Interactions Between *Rhizoctonia solani* AG-3 and 27 Plant Species

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ABSTRACT

Carling, D. E., Kebler, K. M., and Leiner, R. H. 1986. Interactions between *Rhizoctonia solani* AG-3 and 27 plant species. Plant Disease 70:577-578.

Twenty-seven plant species representing 26 genera were inoculated with *Rhizoctonia solani* anastomosis group 3 (AG-3). Characteristic stem lesions were observed on potato (*Solanum tuberosum*) and necrotic roots were observed on hairgrass (*Deschampsia beringensis*). A superficial discoloration was observed on the roots and crowns of several other species. Dark hyphae and sclerotia were observed on the crowns and roots of most species, indicating an epiphytic but not a pathogenic interaction.

Isolates of *Rhizoctonia solani* Kühn pathogenic to potato (*Solanum tuberosum* L.) have been collected from many species of plants. Jager et al (5) reported isolating *R. solani* from 12 species of wild plants (weeds) growing in potato fields. They collected isolates from 30 plants, and 62% proved pathogenic in varying degrees on potato sprouts. Earlier reports also indicated *R. solani* isolates collected from the roots and crowns of other weeds were pathogenic to potato (3,7). Anastomosis group affinity was not determined in those earlier studies, and it is possible that members of anastomosis groups other than AG-3 may have been included.

Murray (6) identified *R. solani* AG-3 as the causal agent of barley stunt disease in Scotland. This is one of few reports linking AG-3 isolates with disease of a plant other than potato. Several studies conducted in Minnesota (1,2,4) reported AG-3 isolates caused seed rot of flax, radish, and carrot, but infection of the hypocotyl of these plants was not observed. A systematic look at the relationship between AG-3 isolates of *R. solani* and a cross section of weeds and crop plants has not been made. In this study, 27 plant species representing 26 genera were inoculated with isolates of *R. solani* AG-3. The purpose was to observe pathogenic or other associations that may exist between this fungus and selected plant species.

Journal Series Article J162, Alaska Agricultural and Forestry Experiment Station.

Accepted for publication 20 December 1985.

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MATERIALS AND METHODS

Seeds of each plant species (Table 1) were planted in 14-cm-square pots containing a sterilized 2:2:1 sand-soil-vermiculite mix. Five pots of each species were seeded, and four of them were inoculated with *R. solani* AG-3 when the plants were well established. Fungal inoculum consisted of barley kernels colonized by a mixture of five AG-3 isolates collected from naturally infected potato plants growing in south central Alaskan fields. Ten colonized barley kernels were placed in the soil of each inoculated pot. A control pot of each plant species was inoculated with 10 autoclaved barley kernels. Pots with no plants were inoculated with colonized barley kernels to document the survival of the fungus in plantfree soil. Plants were maintained in a growth chamber under fluorescent lights at temperatures ranging from 15 to 25 C and were watered and fertilized as needed.

Harvest occurred after plants had been exposed to the fungus for about 60 days. Root systems were washed and inspected for symptoms and signs of *R. solani* AG-3. Attempts were made to reisolate the fungus from the root systems of each plant species by placing surface-disinfected (0.5% sodium hypochlorite) pieces of root and crown tissue on plates of rehydrated potato-dextrose agar. Each recovered isolate was matched with an AG-3 tester isolate to confirm anastomosis group affinity (9). Presence of AG-3 in the soil was confirmed at the end of the experiment by the beet seed assay method (8). The study was repeated twice with similar results.

RESULTS

Lesions induced by isolates of *R. solani* AG-3 were present on the subterranean portions of the potato stems but were not present on any other tested plant species (Table 1). Superficial discoloration of root and crown tissues was observed on several species, and some necrotic roots were present in hairgrass samples. Dark hyphae and sclerotia were present on many species, especially on potato tubers and stolons, on all other solanaceous plant roots, and on carrot and radish roots. Dark hyphae radiated from sclerotia, except on tomato, petunia, wheat, and quackgrass, where only dark hyphae were present. AG-3 isolates were recovered from most root systems bearing dark hyphae or sclerotia. In the hairgrass root system where some dead roots were present, neither dark hyphae nor sclerotia were present on any root surface, though AG-3 isolates were recovered from necrotic roots. Non-inoculated plants of each species showed no symptoms.

