POTATO AND TOMATO LATE BLIGHT IN WISCONSIN: A NEW TYPE OF LATE BLIGHT IN A NEW DECADE

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Introduction

Late blight is a potentially destructive disease of tomatoes and potatoes caused by the fungal-like organism, *Phytophthora infestans*. This pathogen is referred to as a 'water mold' since it thrives under wet conditions. Symptoms of tomato and potato late blight include leaf lesions beginning as pale green or olive green areas that quickly enlarge to become brown-black, water-soaked, and oily in appearance (Fig. 1 and 2). Lesions on leaves can also produce pathogen sporulation which looks like white-gray fuzzy growth (Fig. 1 and 2). Stems can also exhibit dark brown to black lesions with sporulation (Fig. 2). Tomato fruit symptoms begin small, but quickly develop into golden to chocolate brown firm lesions or spots that can appear sunken with distinct rings within them (Fig. 1); the pathogen can also sporulate on tomato fruit giving the appearance of white, fuzzy growth. On potato tubers, late blight symptoms include firm, brown, corky textured tissue (Fig. 2). The time from first infection to lesion development and sporulation can be as fast as 7 days, depending upon the weather (1). Control of late blight in the field is a critical component of long term disease prevention, as infected plant parts, if unexposed to winter killing frost conditions, can carry the pathogen from one growing season to the next (Fig. 3).

Prior to 2009, there had been no reports of late blight on tomato or potato crops in Wisconsin for 7 years. In 2009 and 2010, late blight was identified on tomatoes and potatoes in a number of U.S. states and Canadian provinces. The 2009 epidemic began early spring in southern U.S. states and was initiated in the northeastern U.S. in June, followed by Midwestern reports in late July-early August. The 2010 epidemic did not follow a spatiotemporal pattern similar to 2009. Rather, isolated reports of late blight emerged at varying times and locations from June to October. In some cases, reports of late blight remained isolated without further spread to greater geographic areas. In Wisconsin, the first reports of late blight came on July 14, 2010 on both tomatoes and potatoes, in Marquette and Waukesha counties. By season's end, additional reports of late blight came from a dozen Wisconsin counties from both tomato and potato. Reports were concentrated in the central Wisconsin region.

Our preliminary work on late blight in 2009 indicated that we had a relatively new genotype of *P. infestans*, US#22, which was sensitive to the fungicide active ingredients mefenoxam and metalaxyl and was likely of the A2 mating or compatibility type. Because of the potential impact of late blight on Wisconsin's potato and tomato crops, we initiated characterization studies to further understand the dynamics of the pathogen population. Results of our work have optimized, and will continue to optimize, disease management recommendations for potato and vegetable growers in the state of Wisconsin.

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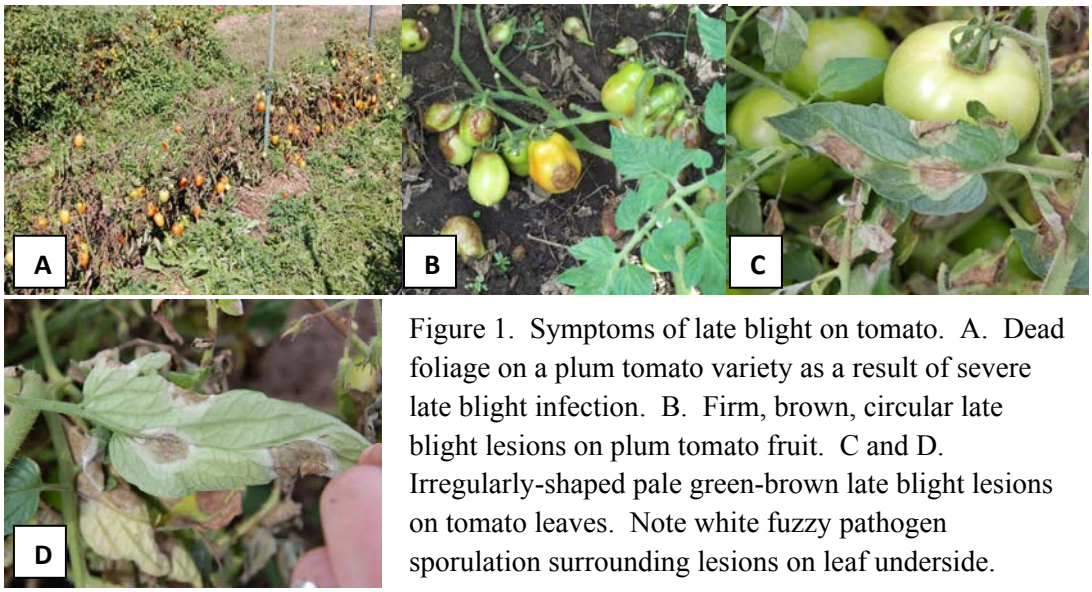

