Fungi isolated from stems and roots of soybean in Ontario

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Thirteen genera of fungi were isolated from stems and roots of soybean *[Glycine max* (L.) Merr.] including the plant pathogens *Corynespora cassiicola* (Berk. & Curt.) Wei, *Fusarium oxysporum* Schlecht., *Phytophthora megasperma* f. sp. *glycinea* Kuan and Erwin, *Pythium* spp., *Rhizoctonia solani* Kuhn., and *Thielaviopsis basicola* (Berk. & Br.) Ferr. *F. oxysporum* and other species of *Fusarium* were isolated more frequently than other fungi. Certain fungi such as *C. cassiicola* were common on roots and others such as *Phomopsis* spp. were common on stems. The incidence of isolation of most fungi was influenced by sample date. Seed treatments with metalaxyl and furmecyclox did not affect the incidence of fungi isolated from stems and roots.

Can. Plant Dis. Surv. 67:1, 3-5, 1987.

Treize genres de champignons ont été isolés à partir des tiges et des racines du soja [*Glycine max* (L.) Merr.] notamment les pathogènes suivants, *Corynespora cassiicola* (Berk. & Curt.) Wei, *Fusarium oxysporum* Schlecht., *Phytophthora megasperma* f. sp. *glycinea* Kuan and Erwin, *Pythium* spp., *Rhizoctonia solani* Kuhn. et *Thielaviopsis basicola* (Berk. & Br.) Ferr. *F. oxysporum* et d'autres espèces de *Fusarium* ont été relevées plus souvent que tout autre champignon. Certains champignons comme *C. cassiicola* étaient communs sur les racines et d'autres comme *Phomopsis* spp. colonisaient davantage les tiges. La frbquence d'isolement de la plupart des champignons dbpendait de la date d'bchantillonage. Le traitement des semences au métalaxyl et au furmbcyclox n'a pas eu d'effet sur le nombre de champignons prélevés sur les tiges et les racines.

Introduction

In Ontario, poor growth and low yield of soybean ***[Glycine max*** (L.) Merr.] may result from root infection by several soil-borne plant pathogens. These pathogens include ***Corynespora cassiicola*** (Berk. & Curt.) Wei (14), ***Cephalosporium*** sp. (6), ***Fusarium oxysporum*** (8), ***Phytophthora megasperma*** f. sp. ***glycinea*** (Hildeb.) Kuan and Erwin (***Pmg***) (5), ***Pythium ultimum*** Trow. (7), ***Rhizoctonia solani*** Kuhn (16; Anderson, unpublished results), ***Macrophomina phaseolina*** (Tassi.) Goid. (9) and ***Thielaviopsis basicola*** (Berk. & Br.) Ferr (2).

Phytophthora root rot has been described as the most important disease of soybean on clay soils in southwestern Ontario. Although recommended cultivars in this area are tolerant or resistant to this disease (3), yields are low in some fields or in low-lying areas of otherwise productive fields. At these locations, plants do not show symptoms characteristic of ***Pmg*** infection (5) but occasionally, red or brown lesions are present on the basal stem and/or upper tap root. It is possible that low yields result from root infection by other fungi such as ***Fusarium, Rhizoctonia*** and ***Pythium.***

Identification of those pathogens within the disease complex that are ultimately responsible for low yield, might be simplified by the use of seed treatment fungicides with a limited spectrum of activity. Seed treatment with metalaxyl with specific activity against Peronosporales (11) reduces infection by ***Pythium*** spp. and ***Pmg*** and seed treatment with furmecyclox with specific activity against Basidiomycetes (13) controls ***R. solani***

The purpose of this research was to determine the incidence of fungi associated with basal stems and roots of soybean during the growing season and to determine if seed treatments would influence the incidence of specific pathogens.

Materials and methods

Plots were planted 13/05/82 at Fingal, Ontario in a field previously observed to have variable yields. The soybean cultivars A1564, Coles, Evans, Hawk and Hodgson were planted in 4 row plots, 3.7 m long with a row spacing of 0.6 m at a seeding rate of 27 seeds/m. The experiment was randomized in a split-plot design with cultivars as the main plots and seed treatments as sub-plots. Chloramben at 4.5 kg a.i./ha was applied prior to emergence to control weeds.

Metalaxyl (Ridomil 25 WP, Ciba-Geigy Canada Ltd.) and furmecyclox (BAS 389 05F, Chipman Chemical Canada Ltd.) were applied at 2 g a.i./kg of seed. Seeds were treated within 1 wk prior to planting.

