Endophyte-mediated resistance against winter cutworm, *Noctua pronuba* in cool-season turfgrass

Pear Intasin[1], Navneet Kaur[1]
Nicole Anderson[1]*, Alec Kowalewski[1],
Alison Willette[1], and Hannah Rivedal[2]
[1]Oregon State University
[2]USDA-ARS Forage Seed and Cereal Research Unit

1. Introduction

Oregon produces 70% of the world's cool season grasses. These grasses are subject to feeding by gregarious pests like the winter cutworm (*Noctua pronuba*). Chemical control options are limited. Endophytes can confer insect resistance and could be a novel management strategy in the grass seed cropping system.

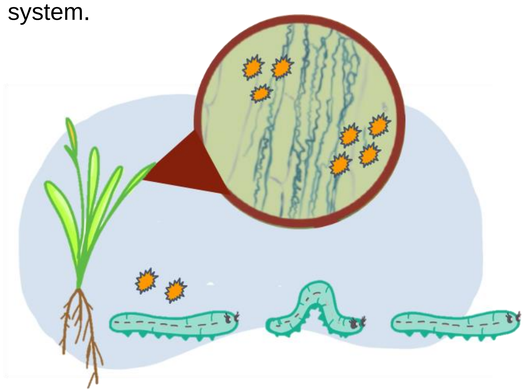

Figure 1. Conceptual diagram illustrating the relationship of the fungal endophyte *Epichloë* and cool-season turfgrass species, which offers insect deterrence benefits to host grass (tall fescue and perennial ryegrass) through the biosynthesis of mycotoxins.

Research Objective

- Evaluate host plant resistance in terms of *N. pronuba* response (Figure 1) in no-choice assays using four commercial perennial ryegrass and tall fescue cultivars with varying endophyte infection levels
- Our research hypothesis (Table 1) was tested in cool-season turf grass systems against *N. pronuba* (Figure 2). Cultivars were acquired from seed companies, affirming initial endophyte infection status. Systemic fungicide treatments were included to determine *N. pronuba* response upon *Epichloe* eradication

Table 1. Testing parameters and hypotheses

Endophyte level	Parameters			
	Insect Mortality (%)	Insect Weight Gain (g)	Grass Biomass (g)	Feeding damage (Green area)
High	↑	↓	↑	↓
Low	↓	↑	↓	↑

2. Methods

- Two no-choice bioassays (trials 1 and 2) were conducted. Five second to third instar *N. pronuba* were added to the plastic containers containing five grass plants of the same cultivar. *Noctua pronuba* larvae were allowed to feed on the grasses for 14 days
- Insect mortality data were collected at 3 day intervals, and final measurements of insect mortality, weight gain, grass biomass, and feeding damage were measured at the end of the experiments

3. Results

- Preliminary results indicated no significant difference in mean insect mortality and weight gain between grass cultivars with high endophyte infection and those with low endophyte infection for both tall fescue and perennial ryegrass at day 14 of trial 1 (Figure 3)
- No treatment effect i.e., fungicide treatment to eradicate endophytes, grass species, and endophyte infection level, on insect mortality and feeding damage were observed (P>0.05, Table 2)

Figure 2 – Study system

Perennial ryegrass *Lolium perenne*

Tall fescue *Schedonorus phoenix* (Scop.) Holub

Winter cutworm *Noctua pronuba,* Lepidoptera: Noctuidae

Figure 3 Insect mortality and weight gain – Trial 1

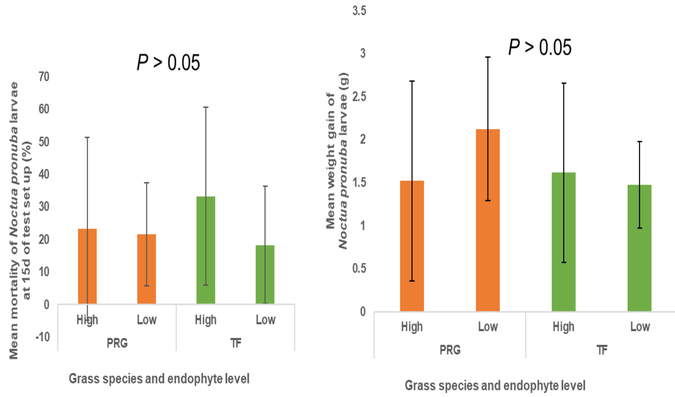

Figure 3. Response of *N. pronuba* to endophyte incidence of perennial ryegrass and tall fescue cultivars in terms of mortality and weight gain after 14 d of release in no-choice experiment (trial 1).

Table 2. GLMM output for insect mortality and green area change

Trial	Variables	Fixed effect	*P*
Trial 2	Insect Mortality	Treatment	> 0.05
		Species	> 0.05
		Endophyte incidence	> 0.05
		Treatment x Species	0.027
		Treatment x Endophyte	0.026
		Species x Endophyte	0.026
		Treatment x Species x Endophyte	0.00117
	Green Area Change	Treatment	> 0.05
		Species	> 0.05
		Endophyte incidence	> 0.05
		Treatment x Species	> 0.05
		Treatment x Endophyte	> 0.05
		Species x Endophyte	0.041
		Treatment x Species x Endophyte	> 0.05

4. Summary and Next Steps

- The next step is to confirm the differences between endophyte infection levels of plant samples used in this study using PCR methods and determine their relationships to *N. pronuba* feeding. The results will help inform if the grass-endophyte association can be practically utilized for *N. pronuba* control in turf systems

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