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Insect bioactive capabilities of *Epichloë festucae var lolii* AR48 infected *Lolium perenne*

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

In

Biochemistry

At Massey University, Manawatū

New Zealand

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2018
ABSTRACT

As the modern world expands and develops, new innovative methodologies for more efficient and environmentally friendly agricultural practices are required. Loss of crops through abiotic (e.g. drought) and biotic (e.g. herbivory) stresses has a major effect on the success of an agricultural industry. For animal production pasture crops are a key aspect of animal husbandry and directly affects yield and health. Symbiotic fungi belonging to the genus *Epichloë* form associations with cool season forage grasses and have been exploited as a new innovative method for insect pest management.

Ryegrass infected with the asexual *E. festucae* var *lolii* strain AR48 has insect bioactivity against both the stem boring fly (*SBF-Ceradontha australis*) and cutworm moth caterpillar (*CC-Agrotis ipsilon*). The bioactive/s targeting both insects is currently unknown. The aim of this thesis was to identify the gene/s and/or bioactive/s present in AR48 infected ryegrass that have bioactivity against the SBF and/or CC. Two approaches were taken; the known insect bioactive secondary metabolite pathways in *Epichloë* were investigated in AR48 through bioinformatics and mass spectrometry, and the gene ‘makes caterpillars floppy’ (*mcf*), encoding an insect toxin like protein, was investigated through reverse genetics and insect bioactivity trials.

A new indole diterpene compound (IDT) was identified in AR48 infected plant material and this compound was absent in other *Epichloë* strains that do not have SBF and CC bioactivity. The same *mcf* gene allele as that present in the *E. typhina mcf* model, previously identified as having CC bioactivity, is present and predicted to be functional in AR48. The other *Epichloë* strains also have *mcf* genes predicted to be functional, however the *mcf* allele is different to the bioactive *E. typhina mcf* model. Overall, this project was able to identify a new IDT compound with potential insect bioactivity as well as identify two *Epichloë mcf* gene alleles that potentially have differing insect bioactivities.
ACKNOWLEDGEMENTS

I would first like to thank my supervisors Barry Scott, Richard Johnson and Gill Norris, for their wealth of knowledge and experience that has been invaluable. I truly appreciate the support and encouragement that they have provided, especially during the tough times that inevitably arise in a PhD. It has been a large undertaking, and I would not have been successful without them.

I would also like to thank my colleagues at both Massey University and AgResearch. Specifically, Wade Mace for his specialised skills in mass spectrometry that have played an important role in the success of my PhD. Also, Alison Popay and Joanne Jenson for providing both the knowledge as well as insects for the insect trials. Finally, Catherine McKenzie for her statistic skills used to analyse the insect trial results. Other people I would like to thank are Anouck de Bonth, Christine Voisey, Debbie Hudson, Jaspreet Singh, Aslinur Ozturk, and Natasha Forester for their advice as well as friendship that has been so important throughout my PhD. Finally, thank you to all the staff members whoms interactions over the years, no matter how minor, are valued.

A PhD is not just the achievement of excellence in scientific knowledge and technique, it is also a journey of personal development that cannot be completed without a network of loving and supportive family and friends. I have been blessed to be in a lab at Massey where I have made lifetime friends. Our “boss” and lab manager Arvina has not only been irreplaceable in her experience and time given to teach me molecular techniques, she has also become a very close friend and her support and belief in me has been indispensable. To my PhD buddies, Nazanin, Berit and Kim, having you beside me has made my PhD experience worth every moment, whether it’s getting coffee together, chatting about our science problems, crying over our failures or laughing over our successes, thank you. Finally, Yonathan and Dan, thank you for the advice and support as well as the many games nights spent together. I could not have chosen a better lab to do my PhD in, so thank you.
I would also like to thank Rachel Miller and Mackenna Dent, you are my closest friends, and I value all the times we have spent together, whether it’s just hanging out or for support, and I truly treasure our friendship.

It has been a long 10 years of study to get to where I am now, and all of this could not have been possible without my loving, caring, and supportive family. Thank you so much Mum and Dad for always believing in me, even when I did not, and providing advice in all aspects of my life. I could not have asked for more loving parents. Thank you to my brother Gareth and Auntie Anita, you both have been so supportive, and I have always cherished our time together. Also, thank you to the West Family you have become a second family to me, and I am very appreciative of the support and the family dinners that we have had together.

Finally, I would like to thank my partner Andrew West. You have been by my side every step in my PhD journey and life, and without fail you have supported me, encouraged me and believed in me. I mean this in every sense; I truly could not have done this without you. There are no words to describe your impact on my life.

Thank you to Massey University and AgResearch for both funding and the opportunity.
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