Fungi associated with the bases of stems were isolated from five plants selected randomly from border rows of each plot. Plants were removed carefully, stored in plastic bags under cool conditions and returned to the laboratory for isolation of fungi. Segments of the lower stem located near the soil line were surface sterilized in 1.2% sodium hypochlorite, cut into 2 mm sections and plated on potato dextrose agar (PDA). Secondary roots were obtained from random soil samples collected in a weed-free area between rows from surface soil 0-15 cm deep and 5-15 cm from the row. Five sections, 5 mm in length, were removed from each of 5 surface sterilized roots per sample plot and plated on PDA. Plates were incubated for 5 to 7 days at 25°C before fungi were identified. Samples were collected 15/06/82. 15/07/82 and 15/08/82.

Results and discussion

A total of 13 genera of fungi were isolated and identified from soybean. The incidence of fungi on each cultivar was similar, therefore the mean incidence from the five cultivars was used

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Accepted for publication October 16, 1986

Table 1. Effect of sample date and seed treatment* on incidence(%)** of soybean roots and stems infected with fungi in Fingal, 1982.

Plant segment	Date	Treatment	Alt	Cc	Chc	Chs	Ct	Fo	Fs	Mu	Ps	Pmg	Py	Rs	Tb	Tv	U
			Fungi+														
Root	15/6	control	0	0	19 ± 2	19 ± 19	0	27 ± 27	4 ± 0	3 ± 2	0	0	355	0	16 ± 11	llk 8	0
		furmecyclox	4k 4	0	13 ± 14	13 ± 12	0	25 ± 27	12 ± 8	3 ± 5	0	0	4 ± 0	0	4 ± 0	9 ± 16	0
		metalaxyl	4 ± 0	0	19 ± 8	27 ± 6	0	13 ± 12	12 ± 11	3f5	3 ± 5	0	0	0	5 ± 2	7 ± 2	0
			322	0	17 ± 3	20 ± 7	0	22 ± 8	9 ± 5	3f0	1 ± 2	0	2 ± 2	0	8 ± 7	9f2	0
	15/7	control	2 ± 2	7f 7	6 ± 7	7f 4	0	37 ± 17	17 ± 13	1 ± 2	0	2k4	0	0	14 ± 13	0	0
		furmecyclox	7f2	17 ± 7	13 ± 5	8 ± 6	0	23 ± 6	24 ± 3	0	0	1 ± 2	0	0	6f3	3f4	0
		metalaxyl	5 ± 5	12 ± 10	8 ± 6	12 ± 6	0	17 ± 9	15 ± 11	0	0	3f4	0	0	9f5	4 ± 3	0
			5 ± 3	12 ± 5	9 ± 4	9 ± 3	0	26 ± 10	19 ± 5	0	0	2 ± 1	0	0	10 ± 4	2 ± 2	0
	1518	control	2 ± 2	31 ± 33	5 ± 6	1 ± 2	0	42 ± 10	38k 9	0	0	2 ± 4	0	1 ± 2	6 ± 5	8 ± 6	0
		furmecyclox	6 ± 2	19 ± 9	3 ± 2	3f 2	0	44 ± 12	35 ± 24	0	0	0	1 ± 2	2f2	6f5	7 ± 7	0
		metalaxyl	3 ± 4	12 ± 14	4f 3	3f 2	0	30 ± 8	46 ± 11	1 ± 2	0	2 ± 2	2f2	2 ± 2	8 ± 6	13f 4	0
			4 ± 2	21 ± 10	4f 1	2 ± 1	0	39 ± 8	40f 6	0	0	1 ± 1	1 ± 1	1 ± 1	8 ± 0	9 ± 3	0
Stem	1516	control	1 ± 2	0	0	7f 4	0	68 ± 18	63 ± 11	1 ± 2	0	1 ± 2	0	0	6 ± 2	8 ± 11	5 ± 5
		furmecyclox	5f 8	0	0	8 ± 6	0	70 ± 17	63212	0	0	0	0	2 ± 2	15 ± 11	12 ± 9	3f4
		metalaxyl	4f 6	0	0	12 ± 6	0	62 ± 17	73 ± 33	0	0	1f2	0	0	8 ± 7	3f4	2 ± 4
			3 ± 2	0	0	9 * 3	0	67 ± 4	66 ± 6	0	0	1 ± 1	0	1 ± 1	10 ± 5	8f5	322
	15/7	control	30f 5	0	0	0	2f4	83 ± 7	94 ± 4	2 ± 2	34 ± 7	0	1 ± 2	0	0	10 ± 10	19 ± 9
		furmecyclox	37 ± 7	0	0	0	2f4	73 ± 24	95f 5	12 ± 7	39 ± 14	0	2f4	0	1 ± 2	11 ± 8	25 ± 16
		metalaxyl	24 ± 9	0	0	0	3 ± 4	70 ± 12	98 ± 4	4 ± 3	29 ± 4	0	1 ± 2	0	1 ± 2	3 ± 2	22 ± 9
			30 ± 7	0	0	0	2f1	75 ± 7	95f 1	6f5	34f 5	0	1 ± 1	0	1 ± 1	8k4	22 ± 3
	15/8	control	16 ± 6	0	0	0	1 ± 2	72 ± 11	100 ± 0	14 ± 10	56 ± 16	0	3f4	2 ± 2	1 ± 2	23 ± 19	34 ± 7
		furmecyclox	18 ± 12	0	0	0	2 ± 4	68 ± 9	96f 7	12f 6	62 ± 19	0	4 ± 3	6 ± 4	0	29 ± 13	45 ± 10
		metalaxyl	22 ± 5	0	0	0	3f6	71 ± 20	98f 3	12 ± 6	45 ± 20	0	3 ± 2	7 ± 4	0	32 ± 3	51 f17
			19 ± 3	0	0	0	2 ± 1	70f 2	93 ± 2	12 ± 1	54k 3	0	3 ± 1	5k3	0	28 ± 5	43 ± 9

