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Pathogen-induced conditioning of the primary xylem vessels – a prerequisite for the formation of bacterial emboli by Pectobacterium atrosepticum

Gorshkov V., Daminova A., Mikshina P., Petrova O., Ageeva M., Salnikov V., Gorshkova T., Gogolev Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 German Botanical Society and The Royal Botanical Society of the NetherlandsRepresentatives of Pectobacterium genus are some of the most harmful phytopathogens in the world. In the present study, we have elucidated novel aspects of plant–Pectobacterium atrosepticum interactions. This bacterium was recently demonstrated to form specific 'multicellular' structures – bacterial emboli in the xylem vessels of infected plants. In our work, we showed that the process of formation of these structures includes the pathogen-induced reactions of the plant. The colonisation of the plant by P. atrosepticum is coupled with the release of a pectic polysaccharide, rhamnogalacturonan I, into the vessel lumen from the plant cell wall. This polysaccharide gives rise to a gel that serves as a matrix for bacterial emboli. P. atrosepticum-caused infection involves an increase of reactive oxygen species (ROS) levels in the vessels, creating the conditions for the scission of polysaccharides and modification of plant cell wall composition. Both the release of rhamnogalacturonan I and the increase in ROS precede colonisation of the vessels by bacteria and occur only in the primary xylem vessels, the same as the subsequent formation of bacterial emboli. Since the appearance of rhamnogalacturonan I and increase in ROS levels do not hamper the bacterial cells and form a basis for the assembly of bacterial emboli, these reactions may be regarded as part of the susceptible response of the plant. Bacterial emboli thus represent the products of host–pathogen integration, since the formation of these structures requires the action of both partners.

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Keywords

Bacterial emboli, biofilm, Pectobacterium atrosepticum, plant cell wall, plant–microbe interaction, reactive oxygen species, rhamnogalacturonan I