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**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°C and 21°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.

CONTENTS

LIST OF TABLES AND FIGURES	vi
LIST OF ABBREVIATIONS	viii
CHAPTER ONE	
GENERAL INTRODUCTION	1
1.1. Photoperiodism in Living Systems	1
1.1.1. Migration in Insects	1
1.1.2. Diapause in Insects	2
1.1.3. Photoperiodic Response Curves	3
1.1.4. Effects of Temperature	3
1.1.5. Photoperiod and Development Rate	4
1.2. Diapause in New Zealand Insects	5
1.2.1. Introduction	5
1.2.2. Evidence for Diapause in New Zealand Insects	6
1.2.3. Conclusion	8
1.3. Hormonal Control of Diapause	9
1.3.1. Juvenile Hormone and Larval Development	9
1.3.2. Juvenile Hormone and Larval Diapause	10
1.4. The Study Animal	10
1.4.1. Classification	10
1.4.2. Life Cycle	11
1.4.3. Host Plants and Pest Status	12
CHAPTER TWO	
MECHANISMS FOR TIME MEASUREMENT IN	
INSECT PHOTOPERIODISM	13
2.1. Introduction	13
2.2. The Photoperiodic Counter	13
2.3. Circadian models for Photoperiodism	14
2.4. External Coincidence Models	16
2.5. Hourglass Models	18
2.6. Two Oscillator Models	19
2.7. The Dual System Model	20
2.8. Resonance Models	21
2.9. Damped Oscillator Models	22
2.10. Conclusion	25
CHAPTER THREE	
EFFECTS OF PHOTOPERIOD AND CONSTANT TEMPERATURE	
ON DEVELOPMENT IN <i>P. OCTO</i>	29
3.1. Introduction	29
3.2. Materials and Methods	30
3.2.1. Insect Rearing and Experimental Conditions	30
3.2.2. Statistical Analyses	31
3.3. Results	31
3.3.1. Larval Development	31
3.3.2. Head Capsule Widths	31
3.3.3. Pupal Weight	34
3.3.4. Pupal Duration	34

3.4. Discussion	35
3.4.1. Larval Parameters	35
3.4.2. Photoperiodic Response Curves	36
3.4.3. Critical Head Capsule Width and Instar Number	37
3.4.4. Pupal Weights	37
CHAPTER FOUR	
EFFECTS OF THERMOPERIODS AND THERMOPHOTOPERIODS	
ON DEVELOPMENT IN <i>P. OCTO</i>	39
4.1. Introduction	39
4.2. Materials and Methods	40
4.3. Results	41
4.3.1. Thermophotoperiods	41
4.3.2. Thermoperiods	42
4.4. Discussion	43
4.4.1. Effects of Thermophotoperiod on Larval Duration	43
4.4.2. Effects of Thermoperiod on Larval and Pupal Duration	44
4.4.3. Pupal Weights	45
4.4.4. Effects of Disturbance	45
CHAPTER FIVE	
LIPID CONTENTS OF <i>P. OCTO</i> UNDER LONG AND SHORT	
DAY PHOTOPERIODS: FURTHER EVIDENCE FOR DIAPAUSE	46
5.1. Introduction	46
5.2. Materials and Methods	47
5.3. Results	48
5.4. Discussion	49
CHAPTER SIX	
LARVAL AND PUPAL DEVELOPMENT OF <i>P. OCTO</i> UNDER NIGHT	
INTERRUPTION AND SKELETON PHOTOPERIODS.	50
6.1. Introduction	50
6.2. Materials and Methods	51
6.3. Results	52
6.3.1. Night Interruption Experiments	52
6.3.2. Extended Night Experiments	52
6.4. Discussion	54
CHAPTER SEVEN	
EFFECTS OF LARVAL TRANSFER FROM LONG TO SHORT	
AND SHORT TO LONG DAYS	56
7.1. Introduction	56
7.2. Materials and Methods	57
7.3. Results	57
7.4. Discussion	57
7.4.1. Larval Development	57
7.4.2. Pupal Weight	58
7.4.3. Head Capsule Widths	59

CHAPTER EIGHT	
INSENSITIVITY OF THE <i>GALLERIA</i> WAX TEST IN MEASURING JUVENILE HORMONE TITRES IN <i>P. OCTO</i>	60
8.1. Introduction	60
8.2. Materials and Methods	60
8.2.1. Preparation of JH Crude Extract	60
8.2.2. The <i>Galleria</i> Bioassay	61
8.3. Results	62
8.4. Discussion	63
CHAPTER NINE	
GENERAL DISCUSSION	64
9.1. Evidence for Diapause in <i>Planotortrix octo</i>	64
9.2. The Photoperiodic Mechanism in <i>P. octo</i>	65
9.2.1. Introduction	65
9.2.2. Description of the Model	66
9.2.3. Simulations Using the Damped Oscillator Model	67
9.2.4. Possible Identity of INDSUM and the Oscillator	69
9.3. Other Possible Photoperiodic Effects in <i>P. octo</i>	70
REFERENCES	72
APPENDIX ONE	91
APPENDIX TWO	98

