Fungal alkaloid occurrence during seedling establishment and early growth in *Lolium perenne* seedlings infected with *Epichloë festucae* var. *lolii* and the influence of adult Argentine stem weevil (*Listronotus bonariensis*) feeding on alkaloid concentrations

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Abstract

Fungal endophytes of the genus *Epichloë* often form stable, symbiotic, and mutualistic relationships with grasses of the Pooideae, including perennial ryegrass (*Lolium perenne* L.). The endophyte provides various benefits to its grass host, through the production of secondary metabolites, which are exploited in New Zealands pastoral agriculture systems. The endophyte can give its host grass an ecological advantage in certain challenging environments, such as during seedling establishment, where young plants are especially vulnerable to insect predation, such as feeding by adult Argentine stem weevil (ASW, *Listronotus bonariensis*).

This thesis focuses on understanding the alkaloid concentrations that occur in endophyte-infected perennial ryegrass seedlings during the early establishment phase. A glasshouse experiment was conducted in which fungal alkaloid concentrations (peramine, lolitrem B, ergovaline, and epoxy-janthitrems) were measured in perennial ryegrass seedlings infected with *Epichloë festucae* var. *lolii* strains AR1, AR37, NEA2, and NZ_{CT} for 69 days after sowing. From the data it is inferred that an initial translocation of alkaloids stored in seed during maturation into the developing shoot of the germinating seedling occurs, followed by a period of alkaloid dilution due to seedling expansion, and finally production of newly metabolised alkaloids in the plant. Alkaloid concentration were found to peak in 8–10 day old seedlings, giving the seedling a "kick start" in protection of the emerging seedling from adult ASW feeding during the first 11 days after sowing.

The influence of adult ASW feeding on alkaloid concentrations in endophyte-infected perennial ryegrass seedlings was also tested. The study demonstrated that adult ASW feeding can influence alkaloid production, although peramine, the main alkaloid responsible for adult

ASW deterrence was not significantly affected. Findings from this thesis improve understanding of the role of fungal alkaloids in endophyte-infected perennial ryegrass seedlings during establishment, and help explain results from earlier studies describing seedling susceptibility to adult ASW.

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Table of contents

Abstract ..... **i**
Acknowledgements ..... **iii**
Table of contents ..... **iv**
List of figures ..... **vii**
List of tables ..... **x**
List of appendices ..... **xii**
Chapter 1 Introduction & literature review **1**
1.1 Perennial ryegrass pastures 3
1.2 *Epichloë* endophytes 6
1.2.1 Taxonomy 6
1.2.2 Biology of asexual *Epichloë* endophytes 7
1.2.3 Symbioses 9
1.3 Secondary metabolites 10
1.3.1 Peramine 11
1.3.2 Lolitrem B 12
1.3.3 Ergovaline 13
1.3.4 Epoxy-janthitrems 14
1.4 Agricultural use of asexual *Epichloë* endophytes 15
1.5 Pasture renewal and seedling establishment 20
1.6 Alkaloids in seed and seedlings 21
1.7 Objectives and thesis aims 23
1.8 Thesis structure 25
Chapter 2 General Materials and Methods **26**
2.1 Cultivars 26
2.1.1 One50 26
2.1.2 Trojan 26

2.2 Endophyte strains 27
2.3 Tissue print immuno blot method of endophyte detection 28
2.4 Alkaloid extractions 29
2.5 Data processing 32
Chapter 3 Alkaloid concentrations in perennial ryegrass seedlings infected with *E. festucae* var. *lolii* 33
3.1 Introduction 33
3.2 Materials and Methods 35
3.2.1 Experimental design 35
3.2.2 Seed experiment 36
3.2.3 Petri dish experiment 36
3.2.4 Grow-out experiment 37
3.2.5 Endophyte alkaloid analysis 39
3.2.6 Statistical data analysis 39
3.3 Results 41
3.3.1 Endophyte infection frequencies 41
3.3.2 Fungal alkaloid occurrence in endophyte-infected seedlings 42
3.3.2.1 Peramine 45
3.3.2.2 Lolitrem B 47
3.3.2.3 Ergovaline 50
3.3.2.4 Epoxy-janthitrems 52
3.3.3 Glasshouse temperatures 54
3.4 Discussion 55
Chapter 4 Influence of adult ASW feeding on alkaloid production in *E. festucae* var. *lolii* infected perennial ryegrass seedlings during establishment 64
4.1 Introduction 64
4.2 Materials and Methods 67
4.2.1 Insect material 67
4.2.2 Experimental design 68
4.2.3 Statistical data analysis 70
4.3 Results 72
4.3.1 Influence of adult ASW feeding on alkaloid concentration 72
4.3.1.1 Peramine 73

