

Potato Mop-Top Virus....Another Likely Production Issue in the Future

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Potato mop-top virus (PMTV) is a relatively new identified virus in the Pacific Northwest (1) but has likely been present for some time. This virus is vectored by the swimming spores (zoospores) of the soil-borne organism that causes powdery scab (*Spongospora subterranea*). This organism causes “scab” on the surface of tubers as well as galls on roots (Figure 1).

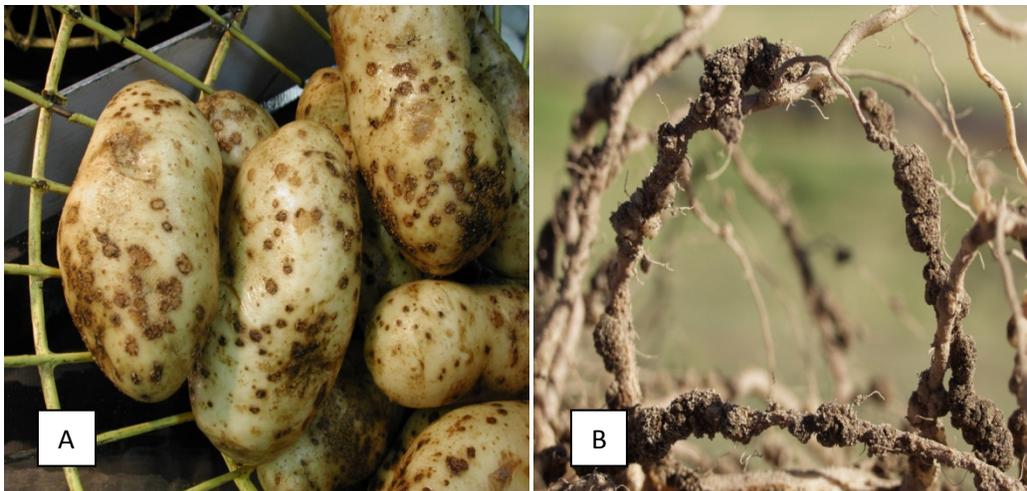


Figure 1. Symptoms of powdery scab on potatoes; tuber (A) and on roots (B).

Foliar symptoms are rare anywhere the disease is found but at first glance may appear similar to *Alfalfa mosaic virus* (AMV). A careful look, however, will show symptoms are quite different. PMTV will have bands (banding or chevrons) of yellow across the leaf whereas AMV will have no yellow banding pattern and most often produces a yellow coloration across the entire plant (Figure 2). PMTV can also cause stunting. Lack of foliar symptoms may be due to the inability of the virus to move within the plant from infected tissue below ground to above-ground portions of the plant. Tuber symptoms are problematic and are responsible for the economic losses caused by this disease. Internal tuber symptoms are variable, including necrotic arcs and/or brown spots/flecks (Figure 3), and can be difficult to separate from corky ringspot disease, caused by *Tobacco rattle virus* (TRV), or other internal problems of potatoes caused by AMV, *Tomato spotted wilt virus* (TSWV) or *Potato virus Y* (^{N:O} and ^{NTN}), Figure 4). While powdery scab can produce symptoms on tuber surfaces, visual symptoms are not always present even though internal symptoms due to PMTV are found. Tuber damage caused by PMTV apparently is on

the rise and significant problems have been reported in several fields in the PNW as well as in at least one other state in the mid west.

