“Prospects for the prevention in the field and the in post – harvest of brown rot and lenticell rot

The most important pathogens

Monilinia fructigena: particularly aggressive on pome fruit but also on stone fruit

Monilinia laxa: affects flowers, shoots, fruits especially stone fruit but also on pome fruit and other Rosaceae

Monilinia fructicola: recently introduced in Italy but already widely

Botrytis cinerea

Rhizopus nigricans

Penicillium expansum
Factors affecting the severity of infections of Monilinia spp

- Temperature
- Relative humidity
- Hours of wetting
- Rain

Influence the number of biological cycles that take place in the growing season

Conidia reach the fruit and can cause rot when there are favorable conditions or remain in a latent stage when weather conditions are unfavorable

Conidia remain viable on the surface of the fruit also for 20 days with relatively low temperatures and high relative humidity
Growth of *Monilinia* spp at different temperatures (after 7 days)

Germination of conidia of *Monilinia* spp at different temperatures (after 20 days)
The development of rots and the economic damage

Protection and prophylaxis
Varietal susceptibility

- It has a genetic basis
- There isn’t any interest for the breeders about resistant cultivars
- It must be known and managed by agricultural producers

Agricultural practices

- Pruning
- Nitrogen nutrition
- Vegetation luxuriance
- Orientation and arrangement of rows
- Excessive irrigation (close to the ripening)

<table>
<thead>
<tr>
<th>28 farm monitored</th>
<th>% of fruit rot *</th>
</tr>
</thead>
<tbody>
<tr>
<td>THESIS COMPARED</td>
<td></td>
</tr>
<tr>
<td>Chemical protection</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>49 a</td>
</tr>
<tr>
<td>Chemical</td>
<td>12 b</td>
</tr>
<tr>
<td>Pruning</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>30</td>
</tr>
<tr>
<td>Green pruning</td>
<td>30</td>
</tr>
<tr>
<td>Soil management</td>
<td></td>
</tr>
<tr>
<td>Plowed</td>
<td>29</td>
</tr>
<tr>
<td>Grassed</td>
<td>32</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>10 b</td>
</tr>
<tr>
<td>Irrigation</td>
<td>34 a</td>
</tr>
</tbody>
</table>

N.S. = not significant; *** = significant at 0.1%; * = after 7 days of shelf-life at 20° C.
Weather conditions

Average temperatures for the period 21/06 – 30/08

<table>
<thead>
<tr>
<th>Tesi</th>
<th>Total fruit harvested in 7 tests</th>
<th>Total fruit with monilia infections after 7 days of shelf life</th>
<th>Average percentage of infected fruits after 7 days of shelf life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check 2007</td>
<td>2393</td>
<td>648</td>
<td>27.08</td>
</tr>
<tr>
<td>Check 2008</td>
<td>1767</td>
<td>1244</td>
<td>70.4</td>
</tr>
</tbody>
</table>

Chemical protection

Classification FRAC – Fungicides Resistance Action Committee

<table>
<thead>
<tr>
<th>Common name</th>
<th>Cod. frac</th>
<th>Mode of action</th>
<th>group</th>
<th>Chemical group</th>
<th>Resistance risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyprodinil</td>
<td>9</td>
<td>Aminoacids synthesis</td>
<td>A-P – fungicides Anilino-Pyrimidines</td>
<td>Anilino-pyrimidines</td>
<td>medium</td>
</tr>
<tr>
<td>Fludioxonil</td>
<td>12</td>
<td>Signal trasduction</td>
<td>P-P fungicides PhenylPyroles</td>
<td>Phenylpyroles</td>
<td>low-medium</td>
</tr>
<tr>
<td>Tebuconazole Fenbuconazole Difenconazole Ciproconazole</td>
<td>3</td>
<td>Biosynthesis of sterols in the cells membranes</td>
<td>DMI – fungicides DeMethylation Inhibitors</td>
<td>Triazoles</td>
<td>medium</td>
</tr>
<tr>
<td>Fenhexamid</td>
<td>17</td>
<td>Hydroxyanilides</td>
<td>Hydroxyanilides</td>
<td></td>
<td>low-medium</td>
</tr>
<tr>
<td>Boscalid</td>
<td>7</td>
<td>Carboxamides</td>
<td>Pyridinecarboxamides</td>
<td></td>
<td>medium</td>
</tr>
<tr>
<td>Pyraclostrobin Trifloxystrobin</td>
<td>11</td>
<td>Respiration</td>
<td>QOI – fungicides Quinone Outside Inhibitors</td>
<td>Methoxy carbamats</td>
<td>high</td>
</tr>
</tbody>
</table>
Risk of infection by *Monilinia* spp in the field:

**Flowering**

**Fruit set**

**Hardening**

**Core**

**Ripening**

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**Evaluation of fungicides effectiveness**

- **Period:** 1998-2014
- **Field trials:** 40
- **Farm involved:** 25
- **Cv involved:** 18

**Experimental design:**
- 1) Plots repeated in randomized block (27 tests)
- 2) Large plots without repetition (13 tests)

**Experimental design:**
- Performing two fungicide treatments carried out at 14 and 7 days from harvesting
- Taking samples of fruits in correspondence with the first two harvests
- Conservation of the fruits in cold store (2 °C) for 7 days
- Placement of the samples of fruits in thermostated cell (18 °C) for the shelf life checks (3 and 7 days)
Tebuconazole efficacy

Average efficiency: 72.9 %

Efficacy of boscalid+piraclostrobin:

Average efficiency: 80.2 %
Considerations

The prevention of brown rot damage due to *Monilinia* spp. involves the cultivation phase and post-harvest management of the product. Therefore, we are interested in:

**Growers**
- Agricultural practices
- Variety choice
- Chemical prophylaxis
- Choice of fungicides and application strategies

**Storage house operators**
- Hygiene of packaging and processing lines
- Adequate storage periods
- Adequate storage conditions (T°-UR)
Control strategies in the prevention of *Neofabraea alba* infections on apple

Sexual form: *Neofabraea alba*  
= *Pezicula alba* (old name)

Asexual f.: *Phlyctema vagabunda*  
= *Phlyctaena vagabunda*  
= *Trichoseptoria fructigena*  
called (past) « *Gloeosporium album* »

*Neofabraea alba*: symptoms
Neofabrea alba

Fruit infection process

- *N. alba* is present in cancers or cracks in the bark
- The contamination occurs through rains and/or run-off
- Incidence of the disease appears to be influenced by the shape and structure of lenticels (cv susceptibility) and their receptivity (maturity of the fruits)
- The stage after the contamination corresponds to germination of spores in the lenticels and the beginning of a long period of quiescence/latency

From G. Bompeix (pers. comm.)
How to evaluate the infection risk in orchard?

• **Rain**
  - Quantity or duration (n. of rainy days)

• **Leaf wetness associated with a rain event**
  - Minimum 4-5 hours!?  
  - Incidence of temperature!?  
    - Cumulative degree-hour during leaf wetness  
  - Incidence of maturity of fruits!?

• **Susceptibility of varieties**
• **Modelisation is a possibility?**
How to evaluate the infection risk in orchard?

There are several factors that make not simple the chemical defense against N. Alba:

- The sources of primary inoculum are undetectable
- The inoculum is not easily monitored
- Factors affecting the relationship between the inoculum and the receptivity of the fruit are not completely known

Remarks

- Raise awareness of the problem with the growers
- More attention on the agronomic practices
- Planning fungicide treatments
- Planning the harvest and not prolong it excessively
- Managing the product in packinghouse anticipating the commercialization of the product at greater risk
- Managing the fruit in storage house - Treatment with 1-mcp
- Managing the fruit in storage house - Thermotherapy