

Purdue University
Department of Entomology
Undergraduate Capstone
Project Summary

Name of Student:

Katherine Wells

Name of Mentor:

Dr. Doug Richmond

Name of Academic Advisor:

Dr. Christian Oseto

Project Title:

Influence of tall fescue endophytes on feeding and survival of several sod webworm species

Project Summary:

The main goal of this project was to examine how tall fescue cultivar and endophyte strain influence feeding behavior and survival of four common sod webworm species. Sod webworms are an important pest of turfgrass. Tall fescue is important because it has lower fertility requirements and better drought tolerance than most other cool-season turfgrasses. Tall fescue also possesses greater shade tolerance and the development of dwarf varieties require less mowing. Another important biological property of tall fescue is that it often contains the fungal endophyte *Neotyphodium coenophialum*. *Neotyphodium* endophytes are symbiotic fungal mutualists of many cool seasonal grasses. They are found in the leaf and stem tissue of the plant and help the plant by providing defensive compounds. They also help improve resistance to diseases and enhance nutrient acquisition. There are alkaloids that are associated with endophytes that provide insect resistance. The only problem is that some of these alkaloids are toxic to mammals as well as insects. Some examples of the different alkaloids are ergovaline, lolitrem, lolines, and peramine. Ergovaline and lolitrem are toxic to mammals and insects while lolines and peramine are toxic to just insects. Alkaloid types and concentrations are a product of plant cultivar and endophyte strain. There were two cultivars of turfgrass used in the current study: Goalkeeper and Jesup. One line of Goalkeeper was endophyte free while another line had endophytes. There were three lines of Jesup that were used. One line was endophyte free, another had a New Zealand strain of endophyte called 542, and the last line had a New Zealand strain of endophyte called 584. The Goalkeeper infected with endophytes contains ergovaline and so it is toxic to insects and mammals. The endophytes in the two Jesup lines contain lolines and peramine so they should be toxic to just insects. It is unclear if endophyte strains that do not produce vertebrate toxins will be effective against sod webworms and the susceptibility of different sod webworm species to endophyte-mediated resistance is unknown.

Materials and Methods

Moist filter paper was placed in the bottom of a small (5.0 cm diameter) Petri dish. Each Petri dish then received four 2 cm long clippings of one of five different tall fescue lines (Goalkeeper E- and E+, Jesup E-, Jesup 542 and Jesup 584) and five newly emerged larvae of each of four different sod webworm species (*Parapediasia teterrella*, *Fissicrambus mutabilis*, *Pediasia trisecta*, and *Agriphila vulgivagella*). After 24 hours, the settling response was determined by recording number of larvae that have settled on and started to feed on the grass. Observations were made every day to make sure the grass was in good condition and the filter paper stayed moist. Survival rates of the sod webworms were observed after five days. There were a total of 10 replicates for each combination of sod webworm species and grass line.

Results

P. trisecta had the highest settling response at 24 hours, whereas *A. vulgivagella* had the lowest settling response (Fig 1). This was regardless of grass line or endophyte strain. After 24 hours the different species of sod webworms had the highest percent settling on the goalkeeper grass without the endophytes (Fig. 2). This settling response was greater in number than any other except the goalkeeper with endophytes. The settling response varied between the grass lines. After five days, percent survival on different grasses varied the most with *P. teterrella* (Fig. 3). Survival not only varied within the webworm species but also within the different grass lines. Goalkeeper infected with endophytes had some of the lowest overall survival rates.

Conclusions

Settling response is not necessarily a good predictor of host suitability for sod webworms. Both the plant line and endophyte strain may influence sod webworm performance, but the response of individual sod webworm species may vary in this regard. Endophyte strains that produced ergovaline significantly reduced survival of three out of the four sod webworm species. The endophyte strains that did not produce ergovaline provided much more variable results. A more detailed analysis of the specific alkaloid profiles associated with these plant lines is needed.

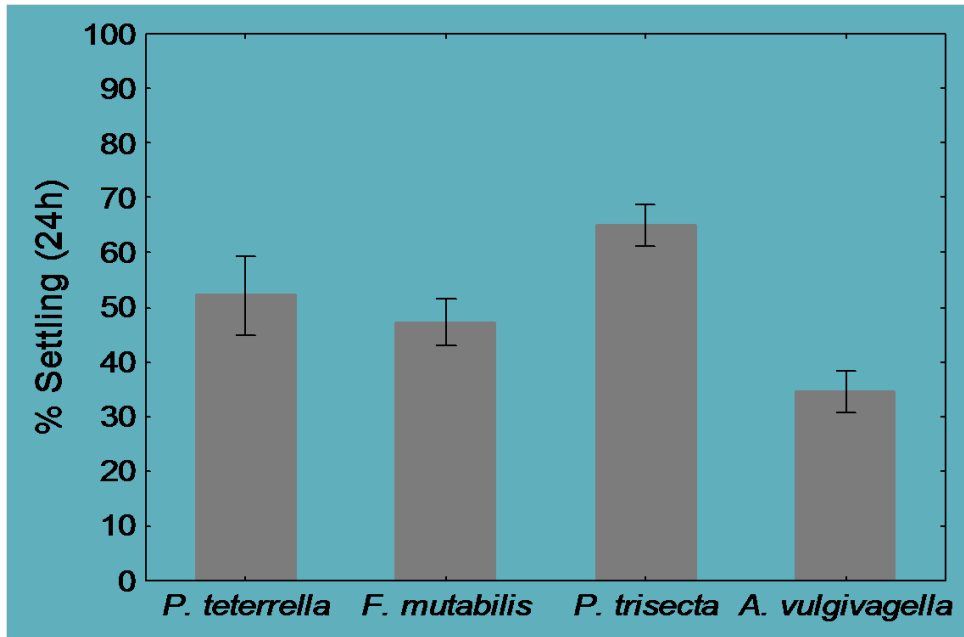


Figure 1. 24 h settling response (% settling) of four different species of sod webworm larvae on tall fescue.

