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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 Zealand's 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 NZCT 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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