DISCUSSION

R. solani AG-3 is a pathogen of potato,

Table 1. Summary of symptoms, signs, and fungal recovery from plants inoculated with *Rhizoctonia solani* AG-3

Scientific name	Common name	Symptoms and signs: Dark hyphae[a]	Sclerotia[a]	Symptoms[b]	Recovery of fungus[c]: Plant	Soil
Solanaceous plants						
Lycopersicon esculentum Mill.	Tomato	+	0	0	+	+
Nicotiana tabacum L.	Tobacco	+	+	0	+	+
Petunia hybrida Vilm.	Petunia	+	0	0	0	+
Solanum melongena L.	Eggplant	+	+	0	+	+
S. tuberosum L.	Potato	+	+	L	+	+
Other crop plants						
Avena sativa L.	Oats	+	+	0	+	+
Brassica oleracea L.	Cauliflower	0	+	0	+	+
Daucus carota L.	Carrot	+	+	0	+	+
Fagopyrum esculentum Moench	Buckwheat	0	+	0	+	+
Hordeum vulgare L.	Barley	0	0	D	0	+
Lactuca sativa L.	Lettuce	0	0	D	0	+
Medicago sativa L.	Alfalfa	+	+	0	+	+
Phaseolus vulgaris L.	Bean	+	+	D	0	+
Pisum sativum L.	Pea	0	0	D	0	+
Raphanus sativus L.	Radish	0	+	0	+	+
Triticum aestivum L.	Wheat	+	0	D	+	+
Other plants						
Agropyron repens (L.) Beauv.	Quackgrass	+	0	0	0	+
Chenopodium album L.	Lambs-quarter	0	0	0	0	+
Deschampsia beringensis Hultén	Hairgrass	0	0	N	+	+
Epilobium angustifolium L.	Fireweed	+	+	D	+	+
Matricaria matricarioides (Less.) Porter	Pineapple-weed	0	0	0	0	−
Melilotus officinalis (L.) Lam.	Sweetclover	+	+	0	+	+
Poa pratensis L.	Bluegrass	0	0	D	0	+
Spergula arvensis L.	Cornspurrey	+	+	0	+	+
Stellaria media L.	Chickweed	0	0	0	0	+
Taraxacum officinale Weber	Dandelion	+	+	0	+	+
Vicia cracca L.	Birdvetch	0	0	0	0	+
No plants	...	−	−	−	−	+

[a] + = Sign present, 0 = sign not present, and − = no sample.
[b] L = Lesions, D = discoloration, N = necrotic roots, 0 = no symptom, and − = no sample.
[c] + = AG-3 recovered, 0 = AG-3 not recovered, and − = no sample.

but our data suggest that these isolates were of little importance as pathogens on the other plant species evaluated in this study. This appears true despite the close association observed between the AG-3 isolates and many of the plants. One possible exception may be hairgrass where root necrosis was observed, yet additional studies are needed before confirming AG-3 isolates as pathogens of hairgrass. Murray (6) reported AG-3 isolates as the causal agent of barley stunt disorder in Scotland. However, we found no evidence of damage to barley beyond a superficial discoloration of the root and crown, and we could not recover AG-3 isolates from the barley root system.

Although AG-3 isolates may not be pathogenic to plants other than potato, our data demonstrate an epiphytic relationship between this fungus and many plant species. This agrees with Jager et al (5), who stated that *R. solani* was usually present in the form of dark hyphae or sclerotia on root surfaces, but they did not indicate if root lesions were present. Also, Oshima et al (7) stated that the root system of *Portulaca oleracea*, a common weed in Colorado, was extensively invaded by *R. solani*, yet lacked disease symptoms. This too suggests an epiphytic rather than a pathogenic relationship.

AG-3 isolates may derive some benefit from an epiphytic relationship with certain plants other than potato, perhaps via root exudation or some other mechanism. This would have implications when weed control and crop rotation questions arise. Jager et al (5) concluded from their studies that weeds contribute to the survival of *R. solani* and also discussed the possibility of potato plants becoming infected via infested weeds. They do not identify *R. solani* isolates by anastomosis group, but their pathogenicity studies indicate that some and possibly all were AG-3.

Nonhost crop plants that support an epiphytic growth habit of AG-3 isolates may aid their survival in the absence of a potato crop. Data from this study suggest that roots of eggplant, tobacco, cauliflower, carrot, radish, and oats supported extensive development of dark hyphae and sclerotia. Such plants would not be the best choice as rotation crops with potato in regions where AG-3 isolates of *R. solani* are a problem. Similarly, crops such as barley, if parasitized by certain isolates of AG-3, also may be poor choices as crops to be used in rotation with potatoes.

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