

Trefoil Wilt in New York and Vermont is Caused by a Unique Plant Pathogen

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Fusarium wilt, a soil-borne disease associated with rapid wilting, root discoloration, and plant death in seeding year stands of birdsfoot trefoil (Figure 1), was one of the principal factors in the decline of the once thriving trefoil seed industry in the Lake Champlain Valley of New York and Vermont in the 1970s and early 1980s. The disease can still be observed in remnant trefoil plants growing in hay fields in the region. Since the early 1990s this disease has also afflicted birdsfoot trefoil in forage production fields in Erie and Wyoming Counties in western New York. Yet little was known about the characteristics and biology of the fungus that produces these symptoms in trefoil.

In a research article published in the January 2009 issue of the journal *Plant Disease*, Michael Wunsch and coauthors Alexandra Baker, David Kalb, and Gary Bergstrom document the identity of the causal fungus as a unique biological strain of *Fusarium oxysporum* that they named as form species '*loti*' to denote its pathogenicity on trefoil (*Lotus* species). The Cornell plant pathologists utilized plant inoculation experiments and molecular genetic analyses to characterize a collection of the fungus isolated from symptomatic trefoil plants from diverse locations in New York and Vermont between 1985 and 2004. The isolates collected from wilted birdsfoot trefoil caused severe wilt and root discoloration in greenhouse grown plants of birdsfoot trefoil; a low level of disease in some pea plants; but no disease in alfalfa, red clover, dry bean, or soybean plants (Table 1). Also included in the experiments were reference isolates of *Fusarium oxysporum* form species '*medicaginis*' from alfalfa, form species '*pisi*' from pea, and an isolate of *F. oxysporum* from red clover; none of these fungal isolates caused significant disease in birdsfoot trefoil while each produced disease in the host plant from which they had been isolated originally (Table 1).

The genetic analyses employed by the authors suggest that a single strain of *F. oxysporum* causes Fusarium wilt in New York and Vermont. Each of the isolates designated as form species '*loti*' showed vegetative compatibility (a measure of self-recognition in fungi that is useful for assessing genetic similarity) when grown together in laboratory cultures with every other '*loti*' isolate. The DNA sequence of three specific genes was determined for each fungal isolate and compared to published gene sequences for other isolates of *F. oxysporum*. Each of the '*loti*' isolates had identical DNA sequence over the three genes and clustered together in a separate group from isolates that are pathogenic on other plant hosts. Thus the trefoil wilt pathogen found in New York and Vermont appears to be a unique biological strain with a plant host range different from that of any *Fusarium* fungus studied previously. To date this pathogen is known to occur only in certain areas of New York and Vermont. Movement of infested hay or soil is the most likely

mechanism for geographic spread of this fungus. The new genetic tools developed at Cornell should be useful for tracking any future movement of the trefoil wilt pathogen to new areas.

Forage producers whose soils are infested by *F. oxysporum* f. sp. *loti* can consider growing the birdsfoot trefoil variety 'Pardee' which was developed at Cornell and selected for its moderate resistance to this pathogen [Smith et. al. *What's Cropping Up?* 2008. Volume 18 (1): 10-11].

Reference:

Wunsch, M.J., Baker, A.H., Kalb, D.W., and Bergstrom, G.C. 2009. Characterization of *Fusarium oxysporum* f. sp. *loti* forma specialis nov., a monophyletic pathogen causing vascular wilt of birdsfoot trefoil. *Plant Dis.* 93:58-66.



Figure 1. Typical progression of symptoms (left to right) of Fusarium wilt in birdsfoot trefoil plants.

Table 1. Summary of vascular wilt symptoms induced in legume species following inoculation of plants with specific isolates of *Fusarium oxysporum*. Reactions ranged from 0 (no symptoms) to ++++ (severe root necrosis, wilting, and death).

Plant species inoculated:	<i>F. oxysporum</i> f. sp. <i>loti</i> from trefoil	<i>F. oxysporum</i> f. sp. <i>medicaginis</i> from alfalfa	<i>F. oxysporum</i> f. sp. <i>pisi</i> from pea	<i>F. oxysporum</i> from red clover
Birdsfoot trefoil	+++	0	0	0
Alfalfa	0	++++	0	0
Red clover	0	0	0	++
Pea	+	+	++++	+
Dry bean	0	0	0	0
Soybean	0	0	0	0