LIST OF TABLES AND FIGURES

Chapter One		
Fig. 1.1.	Types of photoperiodic response curves common in insects.	3
Chapter Two		
Fig. 2.1.	The damped circadian oscillator showing the threshold concentration and the position of the photoinducible phase.	23
Fig. 2.2.	Computer simulations of the behaviour of the damped oscillator under three thermoperiods.	24
Table 2.1.	Summary of photoperiodism models.	27-28
Chapter Three		
Table 3.1.	Analysis of variance for larval duration.	32
Fig. 3.1.	Percentage (+/- SEM) of larvae developing through more than 5 instars.	32
Fig. 3.2.	Mean (+/- SEM) larval duration at two temperatures.	32
Fig. 3.3.	Mean (+/- SEM) duration of instars 1-3.	32
Fig. 3.4.	Mean (+/- SEM) duration of instars 4-6.	32
Table 3.2.	Analysis of variance for head capsule widths of instars 1-6.	33
Table 3.3.	Mean (SEM) head capsule widths in mm.	33
Fig. 3.5.	Mean (+/- SEM) head capsule width for instars 2, 4 and 6.	33
Fig. 3.6.	Distribution of 5th instar head capsule widths.	33
Fig. 3.7.	Mean (+/- SEM) pupal weight.	34
Fig. 3.8.	Mean (+/- SEM) pupal duration.	34
Table 3.4.	Analysis of variance for pupal weight and pupal duration.	34
Chapter Four		
Fig. 4.1.	Larval development under different thermophotoperiodic regimes.	41
Fig. 4.2.	Mean (+/- SEM) duration for each instar under thermophotoperiodic regimes.	41
Fig. 4.3.	Larval development under different thermoperiodic regimes.	42
Table 4.1.	Analysis of variance for thermoperiods and thermophotoperiods.	42
Fig. 4.4.	Mean (+/- SEM) duration for each instar under thermoperiodic regimes.	43
Table 4.2.	Analysis of variance for thermoperiods and constant temperatures.	43
Fig. 4.5.	Pupal duration and pupal weight under thermoperiodic regimes.	44

Chapter Five

Table 5.1.	Percentage lipids found in different life cycle stages of <i>Planotortrix octo</i> .	49
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Chapter Six

Fig. 6.1.	Night interruption experiments used for determining the position of ϕ_1 .	51
Fig. 6.2.	The extended night experiments used for rearing <i>P. octo</i> .	51
Fig. 6.3.	Larval development under night interruption experiments.	52
Fig. 6.4.	Mean (+/- SEM) duration of each instar under night interruption experiments.	52
Fig. 6.5.	Mean (+/- SEM) pupal duration and pupal weight for night interruption experiments.	52
Fig. 6.6.	Mean (+/- SEM) larval duration for extended night experiments.	53
Table 6.1.	Analysis of variance for night interruption experiments.	53
Table 6.2.	Analysis of variance for extended night experiments.	53

Chapter Seven

Fig. 7.1.	Larval development under transfer experiments.	57
Fig. 7.2.	Mean (+/- SEM) duration for the later instars under transfer experiments.	57
Fig. 7.3.	Mean (+/- SEM) pupal weight.	57
Fig. 7.4.	Mean (+/- SEM) head capsule widths of instars 3 and 4.	58
Table 7.1.	Analysis of variance for transfer experiments.	58

Chapter Eight

Fig. 8.1.	Percentage response (+/- SEM) for different concentrations of JH analogue, using <i>Galleria</i> bioassay.	61
Table 8.1.	Results of <i>Galleria</i> bioassay for larvae and pupae at different developmental stages.	62

Chapter Nine

Fig. 9.1.	Simulations of photoperiodic response curves for larval development using a damped oscillator model.	69
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LIST OF ABBREVIATIONS

DD	Continual darkness.
GC-MS	Gas chromatography - mass spectroscopy.
GPD	General purpose diet.
GU	<i>Galleria</i> unit.
h	Hours.
INDSUM	Diapause induction titre.
JH	Juvenile hormone.
Lx	Duration of instar x.
LD $x_1:x_2$	A light-dark cycle where x_1 and x_2 are the time of the light and dark period respectively in hours.
LDLD $x_1:x_2:x_3:x_4$	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.
W $_x$	Head capsule width of instar x.
ZT	Zeitgeber time.