EPPO Datasheet: *Carlavirus latensolani*

Last updated: 2022-07-05

IDENTITY

Preferred name: *Carlavirus latensolani*
Taxonomic position: Viruses and viroids: Riboviria: Orthornavirae: Kitrinoviricota: Alsuviricetes: Tymovirales: Betaflexiviridae
Other scientific names: *PotLV, Potato Red La Soda virus, Potato latent carlavirus, Potato latent virus*
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EPPO Categorization: Alert list (formerly)
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EPPO Code: POTLV0



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HOSTS

The primary host of potato latent virus (PotLV) is *Solanum tuberosum* (potato) with most of those potato cultivars tested susceptible to infection by PotLV (Brattey *et al*., 2002; Nie, 2010). Only *Physalis alkekengi* (Chinese lantern) has been reported as another natural host. The experimental host range is wider than for the carlaviruses, potato virus M (PVM) and potato virus S (PVS).

Host list: *Alkekengi officinarum*, *Solanum tuberosum*

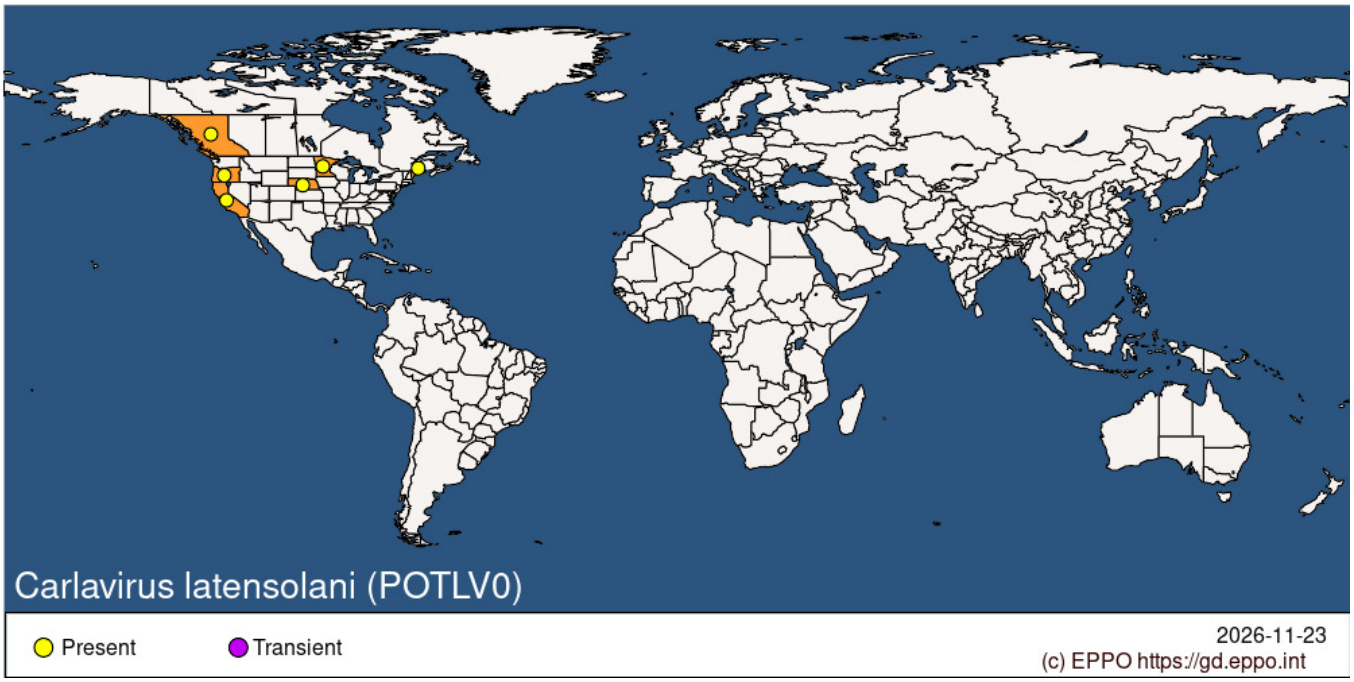
GEOGRAPHICAL DISTRIBUTION

PotLV was first described infecting *in vitro* potatoes of the potato cultivar Red LaSoda imported into the United Kingdom from the USA in the early 1990s through post-entry quarantine (Brattey *et al*., 1995; Brattey *et al*., 2002). It was then discovered infecting 8 out of 270 potato cultivars in the Vancouver Collection of Virus Free Potatoes, British Colombia, Canada and 3 out of 137 cultivars in the USDA National Variety field grown collection of potatoes, maintained at Presque Isle, Maine, USA. It was also reported infecting Red LaSoda in the California winter test supplied from the Vancouver Collection, but which was originally from Nebraska and also from Red LaSoda plants grown in Minnesota (Goth *et al*., 1999). The California winter test is the annual winter grow-out, in which seed lot samples are planted and tested for potato virus Y and other diseases. However, in the past 20 years it has not been reported from Canada where tests for PotLV are done on potato material submitted for nuclear stock production (CFIA, 2018), pre-elite seed potatoes from sources other than nuclear stock (CFIA, 2012) or in leaf or tuber samples submitted by Canadian Food Inspection Agency potato inspectors (H Xu, CFIA, Canada, personal communication, 2021). Similarly, there are no reports of PotLV infecting potato in the USA in the past several decades, where it is not regulated in the seed potato certification schemes and systematic testing is not done (A Karasev, UIDAHO; K Sather and G Secor, NDSU, all USA, personal communications, 2021). Testing appears to be limited, mostly to testing nuclear stocks in a number of states such as Colorado, Idaho, New York and North Dakota (Anon, 2019a; b; c; d) and it has not been detected (A Houser and C Keller, CSU; J Durrin, UIDAHO; K Perry, Cornell, all USA, personal communications, 2022).

