PHOTOPERIODIC CONTROL OF DEVELOPMENT IN THE NEW ZEALAND LEAFROLLER MOTH *PLANOTORTRIX OCTO* DUGDALE (LEPIDOPTERA, TORTRICIDAE)

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ABSTRACT

The aim of this study is to test for photoperiodic control of larval and pupal development in the New Zealand moth *Planotortrix octo* Dugdale.

The photoperiodic response curves for larval and pupal development and especially for instar number at 17^{o}C and 21^{o}C indicate that a photoperiodic mechanism is involved. Superimposed on this response is the suggestion that daylength affects development rate directly, with larvae and pupae developing faster under longer photophases. This effect is especially strong for pupal development (Chapter 3).

The effects of thermophotoperiods (Chapter 4), night interruption and resonance experiments (Chapter 6) provide further evidence for photoperiodic involvement. The response to resonance experiments suggests the involvement of an hourglass rather than a circadian mechanism.

Larvae reared under short days accumulate significantly more lipids in the 5th and 6th instars than larvae reared under long days (Chapter 4). This finding, combined with the suppressed development rate and higher instar number under short days, suggests that a weak form of diapause may be present in this insect. This is significant in being the first recorded incidence of a photoperiodically induced diapause in a phyllophagous New Zealand insect for which a year round food supply is available (Chapter 1).

By transferring insects from long to short days I found that long days have more influence than short days on larval development (Chapter 7).

An attempt was made to measure juvenile hormone titres under long and short days using a *Galleria* bioassay. The test used was not sensitive enough however to measure any significant amounts of juvenile hormone (Chapter 8).

Simulations of the experimental results were performed using a damped circadian oscillator model (Chapter 9). This model was considered the most appropriate to use, based on the experimental results and on a review of the literature (Chapter 2). Simulations showed good similarities with experimental results in most cases, but could not account for resonance responses.

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LIST OF ABBREVIATIONS

DD	Continual darkness.
GC-MS	Gas chromatography - mass spectroscopy.
GPD	General purpose diet.
GU	*Galleria* unit.
h	Hours.
INDSUM	Diapause induction titre.
JH	Juvenile hormone.
Lx	Duration of instar x.
$LDx_1:x_2$	A light-dark cycle where x_1 and x_2 are the time of the light and dark period respectively in hours.
$LDLDx_1:x_2:x_3:x_4$	As above only the light periods are x_1 and x_3 and the dark periods are x_2 and x_4.
LL	Continual light.
PPRC	Photoperiodic response curve.
PTTH	Prothoracicotropic hormone.
RIA	Radioimmunoassay.
T	Period of the light/dark cycle.
τ	Free running period of a biological rhythm.
φ_i	Photoinducible phase.
Wx	Head capsule width of instar x.
ZT	Zeitgeber time.