Purdue University
Department of Entomology
Undergraduate Capstone
Project Summary

**Name of Student:**

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**Name of Mentor:**

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**Name of Academic Advisor:**

Dr. Alan York

**Project Title:**

Screening for endophyte-mediated resistance to fall armyworm

**Project Summary:**

Objective:

To characterize the insect resistance provided by several novel grass cultivars x endophyte combinations that do not produce vertebrate toxins.

Methods:

Two grass species were used which were Perennial Ryegrass and Tall Fescue. There were 13 cultivar x endophyte combinations from each of the grass species that were grown in the greenhouse (Table 1.1 and Table 1.2). From these plants, clippings were provided ad libitum to groups of 10 neonate Fall armyworm larva in Petri dishes. Each cultivar x endophyte combination (treatment) was replicated three times in each of the three trials (blocks). The response variables were 24h settling response, survival at 4 and 7 d, and the final larval mass.

Results:

For perennial ryegrass, cultivar x endophyte combination had a significant influence on FAW survival at 4d and 7d however; it did not influence 24h settling response or larval mass. Survival at 4d was lowest on the cultivar/endophyte combinations D3 and D5 (Fig. 1.1). Survival at 7d was the lowest for combinations B2 and D5, but there was no statistical difference between these combinations and multiple other combinations (Fig. 1.2). Survival at 7d was significantly higher for A1, C2, D2, F3, and D4. Cultivar B contained the endophyte 2 whereas cultivar D contained endophyte 5. Endophyte 2 was present in two additional cultivars that did not perform as well as B2 suggesting that cultivar had a significant influence on the expression of resistance. Quantification of the alkaloid profiles associated with the different grass x endophyte combinations may prove useful for further interpretation of results.

For tall fescue, plant cultivar x endophyte combination had a significant influence on 24h settling response and larval survival at 4d and 7d, but it did not influence larval mass. Combination K12 had the greatest impact on 24h settling response (Fig. 1.3) whereas K12 and IE- both resulted in the lowest larval survival at 4d (Fig. 1.4). The same pattern of larval survival was observed at 7d with K12 and IE- resulting in the lowest survival rates (Fig. 1.5). Although differences were not statistically significant, mean larval mass was also lowest on K12 and IE-. Endophyte 12 was also present in two additional cultivars that did not significantly reduce larval performance, again indicating the potential importance of grass cultivar in mediating insect resistance. One of the more interesting results was that even though cultivar I was endophyte free, it was able to significantly reduce larval performance compared to other cultivars. This finding may indicate potential differences in the nutritional value of the different grass cultivars that, aside from endophyte infection, may have significant impacts on larval performance.

Conclusions:

In both grass species (PR and TF) resistance was a function of cultivar and endophyte strain. The experiment provided information on some potentially useful cultivar x endophyte combinations for management of FAW. However more work is still needed to characterize alkaloid levels and plant characteristics which may account for some observations.

Table 1.1

| Cultivar | Endophyte | Alkaloids |
|---|---|---|
| A | 1 | n/d |
| B | 2 | P |
| C | 2 | P |
| D | 2 | P |
| D | 3 | n/d |
| E | 3 | n/d |
| F | 3 | n/d |
| D | 4 | n/d |
| D | 5 | n/d |
| D | 6 | P |
| D | 7 | P |
| D | 8 | E, P |
| D | E- | 0 |

Thirteen cultivar x endophyte combinations of perennial ryegrass used to screen for resistance against fall armyworm. The alkaloids produced by each combination are shown.

Table 1.2

| Grass | Endophyte | Alkaloids |
|---|---|---|
| G | 9 | n/d |
| H | 10 | P |
| I | 10 | P |
| I | 11 | P,L |
| J | 12 | P,L |
| K | 12 | P,L |
| I | 12 | P,L |
| I | 13 | P,L |
| L | 13 | P,L |
| I | 14 | n/d |
| I | 15 | P,L |
| I | E- | 0 |
| M | 16 | E, P, L |

Thirteen cultivar x endophyte combinations of tall fescue used to screen for resistance against fall armyworm. The alkaloids produced by each combination are shown.

