases must be more reliable, faster and easier than traditional methods. The current challenge lies with scientists developing practical techniques that can be used for molecular diagnostics of plant diseases. Diagnosing plant diseases using molecular methods offers diagnosticians many advantages over traditional methods. For example, it enables the identification of morphologically similar species and the detection of infection before symptoms are formed. Molecular tools do more than just improve the effectiveness, accuracy, and speed of diagnostics. These shared technology foundations offer additional benefits, especially when resources are limited and traditional functionality is difficult to maintain.

Around the world, agricultural yields and cash losses are due to biological stressors such as crop diseases. Accurate, timely and early diagnosis and detection of crop diseases are essential for active investigation and promote effective management strategies. Symptom-based disease diagnosis methods are time consuming, inaccurate, and recognize pathogens only long after the onset of the disease. State of the art methods of molecular biology using essential biomolecules such as DNA, RNA, and proteins have modernized the detection of plant diseases. In addition, practices for treating plant diseases such as the development of transgenic plants, the creation of plant resistance by molecular breeding, and the biological control of plant diseases using beneficial microorganisms will be explained. Recent advances in molecular biology technology have improved the detection and diagnosis of new, emerging, previously described, and reappearing fungal plant pathogens.

Traditional variant-based Polymerase Chain Reaction (PCR) assays, isothermal and post-amplification tools, hybridization techniques, and Next-Generation Sequencing (NGS) approaches are known for their diagnosis in the detection of phyto-fungal diseases. Molecular technology, combined with other new technological advances for the diagnosis of fungal diseases, should become a Point-Of-Care Test (POCT).

CONCLUSION

The challenge is to work with scientists to develop a practical approach for molecular diagnostics of plant diseases. Among the various PCR-centric assays, quantitative PCR is widely used to quantify and identify the causative agent when sample loading is not too important and cannot be detected. Currently, Loop-Mediated Amplification (LAMP) has been successful in detecting fungal diseases, facilitating the identification of different species that cause many catastrophic diseases in plants. NGS can be used on a variety of platforms to sequence the fungal genome and identify emerging pathogens without prior knowledge of pathogen sequences.

Correspondence to: Jason Foster, Department of Plant Pathology, North Carolina State University, North Carolina, USA, E-mail: foster.jason@ncu.edu

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