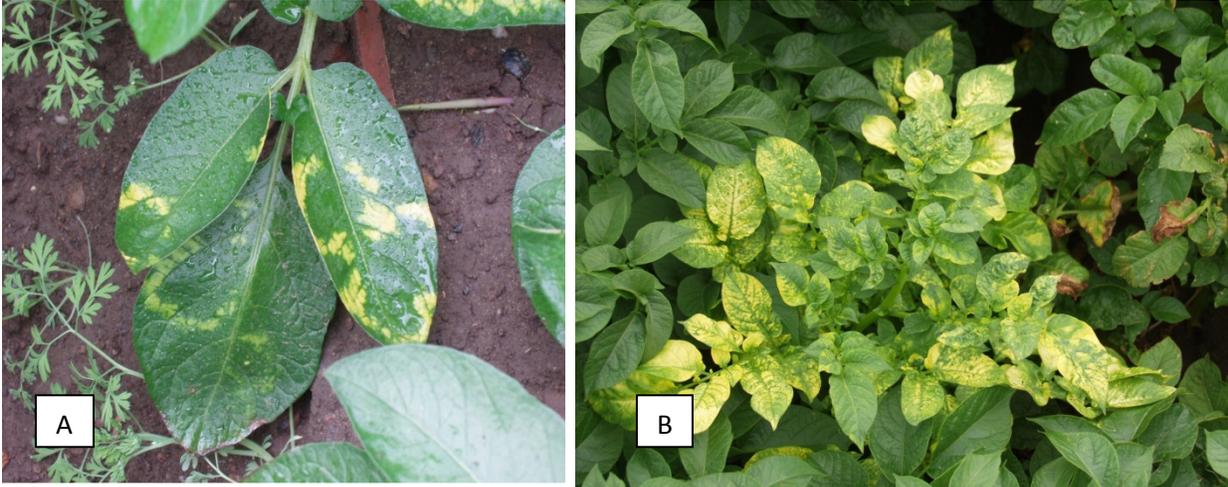


Figure 2. Yellow banding pattern caused by PMTV (A) and that caused by AMV (B).

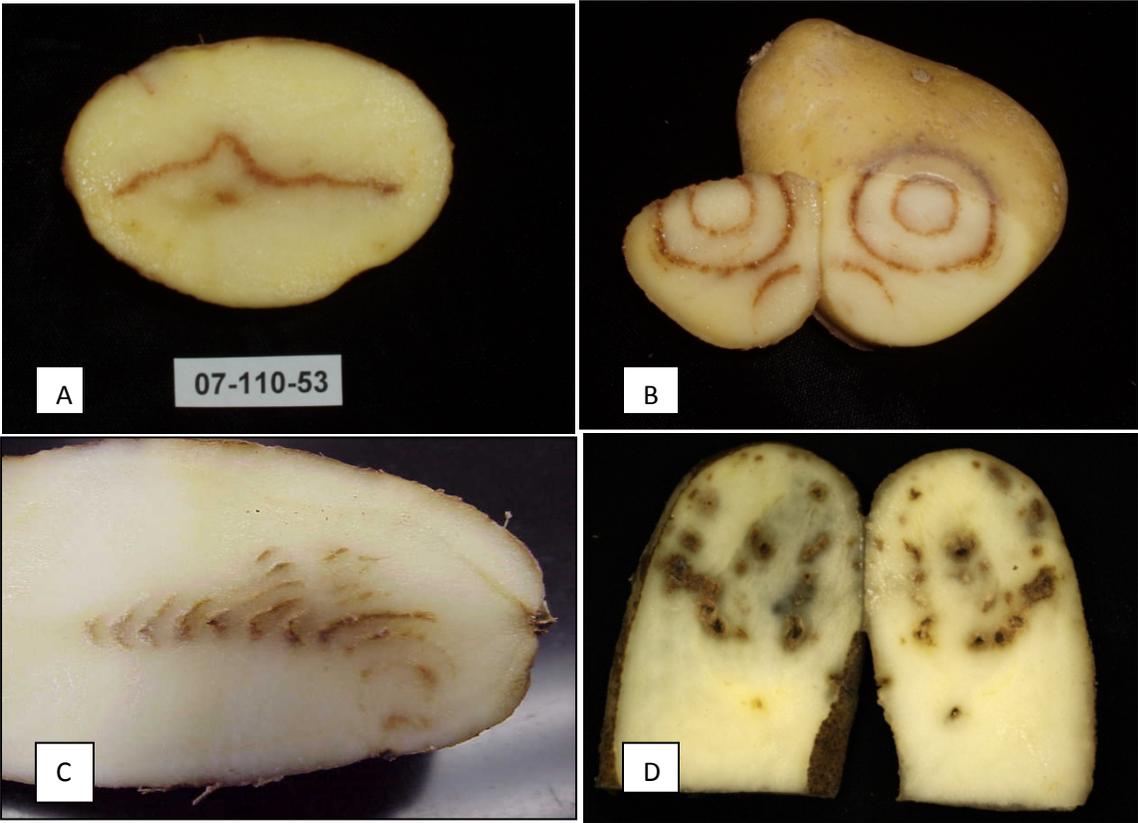


Figure 3. Various symptoms caused by PMTV in potato tubers.

