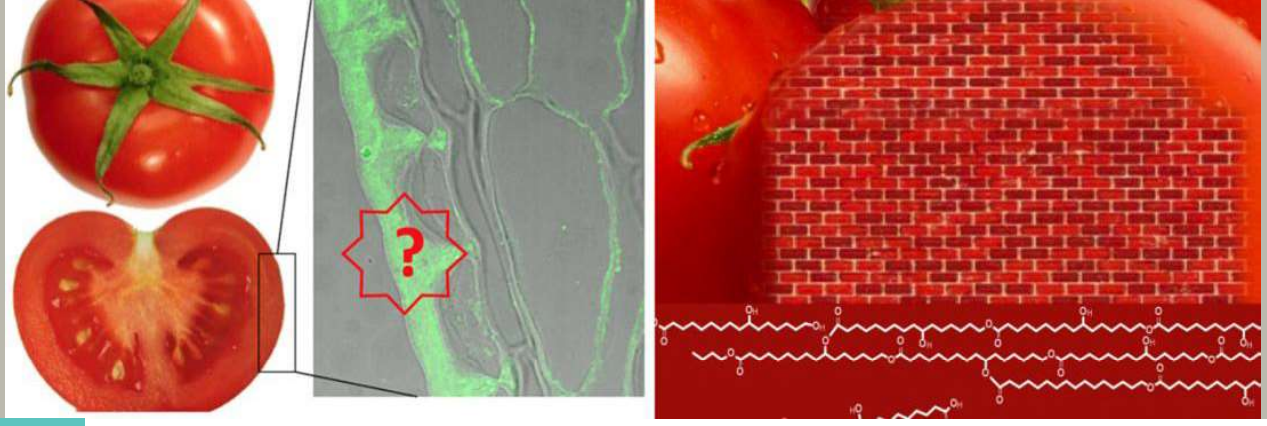

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A new piece in the structural puzzle of plant cuticle

Read more

Philippe G *et al.*

Assembly of tomato fruit cuticles: a cross-talk between the cutin polyester and cell wall polysaccharides.

New Phytologist . 2018 - https://doi.org/10.1111/nph.16402

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Context

The plant cuticle covers the surface of all aerial organs and performs multiple crucial functions (resistance to water loss, adaptation to climatic and biological stress). These properties are determined by the structural organization of the cuticle, a natural composite comprising lipids (cutin polyester) and cell walls (polysaccharides). However, this structural organization is still not fully resolved. In particular, investigations have struggled to get to the cell walls embedded in the cutin lipid polymer, and so their nature has remained unknown.

Results

Using tomato fruit as a model, we developed a multimodal approach mobilizing chemical and enzymatic pretreatments combined with a battery of complementary investigative methods (Raman and NMR spectroscopy, biochemical analysis, immunocytochemistry, infrared mapping). We managed to establish, for the first time, the fine structure of the cell walls entangled in the cutin polymer: the cutin-embedded polysaccharides (CEPs).

These CEPs share very different features to non-cutinized polysaccharide areas. In particular, the CEPs show a high degree of esterification (methylation, acetylation), and a low rhamnogalacturonan branching, and they also concentrate crystalline cellulose. This structural specificity of the CEPs embedded in cutin is a crucial new clue to deciphering the architecture of this natural composite and its structure–function relationships in the plant.

Future outlook

In addition, this research went on to demonstrate that modifying the degree of polymerization of cutin polyester (cutin polymerase-deficient fruit) leads to specific modifications in the CEPs but without modifying non-cutinized polysaccharides. This result provides the first evidence of lipid–cell wall cross-talk in cuticle architecture in planta.

This important work opens up new avenues to progress at the intersection of several research fronts:

i) for controlling cuticle formation for plant resistance properties (agronomics and plant improvement)

ii) and for the design of new bio-inspired materials (biobased materials, biomass streaming and waste-to-value, bioeconomy).