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Characterisation of volatile constituents of six native New Zealand ferns and changes in volatile emission in response to herbivore, mechanical wounding and phytohormone treatments.

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## Abstract

Evolution has led to the development of countless defence strategies in terrestrial plants to deal with the threat of herbivory and disease. The production of specialised morphological structures, such as thorns and trichomes, is a prominent defence mechanism that directly deters potential herbivores. However, plants are capable of enlisting the aid of natural predators and parasites of attacking herbivores as a means of indirect defence, through the production and release of volatile organic compounds. This has prompted much research into the regulation and ecological roles of volatile organic compounds in many higher plant groups. However, similar studies are seldom in lower plants such as the Monilophytes thus we know very little concerning the ecological importance of plant emitted volatiles in this group. In this study, I investigated the volatile compounds released by six abundant native fern species using direct solvent extraction and headspace collections, and characterized the volatile emissions under natural herbivory, phytohormone treatment, and mechanically induced stress. Solvent extracts and headspace collections were analysed using gas chromatography coupled with mass spectrometry allowing the quantitative and qualitative description of the volatile profiles. These results were then used to relate volatile emission to the growth mode and other potential defence strategies of these species. A total of 15 volatile compounds were identified over the course of this thesis with links to fern physiology. Quantitative results revealed no differences in emissions under phytohormone treatment or artificially induced stress. The comparison of two methods, solvent extraction and headspace sampling, reveals the limitations the solvent extraction method has on elucidating fern-insect interactions. Research on fern volatiles could give insight into the evolution of anti-herbivore defence mechanisms in plants and the interactions between native ferns and arthropod communities. Potential applications of research in fern chemistry include pharmaceutical or perfumery uses and fern conservation, which should be incentives for further work. The results and conclusions made from this thesis does not only contribute to the limited pool of knowledge in this field of research but may also serve as a foundation for future studies.



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## Table of Contents

Abstract.....	i
Acknowledgements.....	iii
Table of Contents.....	iv
List of Figures.....	vi
List of Tables.....	vii
List of Abbreviations.....	viii
<b>Chapter 1 : General Introduction and Literature Review.....</b>	<b>1</b>
Plant Secondary Metabolites.....	3
Role and Importance.....	4
Classification.....	5
Plant Volatiles and their Ecological Roles.....	7
Secondary Compounds in Ferns.....	9
Fern Insect Interactions.....	11
Methods for Volatile Collection and Analysis.....	12
Research Objectives.....	14
<b>Chapter 2 : Materials and Methods.....</b>	<b>17</b>
Study Site and Fern Species.....	19
Solvent Extraction.....	20
Phytohormone and Mechanical Damage.....	21
Polyphenol & Chlorophyll Collection.....	23
Herbivore Damage.....	23
Gas Chromatography-Mass Spectre Analysis.....	26
Statistical Analyses.....	28
<b>Chapter 3 : Results.....</b>	<b>31</b>
Solvent Extraction.....	33
Phytohormone and Mechanical Damage.....	<b>Error! Bookmark not defined.</b>
Polyphenol and Chlorophyll Analysis.....	41
Herbivore Damage.....	43

<b>Chapter 4 : General Discussion</b> .....	47
Solvent Extraction vs. Headspace Collection .....	49
Phytohormone Treatment and Mechanical Damage .....	50
Polyphenol and Chlorophyll Analyses .....	53
Herbivore Damage .....	54
Final Remarks .....	55
<b>Chapter 5 : Conclusions and Recommendations</b> .....	59
Conclusions .....	61
Recommendations for Future Work .....	62
Literature Cited .....	65



