Grapevine Defence Mechanisms

Prof Alain Deloire (SupAgro, Montpellier alain.deloire@supagro.fr)

Dr Suzy Rogiers (DPI-NSW, NWGIC, Australia suzy.rogiers@dpi.nsw.gov.au)

Grapevine and self-defence!

Vitis vinifera L. cultivars are able to produce defence compounds which are constitutive (present before the attack of pathogens) or induced by biotic or abiotic factors by a mechanism called elicitation.

Among these compounds involved in plant organ and tissue defence, the most important are:

- Phenols (tannins, stilbenes, resveratrol…)
- Pathogenesis Related Proteins, PRPs (chitinase, glucanase)

The biosynthesis of these compounds depends on the organ and its developmental stage, especially so for the berries themselves.

For instance, tannins are accumulated in berries during the green expansion stage only.

PRPs are naturally accumulated in the fruit from véraison onwards and during ripening. It is possible to induce the biosynthesis of PRPs during the berry green growth stage using elicitors such as salicylic acid or oligosaccharides.

A recent study (Toffolatti et al., 2018) showed one of the first identification of resistance traits within *Vitis vinifera* gene pools, which is opening new and promising perspectives for grapevine sustainable and disease management according to the authors of this study.

Let's quote the abstract of the article: "Based on comparative experimental inoculations, confocal microscopy and transcriptomics analyses, *V. vinifera* cv. Mgaloblishvili, native to Georgia (South Caucasus), exhibits unique resistance traits against *P. viticola*.

Its defence response, leading to a limitation of *P. viticola* growth and sporulation, is determined by the overexpression of genes related to pathogen recognition, the ethylene signalling pathway, synthesis of antimicrobial compounds and enzymes, and the development of structural barriers.

The unique resistant traits found in 'Mgaloblishvili' highlight the presence of a rare defence system in *V. vinifera* against *P. viticola* which promises fresh opportunities for grapevine genetic Improvement".

A few take home messages

- Despite its versatile self-defence capabilities, *Vitis vinifera* L. cultivars are sensitive to pathogens (figure 1) and abiotic stresses
- *V. riparia, V. rupestris, V. aestivalis, …from America; V. amurensis, V. coignetiae* from Asia and Muscadinia species are resistant to targeted pathogens: Powdery & Downy Mildew. These *Vitis* species have genes involved in defence and resistance.
- A resistant variety will arrest the pathogens by inducing a strategy referred to as a hypersensitive response (HR). Due to the functioning of the resistance genes, the cells will form a lesion (an area of dead cells around the infection point) as a barrier against the aggressors (figure 2 is showing HR on a leaf of a resistant variety) .
- Vineyard and vine protection (*V. vinifera* L. cultivars & new resistant varieties) will require integrated and holistic approaches to address stress inducing factors such as pathogen invasion.

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http://www.vignevin.com/recherche/creation-varietale/varietes-resistantes.html

Figure 1: Example of a *Vitis vinifera* leaf infected by Downy Mildew (photos A. Deloire, 2018).

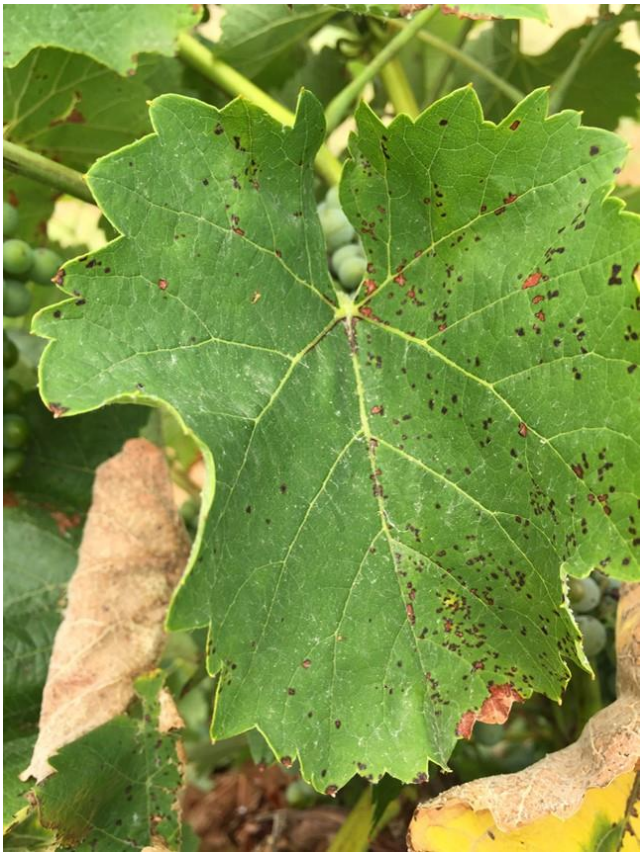

Figure 1: Example of hypersensitive response on a leaf of a grapevine resistant variety. The pathogen is stopped by cells forming lesions (photo A. Deloire, 2017).