Relationship between Stemphylium vesicarium and onion thrips (Thrips tabaci) in the development of Stemphylium leaf blight disease

Ashley Leach¹, Frank Hay², Riley Harding¹, and Brian Nault¹

¹ Department of Entomology, Cornell University, Cornell Agitech, 630 W. North Street, Geneva, NY 14456, ² Plant Pathology and Plant-Microbe Biology Section, School of Integrative Plant Science, Cornell University, Cornell Agitech, 630 W. North Street, Geneva, NY 14456

Introduction

- Stemphylium leaf blight, caused by the fungal pathogen Stemphylium vesicarium, is an emerging foliar disease of onion in northeastern North America, and can cause yield reductions upwards of 85% (Fig. 1a)³⁻⁴.
- Onion thrips (Thrips tabaci) is a significant insect pest of onion and feeds directly on onion leaf tissue which reduces bulb yield and causes premature leaf senescence (Fig. 1b)⁴⁻⁵.
- Onion thrips have previously been shown to interact with certain plant pathogens to exacerbate plant disease, notably the foliar pathogen, Alternaria porri, which causes purple blotch in onions⁶.
- The potential relationship between onion thrips and Stemphylium leaf blight is unknown and may provide insight into managing the disease in the field.

Objectives

1) Determine impact of thrips feeding on the severity of Stemphylium leaf blight disease

1) Determine if Thrips tabaci can passively transfer Stemphylium vesicarium conidiospores to onion

Materials and Methods

Effect of thrips feeding on the colonization of Stemphylium vesicarium and severity of Stemphylium leaf blight. Onions (cv. ‘Alisa Craig’) were grown free of thrips and S. vesicarium in a controlled greenhouse and infested with onion thrips when onions had 5 leaves. After one week, thrips feeding damage was quantified into three groups, “no damage (all leaves without thrips feeding)”, “low damage (leaves have 10-20% feeding damage)”, and “high damage (leaves have >80% damage)” (Fig. 2). Plants from each damage group were inoculated with S. vesicarium conidiospores. Inoculating spore suspension was 300 ml with a mean conidial count of 19,000/ml. Plants from each damage class were also inoculated with Type 2 water as a negative control. The amount of dead tissue was measured (cm) on every leaf weekly for two weeks. After two weeks, plants were individually incubated for 48 hours in plastic bags, and the total area colonized by S. vesicarium measured (cm²) using a dissecting microscope. Trials consisted of 15 plants per treatment, and trials were replicated 3 times for a total of 45 plants per treatment.

Capacity of an individual onion thrips to physically transfer Stemphylium vesicarium to onion plants. Onion thrips were placed on an agar plate with S. vesicarium for 30 minutes, individually placed into 10µl tubes, and transferred singly to thrips-proof cages containing one healthy onion plant. Negative controls containing thrips exposed to only V8 agar were also transferred onto healthy onion plants in thrips-proof cages. After two weeks, all plants were removed, incubated for 48 hours in plastic bags, and examined under a dissecting microscope to determine if S. vesicarium colonized the tissue. Trials consisted of 30 plants per treatment, and were replicated 2 times for a total of 60 plants per treatment.

Results

Effect of thrips feeding on the severity of Stemphylium leaf blight disease

Mean (±SE) percent leaf dieback in onions inoculated with S. vesicarium and in an untreated control within three different levels of thrips damage, ‘No damage’, ‘Low Damage’, and ‘High Damage’. Mean (±SE) percent leaf dieback in onions inoculated with S. vesicarium and in an untreated control within three different levels of thrips damage, ‘No damage’, ‘Low Damage’, and ‘High Damage’. The potential relationship between onion thrips and Stemphylium leaf blight is unknown and may provide insight into managing the disease in the field.

Conclusions

1) Stemphylium colonization and Stemphylium leaf blight disease were significantly impacted by onion thrips feeding. Greater disease and colonization of S. vesicarium was recorded in treatments with thrips feeding. Effective onion thrips control throughout the season may significantly reduce levels of Stemphylium leaf blight.

2) In laboratory assays, only 6.6% of total plants were infected with S. vesicarium after being exposed to thrips with S. vesicarium, which indicates that thrips may be an insignificant factor in transferring S. vesicarium. However, this study only examined the effect of a single thrips, and greater densities of thrips may increase the likelihood of S. vesicarium infection.

3) Further study is underway to better understand how thrips control could reduce Stemphylium leaf blight disease in commercial onion fields.

References