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Characterization of bacteriophages infecting Pectobacterium spp. for phage-based bio control formulation against soft rot in field conditions

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Abstract

Soft rot Enterobacteriaceae, including Pectobacterium and Dickeya, affect a number of plants including vegetables and fruits, causing high economic loses for producers. There is currently no treatment for soft rot Enterobacteriaceae in field conditions, and control is largely based on the use of sanitary growing practices. The increasing number of epidemics in recent years caused by Pectobacterium and Dickeya in Europe indicate a need for the formulation of commercially available and effective biocontrol measures to counteract soft rot pathogens. Highly specific bacterial viruses – bacteriophages – have been investigated by a number of researchers as a biocontrol tool to treat bacterial diseases. In this study, bacteriophages isolated from vegetable processing water have been characterized using transmission electron microscopy (TEM), molecular biology methods, and tested for antimicrobial and lytic activity. Bacteriophages efficacious against soft rot Enterobacteriaceae in potato have been formulated into a phage-based 'cocktail', which has been assessed through bioassays and field trials. It has been shown that the phage 'cocktail' decreased soft rot symptoms and increased yields in vivo.

In the face of global population growth, there is a need for integrated pest control strategies to improve agricultural production and increase sustainable food production. To combat significant food loss in crop production, the novel, safe and effective measures should be tested for viruses. Pectobacteriaceae species are one of the main causes of onion rot eventually leading to crop loss due to ineffective control measures against the virus. Therefore, the purpose of this study was to isolate and disperse the bacteriophages that can be synthesized in cocktail and used in the planta under natural environmental conditions. Transmission electron microscopy (TEM) and genome analysis revealed that the Siphoviridae and Podoviridae families are bacteriophages. To evaluate the protective effect of phage cocktail designed to combat soft rot, it was performed for three years of field testing, using three different methods of applying for treatment. This is the first study to show the use of phage cocktail containing Podoviridae and Siphoviridae bacteriophages that are able to protect onions from soft rot in field conditions.

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