## List of Figures

<b>Figure 2-1.</b> The location of vegetative areas (red circles) within Massey University (Google Earth).....	19
<b>Figure 2-2.</b> Native fern species used for volatile analysis; (a) <i>Dicksonia squarrosa</i> , (b) <i>Microsorium pustulatum</i> , (c) <i>Asplenium bulbiferum</i> , (d) <i>Asplenium oblongifolium</i> , (e) <i>Cyathea dealbata</i> , (f) <i>Cyathea medullaris</i> .....	20
<b>Figure 2-3.</b> Examples of solvent extraction process: (a) initial filtering process using 70mm glass microfiber filter, (b) sealed containers containing fern material submerged in solvent/internal standard solution. ....	21
<b>Figure 2-4.</b> Example of a field experimental setup of the dynamic volatile headspace collection system using a PVAS22 unit on <i>Dicksonia squarrosa</i> .....	22
<b>Figure 2-5.</b> Example of herbivore damage by <i>H. crassidens</i> on frond cuttings of <i>C. medullaris</i> in preliminary trials. ....	23
<b>Figure 2-6.</b> Example of a laboratory experimental setup of the dynamic volatile headspace collection system using a PVAS22 unit on <i>D. squarrosa</i> . ....	24
<b>Figure 2-7.</b> Examples of insects interacting with ferns: (a) <i>S. australis</i> resting on <i>D. squarrosa</i> , (b) <i>H. crassidens</i> consuming pinna leaves of <i>D. squarrosa</i> . ....	25
<b>Figure 2-8.</b> Example of manual peak integration using ion chromatography. ....	26
<b>Figure 2-9.</b> Example of compound identification comparing mass spectrum data from samples to target reference values within the NIST05 MS library. ....	27
<b>Figure 3-1.</b> Comparisons of confidence intervals (95%) and mean values of the concentrations of fern extracts according to species (a) and method of growth (b). ....	33
<b>Figure 3-2.</b> Comparison of total volatile emission rates for each treatment; control - no induced damage (C) and two treatments - mechanical damage (PD), and phytohormone treatment (JA). ....	35
<b>Figure 3-3.</b> Comparison of total volatile emission rates for each treatment according to fern species. Control (CT) with two treatments - mechanical damage (PD), and phytohormone treatment (JA). ....	39
<b>Figure 3-4.</b> Comparison of total volatile emission rates for each treatment according to fern growth mode. Control (CT) with two treatments - mechanical damage (PD), and phytohormone treatment (JA). (Note: Tree = CD, CM and DS; Epiphyte = MP; Shrub = AB and AO). ....	40
<b>Figure 3-5.</b> Comparisons of confidence intervals (95%) and mean values of chlorophyll content (a); flavonols (b); anthocyanins (c); and nitrogen balance index (d) of the six native fern species.....	41
<b>Figure 3-6.</b> Comparisons of confidence intervals (95%) and mean values of chlorophyll content (a); flavonols (b); anthocyanins (c); and nitrogen balance index (d) of the three growth modes. (Note: Tree = CD, CM and DS; Epiphyte = MP; Shrub = AB and AO).....	42
<b>Figure 3-7.</b> Example of three ion chromatograms of a control replicate for <i>A. bulbiferum</i> . (a) Chromatogram of volatile measurements prior to herbivore application period, (b) Chromatogram of volatile measurements during the herbivore application period, (c) Chromatogram of volatile measurements 14 hours after herbivore application period. Note: Red lines indicate target volatile compounds.....	44

## List of Tables

<b>Table 3-1.</b> Average concentration of fern extract compounds from fronds of six species. Values indicated with a '*' represent data from a single replicate. Values are presented in ng g <sup>-1</sup> FW. Note: n.d – no data available. ....	34
<b>Table 3-2.</b> Average emission and SE of volatile organic compounds from fronds of six fern species within the control treatment. Values indicated with a '*' represent data from a single replicate. Values are presented in ng g <sup>-1</sup> DW h <sup>-1</sup> . Note: n.d – no data available. ....	36
<b>Table 3-3.</b> Average emission and SE of volatile organic compounds from fronds of six fern species within the phytohormone (jasmonic acid) treatment. Values indicated with a '*' represent data from a single replicate. Values are presented in ng g <sup>-1</sup> DW h <sup>-1</sup> . Note: n.d – no data available. ....	37
<b>Table 3-4.</b> Average emission and SE of volatile organic compounds from fronds of six fern species within the mechanical damage only treatment. Values indicated with a '*' represent data from a single replicate. Values are presented in ng g <sup>-1</sup> DW h <sup>-1</sup> . Note: n.d – no data available. ....	38
<b>Table 3-5.</b> List of compounds detected from the herbivory experiments and corresponding treatments they were observed within. Control (CT), Weta (W) - <i>H. crassidens</i> , Passion Vine Hopper (PVH) – <i>S. australis</i> . n.d – no data available.....	43

## List of Abbreviations

VOC -	Volatile Organic Compounds
CT -	Control
JA -	Jasmonic Acid
PD -	Mechanical Damage
W -	Weta
PVH -	Passion Vine Hopper
GC-MS -	Gas Chromatography–Mass Spectrometry
AB -	<i>Asplenium bulbiferum</i>
AO -	<i>Asplenium oblongifolium</i>
CD -	<i>Cyathea dealbata</i>
CM -	<i>Cyathea medullaris</i>
DS -	<i>Dicksonia squarrosa</i>
MP -	<i>Microsorium pustulatum</i>



