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INTERACTION OF *ROTYLENCHULUS RENIFORMIS* WITH SEEDLING DISEASE PATHOGENS OF COTTON

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Abstract

A greenhouse study was conducted to examine the impact of populations of *Rotylenchulus reniformis* and seedling disease fungi on early season disease and cotton development. Treatments consisted of *Fusarium chlamydosporum, F. equiseti, F. lateritium, F. moniliforme, F. oxysporum, F. oxysporum* f.sp. *vasinfectum*, *F. proliferatum, F. semitectum, F. solani, F. sporotrichioides, Rhizoctonia solani, Thielaviopsis* basicola. Pots containing 500 g of soil were infested with an inoculum concentration of 1% (w/w) of fungal treatments alone and in combination with 2000 *R. reniformis* juvenile and vermiform adult nematodes in a factorial arrangement. There was no significant interaction between *R. reniformis* and seedling disease fungi for survival, height, disease severity, and shoot dry weight. Seedling survival counts were lower at 42 days after planting for every treatment except *F. chlamydosporum* and *F. semitectum*. Treatments containing *R. solani, T. basicola, F. oxysporum* f.sp. *vasinfectum,* and *F. moniliforme* displayed significantly shorter plants at 14, 28, and 42 days after planting. Disease severity observed at 42 days after planting was greater for *R. solani* compared to any other treatment. Treatments infested with *R. solani, T. basicola, F. oxysporum* f.sp. *vasinfectum, F. moniliforme* and *F. lateritium* resulted in significantly less shoot weight. Cotton seedlings from the non-infested soil treatments yielded higher shoot dry weight than seedlings from *R. reniformis* infested soil. Data recorded for root dry weights determined an interaction between fungal treatments and the presence of *R. reniformis*. The control and *F. semitectum* without *R. reniformis*, displayed significantly greater root dry weights than the control and *F. semitectum* with *R. reniformis*. Populations of *R. reniformis* recorded at 42 days after planting were significantly lower in the presence of seedling disease fungi especially *R. solani, T. basicola*, *F. oxysporum, F. oxysporum* f.sp. *vasinfectum*, and *F. moniliforme*.

Introduction

Cotton disease loss estimates for the United States over the last decade averaged about 3.1%, and loss estimates for seedling disease accounted for 27% of the total estimated losses in lint production caused by diseases over those years. Fungi play a major role in the seedling complex causing pre and post-emergence damping off and seedling root rot. Of the fungi involved, species of *Fusarium* are the most common fungi associated with cotton tissues in Alabama. *Rotylenchulus reniformis* is considered to be the most economically damaging nematode on cotton. Damage includes yield suppression and alteration of cotton plants. Increases in the known distribution of *R. reniformis* are occurring in several southern states including Alabama. Seedling disease fungi are often isolated from fields infested with *R. reniformis* in Alabama. The objective of this study was to evaluate the relative impact of populations of seedling disease fungi and *R. reniformis* on early season disease and cotton development.

Materials and Methods

Treatments consisted of Fusarium chlamydosporum, F. equiseti, F. lateritium, F. moniliforme, F. oxysporum, F. oxysporum f.sp. vasinfectum, F. proliferatum, F. semitectum, F. solani, F. sporotrichioides, Rhizoctonia solani, Thielaviopsis basicola alone and in combination with the reniform nematode. One control infested with sterile millet and one control without millet was included. All treatments were evaluated in autoclaved and non-autoclaved field soil. To increase fungal inoculum, 75 cc of millet seed was placed in 250 ml flasks containing 150 ml of tap water. The millet seed was allowed to imbibe water for 24 hours after which the excess water was decanted and the flasks autoclaved twice at 121 C for 20 minutes on subsequent days. Flasks were aseptically inoculated by adding a 5 mm diameter plug from the periphery of one-week-old cultures growing on potato dextrose agar (PDA). All flasks were incubated for 7 days at 25 C under cool-light fluorescent illumination. Each flask was shaken daily to allow for thorough propagule dispersement. Reniform nematode populations were increased on Paymaster 1218 BG/RR cotton for 60 days in the greenhouse.

Greenhouse tests were conducted in the summer of 2002 at the Auburn University plant research facilities. A Marvyn sandy loam (fine-loamy, siliceous, thermic typic kanhapludults) soil was used in all tests. A mechanical soil mixer was used to incorporate 5 g portions of fungal inoculum with 500 g of field soil to obtain an inoculum concentration of 1% (w/w). Inoculum of *R. reniformis* was adjusted to 2000 juvenile and vermiform adult nematodes per 500 cc of soil. Infested and non-infested (control) soils were distributed to 10 cm diameter polystyrene pots. Surface sterilized germinated cotton cv. Paymaster PM 1218BG/RR seeds (radicle 1 cm in length) were placed on the soil surface in each pot and covered with 2.5 cm of the appropriate soil. Each experimental unit was replicated five times in a randomized complete block design with a factorial arrangement of treatments on a greenhouse bench. Parameters measured bi-weekly included cotton seedling survival and height. Disease severity, root and shoot dry weight, and *R. reniformis* populations were recorded at the end of 6 weeks concluding the termination of the experiment. This experiment was conducted three times.