4.3.1.2 Lolitrem B....74
4.3.1.3 Ergovaline....76
4.3.1.4 Epoxy-janthitrems....77
4.3.2 Shoot dry matter....78
4.3.3 Glasshouse temperature....79
4.4 Discussion....80
Chapter 5 General Discussion....83
Chapter 6 Conclusion....91
Appendices....93
References....102

List of figures

Figure 1.1: Growth characteristics of perennial ryegrass (Lolium perenne L.); a) The base of the tiller is purple to bright red, b) The leaves are hairless, smooth, narrow dark-green, which are shiny on the underside, c) short ligule and small auricles, d) inflorescences are awnless spikes. 4
Figure 1.2: Life cycle of asexual Epichloë endophytes (Figure modified from Dapprich (1996)). 8
Figure 1.3: Chemical structures of alkaloids produced by asexual Epichloë endophytes. Epoxy-janthitrem structure shows the basic structure of the five main epoxy-janthitrem compounds. Modified from (Johnson, et al., 2013). 11
Figure 2.1: Data processing of epoxy-janthitrem peaks using Chromeleon 7 software. 32
Figure 3.1: Harvesting 10-day old perennial ryegrass seedlings infected with E. festucae var. lolii strain AR37, which had been germinated in petri dishes, for alkaloid analysis. 37
Figure 3.2: Harvesting 13-day old perennial ryegrass seedlings infected with E. festucae var. lolii strains AR1, AR37, NEA2, and NZ_{CT} from the grow-out experiment for alkaloid analysis into 2 mL screw cap vials. 38
Figure 3.3: Natural logarithmic scale of the total amount of peramine (µg/seedling) and mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var. lolii strains AR1, NEA2, and NZ_{CT} during the early establishment phase. Error bar represent standard error of the mean (±SEM). Shoot dry matter are the means of the harvested seedlings across all endophyte treatments. 45
Figure 3.4: Mean peramine concentration of seeds and seedlings (µg/g) infected with E. festucae var. lolii strains AR1, NEA2, and NZ_{CT} during the early establishment phase. Error bar represent standard error of the mean (±SEM). Each data point is the mean for 18 seeds for day 0 and 13–69 day old seedlings, and 50 seeds for 6–10 day old seedlings analysed as one sample. 46
Figure 3.5: Natural logarithmic scale of the total amount of lolitrem B (µg/seedling) and mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var. lolii strains NZ_{CT}, and NEA2 during the early establishment phase. Error bar represent standard error of the mean (±SEM). Shoot dry matter are the means of the harvested seedlings across all endophyte treatments. 47
Figure 3.6: Mean lolitrem B concentrations of seeds and seedlings (µg/g) infected with E. festucae var. lolii strains NEA2 and NZ_{CT} during the early establishment phase. Error bar represent standard error of the mean (±SEM). Each data point is the mean for 18 seeds for day 0 and 13–69 day old seedlings, and 50 seeds for 6–10 day old seedlings analysed as one sample. 49
Figure 3.7: Natural logarithmic scale of the total amount of ergovaline (µg/seedling) and mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var.

