

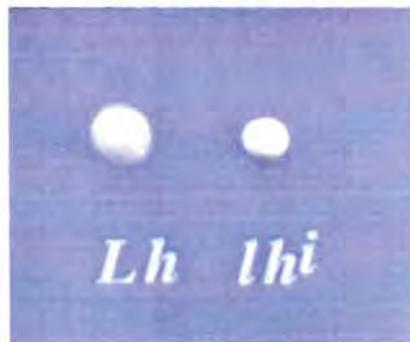
**Gibberellins and seed development in *Pisum***

by

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Submitted in fulfilment of the  
requirements for the degree of

Doctor of Philosophy

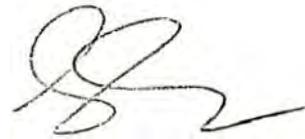


University of Tasmania  
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## Declaration

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university and contains no copy or paraphrase of material previously published or written by another person, except where due reference is made in the text.

A handwritten signature in black ink, consisting of a large, stylized 'S' followed by a horizontal line that ends in a small flourish.

S. M. Swain

## Abstract

### Gibberellins and Seed Development in *Pisum*

The  $lh^i$  and  $ls$  mutations have been used to investigate the role of the gibberellins (GAs) in seed development of the garden pea (*Pisum sativum* L.). These mutations were originally identified by their effects on internode elongation. Plants homozygous for  $lh^i$  or  $ls$  possess reduced levels of endogenous GA<sub>1</sub> in developing shoots, resulting in a dwarf phenotype compared with wild-type plants. The  $Lh$  locus has been shown to be linked to the  $Le$  locus at a distance of ca. 5cM. In conjunction with wild-type plants and other GA-deficient mutants,  $lh^i$ ,  $ls$  and  $le^{5839}$  plants have been used to demonstrate a log-linear relationship between endogenous GA<sub>1</sub> levels and internode elongation, further supporting a role for GA<sub>1</sub> as the major native GA controlling internode elongation in this species. However, the  $lh^i$  mutation differs from other GA-deficient mutations, such as  $lh$ , since the response of  $lh^i$  plants to paclobutrazol (an inhibitor of GA-biosynthesis) is dramatically increased.

The  $lh^i$  and  $ls$  mutations also reduce endogenous GA levels in developing seeds. This has allowed the site of action of the  $ls$  mutation to be identified. Incubation of cell-free enzyme systems from developing wild-type and  $ls$  seeds suggests that  $ls$  plants possess reduced *ent*-kaurene synthetase A activity. The  $lh^i$  mutation also reduces endogenous GA<sub>1</sub> and GA<sub>3</sub> levels in young seeds (a few days after fertilization), while  $ls$  seeds possess similar GA<sub>1</sub> and GA<sub>3</sub> levels at this stage compared with wild-type seeds. Comparison of GA levels in  $lh^i lh^i$ ,  $ls ls$ ,  $Ls ls$  and wild-type seeds suggests that GA-biosynthesis may vary within different tissues (embryo, endosperm and testa) of developing seeds. Seeds homozygous for  $lh^i$  are more likely to abort during development, and weigh less at harvest, compared with wild-type seeds and seeds homozygous for  $ls$ . Altering the source/sink relations of developing  $lh^i$  plants, and <sup>14</sup>C-photoassimilate studies, both suggest that  $lh^i$  seeds possess reduced sink strength compared with wild-type seeds. Fertilizing  $lh^i$  plants with wild-type pollen produces seeds with normal GA levels and restores normal seed development. Culturing of  $lh^i$  embryos with GA<sub>1</sub> *in vitro* also increases embryo size. These results have been used to suggest that GA<sub>1</sub> and GA<sub>3</sub> play an important role early in pea seed development. By contrast, the high GA levels found in maturing wild-type seeds do not have a physiological role in seed development.

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## Contents

Page

Abstract		i
Acknowledgements		ii
Chapter 1	Hormones and seed development	1
	Introduction	1
	Seed development	1
	Physiological roles of the plant hormones	2
	Future directions	11
	Aims of this thesis	12
Chapter 2	General materials and methods	15
Chapter 3	A new allele at the <i>Lh</i> locus	22
Chapter 4	The <i>lh<sup>i</sup></i> allele reduces gibberellin levels in developing seeds, and increases seed abortion	43
Chapter 5	Source-sink relations of gibberellin-deficient <i>lh<sup>i</sup></i> seeds	60
Chapter 6	Genetic analysis of the <i>Lh</i> locus	75
	Linkage of the <i>Lh</i> and <i>Le</i> loci	75
	Possible intragenic crossovers at the <i>Lh</i> locus	81
Chapter 7	Genetic interactions with the <i>lh<sup>i</sup></i> mutation	96
	Introduction	96
	Interaction of genes <i>lh<sup>i</sup></i> and <i>sln</i>	97
	Interaction of genes <i>lh<sup>i</sup></i> , <i>la</i> and <i>cry<sup>s</sup></i>	106
	Interaction of genes <i>lh<sup>i</sup></i> and <i>r</i>	110

Chapter 8	Gibberellins, possibly GA <sub>1</sub> and GA <sub>3</sub> , act early in seed development	114
Chapter 9	General discussion	137
	References	146
Appendix	Published papers containing results from this thesis	162