Results and Discussion

There was no significant interaction between *R. reniformis* and seedling disease fungi for survival, height, disease severity, and shoot dry weight. For seedling survival counts determined at 14 days after planting (DAP), treatments containing *R solani* and *T. basicola* had significantly less plants compared to all other treatments. Every treatment except *F. chlamydosporum* and *F. semitectum* at 28 and 42 DAP had significantly fewer seedlings. Treatments containing *R. solani, T. basicola, F. oxysporum* f.sp. *vasinfectum,* and *F. moniliforme* displayed significantly shorter plants at 14, 28, and 42 DAP. Disease severity observed at 42 DAP was significantly greater for *R. solani* compared to all other treatments. *Fusarium oxysporum* f.sp**.** *vasinfectum***,** *F. moniliforme,* and *F. lateritium* treatments displayed significantly greater disease severity than the control with millet.

Shoot dry weights were recorded at 42 DAP, where treatments infested with *R. solani, T. basicola, F. oxysporum* f.sp. *vasinfectum, F. moniliforme* and *F. lateritium* resulted in significantly less shoot weight. There was a significant interaction between *R. reniformis* infested and non-infested soils for shoot dry weight. Cotton seedlings from the non-infested soil treatments yielded significantly higher shoot dry weight than seedlings from *R. reniformis* infested soil. Data recorded for root dry weights determined a significant interaction between fungal treatments and the presence of *R. reniformis*. The control and *F. semitectum* without *R. reniformis*, displayed significantly greater root dry weights than the control and *F. semitectum* with *R. reniformis*. Every treatment except *F. semitectum*, *F. proliferatum*, and *F. solani* yielded significantly lower root dry weights than the control without *R. reniformis*. Populations of *R. reniformis* recorded at 42 DAP were significantly lower in the presence of seedling disease fungi especially *R. solani, T. basicola*, *F. oxysporum, F. oxysporum* f.sp. *vasinfectum*, and *F. moniliforme*.

Table 1. Percent cotton seedling survival.

Treatment	**14DAP**	**28DAP**	**42DAP**
F.chlamydosporum	80%	80%	80%
F. equiseti	80%	60%	60%
F. lateritium	80%	60%	60%
F. moniliforme	80%	30%	30%
F. oxysporum	90%	70%	60%
F. oxysporum f.sp. *vasinfectum*	80%	70%	70%
F. proliferatum	80%	60%	40%
F. semitectum	100%	80%	80%
F. solani	90%	70%	60%
F. sporotrichioides	80%	70%	70%
R.solani	50%	30%	30%
T. basicola	50%	30%	30%
Control millet	100%	100%	100%
Control	100%	100%	100%
LSD=	20.0	30.0	30.0

Table 2. Cotton seedling height.

Treatment	14DAP	28DAP	42DAP
F.chlamydosporum	1.8	6.6	7.2
F. equiseti	1	7.5	10.1
F. lateritium	1.2	8	11.2
F. moniliforme	0.2	0.6	0.8
F. oxysporum	1.3	6.2	9.4
F. oxysporum f.sp. *vasinfectum*	0.2	0.6	1.5
F. proliferatum	0.9	2.4	2.8
F. semitectum	1.5	6.3	10.2
F. solani	1.3	5.4	7.8
F. sporotrichioides	1.1	9.5	12
R.solani	0.6	1.6	2.5
T. basicola	0.6	3	4
Control millet	1.9	8.6	11.7
Control	1.7	9.9	13.4
LSD=	1.1	2.4	3.3

Table 3. Disease severity.

Treatment	42DAP
F.chlamydosporum	1
F. equiseti	1.2
F. lateritium	1.25
F. moniliforme	1.55
F. oxysporum	1.05
F. oxysporum f.sp. *vasinfectum*	1.5
F. proliferatum	1
F. semitectum	1.15
F. solani	0.9
F. sporotrichioides	0.9
R.solani	2.4
T. basicola	1.15
Control millet	0.85
Control	0.55
LSD=	0.67

Table 4. Cotton seedling shoot dry weight in grams.

Treatment	42DAP
F.chlamydosporum	2.08
F. equiseti	2.13
F. lateritium	1.83
F. moniliforme	1.96
F. oxysporum	2.19
F. oxysporum f.sp. *vasinfectum*	1.65
F. proliferatum	2.31
F. semitectum	2.54
F. solani	2.39
F. sporotrichioides	2.08
R.solani	1.7
T. basicola	2
Control millet	2.15
Control	2.2
LSD=	0.52

Table 5. Cotton seedling root dry weight in grams.

Treatment	**+ *R. reniformis***	**- *R. reniformis***
F.chlamydosporum	1.48	1.64
F. equiseti	1.75	1.6
F. lateritium	1.22	1.34
F. moniliforme	1.35	1.4
F. oxysporum	1.52	1.49
F. oxysporum f.sp. *vasinfectum*	1.17	1.54
F. proliferatum	1.09	2.06
F. semitectum	1.33	2.56
F. solani	1.56	2.01
F. sporotrichioides	1.79	1.81
R.solani	1.17	1.42
T. basicola	1.52	1.53
Control millet	1.44	1.76
Control	1.56	2.44
LSD=	1.21	