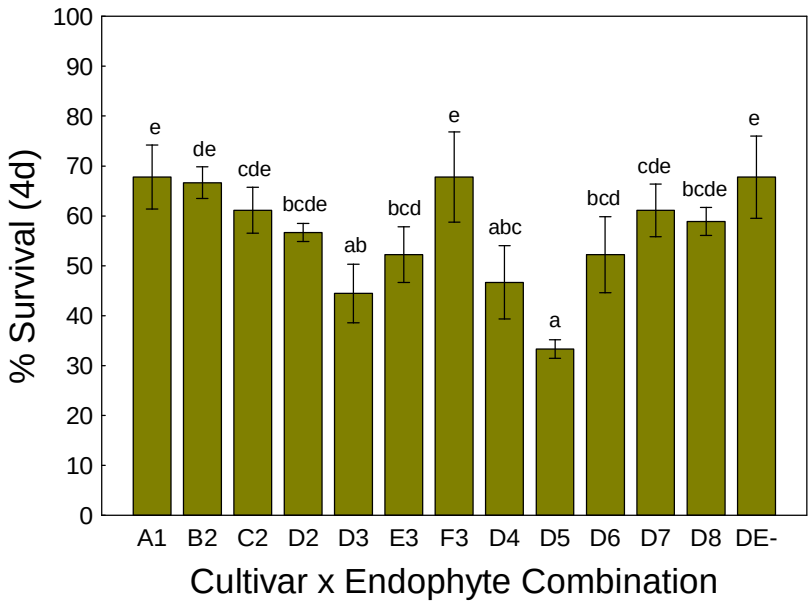


**Figure 1.1.** Fall armyworm survival at 4d on clippings from 13 different cultivar x endophyte combinations of perennial ryegrass.

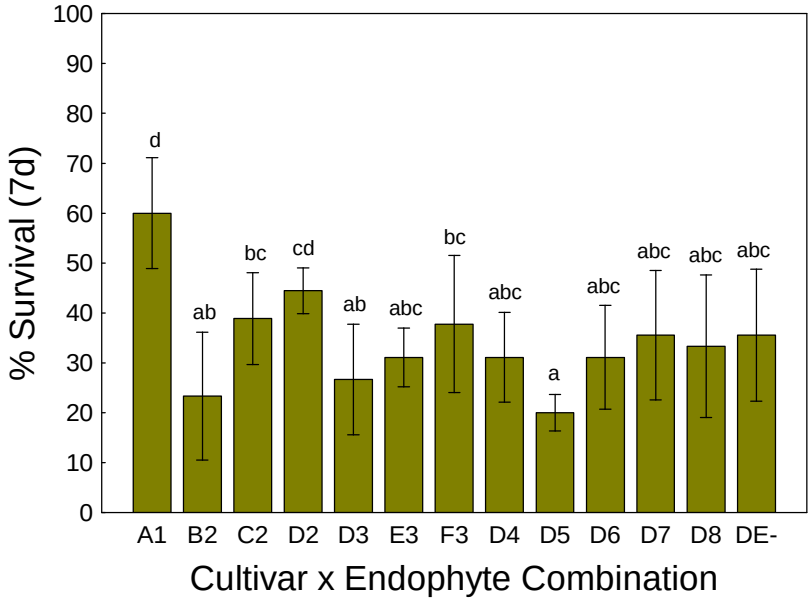


**Figure 1.2.** Fall armyworm survival at 7d on clippings from 13 different cultivar x endophyte combinations of perennial ryegrass.

