EUPHRESCO II

PHYLIB

Epidemiology and diagnosis of potato phytoplasmas and *Candidatus Liberibacter solanacearum* and their contribution to risk management in potato and other crops

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Science and Advice for Scottish Agriculture
EUPHRESCO

- to increase cooperation and coordination of national phytosanitary (statutory plant health) research programmes at the EU level through networking of research funding activities

- management funded from the EU Framework Programme (FP7 from 2011-2013).

is essential to ensure effective support of EU policy and its implementation.
EUPHRESCO

2006-2010: 23 partners in 17 countries

2011-: 31 partners in 22 countries
12 European observer countries
2 international observers
PHYLIB: key objectives

to develop sampling and diagnostic methods to ensure reliable screening of material for phytoplasmas and *Ca Liberibacter solanacearum*

- database of collections (DNA, live) worldwide
- establish reliable methods for maintenance of isolates in host(s) eg potato/periwinkle microplants (in vitro)
- mapping of movement in potato
- establish genetic diversity of populations
- selection of “best” diagnostic protocols/ development
- Ring tests / proficiency tests
PHYLIB: key objectives

to improve our understanding of the epidemiology of both Phytoplasma’s and Liberibacter solanacearum

- Are the Lso haplotypes present in the EU able to affect potato?
- What is the source of inoculum?
  - seed transmission e.g. carrot, celery
  - overwintering hosts
  - other?
- Can vectors transmit Lso from carrot/celery to potato/tomato
<table>
<thead>
<tr>
<th>Ribosomal subgroup</th>
<th>Phytoplasma group</th>
<th>Phytoplasma species</th>
</tr>
</thead>
<tbody>
<tr>
<td>16Srl-A</td>
<td>Aster yellows</td>
<td>Ca. Phytoplasma asteris</td>
</tr>
<tr>
<td>16Srl-B</td>
<td>Aster yellows</td>
<td>Ca. Phytoplasma asteris</td>
</tr>
<tr>
<td>16SrlI</td>
<td>Peanut witches</td>
<td>Ca. Phytoplasma aurantifolia</td>
</tr>
<tr>
<td>16SrlII</td>
<td>Peanut witches</td>
<td>Ca. Phytoplasma aurantifolia</td>
</tr>
<tr>
<td>16SrlIII</td>
<td>X-disease</td>
<td>Ca. Phytoplasma trifolii</td>
</tr>
<tr>
<td>16SrV</td>
<td>Elm yellows</td>
<td>Ca. Phytoplasma trifolii</td>
</tr>
<tr>
<td>16SrVIII</td>
<td>Clover proliferation</td>
<td>Ca. Phytoplasma trifolii</td>
</tr>
<tr>
<td>16SrX-A</td>
<td>Apple proliferation</td>
<td>Ca. Phytoplasma mali</td>
</tr>
<tr>
<td>16SrXII-A</td>
<td>Bois Noir</td>
<td>Ca. Phytoplasma solani</td>
</tr>
<tr>
<td>16SrXIII</td>
<td>Stolbur</td>
<td>Ca. Phytoplasma solani</td>
</tr>
<tr>
<td>16SrXVIII-A</td>
<td>American potato purple top wilt</td>
<td>Ca. Phytoplasma americanum</td>
</tr>
<tr>
<td>16SrXVIII-B</td>
<td>potato purple top</td>
<td>Ca. Phytoplasma americanum</td>
</tr>
</tbody>
</table>

Ca. Phytoplasma asteris
Ca. Phytoplasma aurantifolia
Ca. Phytoplasma trifolii
Ca. Phytoplasma mali
Ca. Phytoplasma solani
Ca. Phytoplasma americanum
Zebra chip disease