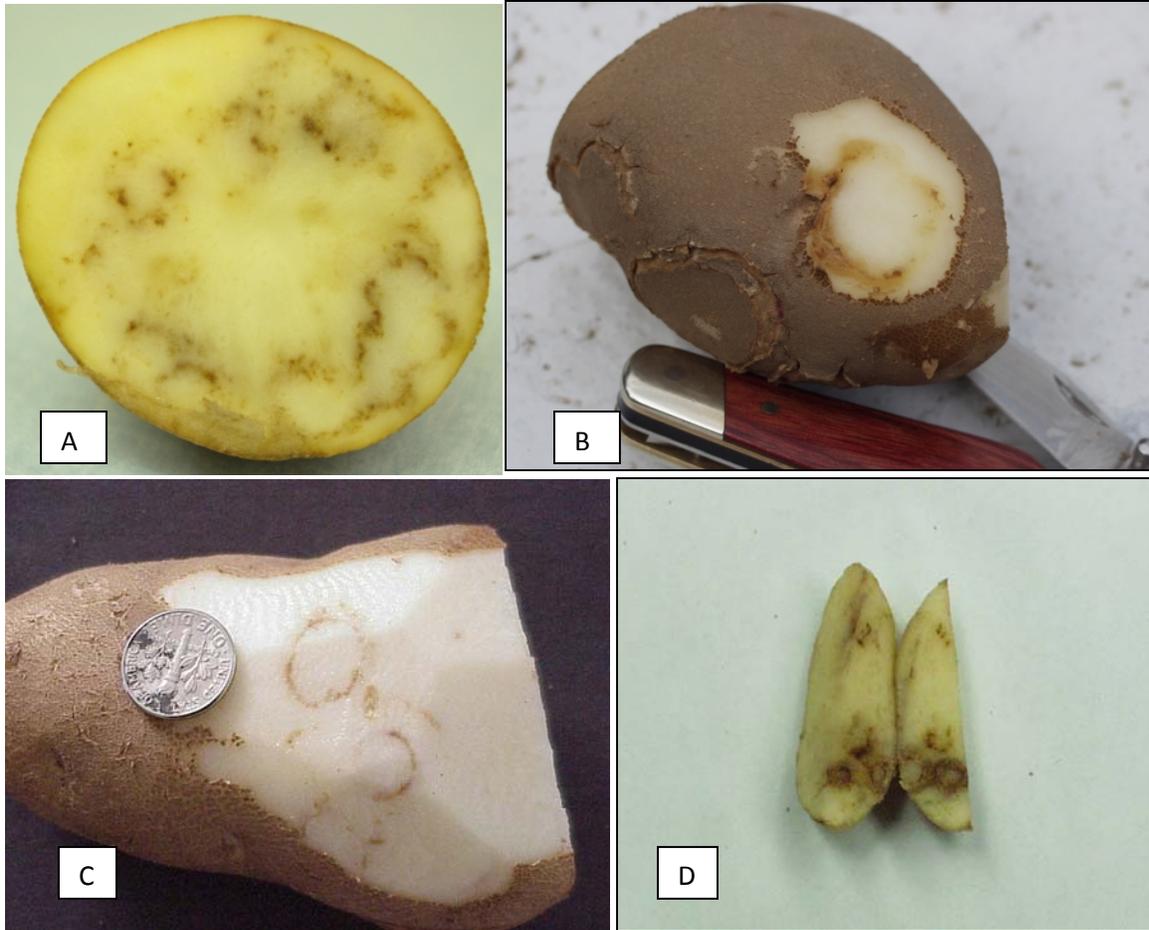


Figure 4. Examples of other viruses that cause necrotic areas in potato tubers; AMV (A), PVY^{NTN} (B), TRV (C), and TSWV (D).