Figure 1. Symptoms of late blight on tomato. A. Dead foliage on a plum tomato variety as a result of severe late blight infection. B. Firm, brown, circular late blight lesions on plum tomato fruit. C and D. Irregularly-shaped pale green-brown late blight lesions on tomato leaves. Note white fuzzy pathogen sporulation surrounding lesions on leaf underside.

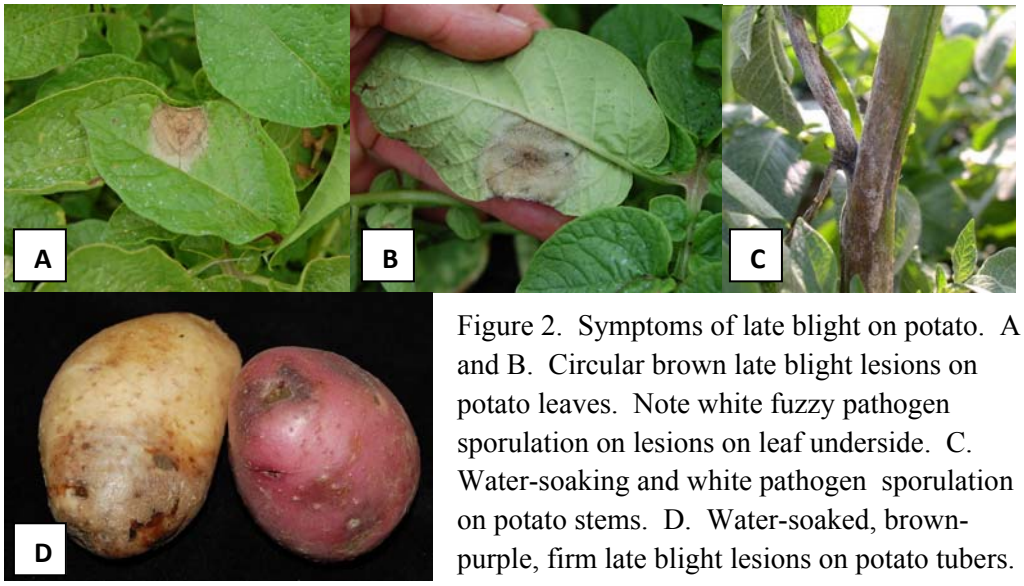

Figure 2. Symptoms of late blight on potato. A and B. Circular brown late blight lesions on potato leaves. Note white fuzzy pathogen sporulation on lesions on leaf underside. C. Water-soaking and white pathogen sporulation on potato stems. D. Water-soaked, brown-purple, firm late blight lesions on potato tubers.

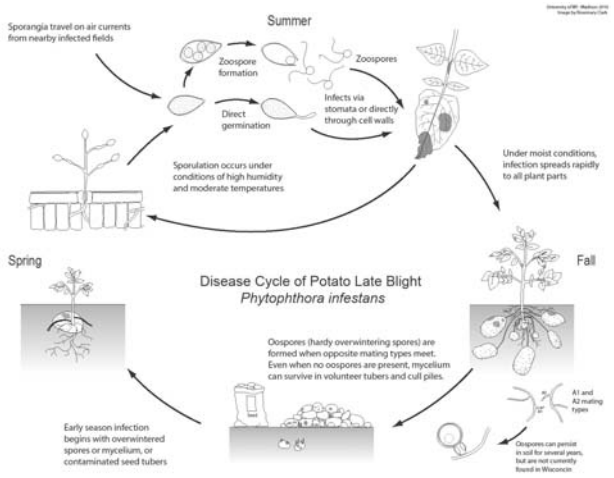

Figure 3. Disease cycle of *Phytophthora infestans*, the pathogen causing late blight of tomato and potato. Cycle depicts disease cycle of potato late blight. Illustration credit to Rosemary Clark, UW-Plant Pathology.

