Le péricarpe du grain de maïs : un modèle pour étudier la synthèse et la féruloylation des arabinoxylanes

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Developing pericarp of maize: a model to study arabinoxylan synthesis and feruloylation

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Cell walls are comprised of networks of entangled polymers that differ considerably between species, tissues and developmental stages. The cell walls of grasses, a family that encompasses major crops, contain specific polysaccharide structures such as xylans substituted with feruloylated arabinose residues. Ferulic acid is involved in the grass cell wall assembly by mediating linkages between xylan chains and between xylans and lignins. Ferulic acid contributes to the physical properties of cell walls, it is a hindrance to cell wall degradability (thus biomass conversion and silage digestibility) and may contribute to pest resistance. Many steps leading to the formation of grass xylans and their cross-linkages remain elusive. One explanation might originate from the fact that many studies were performed on lignified stem tissues. Pathways leading to lignins and feruloylated xylans share several steps, and lignin may impede the release and thus the quantification of ferulic acid. To overcome these difficulties, we used the pericarp of the maize B73 line as a model to study feruloylated xylan synthesis and crosslinking. Using Fourier-transform infra-red spectroscopy and biochemical analyses, we show that this tissue has a low lignin content and is composed of approximately 50% heteroxylans and approximately 5% ferulic acid. Our study shows that, to date, maize pericarp contains the highest level of ferulic acid reported in plant tissue. The detection of feruloylated xylans with a polyclonal antibody shows that the occurrence of these polysaccharides is developmentally regulated in maize grain. We used the genomic tools publicly available for the B73 line to study the expression of genes within families involved or suggested to be involved in the phenylpropanoid pathway, xylan formation, feruloylation and their oxidative crosslinking. Our analysis supports the hypothesis that the feruloylated moiety of xylans originated from feruloylCoA and is transferred by a member of the BAHD acyltransferase family. We propose candidate genes for functional characterization that could subsequently be targeted for grass crop breeding [1].

Références bibliographiques

[1] A.-L. Chateigner-Boutin et al. (2016) Frontiers Plant Science 7, 1476.

Mots-clés

grass cell walls; maize grain; arabinoxylan synthesis and feruloylation