Non-enzymatic post-translational modifications in proteins: at the interface of proteomics and metabolomics

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Non-enzymatic post-translational modifications, such as oxidation, deamidation, lipoxidation and glycation, are widely spread in all living organisms. Among them, glycation is still not completely characterized in plant organisms. In general, this phenomenon represents a post-translational modification of free protein amine and guanidine groups with carbonyl compounds, finally, resulting in formation of advanced glycation end products (AGEs). In mammals, AGEs have an impact in diabetes mellitus and serve as reliable markers of ageing. Accordingly, for several proteins, a clear relation between AGE formation, accompanying structural changes and loss of function was demonstrated. Several years ago, AGEs were identified in exhaustive hydrolyzates of plant proteins. Later, we described the constitutive glycated plant proteome, which differed much from the mammalian one. Thereby, our work was based on the integrative approach, combining metabolomic and proteomic techniques, with employment of model synthetic peptides and incubations under strictly controlled conditions. In this way, we demonstrated that ageing of plant organs is accompanied by formation of AGEs. Thereby, this phenomenon could be confirmed in leaves, seeds and such specialized structures, as legume root nodules. Thereby, specific sites of AGE formation could be identified and corresponding proteins annotated. These glycation hotspots indicate an essential degree of site specificity of the protein Maillard reaction. Finally, experiments with different forms of environmental stress revealed pronounced effects on the patterns of protein glycation both on the qualitative and quantitative levels. Generally, these patterns could be interpreted in the context of corresponding characteristic plant metabolites with a high glycation potential. However, despite relatively high levels of protein glycation, the biological role of this phenomenon in plants still needs further evaluation. The authors thank Russian Science Foundation (project No. 17-16-01042) for financial support.

Phloem fibers of fiber flax contain more rhamnogalacturonan I compared to fibers of linseed flax

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