Using fluorescence in the field to detect crop diseases: How we got there

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Protection against grapevine downy mildew

**Viticulture in Europe**

3,64 Mha
156 MhL (≈15 MT)
60% World production

**Crop protection**

20 annual sprayings
70 000 T/year = 1,9 G€
21,4 kg active substance/ha
including 19,5 kg/ha of fungicides
70% of losses due to downy & powdery mildew

**Health**

2.5 million vinegrape growers
Pollution by phytochemical treatments of growers, the environment and the wine

**Solutions**

IPM (integrated pest management)
Precision agriculture (dose)
Early detection (optical)
Plasmopara viticola the infection agent of downy mildew

Grapevine phytoalexins
Viniferins, stilbenoids, derivatives of resveratrol

resveratrol
trans-piceid
cis-piceid
pterostilbene
trans-ε-viniferin
trans-δ-viniferin
Fluorescence of stilbenoids

Complete analysis of fluorescence: physico-chemical, microscopic et macroscopic

Development of portable field sensors

DUALEX: from 1G to 4 Generation


MULTIPLEX: towards 4G

Kinetics of the infection

Excitation filter: 340/26
Emission filter: 371 nm long pass

Transmission
Fluorescence UV-visible
Transmission
Fluorescence UV-visible

Macrophone Nikon AZ100
Proximal detection Mx330
Signal present on both leaf sides

Bellow et al. (2013) J. Exp. Bot. 64:333
In-field hand-held sensing of downy mildew

Muscat Ottonel

Gewurztraminer

Colmar

Alsace

France
Stilbenes as indicators of downy mildew in grapevine
Mapping and zoning of leaf cover in viticulture
Phytoalexins as disease markers

Mounted Multiplex for hot-spot detection

<table>
<thead>
<tr>
<th>Days 1-3</th>
<th>Days 4-7</th>
<th>Days 8-15</th>
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<tbody>
<tr>
<td>no symptoms</td>
<td>necrosis / sporulation</td>
<td>necrosis / chlorosis / oily spots</td>
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Grapevine stilbenoids
Peanut stilbenoids
Sunflower coumarins

Other crops Phytoalexins
Plant Biospectroscopy team

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Sylvie Meyer
Gwendal Latouche
Sebastien Bellow

Jean-Marc Ducruet
Peter Streb

Thanks to:

Giovanni Agati (Firenze)
Erhard Pfündel (Würzburg)
Fermin Morales (Zaragosa)
Nicolas Tremblay (Montreal)
Mauricio Hunche (Bonn)

Spencer Brown (Gif-sur-Yvette)
Juliette Louis (Paris)
Yves Goulas (Palaiseau)
Ismaël Moya (Palaiseau)
Eric Serrano (Toulouse)
Sébastien Debuisson (CIVIC-Epernay)

International

France

FORCE-A

16th Intl. Congress on Photobiology, Cordoba – Argentina, 2014