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Diseases of leafy spurge in the northern Great Plains

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Commencing in summer 1991, efforts were undertaken to find, identify and characterize the pathogenicity of native, preferably soilborne pathogens of leafy spurge. The invasive and tenacious nature of the root system of leafy spurge, and consideration of the failure of previous efforts in the application of foliar plant pathogens to substantially decrease leafy spurge stand density, led on this approach. As a result of the discovery by two scientists in our unit, Norm Rees and Chuck Quimby, of the early occurrence of symptoms of senescence in a stand of leafy spurge near Bozeman, Montana, and the subsequent appearance of more pronounced symptoms, the soilborn plant pathogen *Rhizoctonia solani* was isolated and identified. County weed supervisors in Montana were contacted to request that local personnel be alert for symptoms similar to those of the initial discovery of the disease. Investigations of other stands of leafy spurge where stunting of the leafy spurge occurred confirmed the wide-spread occurrence of *Rhizoctonia solani* in Montana, Colorado and North Dakota, causing a variety of symptoms on leafy spurge (Table 1.) All binucleate strains of *Rhizoctonia* were found to be of anastomosis group 4. Furthermore, above-ground symptoms on leafy spurge were associated with the presence of binucleate *Rhizoctonia* spp.

Stands that had attained a dense monoculture were observed to be decreasing in density. This "all points bulletin" approach resulted in the discovery of another pathogen of leafy spurge, the bacterium *Agrobacterium tumefaciens.* Field investigations led to the discovery of several airborne pathogens of leafy spurge.

As described above, the discovery of *Rhizoctonia solani* led to the discovery of other pathogens. At several sites where disease had especially severe effect on leafy spurge, complex relationships with pathogens of diverse taxonomy were seen and are under study. The die out of leafy spurge in circular patches at one site, associated with characteristic mushroom "fairy rings", is being investigated. High populations of a strain of *Rhizoctonia solani* are present in the soil at the site. A preliminary study has shown that the strain is moderately virulent on leafy spurge, compared with other strains from the Northern Plains area isolated from this weed. However, there is an apparent interaction with a basidiomycetous fungus also present in the soil at this site. The resulting interac-

tion is the most effective that we have seen in eradicating leafy spurge. Furthermore, the *R. solani* has been shown to be highly effective at preventing reestablishment of leafy spurge from seed through preemergence damping off. In contrast, a *R. solani* strain with pronounced virulence when tested singly on leafy spurge has been somewhat less effective in eliminating leafy spurge in the field due possibly to the presence of the antagonistic bacterium *Erwinia herbicola* in the vascular system of the leafy spurge plants at the site where *R. solani* was found. Figure 1 summarizes a preliminary study of comparative virulence on leafy spurge among several strains of *Rhizoctonia* spp.

Table 1. Origin, field symptoms observed, number of strains isolated, nuclear condition, and anastomosis grouping (AG) of *Rhizoctonia* spp. isolated from leafy spurge.

	Symptoms				
Location	Dead root buds	Crown rot	Stem rot	Number of strains	Strain traits
Ft. Benton, Montana	+	+	-	2	1 - binucleate
					1 - AG-4
White Sulphur Springs, Montana	+	+	+	2	1 - binucleate
					1 - AG-4
Bozeman Montana	-	+	-	1	AG-4
Missoula, Montana	+	+	+	2	1 - binucleate
					1 - AG-4
Sidney, Montana	+	+	-	1	AG-4
Fallon County, Montana	+	-	+	4	3 - binucleate
					1 - AG-4
Colorado	-	+	+	1	1 - binucleate
North Dakota	+	-	-	1	1 - binucleate

Symptom present (+) and symptom absent (-).

Thus, there are several highly important interactions which have been discovered in relation to biocontrol of leafy spurge, indicating that such interactions may profoundly affect the efficacy of such biocontrol agents as *R. solani*, should they be applied in the field through an augmentative approach.

Previous studies have indicated that for canola, potato, and sugar beets, AG-4 is typically less virulent, less prevalent or both, relative to the anastomosis groups that are the principal cause of disease on these crops, which were AG-2, AG-3, and AG-2-2, respectively (1,2,4). This trend has also been noted on other crops and locations (3), where, for example, AG-4 was more commonly isolated from soil in carnation fields than other anastomosis groups, but was weakly pathogenic compared to AG-2-2. Collectively, these results provide evidence that the use of AG-4 as a biological control agent of leafy spurge would be unlikely to present a threat to major crops grown in the Northern Plains, compared to some other anastomosis groups of *R. solani.*

Studies are continuing to assess both comparative virulence and host ranges of the strains of AG-4 described in the present study.

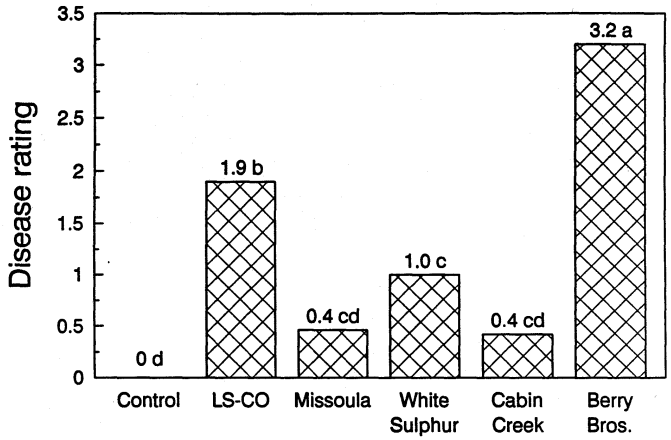

Figure 1. Virulence of *Rhizoctonia solani* isolates as determined with pathogenicity tests on stems of six-week-old leafy spurge. Means followed by the same letter are not significantly different according to Waller and Duncan's k-ration LSD.

Literature cited

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