

## 1. Content of the 'Topic Description' document

### 1.1. Topic area

F: pest/vector biology, epidemiology, taxonomy

### 1.2. Links to the Euphresco Strategic Research Agenda

The topic addresses the following objective(s) of the 2017-2022 Euphresco Strategic Research Agenda:

- Objective 2017-R-1.1: to improve knowledge on the biology, epidemiology and ecology of priority invasive and (re)emerging pests
- Objective 2017-R-2.1: to improve knowledge on emerging pathways of entry and means of spread for pests
- Objective 2017-R-2.2: to expand knowledge on transmission of disease and pathogens for healthy planting material
- Objective 2017-R-3.2: to develop models to summarise the understanding of the spread, establishment and impact of pests
- Objective 2017-R-6.1: to test and validate methods for in situ detection and identification of pests
- Objective 2017-I-2.2: to contribute to databases for plant pests identification and diagnostics

### 1.3. Topic title

The biology and epidemiology of '*Candidatus Liberibacter solanacearum*' and potato phytoplasmas and their contribution to risk management in potato and other crops.

### 1.4. Description of the problem the research should solve

The proteobacterium '*Candidatus Liberibacter solanacearum*' (Lso) is an emerging threat to a range of crops most notably potato, tomato, carrot and celery. Lso causes zebra chip symptoms in potatoes in the Americas and New Zealand, reducing tuber yield and processing quality (Butler & Trumble, 2012). Lso has been reported in several areas of Europe including Scandinavia, France, Spain and the Canary Islands on apiaceous crops.

Lso was initially recorded in Mexico in 1994 infecting potato. From there it has spread through much of Central and Northern America and also to New Zealand where it is thought a psyllid vector was accidentally introduced into tomato crops grown under glass. Escape of the psyllid allowed it to transfer infection to potato, and losses of up to 16% of total yield are now being reported (mainly due to unmarketable tubers). The vector associated with spread in the Americas and New Zealand is *Bactericera cockerelli*. This psyllid species is not native to Europe, however two additional psyllid species *Trioza apicalis* and *Bactericera trigonica*, are believed to be responsible for spread in Europe, with a further one (*B. nigricornis*) currently under investigation. Researchers in Spain have experimentally transmitted Lso from carrot to potato using a psyllid vector (*B. trigonica*) but the rate of transmission is very low (less than 3%). In addition, a few volunteer potato plants within carrot fields in Finland and potatoes for consumption in Spain have been discovered to be infected with Lso.

Currently there are 7 described Lso haplotypes. Haplotype A has been found in Central and North America and New Zealand and haplotype B in Mexico and North America. A and B haplotypes are transmitted by *B. cockerelli* and present in solanaceous crops, and both the haplotypes and vector are regarded as A1 pests under EPPO Annex II. More recently haplotype F has also been reported in a potato. Haplotype C was first reported in carrot crops in Finland and subsequently found to occur more widely in northern Europe, transmitted by *T. apicalis*. Haplotypes D and E are associated with carrot and other apiaceous crops in the South of Europe and in the Mediterranean basin and is transmitted by the psyllid *B. trigonica*. *Bactericera tremblayi* and *B. nigricornis* have both also been suggested as vectors in Spain and the Canaries. Transmission studies about *B. tremblayi*

demonstrated that it is not a vector of Lso and work is underway to determine the contribution of *B. nigricornis* to the spread of Lso. Very little is known about the differences between the haplotypes and any host/ vector specialisation, however both examples of limited and atypical transfer from carrot to potato given above involve the local Lso haplotype (E in Spain and C in Finland) and vector, suggesting that European haplotypes are capable of infecting both solanaceous and non-solanaceous hosts if a suitable vector is present. More recently haplotype U has been identified in Nettle (*Urtica dioica*) and in the psyllid *Trioza urticae* which is presumed to be its vector.

No genome is currently available for LsoE and for the other haplotypes, few complete or draft Lso genomes are available. Moreover, previous genetic studies revealed the presence of more genetic variability than what it was previously described. For these reasons, obtaining complete genomes of European haplotypes and their genetic variants could feed future genomic comparison for a better understanding of this pathosystem and the risks associated with the introduction of new haplotypes and/or vectors for solanaceous crops.