Although PotLV was reported by Suica (2000) and Rosas Díaz (2004) infecting accessions in the native Andean potato cultivar collection, maintained by the International Potato Centre, Peru after testing by ELISA, this latter finding was not confirmed by inoculation to and testing of indicator plants (Rosas Díaz, 2004). Furthermore, it has not been found in Peru, following testing by high throughput sequencing of potato leaf samples taken from throughout the Andean region of Peru (Fuentes *et al*., 2019) or genebank material (J Kreuze CIP, PE, personal communication, 2022) and it was not mentioned as being present in Peru by Kreuze *et al*. (2020).

Apart from potato, PotLV has only been reported infecting field grown *Physalis alkekengi* in Oregon, USA (Diaz-

Lara *et al*., 2017).



North America: Canada (British Columbia), United States of America (California, Maine, Minnesota, Nebraska, Oregon)

BIOLOGY

PotLV infects plants systemically and is efficiently transmitted in susceptible potato cultivars through clonal/vegetative propagation (Nie, 2010). PotLV is transmitted by the aphid *Myzus persicae* (Brattey *et al*., 2002) with uncertain efficiency, and probably non-persistently as for other carlaviruses (ICTV, 2011). Although it can be contact or mechanically transmitted experimentally, whether this occurs in the field as for other carlaviruses (ICTV 2011) such as PVM and PVS, and its relative importance compared with aphid transmission is not known.

DETECTION AND IDENTIFICATION

Symptoms

No symptoms have been reported in naturally infected potato cultivars in the field, or in 58 and 36 infected cultivars tested in the UK and USA respectively, following mechanical inoculation with PotLV (Brattey *et al*., 2002; Nie, 2010). Although symptoms of stunting, chlorotic mottling, and leaf deformation were observed in the USA in field grown *Physalis alkekengi*, the plants were also infected with tomato mosaic virus (Diaz-Lara *et al*., 2017).

Morphology

Virions of PotLV are filamentous and slightly curved and have been reported to be bimodal with modal lengths of 530 and 670 nm (Brattey *et al*., 2002) or with particles 600 to 720 nm in length with a mean of 690 nm (Goth *et al*., 1999).

Viruses in the genus *Betaflexiviridae* are single stranded positive-sense RNA (ICTV, 2011). The complete PotLV genome sequence contains 7890 nucleotides excluding the poly(A) tail and like other carlaviruses has six open reading frames. The PotLV genome is approximately 500–600 nt shorter than the other potato infecting carlaviruses, PVM, potato virus P and PVS, due to the ORF1 gene being shorter (Nie, 2009).

Detection and inspection methods

In the absence of symptoms under natural conditions, field inspection is unlikely to detect the virus. However, PotLV virus is reliably detected in *in vitro* plants of at least 4 weeks old and plants grown from infected tubers using serological and molecular methods. The reliability of testing tubers has not been reported.

Detection may be by ELISA using monoclonal antibodies (Brattey *et al*., 2002; Goth *et al*.,1999), which are available commercially.