Results and Discussion

Isolates of *Phytophthora infestans* from tomato and potato hosts in Wisconsin were collected in 2009 and 2010 for characterization. Each isolate, or single zoospore-generated axenic culture from a unique sample, was evaluated for a) sensitivity to the fungicide mefenoxam, b) mating or compatibility type, and c) allozymes genotypic profile (Gpi) (2). A smaller group of isolates was further characterized for host range, RFLP profile, and growth optima at different temperatures on artificial media and host tissue. Results of our *P. infestans* characterization work further our understanding of the dynamics of the pathogen population and lend to the development of improved disease management recommendations.

Figure 4. A. Allozymes analyses of 12 *Phytophthora infestans* isolates with putative genotype characterization. B. Distribution of different *P. infestans* genotypes in Wisconsin. Isolates collected from tomato and potato plants during the 2010 growing season.

All isolates were sensitive to the fungicide mefenoxam when tested on amended media. Some isolates exhibited greater sensitivity than others. Further studies will be needed to qualify the media amendment assay. US#22 isolates were of the A2 mating or compatibility type. US#23 and US#24 isolates were of the A1 mating type. Opposite mating types were not isolated from the same fields or from the same counties. We are further evaluating compatibility type features of our *P. infestans* isolates.

There were three predominant *P. infestans* genotypes collected from Wisconsin in 2010: US#22, US#24, and putative US#23. Isolates of the US#22 genotype were collected from 7 counties throughout the state. US#24 isolates were collected from just 2 counties in central Wisconsin and isolates of the putative US#23 genotype were collected from 2 counties in southeastern corner of the state (Fig. 4).

US#22 isolates could infect both tomato and potato leaves. The foliage of several solanaceous plant types was resistant to infection by US#22 *P. infestans* and included tomatillo, eggplant, pepper, ground cherry, and few tomato varieties (e.g., 'Matt's Wild Cherry' and 'Wapsipinicon'). RFLP (rapid fragment length polymorphism) analysis was performed on one US#22 isolate and provided further confirmation of genotype characterization. A single US#22 isolate grew optimally at 20 degrees C on tomato foliage (Fig. 5).

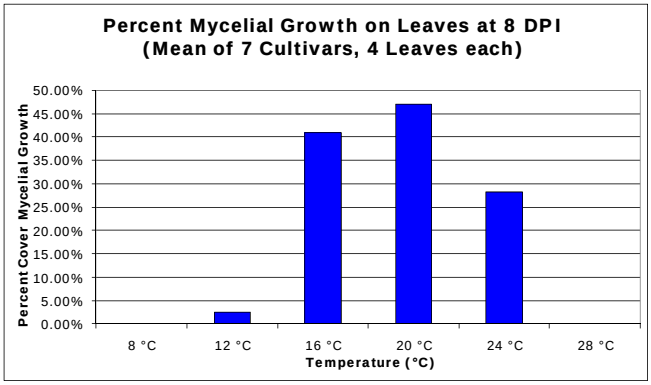

Figure 5. Graph depicting optimal temperatures for the growth of *Phytohpthora infestans* US#22 on tomato leaf tissue at 8 days post inoculation. Data presented is mean growth response on 7 different tomato cultivars.

With the recent presence of the late blight pathogen in the state and likelihood of disease-favorable weather conditions, it is critical that all growers (home gardeners and commercial producers) of tomatoes and potatoes regularly scout their plants for disease symptoms. If late blight is suspected, contact your county extension agent, a crop consultant, the plant disease diagnostic clinic at UW-Madison, or myself. Additionally, protectant fungicides can manage late blight when applied in advance of infection and when re-applied as the crop grows. Wisconsin fungicide recommendations for late blight can be found in the University of Wisconsin Extension Publication entitled "Commercial Vegetable Production in Wisconsin," publication number A3422 (http://learningstore.uwex.edu/assets/pdfs/A3422.PDF) and additional information is provided in weekly newsletters during the growing season (provided at the vegetable pathology website: http://www.plantpath.wisc.edu/wivegdis/).

References

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Legard, D.E., and W.E. Fry. 1996. Evaluation of field experiments by direct allozyme analysis of late blight lesions caused by *Phytophthora infestans*. Mycologia 88(4) 608-612.