lolii strains NZ_{CT} and NEA2 during the early establishment phase. Error bar represent standard error of the mean (±SEM). Shoot dry matter are the means of the harvested seedlings across all endophyte treatments. 50
Figure 3.8: Mean ergovaline concentration of seeds and seedlings (µg/g) infected with E. festucae var. lolii strains NEA2 and NZ_{CT} during the early establishment phase. Error bar represent standard error of the mean (±SEM). Each data point is the mean for 18 seeds for day 0 and 13–69 day old seedlings, and 50 seeds for 6–10 day old seedlings analysed as one sample. 51
Figure 3.9: Natural logarithmic scale of the total amount of epoxy-janthitrems (µg/seedling) and mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var. lolii strain AR37 during the early establishment phase. Error bar represent standard error of the mean (±SEM). Shoot dry matter are the means of the harvested seedlings across all endophyte treatments. 52
Figure 3.10: Total epoxy-janthitrem concentrations of seeds and seedlings (µg/g) infected with E. festucae var. lolii strain AR37 during the early establishment phase. Error bar represent standard error of the mean (±SEM). Each data point is the mean for 18 seeds for day 0 and 13–69 day old seedlings, and 50 seeds for 6–10 day old seedlings analysed as one sample. 53
Figure 3.11: Mean glasshouse temperature (°C) and mean relative humidity (%) recordings from 29th June to 7th September 2015. Error bar represent standard error of the mean (±SEM). 54
Figure 3.12: Natural logarithmic scale of total amount of peramine (µg/seedling), peramine concentration (µg/g), and mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var. lolii strains AR1, NEA2, and NZ_{CT} during the early establishment phase. Dry matter values are the means of all seedlings across all endophyte treatments. Minimum adult and larvae ASW peramine threshold in the field is estimated to be 15 µg/g (Popay and Wyatt, 1995). Error bar represent standard error of the mean (±SEM). 56
Figure 4.1: A bioassay in progress. One bioassay consisted of four cages. In each cage adult ASW were able to feed for 5 days on seedlings infected with E. festucae var. lolii strains AR1, AR37, NEA2, and NZ_{CT}. Developing seedlings were then harvested and analysed for alkaloid concentrations. 69
Figure 4.2: Latin square design with four endophyte strains AR1, AR37, NEA2, NZ_{CT} and four replications per bioassay. Grey shadowed data were excluded from data analysis. The same cage layouts were used for each bioassay. 70
Figure 4.3: The effect of adult ASW feeding on mean peramine concentrations (µg/g) in developing perennial ryegrass seedlings infected with E. festucae var. lolii strains AR1, NEA2, and NZ_{CT}. Adult ASW had a marginal significant impact on peramine concentration overall (p=0.053). Error bar represent standard error of the mean (+SEM). 73
Figure 4.4: The effect of adult ASW feeding on mean lolitrem B concentrations (µg/g) in developing perennial ryegrass seedlings infected with E. festucae var. lolii

strains NEA2 and NZ_{CT}. In 62-day old plants lolitrem B concentrations were significantly lower in plants exposed to ASW feeding (p=0.036). Error bar represent standard error of the mean (+SEM). 75
Figure 4.5: The effect of adult ASW feeding on mean ergovaline concentrations (µg/g) in developing perennial ryegrass seedlings infected with E. festucae var. lolii strains NEA2 and NZ_{CT}. Adult ASW feeding significantly increased ergovaline concentration in 41-day old plants. In contrast 41-day old seedlings produced significantly lower ergovaline levels when exposed to adult ASW than control plants (p=0.014). Error bar represent standard error of the mean (+SEM). 76
Figure 4.6: The effect of adult ASW feeding on mean epoxy-janthitrem concentrations (µg/g) in developing perennial ryegrass seedlings infected with E. festucae var. lolii strain AR37. Adult ASW had no significant impact on epoxy-janthitrem concentrations overall (p=0.437). Error bar represent standard error of the mean (+SEM). 77
Figure 4.7: The effect of adult ASW feeding on dry matter production (mg/seedling) of E. festucae var. lolii infected perennial ryegrass seedlings. Error bar represent standard error of the mean (+SEM). 78
Figure 4.8: Boxplot of temperature (°C) and relative humidity (%) recordings for each adult ASW bioassay (Bioassay 1=36–41 day old seedlings; bioassay 2= 43–48 day old seedlings; bioassay 3= 50–55 day old seedlings; bioassay 4= 57–62 day old seedlings). 79
Figure 5.1: The relationship between peramine concentration (mean of AR1, NEA2, and NZ_{CT}) and adult ASW feeding in E. festucae var. lolii infected perennial ryegrass seedling during the early establishment phase. Adult ASW feeding scores were reproduced from Ruppert, et al. (2016) (on a scale of 0–6 whereby: 0= no damage, 1= little feeding; test nibbles can be seen, 3= feeding on base of tiller, 4= feeding on base and tip of tiller, 5= seedling completely chewed off and detached from seed and 6= seedling died after extensive feeding. Feeding score of peramine containing seedlings is the mean of AR1, NEA2, and NZ_{CT}. Feeding score of non-peramine containing seedlings is the mean of AR37 and endophyte-free seedlings. Error bar represent standard error of the mean (+SEM). 85