* furmecyclox and metalaxyl applied at 2 g a.i./kg of seed

** means of 5 cultivars, 5 plants/cultivar

\+ Alt = *Alternaria* spp., Cc = *Corynespora cassiicola*, Chc = *Chaetomium cochloides*, Chs = *Chaetomium* spp., Ct = *Colletotrichum dematium* var. *truncatum*, Fo = *Fusarium oxysporum*, Fs = *Fusarium* spp., Mu = *Mucor* sp., Ps = *Phomopsis* sp., Pmg = *Phytophthora megasperma* f. sp. *glycinea*, Py = *Pythium* spp., Rs = *Rhizoctonia solani*, Tb = *Thielaviopsis basicola*, Tv = *Trichoderma viride*, U = Species of *Aspergillus, Cladosporium, Rhizopus* and unidentified fungi.

to compile the results (Table 1). ***Fusarium oxysporum*** and ***Fusarium*** spp. were isolated frequently from both roots and stems at all sample dates. The frequency of isolation was similar to the results from a study in Delaware in which the incidence of isolating ***F. oxysporum*** from soybean roots and stems was 84% (4). Although ***F. oxysporum*** was isolated frequently from stems and roots, symptoms of Fusarium wilt (4) were not observed in the present study. ***Pmg, Pythium*** spp. and ***Rhizoctonia solani*** were isolated infrequently. The incidence of specific fungi on stems and roots did not reflect the reported spectrum of activity of metalaxyl and furmecyclox. Furmecyclox did not reduce the incidence of Fusarium isolations compared to untreated checks at any sample date. Results may have been influenced by the low incidence of ***Pmg, Pythium*** spp. and ***R.*** solani at the site based on infrequent isolation from check plants. Although ***Pmg*** was isolated infrequently from stems and lateral roots, it is possible that root tips were infected. Root tips of soybean are known to attract (10) and support reproduction of ***Pmg*** (1, 15). Determination of the incidence of ***Pmg*** in root tips in field grown plants would be difficult because of the fragile nature of infected root material. Plant segment and sample date affected the incidence of isolated fungi. ***Corynespora cassiicola, Chaetomium cochloides, Chaetomium*** spp. and ***Thielaviopsis basicola*** were isolated infrequently from the basal portion of stem but they were common on roots in all treatments. The incidence ot ***T. basicola*** was not affected by furmecyclox. Seed treatment trials in infested greenhouse soil suggest this compound has limited effect on infection by ***T. basicola*** (12). Seed treatment with furmecyclox at 2 g a.i./kg of cotton seed increased emergence and stand and reduced disease severity in greenhouse soil infested with ***R. solani*** and ***Fusarium*** spp. but not in field soil where the predominent pathogens were ***R. solani, T. basicola*** and ***Fusarium*** spp. (12). ***Colletotrichum dematium*** var. ***truncatum*** and ***Phomopsis*** sp. were isolated from stem bases more frequently than roots. Incidence of ***C. cassiicola*** and ***Phomopsis*** sp. increased with later sampling dates but the incidence of ***C. cochloides*** and ***Chaetomium*** spp. decreased at later sample dates. ***Corynespora cassiicola*** was isolated frequently from roots and has been reported to cause root necrosis and seedling stunting under cool (20°C) temperatures (14). ***Chaetomium cochloides*** and ***Chaetomium*** spp. were isolated from roots but the role of these organisms in the root rot complex is unknown.

Acknowledgments

I wish to thank the Ontario Soybean Growers' Marketing Board for providing financial assistance, C. Meharg and T. Rupert for technical assistance, and Dr. M. P. Corlett, Biosystematics Research Institute, for identifying ***Chaetomium cochloides.***

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