

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



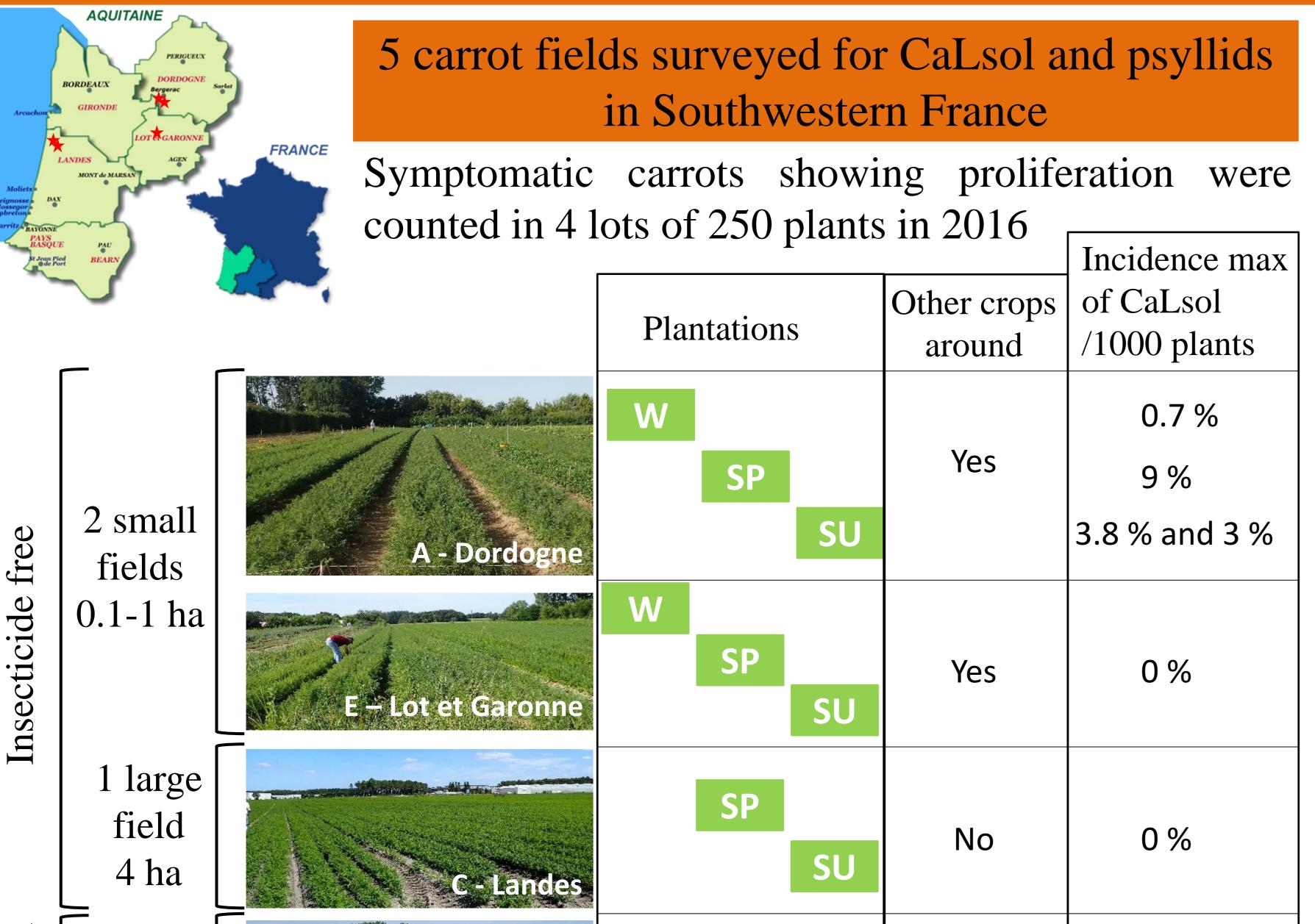
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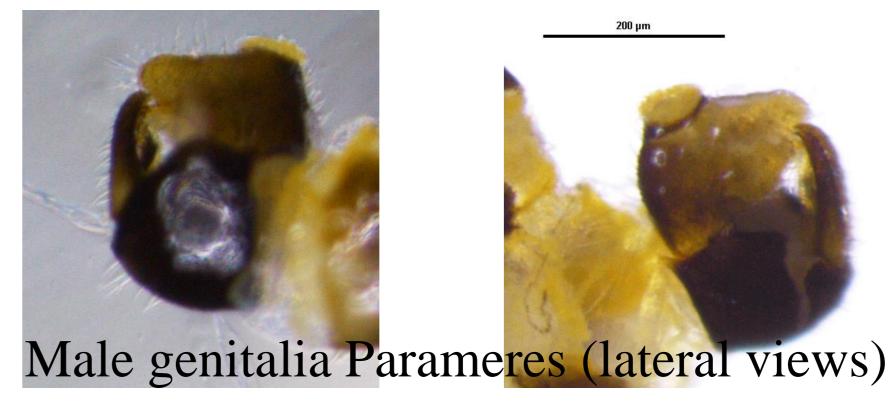
The phloem-limited bacterium, Candidatus Liberibacter solanacearum (CaLsol), is responsible of several diseases on Solanaceae (USA, New-Zealand) and on Apiaceae such as carrots in several European countries (Spain, France, Finland, Sweden, Germany). This bacterium is vectored by psyllids, *Bactericera cockerelli* to potatoes, or *B. trigonica* and *Trioza apicalis* to carrots. Differents haplotypes of the bacterium were identified, based on the 16S 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.



