Plant Surface
Preformed Barrier and Contact Zone

Role of Plant Surface for Plant-Pathogen Interaction

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Berry Surface

Protection
- Evaporation
- UV-Radiation

Preformed Barrier
- Fungi & Oomycetes
- Bacteria
- Insects & Mites

Vitis vinifera ssp silvestris
Alluvial Forrest at the River Thur (Alsace)
Experimental set up - Kryo-SEM

Sampling at distinct stages of berry development
Preparation of an intact slice of berry skin and mounting on a specimen holder
Kryofixation in Nitrogen slush (< -185°C)
Sputtering with 20 nm Au at low temperatures and high vacuum
Analysis with SE Detector at high vacuum and -170°C
5 kV - 10kV acceleration voltage

Philips XL30 ESEM
Field emission-Scanning-Elektronenmikroskopie with Cryo unit Gatan Alto 2500
Bio Centre University Basel

Zentrum für Mikroskopie
Experimental set up – Chemical Analysis

Native fruit → Extraction of hydrophilic substances on the surface → Mechanical removal of EW → Enzymatic isolation of the cuticle → Chemical extraction

Water → Ultra sonic → Methanol, Chloroform

HPLC, LC-MS, GC-MS

Wax Composition, Cutin Composition
Berry Development

Characteristic dense layer of epicuticular waxes after the start of ripening and sugar influx

Stomata are out of function and closed

The surface is hydrophobic
Platelets of epicuticular Waxe

AFM analysis to measure the size of platelets

Height ≤900 nm
Different Structure of Berry surface

Platelets of epicuticular waxes on the berry surface

cv. Pinot noir

cv. Müller Thurgau

Kryo-SEM 16.000x
Different Composition of epicuticular waxes

Total amount of epicuticular waxes on the berry surface

![Bar chart showing the total amount of epicuticular waxes on the berry surface for different samples (CBF, MTH, BSB, WB). The chart includes categories such as n.i., Triterpenoid, Sterol, Alkylester, Alkan, Aldehyd, Alkohol, and Säure.](image-url)
Different Composition of epicuticular waxes

![Graph showing the composition of epicuticular waxes for cv. M.-Thurg. and cv. Pinot noir. The graph includes bars for Fatty acids, Alcohols, Aldehydes, Alkanes, Alkyl esters, ß-Sitosterol, Stigmasterol, and Oleanolic acid with error bars indicating variability. The graph highlights differences between the two cultivars.]
Infection Strategy - Powdery Mildew

- Attached conidia
- Germination tube
- Swollen germination tube
- Appressorium
Specific Attachment on the Host Surface

Secretion of an extracellular matrix

Cuteolytic activity – etching of the epicuticular waxes on the cuticle
Penetration of the Host Cell

Underneath the apressorium a penetration peg perforates the cuticle and the epidermis cell wall
Penetration of the Host Cell

Penetration of the epidermis within 3 hpi to 8 hpi

Diameter of the penetration peg max. 500 nm

Etched cuticle around the penetration site
Colonization of young Berries
Colonization of ripening Berries

Dense layer of epicuticular waxes after the start of ripening and sugar influx

Decreased susceptibility for infections by *Erysiphe necator*
Colonization of ripe Berries
Conclusions

Structure of the berry surface

- Complex layer of wax platelets on developing and ripe berries
- Differences in shape and structure between cultivars
- Differences in the chemical composition between cultivars

Interaction between berry surface and *Erysiphe necator*

- Close interaction between germinating conidia and wax layer
- Dense layer of wax platelets inhibit formation of infection structures
- Putative role of wax compounds as a trigger for the development of infection structure