

Diagnosis of *Synchytrium endobioticum*, the causal agent of potato wart.

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Introduction

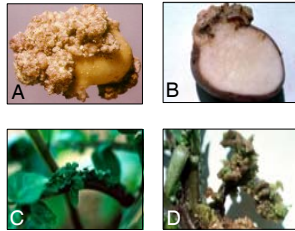
Potato wart is caused by *Synchytrium endobioticum* an obligate pathogen. Due to the significant crop losses this disease can cause and the long-term persistence of the pathogen in soil it is an important quarantine pest throughout the world. Naturally the disease spreads slowly, so regulatory restrictions have been used effectively to limit disease spread.

Potato wart is spread by infected seed tubers and by movement of infested soil. Predictive models suggest that if the pathogen were introduced into the United States potato wart survival is possible in the Northeast, Rocky Mountains, Northern Plains and the Lake States. Chemical soil treatments are not a viable option to eradicate sporangia from infested fields.

NPDN diagnosticians in potato growing areas of the U.S. need to be familiar with the signs and symptoms of potato wart in order to accurately and quickly detect and diagnose this disease.

Symptoms

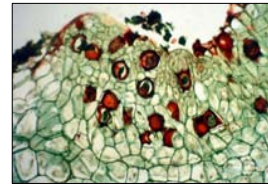
Disease symptoms include lumpy gall-like growths (A, B). Galls form on stem tissue (C,D), including the stem base, stolon bud and tuber eyes. Less commonly galls form on foliage and flower tissues. Galls range in size (1 to 8 cm) and can vary in color. Above ground galls are green to brown, turning a darker color and decaying as they age. In severe cases tubers may be completely replaced by gall. Plants are not killed but sprouts can be damaged, limiting emergence from seed tubers.



Symptoms of potato wart.
Photos by M.C. Hampson

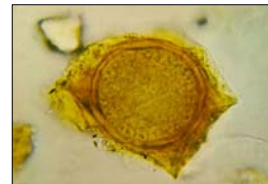
Spore Types

Three spore types are produced: summer sporangia, zoospores, and winter sporangia.



Sporangia are formed within host cells of diseased tissue. Summer sporangia are thin walled and transparent. Zoospores may be visible within the summer sporangia.

Photo by M.C. Hampson



Resting spores, or "winter sporangia" are golden brown, aseptate, and have thick walls. As the host galls decay the host cell wall disintegrates, slightly changing the appearance of the outer surface of the sporangia. After the host cell walls disintegrate the sporangia are left with a characteristic angular appearance. Resting spores can remain viable in soil for up to 20 years.

Photo by Central Science Laboratory

Diagnosis

Plant material with warts should be examined for sporangia. Mount slices of affected tissue in water and observe at 100 – 400x magnification under a light microscope. During the growing season thin-walled summer sporangia can be found in young warts. Thick-walled, resting spores or winter sporangia can also be found in tissues during the growing season and in decomposing warts. Diagnosticians should be careful not to confuse potato wart symptoms with those caused by physiological eye proliferation and powdery scab. Pollen grains can also be found in soil and should not be confused with sporangia.

Soil Sampling

Soil sampling is used to detect winter sporangia in field soil, often for regulatory purposes. Both wet-sieving and centrifugation methods are used to concentrate sporangia in soil samples. Soil extracts are viewed microscopically for the presence of sporangia. The viability of the sporangia can also be assessed during the microscopic observation; plasmolysed sporangia are not viable.

Soil Bio-assay

Soil bio-assays are used to confirm the presence of viable sporangia within a soil sample. Tubers of a susceptible potato cultivar are planted in field soil samples. Tubers are removed and evaluated 70 to 100 days after planting. There are several important pathotypes of *S. endobioticum*, soil bio-assays are also used to differentiate pathotypes of *S. endobioticum*. Differentiation of the pathotypes is based on disease development and severity on several different potato cultivars.

PCR

A PCR based detection method has been developed, using primers and probe specific to the ITS region of the multi-copy rDNA gene. This protocol allows for both detection and quantification of *S. endobioticum* in soil and host tissues. Protocols for the detection and diagnosis of this pathogen are currently being validated by USDA /APHIS/PPQ lab.

References

- EPPO (2004) Diagnostic protocols for regulated pests *Synchytrium endobioticum*. OEPP/EPPO Bulletin 34, 213-218.
- Nappfast Pest Assessment: *Synchytrium endobioticum*, (Potato Wart).
- P.H.J.F. van der Boogert et al. (2005) Development of PCR-based detection methods for the quarantine phytopathogen *Synchytrium endobioticum*, causal agent of potato wart disease. European Journal of Plant Pathology 113:47-57.

Current Distribution of Potato Wart