### 1.5. Description of the expected results

- Understanding of Psyllid vectors and their respective Lso haplotypes and their ability to transmit Lso to / between crop hosts
- Genome seq / MLST of haplotype U (from multiple locations)
- Establishing SNPs and Indels of CLso haplotypes
- Real-time PCR assays for the identification of additional psyllid species
- Screening alternative insect groups for Lso and Phytoplasmas (aphids, hoppers, other hemiptera)
- Distribution of Lso in European countries
- Improved understanding of the host range of Lso
- Improved knowledge of Lso psyllid vectors bionomy and overwintering

### 1.6. Beneficiaries of this research product

- National and EU policy makers
- National Plant Protection Organisations, including risk managers and diagnosticians
- EPPO and its members (validated diagnostic protocols; information contributing to EPPO PRAs)
- Industry and other stakeholders

### 1.7. Research funders and research contribution/ distribution

Funding organisation	Research activity and researchers involved
1. Science and Advice for Scottish Agriculture, United Kingdom  David Kenyon <a href="mailto:David.kenyon@sasa.gov.scot">David.kenyon@sasa.gov.scot</a>	-Characterization of new Lso haplotypes/ Liberibacter spp. from new psyllid hosts; -Genome seq / MLST of haplotype U; -Screening psyllid specimens for Lso; -Screening alternative insect groups for Lso; -Set-up colonies of <i>T. urticae</i> , <i>T. anthrisci</i> and <i>C. subpunctata</i> ; -Transmission studies on <i>T. urticae</i> , <i>T. anthrisci</i> , and <i>N. subpunctata</i> ; -Plant choice studies; -Overwintering hosts; -EPG on <i>T. anthrisci</i> ;  Contact person: Jason Sumner-Kalkun E-Mail address: <a href="mailto:Jason.sumner-">Jason.sumner-</a>



<p>2. Austrian Agency for Health and Food Safety, Austria</p> <p>Sylvia Bluemel <a href="mailto:sbluemel@ages.at">sbluemel@ages.at</a></p>	<p><a href="mailto:kalkun@sasa.gov.scot">kalkun@sasa.gov.scot</a></p> <ul style="list-style-type: none"> <li>-Lso from potential new psyllid species in the outbreak area (Tyrol);</li> <li>-Screening psyllid specimens for Lso;</li> <li>-Screening alternative insect groups for Lso;</li> <li>-Identification of possible disease entry pathways (commercial plantlets);</li> </ul> <p>Contact person: Christa Lethmayer E-Mail address: <a href="mailto:christa.lethmayer@ages.at">christa.lethmayer@ages.at</a></p> <p>Contact person: Richard Gottsberger E-Mail address: <a href="mailto:richard.gottsberger@ages.at">richard.gottsberger@ages.at</a></p>
<p>3. Federal Public Service Health, Food Chain Safety and Environment, Belgium</p> <p>Ria Nouwen <a href="mailto:ria.nouwen@health.belgium.be">ria.nouwen@health.belgium.be</a></p>	<ul style="list-style-type: none"> <li>-Potential research activities to be confirmed after national VP-selection &amp; peer review;</li> <li>- Selection and monitoring of a limited number of carrot fields for the presence of psyllids and other potential vectors. Monitoring around the crop, in surrounding weeds and trees;</li> <li>- Morphological and molecular identification of collected psyllids and other potential vectors;</li> <li>- Testing of collected psyllids and other potential vectors for the presence of phytoplasmas and Lso;</li> <li>- Possible contribution to transmission experiments;</li> </ul> <p>Contact person: to be confirmed after national selection</p>
<p>4. Canadian Food Inspection Agency, Canada</p> <p>Philip Macdonald <a href="mailto:Philip.Macdonald@canada.ca">Philip.Macdonald@canada.ca</a></p>	<ul style="list-style-type: none"> <li>-Genomics and transcriptomics sequencing for the detection of potato zebra chip disease in potato and tomato;</li> </ul> <p>Contact person: Sean Li E-Mail address: <a href="mailto:Sean.li3@canada.ca">Sean.li3@canada.ca</a></p>
<p>5. Central Institute for Supervising and Testing in Agriculture, Czech Republic</p> <p>Michal Hnizdil <a href="mailto:michal.hnizdil@ukzuz.cz">michal.hnizdil@ukzuz.cz</a></p>	<ul style="list-style-type: none"> <li>-Survey for the presence of Lso and psyllid vectors in carrot and parsley fields and surrounding weeds;</li> <li>-Identification of the collected psyllid species.</li> <li>- Identification of Lso haplotypes in psyllids and in plants;</li> <li>-Monitoring of potential presence of <i>B. tremblayi</i> and <i>B. cockerelli</i> in the Czech Republic;</li> <li>-Detection of Lso in seeds of carrot and parsley and testing of potential transmission of Lso via seeds;</li> <li>-Participation to PT for the validation of diagnostic methods for Lso;</li> </ul> <p>Contact person: Václav Čermák E-Mail address: <a href="mailto:v.cermak@ukzuz.cz">v.cermak@ukzuz.cz</a></p>
<p>6. Ministry of Agriculture, Rural Development and Environment, Cyprus</p>	<ul style="list-style-type: none"> <li>-Contribution to be detailed</li> </ul>