Darkened stripes in potato crisps

Discolouration of medullary rays

Sporadic losses

Mexico 1994
USA 2000

Swollen nodes, leaf curl, purple top, wilt, aerial tubers

2004+ USA
$ million + losses

2006+ eastern Europe
$ million + losses

Images: G Secor
Bacteria associated with zebra chip

*Candidatus* Liberibacter solanacearum

**NZ** 2008

**North America:** Mexico (Coahuila, Sinaloa), USA (California, Kansas, Nebraska, Nevada, Texas, Wyoming).

**Central America:** Honduras, Guatemala

**Ca. Phytoplasma solani**

**Europe:** Hungary, Romania, Russia

**Phytoplasmas and Liberibacter**

- Obligate parasites of plant phloem tissue
- They cannot be cultured *in vitro* in cell-free media
- Liberibacter has a cell wall (gram-negative)
- Phytoplasmas do not have a cell wall
### Vectors and hosts

<table>
<thead>
<tr>
<th><strong>Ca P solani</strong></th>
<th><strong>Ca L solanacearum</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VECTOR</strong></td>
<td><strong>VECTOR</strong></td>
</tr>
<tr>
<td>Plant/leaf hopper: <em>Hyalesthes obsoletus</em></td>
<td>Psyllid: <em>Bactericera cockerelli</em> (potato/tomato)</td>
</tr>
</tbody>
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<tr>
<th><strong>HOSTS</strong></th>
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<tr>
<td>Solanaceous crop plants e.g. Potato Tomato</td>
<td>Solanaceous crop plants e.g. Potato Tomato Pepper/Chilli Eggplant Cape gooseberry</td>
</tr>
</tbody>
</table>

*Psyllid not present in Europe*
CLIMEX: Potential distribution of Bactericera cockerelli

Potential distribution based on N America pest data

Potential distribution based on New Zealand pest data

Source: EPPO
**Ca L solanacearum**: Carrots, Finland 2010
Carrots, celery, Spain 2011
Carrots, France, Norway, Sweden 2012

**Carrot psyllids (Trioza apicalis)**

**Feeding damage**

**Does not feed on potato**

**Bactrocera trigonica**

**Infection with Ca L solanacearum**

**Feeds on potato?**

Images: Anne Nissinen (carrots) Joe Botting (T apicalis)
EU: Potato stolbur legislation 2000/29/EC

HARMFUL ORGANISMS WHOSE INTRODUCTION INTO, AND SPREAD WITHIN, ALL MEMBER STATES SHALL BE BANNED IF THEY ARE PRESENT ON CERTAIN PLANTS OR PLANT PRODUCTS HARMFUL ORGANISMS KNOWN TO OCCUR IN THE COMMUNITY AND RELEVANT FOR THE ENTIRE COMMUNITY

Plants of *Solanaceae*, intended for planting, other than seeds

**EPPO (Recommendations)**

Potato stolbur A2 pest
Potato purple-top wilt phytoplasma A1 pest
Candidatus Liberibacter solanacearum and Bactericera cockerelli

EPPO Pest risk analysis for:

- *Candidatus* Liberibacter solanacearum in *Solanaceae*
- *Bactericera cockerelli*
- Approved by EPPO September 2012
- EPPO A1 quarantine pests

Candidatus Liberibacter solanacearum and Bactericera cockerelli

EPPO Pest risk analysis for:
- Candidatus Liberibacter solanacearum in Solanaceae
- Bactericera cockerelli

Approved by EPPO September 2012


Action by EU Plant Health Standing Committee
Diagnostics

Post-entry quarantine requirements for potato specified in 2008/61/EC

- no testing is specified for phytoplasmas and Liberibacter solanacearum

- EPPO recommends testing for phytoplasmas using universal primers
Diagnostics

Post-entry quarantine requirements specified in 2008/61/EC

☐ no testing is specified for phytoplasmas and Liberibacter solanacearum

☐ EPPO recommends testing for phytoplasmas using universal primers

No testing done by NPPOs in potato post-entry quarantine or potato nuclear stocks for entry to potato certification schemes?