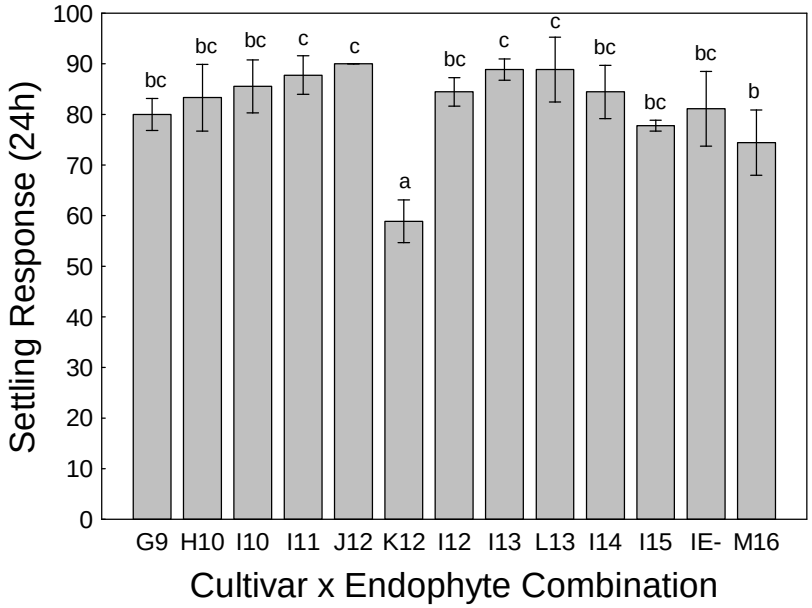


**Figure 1.3.** Twenty four hour settling response of neonate fall army worm larvae associated with 13 different cultivar x endophyte combinations of tall fescue. Settling response was determined as the percentage of larvae (n=10) residing on clippings from each type of plant material after 24h in non-choice Petri dish assays.

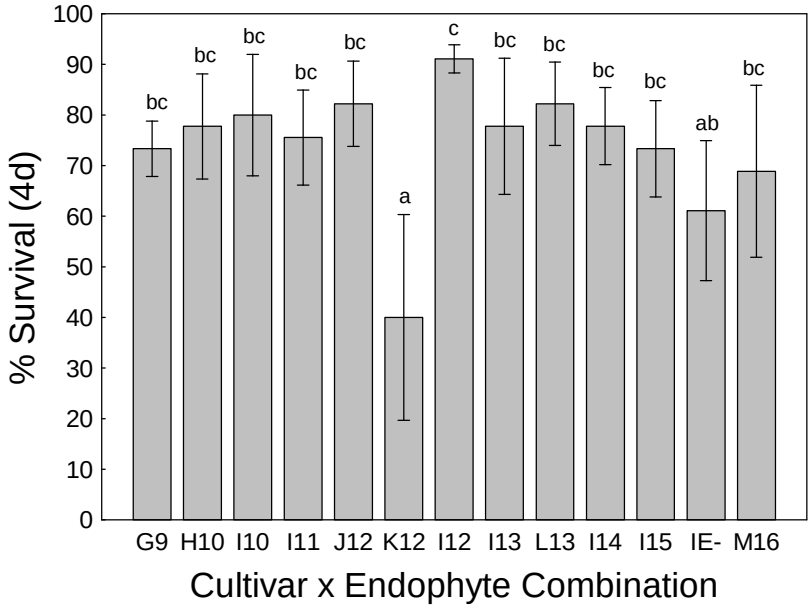


**Figure 1.4.** Fall armyworm survival at 4d on clippings from 13 different cultivar x endophyte combinations of tall fescue.

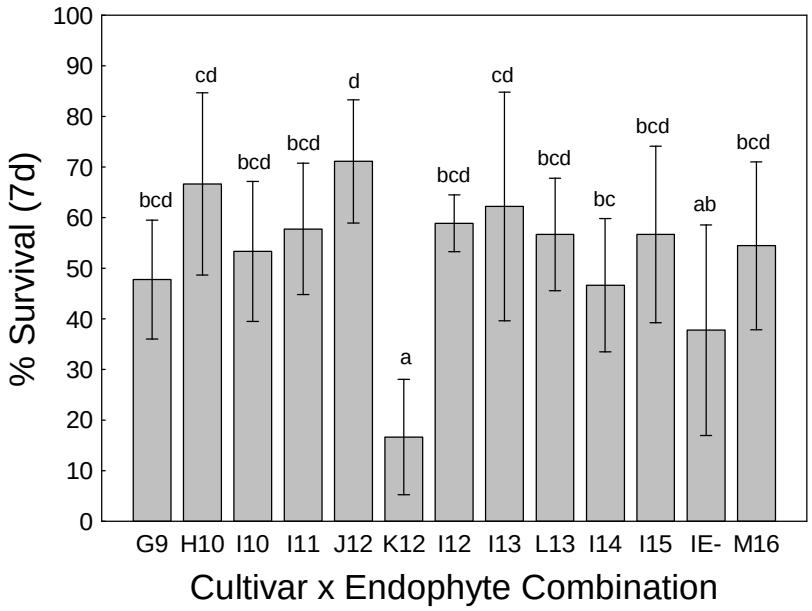


**Figure 1.5.** Fall armyworm survival at 7d on clippings from 13 different cultivar x endophyte combinations of tall fescue.