

Potato Virus Y

Importance:

- One of the most important plant viruses affecting potato production: potato tuber necrotic ringspot disease' (PTNRD). Infects other members of Solanaceae family
- Shows synergistic pathogenicity with Potato Virus X
- Three chief strains of PVY are recognized: PVY^C, PVY^N and PVY^O.

Transmission: Aphid (non persistent, non circulative)- attaches to stylet for 4-17 h, mechanical, sap inoculation

PVY^C induces hypersensitive responses in a wide range of potato cultivars. These reactions include the formation of mild mosaic patterns or stipple streak. Unlike the other strains of PVY, some PVY^C strains are non-aphid transmissible

PVY^N results in leaf necrosis and mild or even no damage to the tubers, Aphid transmissible

PVY^O strain results in mild tuber damage and does not cause leaf necrosis

In Europe these two strains have been shown to have recombined to form PVY^{NTN}. The PVY^{NTN} has been accredited with the ability to induce potato tuber necrotic ringspot disease (PTNRD). Tubers damaged by PTNRD become unmarketable and infection by PVY^{NTN} thus results in a larger economic impact than infection by the other strains.

Transmission: Aphids, Seeds

Classification

Group: Group IV ((+)ssRNA)
Family: Potyviridae
Genus: Potyvirus
Species: Potato virus Y



Some PVY strains cause necrotic rings on potato tubers.



Yukon Gold potato infected with PVY^{NTN}

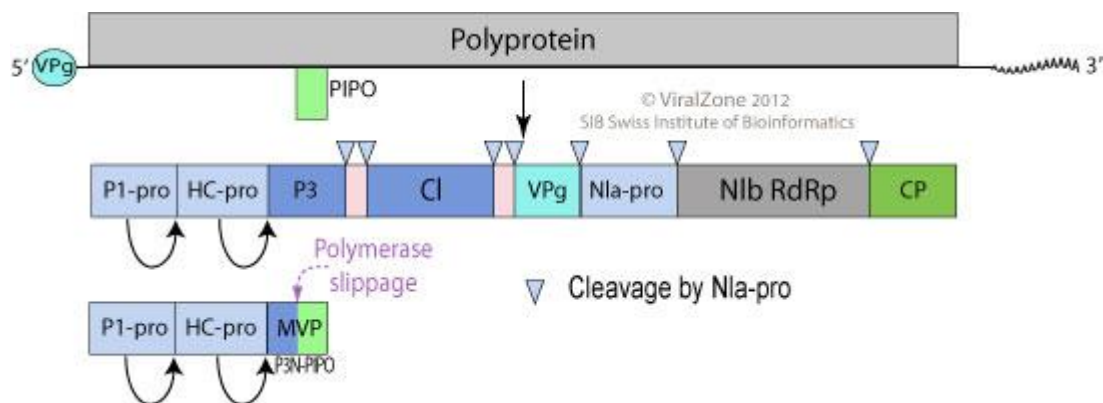
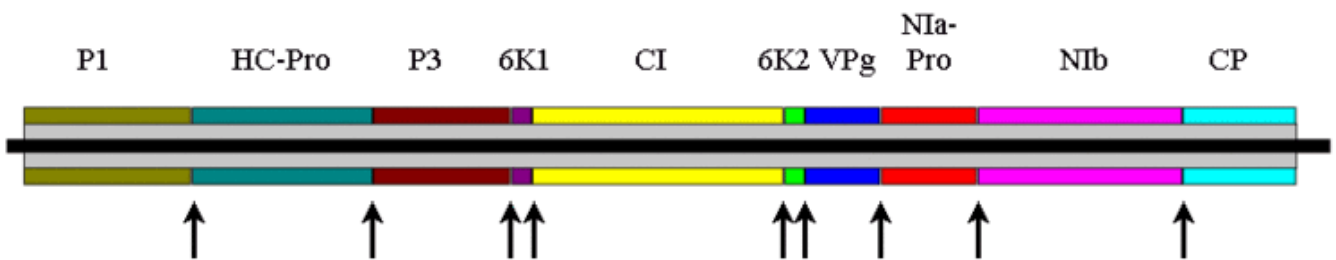
Structure:



Non-enveloped filamentous structures that are 680 – 900 nm in length and 11 to 15 nm in width

- 2000 copies of capsid/coat protein with helical symmetry
- Genome:
 - single strand of positive sense RNA which is in the order of 10 kb in length and has a non-translated 5'-terminal region (5'-NTR) as well as a 3'-poly-A tail.
 - 5'-NTR is associated with a Viral genome linked protein (VPg) which is said to act as an enhancer of transcription
 - open reading frame encodes for a 350 kDa polyprotein which is proteolytically cut by viral proteases (N1a, HC-Pro and P1) and undergoes co- and post-translational cleavage to yield several multi-functional proteins.
 - These include the following:

- P1 (P1 Protein)- Serine protease
- HCPro (Helper Component Proteinase)- Helps in Aphid transmission,
- P3 (P3 Protein)- unknown, interacts with RUBISCO enzyme
- 6K1 (6-kDa Protein 1),
- CI (Cylindrical Inclusion)- RNA helicase, 6K2 (6-kDa Protein 2),
- VPg (Viral Protein genome-linked),
- NIaPro (Nuclear Inclusion Protein a, Proteinase domain),
- NIb (Nuclear Inclusion Protein b): RNA dependant RNA Polymerase
- CP (Coat Protein)



Replication Cycle (Occurs in cytoplasm, ER, Golgi Complex)

1. Virus penetrates into the host cell through mechanical or aphid transmission.
2. Uncoating, and release of the viral genomic RNA into the cytoplasm which acts as mRNA
3. The viral RNA is translated to produce a polyprotein which is processed by viral proteases into the RdRp protein and structural proteins.
4. Replication takes place in cytoplasmic viral factories. A dsRNA genome is synthesized from the genomic ssRNA(+).
5. The dsRNA genome is transcribed/replicated thereby providing viral mRNAs/new ssRNA(+) genomes.
6. Virus assembly in the ER.
7. Viral movement protein P3N-PIPO probably mediates virion cell-to-cell transfer via plasmodesmata.

Diagnosis

- Microscopy: Presence of viral inclusion bodies

- RT-PCR (Reverse Transcriptase PCR)
- ELISA

Control

- Aphid vector control
- Use of disinfectants for tubers prior to planting
- Use of virus free certified tubers

Reference

- <https://www.slideshare.net/MuhammadAmmar30/>
- [https://viralzone.expasy.org/50?outline=all by species](https://viralzone.expasy.org/50?outline=all%20by%20species)
- https://en.wikipedia.org/wiki/Potato_virus_Y
- <https://alchetron.com/Potyvirus>

