PROJECT FACTSHEET

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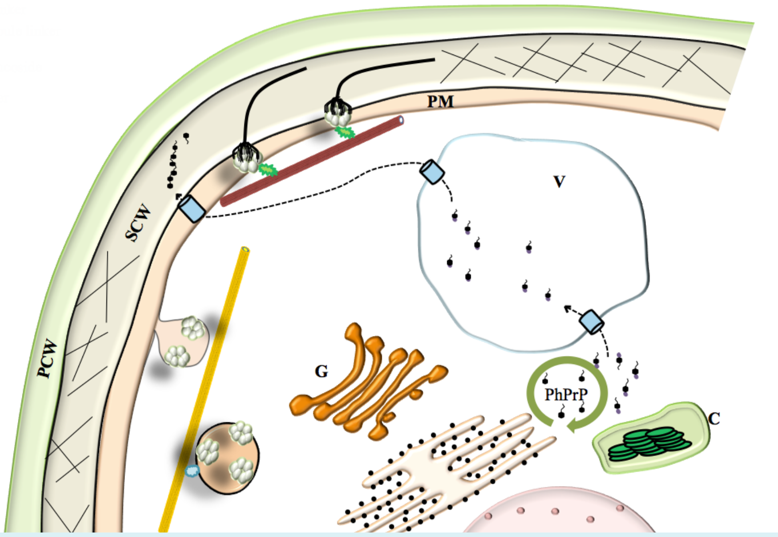
CANCAN

Investigating the molecular basis of the heterogeneous cell wall composition in hemp stems



Inspiration

The use of plant-sourced products as alternatives to fossil carbon-based materials holds great value both for the environment and the economy. The progressive shift towards a bio-based economy is evidenced by the increasing number of research programs interested in sustainable agriculture and renewable resources. Particularly relevant in this respect is a group of plants, collectively called fibre crops, which constitute relevant sources of plant dry matter (lignocellulosic biomass, composed of cellulose, hemicellulose and lignin). Hemp (Cannabis sativa L.) is a historic fibre crop which in addition to supplying nutritionally relevant secondary metabolites, also displays several practical advantages, namely rapid growth, ecological adaptability and high yield of cellulosic fibres. This last feature is a direct consequence of the dramatically contrasting cell wall composition of hemp stems: the core contains more wood fibres, while the cortex is rich in fibres mainly composed of cellulose.

Innovation

The core of the CANCAN project is to shed light on the physiological events which determine this contrasting cell wall composition, by putting special emphasis on the intercommunication between phenylpropanoid pathways and cell wall formation. The anatomy of hemp stems makes them ideal for integration of different -omics approaches. During the first stage of CANCAN, the spatial distribution of cell wall polymers will be assessed using immunohistochemical techniques; subsequently, selected metabolites will be quantified and a global proteome and metabolomics study will be carried out. The focus of the proteomics study will also be on the analysis of posttranslational modifications. The expression of genes, pivotal in cell wall biosynthesis, will be quantified and a subset of target genes will be characterized at the functional level. Finally, artificial induction of lignification through the selective use of plant growth regulators will be carried out to confirm the role of the previously identified genes/proteins in lignin deposition. This stage also has a direct practical implication, as it provides a way to enhance the deposition of woody fibres, which are known to display desirable physical properties as materials for the construction sector.

Impact

Knowledge on the intercommunication between the phenylpropanoid pathway and cell wall formation in hemp is the prelude to a wide array of applications in the building sector. Currently, the woody core of hemp constitutes one of the best natural materials as it couples strength with elasticity, but problems with the moisture and degradability of the sustainable components in building materials limit their application. In order to obtain plant-sourced material with superior properties, an understanding of the way biopolymers are formed and integrated in the cell wall could prove to be vital. In order to link the scientific outcome of the current proposal with applied future research, the Luxembourgish innovation pole for sustainable construction, Neobuild, will participate as a non-contracting partner.

Partners

Neobuild (LU) , Université Catholique de Louvain (BE) , UMR "Stress Abiotiques et Différenciation des Végétaux Cultivés" - Université de Lille (FR) , University of Vienna (AT)

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