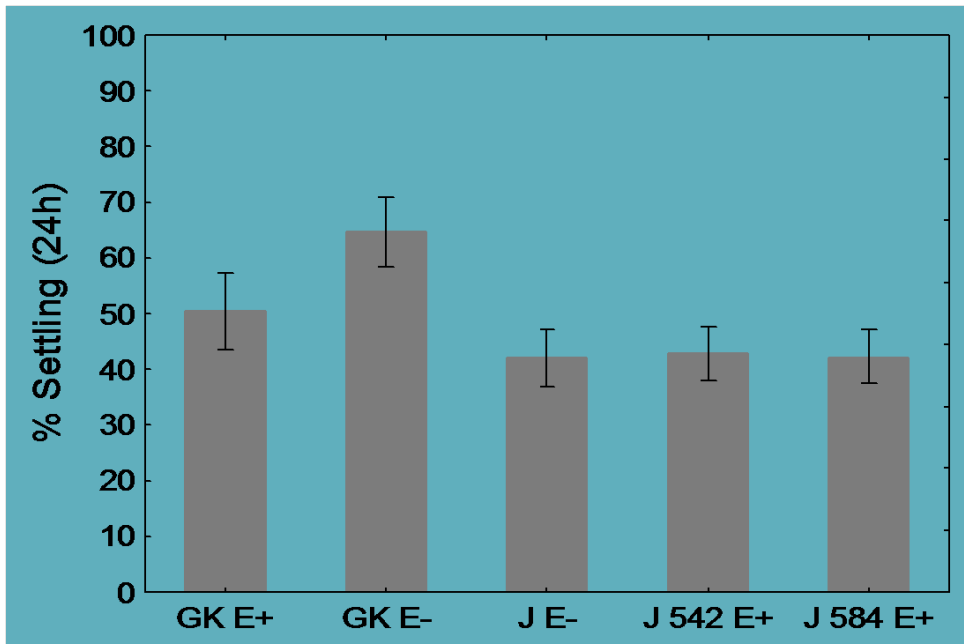


Figure 2. 24 h settling response (% settling) of sod webworm larvae on five different tall fescue lines.

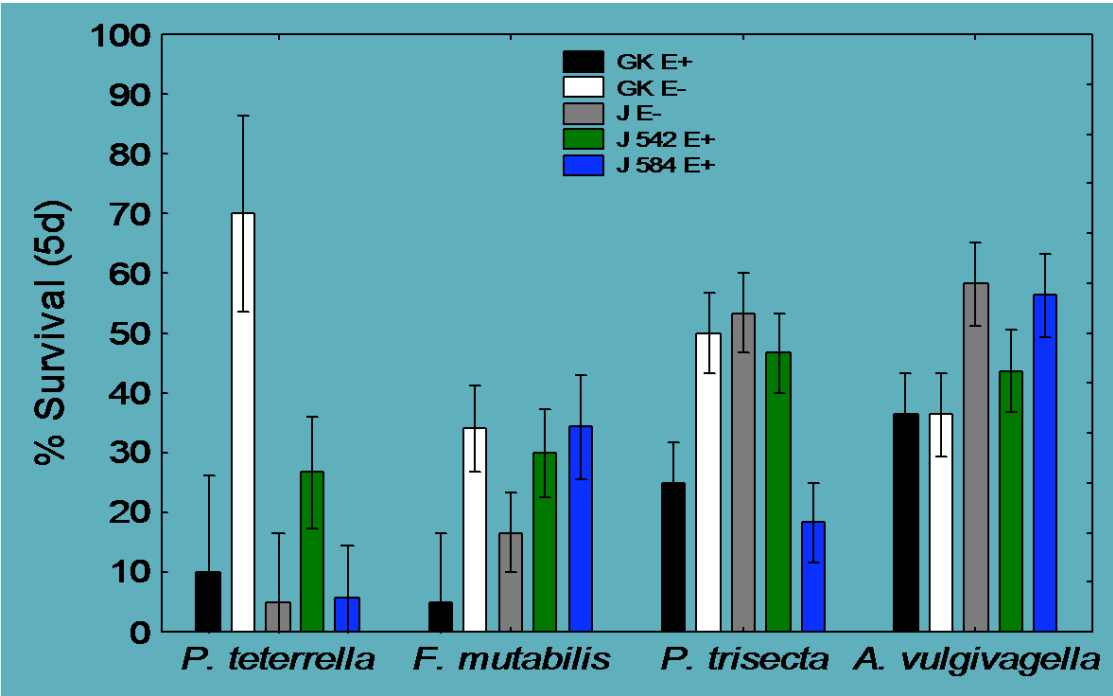


Figure 3. Survival of four different species of sod webworm larvae on five different lines of tall fescue.