New Disease Reports

First report of '*Candidatus* Liberibacter solanacearum' in common hogweed (*Heracleum sphondylium*) in Austria

C. Lethmayer* and R.A. Gottsberger

Austrian Agency for Health and Food Safety (AGES), Institute for Sustainable Plant Production, Spargelfeldstraße 191, A-1220 Vienna, Austria

*E-mail: christa.lethmayer@ages.at

Received: *24 Sep 2020.* ***Published:*** *26 Nov 2020.* ***Keywords:*** *Apiaceae, carrot, celery, haplotype C, Trioza apicalis*

'*Candidatus* Liberibacter solanacearum' (CaLsol) causes important diseases in apiaceous and solanaceous crops (zebra chip disease) and has been reported from European countries during the last decade. After the first record of CaLsol on symptomatic carrots and celery from two fields in Austria in 2014, monitoring activities on plants and potential vectors were undertaken on 20 fields in the outbreak area around the villages of Arzl, Rum and Thaur (Inn valley near Innsbruck, Tyrol) between 2016 to 2019.

Plants from species in the Apiaceae and Solanaceae were collected randomly in fields and field margins (n=84) and tested for infection with CaLsol using real time PCR according to Li *et al*. (2009). DNA from plant petioles was extracted using a DNeasy Plant Mini Kit (Qiagen, Germany) and from psyllids with a QIAamp DNA Micro Kit (Qiagen) according to the manufacturers' instructions. CaLsol was only detected in apiaceous plants (n=72), in which 43% of the samples were positive, but not in solanaceous plants (n=12; comprising *Solanum dulcamara*, *S. lycopersicum* and *S. tuberosum*) (Table 1). All positive CaLsol samples harboured the haplotype C, as confirmed by PCR according to Ravidran *et al*. (2011) and subsequent sequencing of the amplicons. The infected apiaceous species were carrot (*Daucus carota*; GenBank Accession No. MT753007.1), celery (*Apium graveolens*; MT753005), parsnip (*Pastinaca sativa*), parsley (*Petroselinum crispum*) and common hogweed (*Heracleum sphondylium*; MT753008.1). Of these species, CaLsol symptoms were only observed in carrot (leaf reddening and deformed roots with increased adventitious roots) and celery (leaf yellowing of the leaves and stunted petioles; Fig. 1). CaLsol was not detected in other Apiaceae members including *Aegopodium podagraria*, *Anethum graveolens*, *Anthriscus sylvestris* and *Foeniculum vulgare*. One to three randomly selected positive samples from each species were sequenced each year with identities ranging from 99.4 to 100%, confirming all were haplotype C.

The Inn valley is the only location where CaLsol is known to occur in Austria; the source of the infection is not known. The common hogweed samples were collected from a field margin adjacent to a symptomatic carrot field in Thaur in 2019. To our knowledge this is the first known report of CaLsol infecting common hogweed. The plant is a host of the vector *Trioza apicalis* (Ouvrard, 2020) and psyllids of this species carrying CaLsol have been observed in the Austrian outbreak area. For this reason, common hogweed is suspected to be an important reservoir of CaLsol.

Psyllids were collected from carrot fields in the Inn valley and samples were obtained by agitating the crop canopy and collecting samples using a net held underneath. In total 579 psyllids (2016: 13; 2017: 253; 2018: 313) were identified morphologically as *T. apicalis* according to Ossiannilsson (1992). Molecular analyses using PCR (Ravidran *et al*., 2011) and sequencing (MT753004.1, MT753006.1) resulted in a sequence identity of 99.7 and 100%, respectively with CaLsol haplotype C identified in *T. anthrisci* (MF421730.1, MF421728.1)

A high infection rate of the carrot psyllids with CaLsol, especially females, was noted. In 2018, 41.85% of analysed *T. apicalis* individuals (110 ♂♂, 203 ♀♀) tested CaLsol-positive (♀♀: 49.85%; ♂♂: 27.27%) (Fig. 2). These 313 single psyllids were collected randomly from carrot plants in three different fields in 2018, in contrast to samples from 2016 and 2017, which were taken from selected symptomatic carrot plants and had an infection rate of 98%. Studies with pear psyllids (*Cacopsylla pyricola*, *C. pyri* and *C. pyrisuga*) showed that females were more frequently infected by the specific phytoplasma ('*Ca.* P. pyri') than males (Reisenzein & Lethmayer, 2016) suggesting that female psyllids may play a more important role in disseminating the disease.

