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Evaluation of non-cellulosic polysaccharide distribution in differentiating and mature poplar tension wood fibres: abundance of rhamnogalacturonan I, presence of acetylated glucomannan and absence of xyloglucan in the G-layer

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Introduction

Tension wood (TW) is produced by temperate hardwood trees in order to support their increasing load, orient their axes and cope with environmental cues such as wind. TW fibres often harbour a supplemental layer, the G-layer, rich in crystalline cellulose, containing matrix polysaccharides but no lignin. The tensile force responsible for the specific TW properties originates from the G-layer and is transmitted to cellulose microfibrils soon after their deposition during G-fibre maturation. This force is potentially generated from physical changes in the high porosity hydrogel recently identified in the G-layer.

In search for molecules with gelling properties...

In order to identify molecules potentially involved in hydrogel formation, the distribution of the different classes of non-cellulosic polysaccharides was evaluated during xylem fibre differentiation by immunolocalization, both in TW and in opposite wood (OW), a wood devoid of G-fibres. In parallel, differentiating G-layers were isolated and their polysaccharide composition determined.

We found a few promising candidates...

These complementary approaches provided us with data on the evolution of non-cellulosic polysaccharides during G-fibre differentiation: contrary to previous reports, we did not find any evidence for the presence of xyloglucan in poplar G-layers, but evidence was found for an abundance of rhamnogalacturonan type I pectins (RG-I) in the G-fibre, with an apparent progressive loss of RG-I side chains during G-layer maturation. Likewise, glucomannan deacetylation seems to take place during G-layer maturation. Both RG-I and deacetylated glucomannans may be involved in the formation of a gel. These novel results will be discussed in the light of previous studies on the subject.

References

Guedes F.T.P, Laurans F., Quemener B., Assor C., Boizot N., Vigouroux J., Lesage-Descauses M.-C., Leplé J.-C., Déjardin A., Pilate G. (2015) Modification in non-cellulosic polysaccharide distribution and composition during G-layer formation in poplar tension wood fibers, submitted.