Genetic characterization of Candidatus Liberibacter solanacearum strains infecting carrot psyllids in Southwestern France

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UMR 1332 Fruit Biology and Pathology, INRA, University of Bordeaux, CS20032, 33882 Villenave d'Ornon cedex, France The phloem-limited bacterium, Candidatus Liberibacter solanacearum (CaLsol), is responsible of several diseases on Solanaceae (USA, New-Zealand) and on Apiaceae such as carrots in several European countries (Spain, France, Finland, Sweden, Germany). This bacterium is vectored by psyllids, Bactericera cockerelli to potatoes, or B. trigonica and Trioza apicalis to carrots. Differents haplotypes of the bacterium were identified, based on the 16 S rDNA and the ITS sequences: A and B on the american continent, C, D and E in Europe.
In France, since the 1970s, proliferation of carrots was shown to be associated with this psyllid-transmitted, phloem-limited bacterium. In order to reassess disease impact and better characterize the bacterium involved, five organic or non-organic carrot fields were surveyed in 2016 for CaLsol and psyllids in three production areas of Southwestern France.


## 5 carrot fields surveyed for CaLsol and psyllids in Southwestern France

Symptomatic carrots showing proliferation were counted in 4 lots of 250 plants in 2016


- Symptomatic carrots were identified only in one field (A).
- Incidence of CaLsol is very low but increased up to $9 \%$ in field A.


## Psyllids populations

Number of psyllids captured ( $10 \times 10$ sweeps)

12
10




Psyllids were present in all fields but one (field B) - Population increased at the end of summer for Field A and during fall for the other fields


Psyllids collected on carrots were mostly Bactericera trigonica. Only one Bactericera urticae was identified.

| CaLsol detection in psyllid populations |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Region | Fields | Insecticide <br> treated (T) <br> or not (NT) | Date of seedling | nb psyllids positive for CaLsol / total tested |  |  |  |
|  |  |  |  | May | July | August | September |
| Dordogne | A | NT | 2015-11 | 6/39 |  | 1/10 |  |
|  |  |  | 2016-02 |  |  | 1/14 |  |
|  |  |  | 2016-06 |  |  |  |  |
|  | B | T | 2016-02 |  |  |  |  |
| Landes | C | NT | early spring 2016 |  |  | 0/6 |  |
|  |  |  | summer 2016 |  |  |  | 3/24 |
|  | D | T | early 2016 |  | 4/7 |  |  |
|  |  |  | mid 2016 |  |  |  |  |
| Lot-etGaronne | E | NT | 2015 |  | 0/27 |  |  |
|  |  |  | early 2016 |  |  | 2/11 |  |
|  |  |  | early 2016 |  |  |  | 3/25 |

CaLsol detection in psyllids was globally of $12 \%$ and ranged from $0 \%$ to $57 \%$ per sampling (rt-PCR detection, Teresani et al. 2014)
Three haplotypes ( 16 S rDNA and ITS) were identified: two variants of D, named D2 and D3, and E.
Haplotype D2 differs from D by 2 SNPs in 16 S and ITS, and D3 is identical to D for 16 S and to D2 for ITS.
D2 and E were found in carrots; D2, D3 and E in psyllids.

## MLSA of CaLsol detected in Southwestern France


(Haplotype D2)

- Psylle from field A (Haplotype D2 recombinant meta foom hapoltype E)

Carrot from field A (Haplotype E)

Conclusions
Psyllid populations were found in carrot fields in Southwestern France, mostly B. trigonica. Some were infected with CaLsol. The capacity of B. trigonica to transmit CaLsol from carrot to other crops remain to be established.

