Pollen tubes and vegetative organs have structurally divergent cell wall xyloglucan in Solanaceae species

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Pollen grain, pollen tube and seed production



The pollen tube :a model for understanding cell wall biosynthesis and remodelling?



The pollen tube has a fast and tip polarized growth



Transmission Electron Micrograph



Constant biosynthesis, secretion and remodelling of cell wall polymers during growth : Model to understand cell wall biosynthesis and remodelling

Dardelle et al., 2010 Plant Physiology

The two classes of Xyloglucan



Nature Reviews | Molecular Cell Biology

Mainly made of Cellulose, pectin and hemicellulose

Most abundant hemicellulose in eudicotyledone: Xyloglucan

2 Structures of XyG:

Arabinoxyloglucan and the fucogalactoxyloglucan



Smith LG, Nature Reviews Molecular Cell Biology (2001)

Nomenclature according to Fry et al., Physiologia Plantarum (1993)

Distribution of Fuco Galacto XyG and Arabino Xyloglucan among plant species



Non commelinoids dicotyledoneous including *Nicotiana* and solanaceae (tomato, potato, egg plant, pepper, ...



Fragment of Xyloglucan are released after endoglucanase treatment : Xyloglucan Investigation with MALDI-TOF MS

The main motif of *Arabidopsis* leaf Xyloglucan is XXXG



The main motifs of *Arabidopsis* pollen tube xyloglucan are XX<u>F</u>G and XX<u>L</u>G/X<u>L</u>XG Fucosylated motifs ~52% *O*-acetylated motifs ~65%







Dardelle et al., (2010) Plant Physiology

Xyloglucan epitopes are detected all along the pollen tube

Specific MAbs recognize different fragments of XyG









The main motif is different between the vegetative and the reproductive tissus In *Arabidopsis* pollen tube xyloglucan are highly fucosylated and highly acetylated

Fucosylated motifs ~52% *O*-acetylated motifs ~65%

Dardelle et al., (2010) Plant Physiology

In the Solanaceae, Xyloglucan in the cell wall of vegetative organs is <u>not</u> Fucosylated <u>but</u> Arabinosylated



In most angiosperms, the XyG of somatic cells is fucosylated, except in the Asterid clade (including the Solanaceae), where the fucosyl residues are replaced by arabinose, presumably due to an adaptive and/or selective diversification.

What about XyG of the pollen tube in these species?

- Lamiid clade
 - Solanaceae
 - Tobacco (Nicotiana tabacum)
 - domesticated tomato (Solanum lycopersicum)
 - wild tomato (Solanum pimpinellifolium), (Solanum peruvianum)

Xyloglucan of Nicotiana tabacum pollen tubes is mostly Fucosylated



The main fragment is the same as Arabidopsis pollen tube

Xyloglucan of tomato leaves is not Fucosylated

4 species were investigated : from the wild species to the domesticated species



Xyloglucan of tomato pollen tubes is mostly Fucosylated



Dardelle et al., (2015) Annals of Botany

Xyloglucan of Wild tomato species is more Fucosylated than the domesticated species



Why Solanaceae pollen tubes have kept fucosylated XyG?

Root hairs have also specific XyG also found in the tip growing moss *Physcomitrella patens*

it reinforces the idea that tip-polarized cells have specific cell wall structural properties adapted to their fast intrusive growth

Dardelle et al., (2015) Annals of Botany

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GRR





