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ORAL PRESENTATION

Maturation stress generation starts before the formation of the G-layer in poplar tension wood

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Introduction

Tension wood is widespread in organs of woody plants. During its formation, it generates large tensile mechanical stress, called maturation stress [1]. This stress performs essential biomechanical functions such as optimizing the stem mechanical resistance, performing adaptive movements and ensuring long-term stability of growing plants. The mechanism generating this stress is not yet fully understood, although various hypotheses have recently been proposed [2-6]. In order to discriminate between these hypotheses, we investigated structural changes in cellulose microfibrils along sequences of xylem cell differentiation in tension and normal wood of poplar.

Material and Methods

Experiments have been performed on artificially tilted poplar trees (*Populus deltoides* x *P. trichocarpa* cv. I45-51). Samples were kept as 40-cm long stem segment to keep the mechanical state of the wood as it is *in planta*. Thanks to synchrotron radiation micro-diffraction (ID13 - ESRF) [7], diffraction patterns were recorded every 10 μm from bark to mature wood (Fig.1). Analysis of diffraction patterns allows measuring the evolution of the angle (on 200 diffraction peak) and lattice spacing (d_{004}) of crystalline cellulose associated to the deposition of successive cell wall layers.

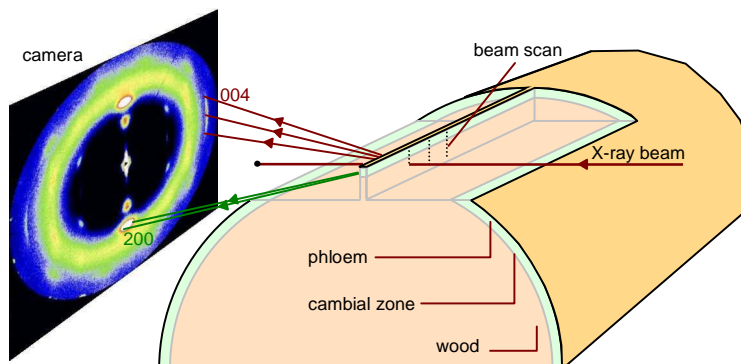


Fig. 1: setup of the experiment.

Results

Profiles of normal and tension wood were very similar in early development stages corresponding to the formation of the S1 and the outer part of the S2 layer. The microfibrils angle in the S2 layer was found lower in its inner part than in its outer part, especially in tension wood. In tension wood only, this decrease occurred together with an increase in cellulose lattice spacing, and this happened before the G-layer is visible. The relative increase in lattice spacing was found close to usual value of maturation strains, strongly suggesting that microfibrils of this layer are put into tension and contribute to the generation of maturation stress.

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