Bacterial Plant Diseases Programme

Lso-infected carrots (right) compared to healthy carrots (left) credit: EPPO

EVALUATING THE RISK OF '*CANDIDATUS* LIBERIBACTER SOLANACEARUM' (LSO) DISEASES IN UK CARROTS, POTATOES AND TOMATOES

The potato psyllid, ***Bactericera cockerelli***, **which can carry '*Candidatus* Liberibacter solanacearum'**
Credit: Wikimedia Commons

Disease only occurs with the right combination of plant, bacterium, and insect

'Candidatus Liberibacter solanacearum' (Lso) is a bacterium which causes zebra chip disease in potato. Lso exists in different variants (called haplotypes). Different variants can also lead to significant losses in other crops including tomato, carrot, and celery in some parts of the world. Lso is not currently causing widespread damage in the UK despite the bacterium being present here.

Essential to understanding the spread of Lso is understanding the insects that carry it. The disease is only transmitted from plant to plant by sap-feeding insects called psyllids. These insects are highly specific, typically feeding on just one or a few host plant species. This means that for disease to occur both the plant-specific psyllid, and a suitable Lso haplotype need to be present.

This research documented the presence of Lso and insect vectors across the UK

Over the course of 3 years we analysed 8458 plants and 2646 insects collected from 40 carrots fields and their margins across the UK. We tested all the samples for the presence of Lso. When Lso was found we used genome sequencing to identify which of the haplotypes was present. We also sequenced the genome of psyllid insect vectors to develop biomarker tests.

Parallel to the field testing, we also developed a risk assessment and economic impact model to evaluate the current and potential future impact of Lso to UK agriculture.

Collecting psyllids in a carrot field

Bacterial haplotype	Haplotype present in UK?	Insect vector	Insect present in UK?	Host Plant	Potential economic impact	Current risk to UK
A	✗	*Bactericera cockerelli*	✗	Potato, tomato, pepper, aubergine, *Physalis philadelphica*	Very high	High
B						
C	✓	*Dyspersa apicalis* *Dyspersa pallida*	✓	Carrot, cow parsley, common hogweed	Very high	High
D	✗	*Bactericera trigonica*	✗	Carrot, celery, parsley, parsnip, fennel	Potentially high	High
E						
F	✗	Unknown	✗	Potato	Unknown	Unknown
G	✗	Unverified	✗	Blue witch nightshade (*Solanum umbelliferum*)	Unknown	Unknown
H	✗	Unknown	✗	Carrot, parsnip, *Persicaria lapathifolia, Fallopia convolvulus*	Unknown	Unknown
H (Con)	✗	*Bactericera cockerelli*	✗	Sweet potato	Unknown	Unknown
U	✓	*Trioza urticae*	✓	Stinging nettle	Negligible	Very low

Discoveries

We found low levels of Lso suggesting the prevalence is currently low

- 7% of plants and 20% of insects sampled carried Lso, but disease symptoms were rare.
- The most abundant haplotype we detected was the one restricted to stinging nettle (*Urtica dioica*) which doesn't seem to be impacting important crops like carrots.
- At present environmental conditions don't appear favourable for the most concerning vector (*Bactericera cockerelli*) but changes in land use could increase this risk.
- Increasing imports of tomatoes or potatoes from areas where *Bactericera cockerelli* is more common (North/Central America) risks introducing this vector to UK crops.

Recommendations

Our research has shown that, although Lso is not currently a significant risk to UK agriculture, changes in land use and ecology might create more favourable conditions for the insects which transmit the disease.

- More research to understand how changes in land use and agricultural practices, e.g. increasing overwintering habitats for the insect, could increase the risk.
- Greater emphasis on monitoring in the wider environment, not just on farms and managed sites.
- Focus efforts on preventing the introduction of the psyllid *Bactericera cockerelli*. If introduced carrying a haplotype which can infect potatoes and tomatoes it could be devastating for UK potato and tomato crops.

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Bacterial Plant Diseases Programme

An interdisciplinary research consortium working together to understand bacterial plant diseases to protect UK farms, forests and gardens.

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