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THIELAVIOPSIS BASICOLA AND *ROTYLENCHULUS RENIFORMIS* AS INDEPENDENT OR INTERACTIVE PATHOGENS ON COTTON IN DIFFERENT SOIL TYPES

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Abstract

Five different Mississippi s soils (Bosket silty loam, Brooksville silty clay loam, Caledonia sandy loam, Grenada silty loam and Sharkey silty loam), were examined to determine disease severity and plant health on cotton in the presence of *T. basicola* and *R. reniformis* . Reductions in seedling survival, dry weight, and plant height occurred for the concomitant treatments. Disease severity, as measured by hypocotyl and root disease indices, and final population trends for both pathogens were similar. In biotron studies, *R. reniformis* was significantly increased in the presence of the fungus on Caledonia soil, but in the field plots only on Bosket and Grenada soils. No differences in fungal reproduction were detected in the field study, but in the biotron, final fungal populations were higher in the presence of the nematode on Bosket and Caledonia soils. Yield measured in the field plots was significantly higher in the control treatments on Bosket, Grenada, and Brooksville soils.

Introduction

Parasitic relationships involving soilborne microorganisms on field crops are common. Fungi and nematodes may develop complex, interactive associations with plant roots. Each year, nematode and fungal pathogens cause considerable losses as independent pathogens. The potential interactive association of these pathogens could result in further yield losses. The reniform nematode alters the structure and physiology of plant roots and play an important role in the pathogenesis of fungi such as *Thielaviopsis basicola*.

Interactions between the reniform nematode and plant pathogenic fungi have been investigated for many disease complexes. The effects of root-rot and wilt diseases of cotton caused by *Fusarium oxysporum*, *Rhizoctonia solani* and *Verticillium dahliae* are all increased in the presence of the reniform nematode. However, little attention has been placed on the reproduction dynamics of the pathogens involved. Root damage by nematodes, subsequent changes in root physiology, and edaphic factors appear to be responsible for the increase in disease severity and or populations of many fungi.

Thielaviopsis basicola and the reniform nematode have been reported on many different soil types. Reproduction of both pathogens prefer heavier, clay-based soils. High soil pH and soil chemical factors related to soil pH, including high cation exchange capacity, base saturation, and calcium and aluminum ion concentrations also increase disease severity for black root rot. However, there are reports of no consistent relationship between the reniform nematode and soil texture or pH.

Recent surveys have indicated that *T. basicola* is often found in association with many nematode species and many different soil types. Yet, the relationship between *T. basicola* and the reniform nematode has not been investigated. The objectives of our study were first, to determine the severity of disease caused by *T. basicola* and *R. reniformis* when acting independently or concomitantly and secondly, to determine this relationship in different soil types.

Materials and Methods

Tests were conducted in a biotron and in the field using Delta and Pine Land (DPL) 50 cotton. The experiments were arranged in a split-plot design. Five replications per treatment were planted. Results were subjected to an analysis of variance, and means were separated with Fisher's protected least significant difference test.

Five soil types, Bosket silty loam, Brooksville silty clay loam, Caledonia sandy loam, Grenada silty loam and Sharkey silty loam were used in this study. Treatments were: 1) an uninoculated control, 2) *T. basicola* and reniform nematode, concomitantly at planting, 3) *T. basicola* inoculum, alone at planting, and 4) reniform nematode alone at planting.

A population density of 5000 reniform juveniles and eggs per 500 cc of soil were used as nematode inoculum. Endoconidial concentration of 200 propagules per gram of soil was used for *T. basicola*. Soil was placed into 2000 cm^3/pots, and five seeds planted.

Measurements recorded included seedling survival, plant height, shoot dry weight, hypocotyl and root disease indices and final quantification of populations of each pathogen. Hypocotyl and root disease indices were assigned on scales ranging from one to five where: 1 = no symptoms, 2 = few pinpoint lesions or diffuse discolored areas, 3 = distinct necrotic lesions, 4 = girdling lesions, and 5 = dead seedling. The root disease index was: 1 = no symptoms, 2 = 1-10% of the root system discolored, 3 = 11-25% discolored, 4 = 26-50% discolored, and 5 = 51-100% discoloration. Surviving seedlings were counted at 14 DAP. Reniform nematodes were extracted by gravity screening and centrifugal flotation. Quantification of *T. basicola* utilized a pour-plate procedure and TB-CEN media.

In the field plant growth and development measurements were taken throughout the experiment. Seedling survival was determined at 21 days after planting and plants were rated for disease severity. Yields were harvested at maturity.

<u>Results</u>

Biotron test -Significant differences were detected for plant dry weight, hypocotyl disease ratings, and final populations due to soil type and treatment. Throughout all soil types, the control produced more dry weight than the other treatments, while the concomitant treatment was consistently lowest. No differences in dry weights were found with respect to the different soil types.

Differences due to soil type and treatment were found for the hypocotyl disease indices. The Grenada soil which had a significantly lower hypocotyl disease rating.

No differences were detected for final nematode populations in treatments with the nematode present. The only difference, due to soil type alone, was where Nematode reproduction was significantly increased in the Caledonia soil.

The reniform nematode reduced seedling survival in Grenada soil and *T. basicola* reduced seedling survival in the Brooksville soil. Plant height was tallest in the control treatments and the Bosket and Grenada soils. Cotton plant height in the concomitant treatment were significantly shorter than the nematode alone in all but the Brooksville soil.

Field test -Treatments containing *T. basicola* (*T. basicola* alone and in combination with the reniform) significantly reduced seedling survival compared to the control. The reniform nematode did not affect seedling survival in this study. Similarly, *T. basicola* alone and in combination with the reniform nematode reduced the number of nodes above the first white flower, average number of fruiting branches, and bolls per plant compared to the control. The reniform nematode reduced the average number of fruiting branches and the number of bolls per plant compared to the control. Plants with the *T. basicola* and concomitant inoculum had higher hypocotyl and root disease indices. Rootdisease indices were higher when both pathogens were present than for *T. basicola* alone. The percent fruit retention of the first fruiting position was reduced, compared to the control, when both pathogens were present.

Plant height was taller in the control than all other treatments. *Thielaviopsis basicola* and the reniform nematode alone or together, reduced yield of cotton in all soils tested. Root disease indices were higher when both pathogens were present than for *T. basicola* alone. The percent fruit retention of the first fruiting position was reduced, compared to the control, when both pathogens were present.

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