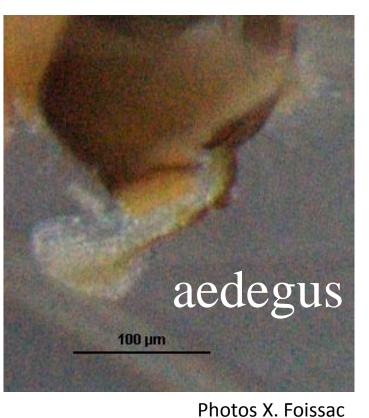
Identification of psyllids collected on carrots







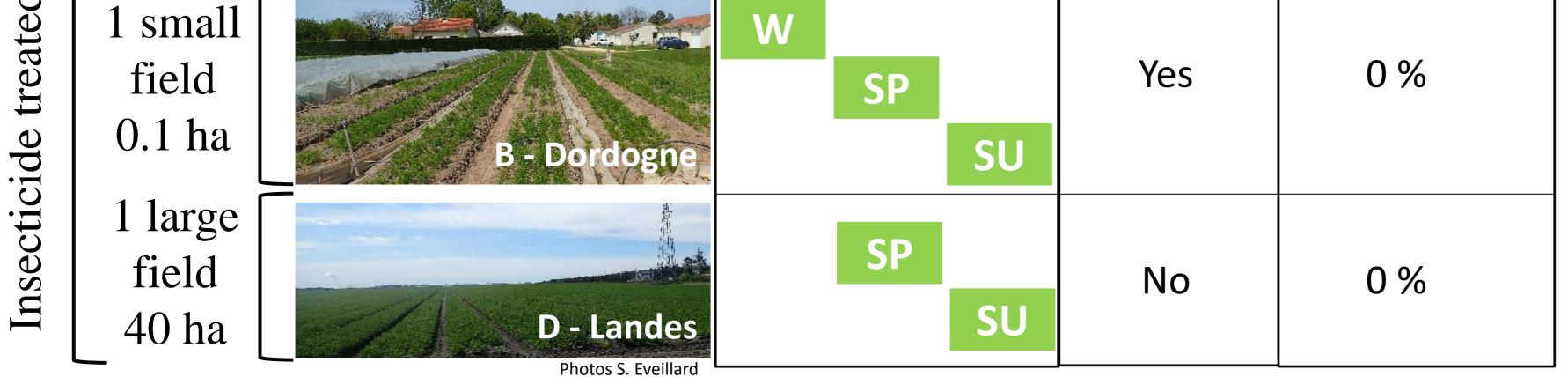
Insecticide



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

Callsol detection in psyllid populations

nb psyllids positive for CaLsol / totol tootod

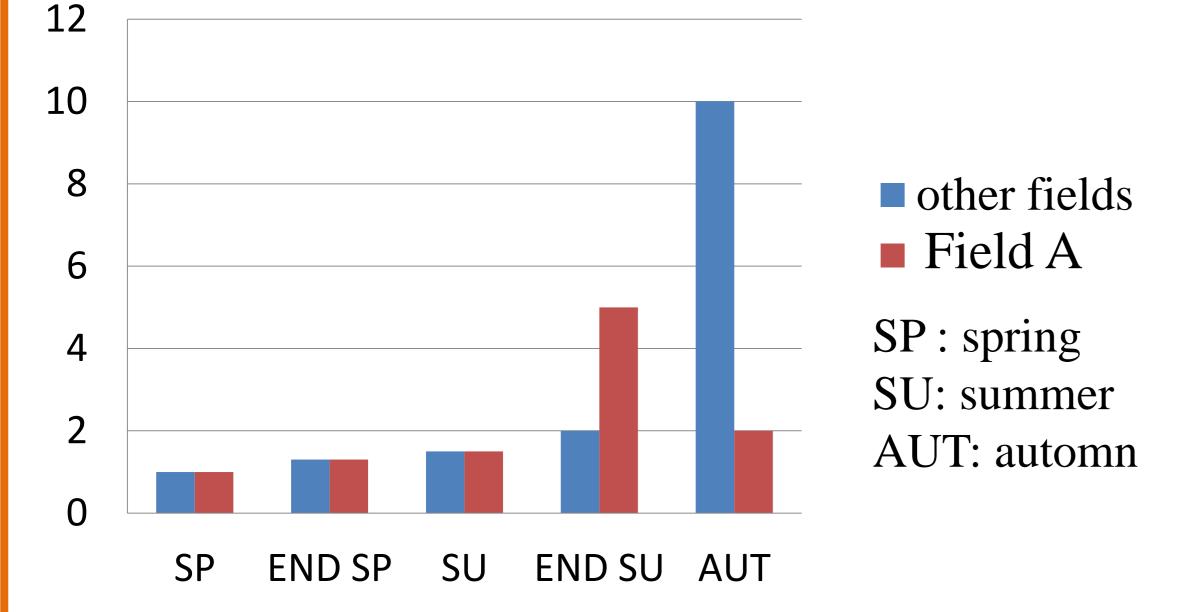


W: winter; SP : spring; SU: summer

- 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 x 10 sweeps)



Carrot with symptoms of proliferation AH2-16-03-C88

	Region	Fields	treated (T) or not (NT)	Date of seedling	total tested			
					May	July	August	September
	Dordogne	A	NT	2015-11	6/39		1/10	
				2016-02			1/14	
				2016-06				
		В	Т	2016-02				
	Landes	С	NT	early spring 2016			0/6	
				summer 2016				3/24
		D	Т	early 2016		4/7		
				mid 2016				
	Lot-et- Garonne	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 (16S rDNA and ITS) were identified: two variants of D, named D2 and D3, and E.
- Haplotype D2 differs from D by 2 SNPs in 16S and ITS, and D3 is identical to D for 16S and to D2 for ITS.

- 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

Carrot without symptoms of proliferation

AHZ-16-09

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.

D2 and E were found in carrots; D2, D3 and E in psyllids.

MLSA of CaLsol detected in Southwestern France

Carrot from field A (Haplotype D2) - Psylle from field A (Haplotype D2 recombinant metG from haplotype E)

Carrot from field A (Haplotype E)

CLso-ZC1 American haplotype B

HPIS 2017

CLso-RSTM American haplotype A

5 mutations Maximum parsimony dnaG-metG-mutS-recA-adk (2032 nt) - All haplotypes D variants had the same MLSA markers except one recombinant isolate. All haplotype E had the same MLSA markers.