Detection may also be using the RT-PCR using the forward primer Car?F2b (Nie *et al*., 2008) and reverse primer Not1pdt (Badge *et al*., 1996; EPPO, 2019) to detect carlaviruses with a PCR product of 900 bp, followed by sequencing for identification, or using the primers 1000F/1000R (Nie, 2010) or PotLVfor1/PotLVrev1 (Diaz-Lara *et al*., 2017) which produce respectively PotLV-specific fragments of 353 bp or ?1000 bp.

Use of indicator plants may be unreliable since not all inoculated plants show symptoms, and these may be transient (Brattey *et al*., 2002). In *Chenopodium murale* and *Nicotiana bigelovii* symptoms are respectively, faint local chlorotic/necrotic spots and systemic vein clearing (Brattey *et al*., 2002), and in *N. debneyi* and *N. occidentalis*-P1 chlorotic mottling and leaf deformation (C Jeffries, SASA, UK, personal communication, 2022).

PATHWAYS FOR MOVEMENT

Plants for planting, such as seed potato tubers and *in vitro* potato plants, is the main pathway for long distance movement. In countries where PotLV is present, even though aphids and mechanical transmission could theoretically contribute to local spreading, planting infected seed tubers is probably the main way PotLV spreads. PotLV is unlikely to be transmitted by true potato seeds since other carlaviruses are not transmitted in this way.

Even though *M. persicae* is not regulated and is widespread, given the probable nonpersistent transmission of PotLV, entry with the vector would only be possible if the transfer occurs within a few hours of entry (EFSA, 2019).

PEST SIGNIFICANCE

Economic impact

Although most of those potato cultivars tested were susceptible to infection by PotLV, no studies have been conducted to determine yield loss, or the effect of PotLV in combination with other viruses. However, a yield loss might be expected since the carlavirus PVS, which also does not produce symptoms, or few symptoms, in many potato cultivars, may cause yield losses up to 20% (reviewed by Lambert, 2005).

Whether the virus is categorized as a quarantine or regulated non-quarantine pest will also determine the level of indirect economic loss. Indeed, should the virus be detected, phytosanitary measures may be required such as respectively crop destruction or downgrading of seed potato crops depending on quarantine or regulated non-quarantine status. The other reported natural host *P. alkekengi* is cultivated as an ornamental in the EPPO region where it has naturalized in southern countries. However, any fruit production in Europe for this genus is based on other *Physalis* spp., such as *Physalis peruviana* (Cape gooseberry) and it is not known whether this can be infected by PotLV.

Control

Cutting seed potatoes should be avoided because other carlaviruses are mechanically transmitted (ICTV 2011) and if PotLV is as infective as PVS (Franc & Banttari, 1984), it will be efficiently transmitted by this practice. Insecticide control in the field would be as for the other non-persistently transmitted potyvirus such as PVY. Although fewer PotLV resistant cultivars are available than for PVM or PVS (Brattey *et al*., 2002), this resistance suggests that resistance genes to PotLV are available for breeding programmes (Nie, 2010). Both authors found that the cultivar

Jemseg was resistant to infection by PotLV.

In countries where PotLV is present, to ensure that infected asymptomatic stocks are not introduced to the certification system, nuclear stocks should be tested for freedom from PotLV. In Canada PotLV is only regulated at the nuclear stock *in vitro* initiation phase (CFIA, 2018).

Phytosanitary risk

Potato is the main crop at risk in the EPPO region and for many countries the pathway is closed from North America because import of seed potatoes is prohibited except through post-entry quarantine. However, such import is sometimes authorized under derogation procedures, e.g. with Commission Implementing Decision 2011/778/EU, which allows Portugal to import seed potatoes from the Canadian provinces of New Brunswick and Prince Edward Island.

PHYTOSANITARY MEASURES

Although the EPPO PRA (EPPO, 2001) recommended listing PotLV as a quarantine pest, this was not done since it was concluded that PotLV was not sufficiently well characterized and the potential for economic damage was unclear. However, it is recommended for specific testing in post-entry potato quarantine (EPPO, 2019). Infected material should not be released from post-entry quarantine since it may be used for seed potato production or for field trials. For the European Union, although not named as a quarantine pest, PotLV is regulated in Commission Implementing Regulation (EU) 2019/2072 Annex II Part A under '*Potato viruses, viroids and phytoplasmas, such as ...* '. Recently, however, EFSA (2020) indicated that PotLV did not qualify as potential quarantine pest because it was not expected to have an impact on the EU territory primarily because no symptoms had been reported.

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Datasheet history

This datasheet was first published in 2022. It is maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

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