This disease has been found in many parts of the world. In North America, PMTV was first reported in the U.S. in Maine in 2003 (3), and a year later reported from commercial fields in Canada and from tubers, most without symptoms, from plantings throughout the U.S. (5). The problem has been officially reported in Washington (1), North Dakota (2) and Maine (3), but PMTV-positive soil and tubers tested by us have originated from Oregon, Idaho, New Mexico, Michigan, and Colorado. Given the wide-spread occurrence of the vector (Figure 5) throughout the U.S. and Canada, this virus is likely found at some level in most areas where powdery scab has been reported.



Figure 5. States where powdery scab has been reported. Powdery scab has been reported in most if not all Canadian provinces.

Powdery scab is caused by a fungus like organism that is encouraged by wet and cool soil conditions. When soils are wet for a prolonged period of time, found commonly in low spots, compacted soil areas, or from overwatering, zoospores are produced from resting spores that can survive for at least six years (4) and follow a chemical gradient (exudates) coming from roots, stolons and tubers to find the host and infect the plant. Tuber lenticels and eyes are particularly susceptible to infection. Smooth-skin potato cultivars are more susceptible. If the resting spores are produced after infecting a PMTV infected plant, the zoospores produced will also be PMTV carriers and will have the ability to transmit the virus to a new plant. During the growing season more resting spores are produced and the cycle (with the virus) perpetuates itself. Confirmation of the virus (and vector) is accomplished by testing tubers or roots with or without powdery scab infections, or from baiting soil by growing tobacco for a number of weeks and then testing the roots of the tobacco plant. Use of PCR or ELISA can be effective to confirm this pathogen in plant material. While the host range of the vector is relatively large, PMTV appears to infect only plants belonging to the Solanaceae, such as potato and nightshade.

Spread of the disease throughout many (all?) significant potato producing areas in the U.S. was likely due to the movement of contaminated soil adhering to tubers or infected but likely asymptomatic potato seed. Comparison of many isolates of the virus from many locations indicates very little difference among them. This would suggest a recent and relatively rapid movement and seed may be the best explanation.

Until the last couple of years this disease has been more of a novelty than anything else. While PMTV has been known to occur in the Columbia Basin at high frequency (many fields confirmed to contain the vector and pathogen), only an occasional positive tuber with symptoms has been found. This is likely due to the failure to correctly identify the pathogen (called it another virus problem) and/ or incidence of symptoms in tubers was very low. However, given the cooler summers of the past two years, particularly last year, the level of disease seems to be increasing.

Management of this disease is difficult at best but begins by correctly identifying the cause of the internal tuber symptoms. Two laboratories in the Columbia Basin can perform these tests, the plant pathology laboratory at the OSU Hermiston Agricultural Research and Extension Center and Jim Crosslin's laboratory at Prosser, WA. Management of this disease begins by not planting infected seed. This is difficult given the nature of this problem oftentimes not producing tuber symptoms. On the sanitation side, the soilborne nature of the resting spores is another example of why plant pathologists recommend the washing off of equipment when moving from one field to another. While controlling excess soil moisture is essential to help reduce zoospore formation and movement, this is also a difficult aspect of growing potatoes in the Columbia Basin. Be mindful that overwatering not only favors this disease but many others (Pythium leak, late blight, pink rot, bacterial soft rot). Direct control of the vector at this time is impossible. While soil fumigation likely reduces spore population levels, neither that tool nor seed treatments or in-furrow chemical treatments have been found to be successful in controlling powdery scab. Long term control will likely be accomplished by breeding immunity (no infection by powdery scab) into potato cultivars.

Given the higher incidence of this disease over the past two years, the difficulty in confirming the presence of PMTV (due to lack of symptoms or misidentification), the possible changing environment that may favor this disease (cool and moist soil) and the inability to control the vector by chemical means, this disease may become a significant issue in the future.

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