<p>Tefkros Iacovides <a href="mailto:tiacovides@da.moa.gov.cy">tiacovides@da.moa.gov.cy</a></p>	<p>Contact person: Despina Philippou E-Mail address: <a href="mailto:dphilippou@da.moa.gov.cy">dphilippou@da.moa.gov.cy</a></p>
<p>7. French Agency for Food, Environmental and Occupational Health &amp; Safety, France</p> <p>Géraldine Anthoine <a href="mailto:geraldine.anthoine@anses.fr">geraldine.anthoine@anses.fr</a></p>	<p>-Genome sequences of LsoD, LsoE and genetic variant of LsoD;</p> <p>Contact person: Marianne Loiseau E-Mail address: <a href="mailto:marianne.loiseau@anses.fr">marianne.loiseau@anses.fr</a></p>
<p>8. Department of Agriculture, Food and Marine, Ireland</p> <p>Maria Laura Destefanis <a href="mailto:Maria.Destefanis@agriculture.gov.ie">Maria.Destefanis@agriculture.gov.ie</a></p>	<p>-Contribution to be detailed</p> <p>Contact person: Sinead Kelly E-Mail address: <a href="mailto:Sinead.kelly@agriculture.gov.ie">Sinead.kelly@agriculture.gov.ie</a></p>
<p>9. Council for Agronomic Research and analysis of the Bioeconomy, Italy</p> <p>Luca Riccioni <a href="mailto:luca.riccioni@entecra.it">luca.riccioni@entecra.it</a></p>	<p>-Participation to PT and TPS for the validation of diagnostic methods for Lso; -Survey for the presence of Lso and psyllid vectors; -Identification of the collected psyllid species;</p> <p>Contact person: Vincenza Ilardi E-Mail address: <a href="mailto:vincenza.ilardi@crea.gov.it">vincenza.ilardi@crea.gov.it</a></p> <p>Contact person: Sabrina Bertin E-Mail address: <a href="mailto:sabrina.bertin@crea.gov.it">sabrina.bertin@crea.gov.it</a></p>
<p>10. Ministry of agricultural food and forestry policies, Italy</p> <p>Alberto Masci <a href="mailto:a.masci@politicheagricole.it">a.masci@politicheagricole.it</a></p>	<p>-Refer to partner Council for Agronomic Research and analysis of the Bioeconomy</p>
<p>11. All Russian Plant Quarantine Center, Russian Federation</p> <p>Natalia Sherokolova <a href="mailto:natalia_sh@mail.ru">natalia_sh@mail.ru</a></p>	<p>-Participation to PT and TPS for the validation of diagnostic methods for Lso; -Monitoring of territory of Russia for Liberibacter spp.; -Surveillance on field crops with focus on different hosts; -Optimisation of DNA extraction methods for different parts of plants and seeds;</p> <p>Contact person: Yuri Shneyder E-Mail address: <a href="mailto:yury.shneyder@mail.ru">yury.shneyder@mail.ru</a></p>
<p>12. University of Banjaluka, Bosnia and Herzegovina</p> <p>Duška Delic <a href="mailto:duska.delic@agro.unibl.org">duska.delic@agro.unibl.org</a></p>	<p>-Contribution to be detailed</p> <p>Contact person: Duška Delic E-Mail address: <a href="mailto:duska.delic@agro.unibl.org">duska.delic@agro.unibl.org</a></p>
<p>13. The National Federation of the seed potato growers, France</p> <p>Yves Le Hingrat <a href="mailto:yves.lehingrat@fnpppt.fr">yves.lehingrat@fnpppt.fr</a></p> <p>Virginie Gobert</p>	<p>- Monitoring of Lso and psyllids in potato crops and their environment; - Testing of collected psyllids for the presence of Lso; - Participation to PT or TPS on new diagnostic methods for the detection of Lso or/and the identification of the haplotypes;</p>

