On a potential involvement of RG-I pectins in the generation of maturation stress in the secondary cell wall of poplar tension wood fibres

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Tension wood (TW) produced by temperate hardwood trees is known for its outstanding mechanical properties. The mechanism that generates the tensile force responsible for TW properties is still not elucidated: it may originate from a high porosity hydrogel identified in the G-layer, an extra cell wall layer present in TW fibres. Further, it has been proposed that the hydrolysis of pectin rhamnogalacturonan-I (RG-I) side chains by a β-galactosidase was responsible for the formation of this gel. To test this hypothesis, we used as a proxy of TW fibre maturation, the files of fibres located from the cambium toward the pith to compare both the kinetics of RG-I side chain hydrolysis by immunolocalisation and the evolution of G-layer indentation modulus, a proxy of its stiffness, by Atomic Force Microscopy (Arnould et al., 2021). We found a good correlation between the kinetics of global β-galactosidase activities and the labeling profiles of LM5 (specific to RG-I side chains) and RU1 (specific to RG-I backbone) antibodies that may reflect RG-I side-chain hydrolysis. However, it appeared that this occurred long after the main G-layer stiffening that took place earlier when G-layers were still thin, but it correlated with a second minor increase in G-layer stiffness. The labeling profiles of several other antibodies led to identifying other candidates potentially involved in the building of TW mechanical properties. G-layer stiffening is a complex process that probably involves several molecular actors,β-galactosidases being only one of them.

Arnould O, Capron M, Ramonda M, Laurans F, Alméras T, Pilate G, Clair B. Mechanical characterisation of the developing cell wall layers of tension wood fibres by Atomic Force Microscopy. bioRxiv 2021.09.23.461481; doi: https://doi.org/10.1101/2021.09.23.461481

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