Connecting the molecular structure of cutin to ultrastructure and physical properties of the cuticle in petals of Arabidopsis.

Autorzy

Sylwester Mazurek

Imène Garroum

Jean Daraspe

Damien De Bellis

Vilde Olsson

Antonio Mucciolo

Melinka A. Butenko

Bruno M. Humbel

Christiane Nawrath

Rok wydania

2017

Czasopismo

Plant Physiology

Numer woluminu

173

Strony

1146-1163

DOI

10.1104/pp.16.01637

Kolekcja

Naukowa

Język

Angielski

Streszczenie

The plant cuticle is laid down at the cell wall surface of epidermal cells in a wide variety of structures, but the functional significance of this architectural diversity is not yet understood. Here, the structure-function relationship of the petal cuticle of Arabidopsis thaliana was investigated. Applying FTIR microspectroscopy, the cutin mutants lacs2, pec1, cyp77a6, gpat6 and dcr were grouped in three separate classes based on quantitative differences in the ν(C=O) and ν(C-H) band vibrations. These were associated mainly with the quantity of 10, 16 dihydroxy hexadecanoic acid, a monomer of the cuticle polyester, cutin. These spectral features were linked to three different types of cuticle organization: a normal cuticle with nanoridges (lacs2 and pec1 mutants); a broad translucent cuticle (cyp77a6 and dcr mutants); and an electron-opaque multi-layered cuticle (gpat6 mutant). The latter two types did not have typical nanoridges. Transmission electron microscopy revealed considerable variations in cuticle thickness in the dcr mutant. Different double mutant combinations showed that a strong reduction of C16 monomers in cutin leads to the appearance of an electron-translucent layer adjacent to the cuticle proper, which is independent of DCR action. We concluded that DCR is not only essential for incorporating 10, 16 dihydroxy C16:0 into cutin, but also plays a crucial role in the organization of the cuticle, independent of cutin composition. Further characterization of the mutant petals suggested that nanoridge formation and conical cell shape may contribute to the reduction of physical adhesion forces between petals and other floral organs during floral development.

Słowa kluczowe

Membrane Lipids / chemistry, Arabidopsis Proteins / metabolism, Spectroscopy, Fourier Transform Infrared, Palmitic Acids

Typ publikacji

Artykuł

Adres publiczny

https://doi.org/10.1104/pp.16.01637

Strona internetowa wydawcy

http://www.plantphysiol.org