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Biological control of leafy spurge

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Crown and root rot

On June 24, 1987, Dr. Dave Davis and his technician, Prudence Olson, found a crown rot killing numerous stems of leafy spurge at Kindred, North Dakota. We are isolating fungi and bacteria from the lesions at the base of the stems and will start pathogenicity tests, first with a *Fusarium* species that is appearing among the isolates.

A *Fusarium* species was isolated from the few dead and dying leafy spurge (*Euphorbia esula*) plants found by Dr. Hosford in Washington and Wyoming in June-July, 1986. Inoculation of soil around spurge plants in the greenhouse with the *Fusarium* alone has not, to date, resulted in wilt or root rot. In November, 1986 a *Fusarium* fungus was repeatedly isolated by Mr. Jordahl from brown streaks in roots of wilting leafy spurge plants growing in Sunshine Mix (a soilless mixture of peat moss, perlite and vermiculite from Canada). Spurge plants inoculated with this fungus have remained healthy.

Alternaria species

In September, 1985 Dr. Hosford observed a disease killing some inflorescences and then the flowering stem of leafy spurge in western North Dakota, central Montana, and southern Oregon. The disease was scattered in patches of spurge at one site in North Dakota, one site in Montana, and abundant in a solid 100 acre stand of leafy spurge covering a valley in southern Oregon (4). In May, 1986 Dr. Hosford and Mr. Don Mundal observed a similar disease in eastern North Dakota. *Alternaria* was repeatedly isolated from the advancing edge of stem lesions from all these sites. Using wet periods of 36-65 hours, isolates B1-1 and B1-6 of *Alternaria* from central Montana caused small dark spots to extensive dark lesioning, killing flowers, leaves and stems of leafy spurge biotypes 113, 110 and 108 in greenhouses in Fargo, ND. All 27 conidial inoculated plants developed spotting and/or top dieback. The 25 water inoculated check plants were not spotted. *Alternaria* resembling B1-1 and B1-6 were reisolated from the lesions and not from healthy check plants. On April 30, 1986 Dr. Joe Krupinsky sent us two of his stem killing isolates of *Alternaria* from Mandan, North Dakota (6). To date his two isolates have caused the greatest stem killing of any of the *Alternaria* isolates. On June 26, 1987 Dis-

trict Ranger John A. Madden sent us leafy spurge plants from near Fairfield, Idaho. Many of the stems were dying from the top down. We are isolating microorganisms from the advancing edge of the dying areas and expect to find an *Alternaria* pathogen.

In the prairie provinces of Canada, *Alternaria* spp. have caused leaf spotting to top dieback in up to 10 percent of the leafy spurge at some sites (8). *A. tenuissima* f. sp. *euphorbiae* caused leaf spotting and top dieback in North Dakota, but artificial field inoculation at 3 sites in 1984 resulted in only a little infection, probably due to inadequate moisture (6, L. J. Littlefield, personal communication).

Uromyces striatus

The rust, *Uromyces striatus*, was detected killing leafy spurge near Lidgerwood in southeastern North Dakota in 1982. It spread slowly from plant to adjacent plant through 1982-84. In 1985 it spread to scattered plants over 3 acres of spurge, perhaps by aerial spores (5,7). In 1985 Mr. J. G. Hoch found its uredospores on alfalfa in the fields, then produced them in the greenhouse and stored in liquid nitrogen. On May 7, 1986 Dr. Hosford and Mr. Mundal found a rust disease resembling *U. striatus* killing a few plants near Lisbon, ND but not in an adjacent alfalfa field. We have a report of this rust on a few leafy spurge plants south of Carrington, ND. The rust kills the spurge plant. In the spring of 1987 Dr. Statler, his technicians Melinda McVey and Mr. Jordahl, found that the rust continued to spread slowly at Lidgerwood and Lisbon. We are looking for another alternate host other than alfalfa or clover (3) from which spurge may be infected.

***Melampsora euphorbiae*, *Uromyces* spp. and *Endophyllum* spp.**

In September, 1985 Dr. Hosford found *Melampsora euphorbiae*-like rust on an Oregon State University herbarium specimen of *E. esula* collected in Medford, Oregon in 1964. He did not find the rust in Medford, but M. R. Hubbell, who collected it in 1964, is looking for it for us (4). *Melampsora* rust spp. occur on *Euphorbia* spp. and are highly specific for their hosts. This, combined with their urediospore on *Euphorbia* spp., makes them good candidates for biocontrol of leafy spurge. *Melampsora euphorbiae* was collected at Victoria, B.C. by Dr. Littlefield in August, 1984 and sent to the Plant Disease Research Laboratory (PDRL) at Frederick, Maryland. *Uromyces euphorbiae* was collected by Dr. Littlefield on a collecting trip to Eastern Europe in the spring of 1984, and that rust was also sent to PDRL. Evaluation of these rusts for host range, prior to release to us, is in progress. At Frederick, Dr. W. L. Bruckart is studying these and other microorganisms that he, Dr. Littlefield and others have collected (1). Dr. Bruckart reports that in Swiss studies by Dr. G. Defago et al., *Uromyces scutellatus* is reducing stands of cypress spurge by 90% (1,2). He found that *M. euphorbiae* from Eastern Europe caused very limited infection on spurge collections other than those from which it came (1). We are looking for these fungi on leafy spurge in the United States. Harris et al. (3) recommended the "autoecious rusts, such as *Melampsora euphorbiae* (Schub.) Cast., *Uromyces scutellatus* (Pers.) Lev and *Endophyllum* species, as possible biocontrol agents for

control of North American leafy spurge.” Recently, Dr. Sam Young joined Dr. Bruckart at Frederick to work on biological control of weeds.

On Oct. 21, 1986 Dr. Larry Littlefield sent us the uredial/telial stage of an autoecious rust (*Uromyces prominens* or *U. Magorii*?) on *Euphorbia dentata* (?), toothed spurge, in Oklahoma. On August 19, 1986, Sharon Collman, County Agent for King County, Washington, sent us an orange rust severely rusting petty spurge in Cowlitz County. On Nov. 7, 1986, Jack Waud, County Agent for Clallam County, Washington, sent us an orange rust and leaf spots on small to medium sized spurge plants in Clallam County has determined that these rusts cause only fleck reactions on leafy spurge.

Sclerotium rolsii

Dr. Littlefield obtained *Sclerotium rolsii* isolates through State-Federal clearance from southern United States to test an leafy spurge in North Dakota (7). On January 28, 1986 10 ml of 2 two-week-old petri plate cultures containing sclerotia and mycelium of *S. rolsii* in 50 ml of water plus 2 drops of Tween 20 were poured on the base of each of 5 plants of leafy spurge biotype 113. The plants in each of 5 pots were watered daily. By 8-18 days after inoculation, the stems of the inoculated plants were killed at the soil surface, but new stems grew from the roots. Five water inoculated check plants were undamaged. This fungus damages many important plants and crops in the southern United States. It is assumed that it will not survive northern winters. If it were to survive, it might become a serious problem. We have studied this fungus only in the greenhouse in the winter and sterilizing all experimental remains. As stated, it kills some stems of leafy spurge, but others grow to replace them.

Conclusions

We should continue studying crown and root rot diseases for a potential control of leafy spurge, look for more virulent or aggressive isolates of *Alternaria* and autoecious rusts, such as *Melampsora euphorbiae* (Schub.) Cast, *Uromyces scutellatus* (Pers.) Lev., and *Endophyllum* species, on North American leafy spurge. We should also look for any other organisms, fungi, bacteria, viruses, nematodes, etc. that may be damaging leafy spurge.

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