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High-throughput Expression Profiling of Xylem Sap Proteome of Tomato from Both Susceptible and Resistant Genotypes with LC-MSMS

Diwakar Dahal[1], Andreas Pich[2], Kerstin Wydra[1]

[1] *Leibniz Universität Hannover, Institute of Plant Disease and Plant Protection, Germany*
[2] *Medizinische Hochschule Hannover, Institute of Toxicology,*

Abstract

The unidirectional long distance transport of water and nutrients in all vascular plants are principally carried out by xylem and phloem which is essential for the coordinated growth and developments of all plant organs. The xylem sap has been considered as the primary conduit for water and minerals translocation from roots to aerial parts but evidences of containment of organic macromolecules especially proteins in the sap are emerging continuously. However, the comprehensive proteome profile of the xylem sap is still at large. The xylem sap proteins from healthy adult tomato plants collected under root pressure exudates system were separated with one dimensional gradient polyacrylamide gel electrophoresis (1-D SDS PAGE). The analysis of whole protein bands by LC MALDI TOF /TOF MS revealed for the first time as many as 200 proteins in the sap. The xylem sap proteome displayed several physiologically important groups of proteins such as cell wall metabolism proteins; proteases; networks of defense related proteins including PR proteins, antioxidants, detoxifying agents, resistance proteins, and peroxidase; signalling molecules; transport proteins; transcription and transcription factors; and enzymes of both primary and secondary metabolism. The presence of peroxidase, cell wall associated proteins, proteases, and defense proteins were reported to be conserved in many plants indicating that they are involved in xylem growth, development, and differentiation process essential for the formation of functional xylem conduit. The presence of many signalling and transport proteins is expected to be required for root to shoot communication. The identification of numerous proteins without known functions may provide candidates with novel physiological functions. The xylem sap not only showed the presence of secretory proteins but also non- secretion signal proteins. The comparison between the healthy xylem proteins of the susceptible (WVa700) and resistant (Hawaii7996) plants showed the occurrence of higher percent of defense proteins and peroxidase in the resistant genotypes.

Keywords: Cell wall proteins, defense proteins, mass spectrometry, secretory signal proteins, tomato, xylem sap proteome

Contact Address: Diwakar Dahal, Leibniz Universität Hannover, Institute of Plant Disease and Plant Protection, Karl-Wiechert Allee 15, 30625 Hannover, Germany, e-mail: dahal@ipp.uni-hannover.de