Acknowledgements

We are very grateful to Alfred Unmann, Tyrolean Chamber of Agriculture, for great help in the field with sampling of plants and psyllids.

References

1. Li W, Abad JA, French-Monar RD, Rascoe J, Wen A, Gudmestad NC, Secor GA, Lee IM, Duan Y, Levy L, 2009. Multiplex real-time PCR for detection, identification and quantification of '*Candidatus* Liberibacter solanacearum' in potato plants with zebra chip. *Journal of Microbiological Methods* **78**, 59-65. http://dx.doi.org/10.1016/j.mimet.2009.04.009
2. Ossiannilsson F, 1992. *The Psylloidea (Homoptera) of Fennoscandia and Denmark*: 26 (*Fauna Entomologica Scandinavica Series)*. Leiden, Netherlands: E.J. Brill.
3. Ouvrard, D. (2020) *Psyl'list - The World Psylloidea Database*. http://www.hemiptera-databases.com/psyllist. Accessed 24 September 2020.
4. Ravindran A, Levy J, Pierson E, Gross DC, 2011. Development of primers for improved PCR detection of the potato zebra chip pathogen, '*Candidatus* Liberibacter solanacearum'. *Plant Disease* **95**, 1542-1546. http://dx.doi.org/10.1094/PDIS-05-11-0386
5. Reisenzein H, Lethmayer C, 2016. Studies on the interaction between '*Ca*. Phytoplasma pyri' and the vectoring psyllids. *IOBC-WPRS Bulletin* **112**, 55-60.

Figure 1

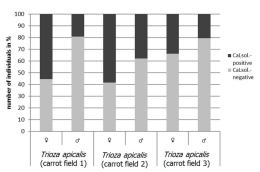

Figure 2

Table 1. Number and taxa of plants tested for '*Candidatus* Liberibacter solanacearum' (CaLsol) (positive/negative) in the Austrian outbreak area (Inn valley near Innsbruck, Tyrol).

		Apium graveolens	*Daucus carota*	*Heracleum sphondylium*	*Petroselinum crispum*	Other Apiaceae	*Solanum dulcamara*	*Solanum lycopersicum*	*Solanum tuberosum*
2014	CaLsol neg.	-	5	-	-	-	-	2	2
	CaLsol pos.	2	2	-	-	-	-	-	-
2015	CaLsol neg.	2	-	-	-	-	-	-	-
	CaLsol pos.	6	3	-	-	-	-	-	-
2016	CaLsol neg.	-	-	-	-	1	1	1	1
	CaLsol pos.	2	3	-	-	-	-	-	-
2017	CaLsol neg.	-	2	-	4	8	-	-	1
	CaLsol pos.	1	4	-	1	1	-	-	-
2018	CaLsol neg.	2	1	-	2	1	-	1	3
	CaLsol pos.	-	5	-	-	-	-	-	-
2019	CaLsol neg.	1	3	-	1	8	-	-	-
	CaLsol pos.	-	-	1	-	-	-	-	-

Figure 3

To cite this report: Lethmayer C, Gottsberger RA, 2020. First report of '*Candidatus* Liberibacter solanacearum' in common hogweed (*Heracleum sphondylium*) in Austria. *New Disease Reports* **42**, 17. http://dx.doi.org/10.5197/j.2044-0588.2020.042.017

This report was published on-line at www.ndrs.org.uk where high quality versions of the figures can be found.