

Rapid Classification of Soft Rot Enterobacteriaceae Phyto-Pathogens Pectobacterium and Dickeya Spp. Using Infrared Spectroscopy and Machine Learning

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Abstract : Pectobacterium and Dickeya spp which negatively affect a wide range of crops are the main causes of the aggressive diseases of agricultural crops. These aggressive diseases are responsible for a huge economic loss in agriculture including a severe decrease in the quality of the stored vegetables and fruits. Therefore, it is important to detect these pathogenic bacteria at their early stages of infection to control their spread and consequently reduce the economic losses. In addition, early detection is vital for producing non-infected propagative material for future generations. The currently used molecular techniques for the identification of these bacteria at the strain level are expensive and laborious. Other techniques require a long time of ~48 h for detection. Thus, there is a clear need for rapid, non-expensive, accurate and reliable techniques for early detection of these bacteria. In this study, infrared spectroscopy, which is a well-known technique with all its features, was used for rapid detection of Pectobacterium and Dickeya spp. at the strain level. The bacteria were isolated from potato plants and tubers with soft rot symptoms and measured by infrared spectroscopy. The obtained spectra were analyzed using different machine learning algorithms. The performances of our approach for taxonomic classification among the bacterial samples were evaluated in terms of success rates. The success rates for the correct classification of the genus, species and strain levels were ~100%, 95.2% and 92.6% respectively.

Keywords : soft rot enterobacteriaceae (SRE), pectobacterium, dickeya, plant infections, potato, solanum tuberosum, infrared spectroscopy, machine learning

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