List of tables

Table 1.1: Summary of most common pasture insect pests in New Zealand and the ability of specific endophyte strains to control them (Table adapted from Stewart, et al. (2014). Pictures: AgResearch, Te Ara, Peter Bailey). 19
Table 2.1: The occurrence of peramine, lolitrem B, epoxy-janthitrems and ergovaline in commercial ryegrass endophyte associations used in this experiment. Constitution and comparison of alkaloid concentration are estimated on a mid-summer harvest. Peramine: high (+30µg/g), low/medium (2.5–15µg/g). Lolitrem B: medium (0.1–1.0µg/g), high (1.0–5.0 µg/g). Epoxy-janthitrems: medium (20–50µg/g). Ergovaline: medium (0.2–1.0µg/g), high (1.0–2.5µg/g) (Wade Mace, personal communication). 27
Table 3.1: Alkaloid measurements in developing perennial ryegrass seedlings infected with E. festucae var. lolii were set up in three parts. The first alkaloid measurement was conducted on seeds followed by seedlings grown in petri dishes and plants grown from seed sown in propagation trays filled with standard seed raising mix. 35
Table 3.2: Example of experimental design with four endophyte treatments (strains) and four replications per harvesting date for day 13. Each endophyte treatment consisted of 18 seedlings which were bulked up to one sample. 39
Table 3.3: Seedling emergence (%) and viable endophyte infection frequency (%) for selected host-endophyte combinations. Endophyte infection was tested using tissue print immuno blot method. 41
Table 3.4: Total amount of alkaloid per seed (µg/seed) and seedling (µg/seedling) of selected alkaloids from perennial ryegrass seedlings infected with E. festucae var. lolii strains AR1, NEA2, NZ_{CT}, and AR37 during the early establishment phase. Significance of difference in total amount of alkaloid was tested for each alkaloid compound separately and can be compared between endophyte strains (column) and seedling age (row) (values followed by the same letter within each alkaloid compound are not significantly different at $p<0.05$). Standard error of the mean (± SEM) is given for each treatment underneath total amount of alkaloid. Analyses of alkaloid concentration in seeds (0), 6–10 day old plants, and 13–69 day old plants were performed separately. 43
Table 3.5: Mean alkaloid concentration (µg/g) of selected alkaloids from seedlings infected with E. festucae var. lolii strains AR1, NEA2, NZ_{CT}, and AR37 during the early establishment phase. Significance of difference in total amount of alkaloid was tested for each alkaloid compound separately and can be compared between endophyte strains (column) and seedling age (row) (values followed by the same letter within each alkaloid compound are not significantly different at $p<0.05$). Standard error of the mean (± SEM) is given for each treatment underneath mean alkaloid

concentration. Analyses of alkaloid concentration in seeds (0), 6–10 day old plants, and 13–69 day old plants were performed separately.....44
Table 4.1: Experimental set up for adult ASW bioassays. Adult ASW were able to feed on developing seedlings for five consecutive days before plants were harvested for alkaloid analysis. 68

List of appendices

Appendix 1: GenStat code and output for peramine concentrations in seed statistical analysis. 93
Appendix 2: GenStat code and output from statistical analysis from the influence of adult ASW feeding on peramine concentrations in seedlings infected with E.festucae var. lolii strain AR1, NEA2, and NZ_{CT}. Peramine concentrations were square-root transformed. 95
Appendix 3: Mean alkaloid concentrations (µg/g) from E. festucae var. lolii infected perennial ryegrass seedlings after five days exposure to adult ASW feeding at different seedling ages (bioassays). Significance of difference in alkaloid concentrations were tested for each alkaloid compound separately in the interaction between the occurrences of adult ASW feeding (ASW/Control) across the four bioassays. Values followed by the same letter within each alkaloid compound are not significantly different at given p-value. Standard error of the mean (± SEM) is given for each treatment underneath mean alkaloid concentration. 99
Appendix 4: Mean alkaloid concentrations (µg/g) from seedlings infected with E. festucae var. lolii strains AR1, NEA2, NZ_{CT}, and AR37 after 5-day exposure to adult ASW feeding at different seedling ages (bioassays). Significance of difference between alkaloid concentrations were tested for each alkaloid compound between the occurrence of adult ASW feeding, seedling age and endophyte strain. Values followed by the same letter within the alkaloid compound are not significantly different at given p-value. Standard error of the mean (± SEM) is given for each treatment underneath mean alkaloid concentration. 100
Appendix 5: The effect of adult ASW feeding on the mean shoot dry matter (mg/seedling) of seedlings infected with E. festucae var. lolii strains AR1, AR37, NEA2, and NZ_{CT}. Error bar represent standard error of the mean (+SEM). 101