

Gibberellins and seed development in *Pisum*

by

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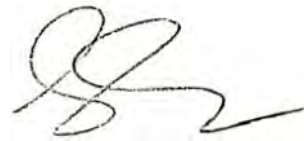


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Declaration

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.

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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 GA₁ 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 GA₁ levels and internode elongation, further supporting a role for GA₁ 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 GA₁ and GA₃ levels in young seeds (a few days after fertilization), while ls seeds possess similar GA₁ and GA₃ 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 ¹⁴C-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 GA₁ *in vitro* also increases embryo size. These results have been used to suggest that GA₁ and GA₃ 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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