<a href="mailto:virginie.gobert@fnpppt.fr">virginie.gobert@fnpppt.fr</a>	- Field transmission studies (risk evaluation);  Contact person: Anne-Claire Le Roux E-Mail address: <a href="mailto:anneclaire.leroux@fnpppt.fr">anneclaire.leroux@fnpppt.fr</a>
13. University of West Indies, Jamaica  Sherline Brown <a href="mailto:sherline.brown02@uwimona.edu.jm">sherline.brown02@uwimona.edu.jm</a>	-Contribution to be detailed  Contact person: E-Mail address:
14. Natural History Museum, United Kingdom  David Ouvrard <a href="mailto:d.ouvrard@nhm.ac.uk">d.ouvrard@nhm.ac.uk</a>	-Collecting psyllids; -Psyllid taxonomy and identification (morphology and DNA barcoding); -Specimen imaging and databasing; -Collection and curation of voucher specimens; -Use of NHM extensive collection; -Liaison with other Museums;  Contact person: David Ouvrard E-Mail address: <a href="mailto:d.ouvrard@nhm.ac.uk">d.ouvrard@nhm.ac.uk</a>

### 1.8. Research project partnership outside Euphresco

Euphresco funding ensures a certain level of transnational collaboration among Euphresco member countries. It is possible, if the funding consortium is interested, to contact funding organisations or research groups outside the geographical area covered by Euphresco members. The Euphresco coordinator could advertise the research topic in order to have an enlarged collaboration. If funders are interested in this possibility, please check the case below:

The funding consortium of the topic mentioned in section 1.2 requires that the topic is advertised outside the Euphresco network

Information to define the profile of sought partners could be useful (but not mandatory): country/region (if there are preferences), skills/expertise required, etc.

### 1.9. Any other relevant information on content

Work related to this topic was already funded under PhyLib I and II and therefore duplication should be avoided; close collaboration with other projects (weedvec) in the field is envisioned.

## 2. Euphresco management aspects of the project

### 2.1. Indication of the topic budget

Funding organisation <sup>a</sup>	Mechanism <sup>b</sup>	Total Budget <sup>c</sup>
1. SASA (GB)	NC	€
2. AGES (AT)	NC	€
3. FPS (BE)	NC / VP	€
4. CFIA (CA)	NC	€
5. UKUZ (CZ)	NC	€
6. MOA (CY)	NC	€
7. ANSES (FR)	NC	€
8. DAFM (IE)	NC	€
9. CREA (IT)	NC	€
10. VNIIKR (RU)	NC	€
11. UNIBL (BA)	NC	€
12. FN3PT (FR)	NC	€
13. UWIMONA (JM)	NC	€
14. NHM (GB)	NC	€
total		€

### 2.2. Expected duration of the project (only for non-competitive topics)

24 months.

### 2.3. Identification of project coordinator

Has the research project coordinator been identified?

Yes

No

### 2.4. Any other relevant information on topic organisation and management

<sup>a</sup> First member is project coordinator. A minimum of two partners are necessary for each proposal. Add lines as needed.

<sup>b</sup> Please indicate the preferred mechanism (e.g. real pot RP; virtual pot VP; non-competitive NC), or several mechanisms if there is flexibility.

<sup>c</sup> Optional, as this amount can still change in the next phase. In-kind contribution should also be indicated in this column.