Flavescence Dorée and its management in the vineyard

Contain the disease and avoid further spread

How to manage FD with more precision in the regions already infected?

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 652601
Introduction

Flavescence dorée has been detected since 1950 in France

• Incurable quarantined disease

• Liste A2 EPPO

• Grapewine yellows symptoms

• Combination of a phytoplasma, a vector and a host

→ Rapid spread, important yield losses and vineyard dieback
Spread of flavescence dorée

• **Phytoplasma**: European origin

• **Vector**: leafhopper named *Scaphoideus titanus* imported from North America
Spread of flavescence dorée

- **Phytoplasma**: European origin and spread from wild plant to grapevine
- **Vector**: leafhopper named *Scaphoïdeus titanus* imported from North America

→ Distribution of the leafhoppers is wider than the phytoplasma

→ Leafhopper *S. titanus* discovered in Alsace in 2016
Symptoms and impacts

Main symptoms but non distinguishable from other grapevine yellows

<table>
<thead>
<tr>
<th>First symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Delay of budburst</td>
</tr>
<tr>
<td>• Lack of budburst</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reducing growth of fruiting cane</td>
</tr>
<tr>
<td>• Change in leaf colour and curling leaves</td>
</tr>
<tr>
<td>• Premature leaf fall</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Failure to lignify</td>
</tr>
<tr>
<td>• Dessication of inflorescences and grapes</td>
</tr>
</tbody>
</table>
Symptoms and impacts

In case of any doubts

Check the simultaneous presence of the three following symptoms

Discoloration and curling leaves

Failure to lignify

Dessication of the grapes

© Canadian Food Inspection Agency
Symptoms and impacts

Characteristic symptoms and non distinguishable from other grapevine yellows

→ More or less visible depending on the variety
→ Rootstocks can be asymptomatic

Similar symptoms to Stolbur disease

→ If a flavescence dorée hypothesis exists, a PCR analysis is done to identify the phytoplasma
The actors of the disease

1) **Infectious agents**: FD 1, 2 and 3 phytoplasma

- Intracellular bacterium without wall living in the screened tubes of phloem → Transmitted by a vector or cuttings / grafting

- 3 genetic groups causing flavescence dorée:
  - FD1, mainly located in the South West of France
  - FD2, major group in Europe
  - FD3 mainly in Italy

- Wild compartment: *Aulnus* and *Clematis*
The actors of the disease

2) The vector: *Scaphoïdeus titanus*

**Life cycle**

- Only one generation per year
- Usually larvae remain on the plant where they hatch
- Adults are very mobile and fly from vines in vines
The actors of the disease

2) The vector: *Scaphoïdeus titanus*

Feeding behavior

- A stinging and sucking insect that feeds on vine leaves

- Acquisition of the phytoplasma possible from the first larval stage

- Incubation period of one month and then infectious for life
The actors of the disease

3) The host: the vine

- *Scaphoïdeus titanus* depends vitaly on vines: the leafhopper can only carry out its life cycle on *Vitis vinifera*
  - very epidemic disease

- Phytoplasma present on other wild plants: *Alnus* or *Clematis*
  - Associated with other vectors: possible transmission

*Oncopsis Alni* © Tristan Bantock

*Dictyophara europaea* © Dimitri Geystor

*Clématis vitalba* © Visoflora

*Alnus glutinosa* © Visoflora
Management of the vector

- **Treatment strategies**:  
  - Use of insecticide → decrease vector population  
  - Apply at the right moment → national decree

- First treatment **one month after hatching** (emerging cages and field monitoring)  
- Second treatment at the **end of remanence** of the first  
- Third treatment depends on the regions according to **FD history**
Management of the vector

- Monitoring with more precision
- Limited efficacy → sensitive to high temperature & UV radiation
- Natural pyrethrum and Azadirachtin
- Contact poison / Active principles-neurotoxic

© Wikipédia
Prospecting and monitoring

Preventing infection by acting on potential reservoirs:

• Potential reservoirs of the vector: wild vines and other plants such as *Clematis* or *Alnus*:
  • Risk of epidemic emergence
  • BUT also important for biodiversity and ecosystems

→ To reason according to the situation
Prospecting and monitoring

Recognition of the leafhopper

2 symmetrical black points in dorso-lateral position

Larval stages: L1 on the left, L3 in the center and L5 on the right

- Brown color
- Size between 4.8 and 5.8 mm
- 3 strips on the head for females

*Scaphoideus titanus*
Prospecting and monitoring

Detection of the leafhopper

• Possible from the first larval stage by trained technicians

• Visual inspection on 100 to 200 leaves, on suckers and leaves close to the base

• Insecticides treatments: mandatory dates

• Sticky traps to capture the adult leafhopper in the plots or near wild vines: decision for the third treatment

Sitcky trap use by IFV
Atypical practices to control the vector

Can be used complementary to chemical treatments but can not replace it

**Orange oil application**
- Not registred as insecticide
- Dessicate nymphs
- Side-effects

**Kaolin application**
- Mortality on nymphs and adults
Management of infected vines

- Monitoring vineyard is the main key point
- Individual and regional scale
- Organized by a dedicated organism
- Laboratory analyses to confirm FD case

- National decree ➔ uprooting and destruction of all infected vines

- Complete uprooting if more than 20% infected vines in the plot
Research on the vines

- **Cultivar sensitivity**
  - Differences of sensitivity to FD → identify non attractive-cultivars
  - Light or any symptoms on rootstocks
  - Genetic resistance → Stimulate natural defenses

The less the cultivar express symptoms
→ The less the phytoplasma multiplies
→ The less the disease spread
Research on the host and phytoplasma

- **Molecular inhibitors**
  - block phytoplasma before it reaches the cells

- **Air seeking**
  - using drones to early identify FD symptoms
Research to control the vector

• **Mating disruption**
  - Disturbing signals emitted by males to attract females
  - Inhibition of the reproduction
  - Decrease of the population from one year to another

• **Biological control**
  - Use parasitoids
  - Impossible for a large scale
Conclusion

• Rapidly spreading serious disease and considerable economic losses

• **Collective management** is the key

• Importance of control measures of the vector and infected vines