

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

THE CASEMOTH,  
LIOTHULA OMNIVORA  
(PSYCHIDAE : LEPIDOPTERA)

A THESIS  
PRESENTED IN PARTIAL FULFILMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF SCIENCE IN ZOOLOGY  
AT MASSEY UNIVERSITY

THEAN CHOOI OOI

1967

## ACKNOWLEDGEMENTS

The author wishes to thank his supervisors Mr D.E. Gaskin and Mr M.J. Winterbourn for the assistance and advice given throughout this project. The interest and guidance of Mr P.S. Dale is also gratefully acknowledged. Dr. W.C. Clark, Mr L. Gurr, Dr T.J. Brown and Mrs G. Beardsell gave much invaluable help and advice. Thanks are particularly due to Mr M. Mannering for his technical assistance and other members of the Zoology Department at Massey University.

The author is indebted to many members of the Massey University Library, particularly Miss M.G. Campbell and her library staff for assistance in obtaining literature.

Grasslands Division, D.S.I.R., Palmerston North supplied the meteorological data.

Thanks are also due to Mr J. Dugdale and Mr E. Valentine of D.S.I.R., Nelson, for the identification of insect parasites; Dr. A. Watson of the British Museum (Natural History) for locating the type specimen; and Mr P.S. Yalden for his assistance in the identification of the host plants.

Special acknowledgement is due to Miss M. Bishop for typing this thesis.

Finally thanks are due to the New Zealand Government for supplying research facilities including the services of the Central Photography Unit at Massey University.

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
	Acknowledgements	
I	Introduction	1
II	Anatomy	
	External anatomy	
	The egg	3
	The larva	3
	The pupa	12
	The imago	15
	Internal anatomy	
	The larva	24
	The pupa ( 7-day )	27
	The imago	31
III	Life history and biology	47
IV	Experimental studies on case building and case function	70
V	Parasites	81
VI	Summary	87
	Bibliography	90
	Appendices	

LIST OF FIGURES

<u>Figure</u>		<u>Following page</u>
1 A	Egg	
B	Head capsule of 7th instar larva, anterior aspect.	46
2	Head capsule of 7th instar larva, posterior aspect.	"
3	Head capsule of 1st instar larva, anterior aspect.	"
4	Left antenna, 7th instar, dorsolateral aspect.	"
5	Labrum, 7th instar, anterior aspect.	"
6	Left mandible, 7th instar, anterolateral aspect.	"
7	Left mandible, 7th instar, posterior aspect.	"
8	Maxillolabial-hypopharyngeal complex, posterior aspect.	"
9	Left maxilla, 7th instar, detail of distal portion anterior aspect.	"
10	Left maxilla, 7th instar, detail of distal portion, posterior aspect.	"
11	Labium, 7th instar, detail of distal portion, ventral aspect.	"
12	Spinneret, 7th instar, lateral aspect.	"
13	1st instar larva at two days, lateral aspect.	"
14 A	7th instar larva, lateral aspect.	"
B	2nd abdominal spiracle of 7th instar larva.	"

<u>Figure</u>		<u>Following page</u>
15 A	Left thoracic leg, 7th instar, anterior aspect.	46
B	Left ventral proleg, 7th instar, lateral aspect.	"
16	Cranial chaetotaxy, anterolateral aspect.	"
17	Setal map of 1st instar larva.	"
18	Setal map of 2nd instar larva.	"
19	Setal map of 3rd instar larva.	"
20	Setal map of 4th instar larva.	"
21	Setal map of 5th instar larva.	"
22	Setal map of 6th instar larva.	"
23	Setal map of 7th instar larva.	"
24	Male pupa, ventral aspect.	"
25	Male pupa, lateral aspect.	"
26	Male pupa, dorsal aspect.	"
27	Genital segments of male pupa, ventral aspect.	"
28	Female pupa, ventral aspect.	"
29	Female pupa, lateral aspect.	"
30	Female pupa, dorsal aspect.	"
31	Genital segments of female pupa, ventral aspect.	"
32	Head capsule of adult male, ventral aspect.	"
33	Thorax of adult male, lateral aspect.	"
34	Forewing axil of adult male, dorsal aspect, with wing outstretched laterally.	"
35	Forewing of adult male ( after Hudson, 1928 ).	"
36	Wing scales from termen of fore-wing.	"
37	Hindwing axil of adult male, dorsal aspect, with wing outstretched laterally.	"

<u>Figure</u>		<u>Following page</u>
38	Hindwing of adult male ( after Hudson, 1928).	46
39 A	Prothoracic leg of adult male, anterior aspect.	
B	Mesothoracic leg of adult male, anterior aspect.	
C	Metathoracic leg of adult male, anterior aspect.	"
40 A	Metathoracic pretarsus of adult male, ventral aspect.	
B	Metathoracic pretarsus of adult male, lateral aspect.	"
41	Genitalia of adult male, lateral aspect.	"
42	Genitalia of adult male, ventral aspect.	"
43	Aedeagus of adult male, lateral aspect.	"
44	Head capsule of adult female, anterior aspect.	"
45	Adult female, ventral aspect.	"
46	Adult female, lateral aspect.	"
47	Adult female, dorsal aspect.	"
48 A	Prothoracic leg of adult female, anterior aspect.	
B	Mesothoracic leg of adult female, anterior aspect.	
C	Metathoracic leg of adult female, anterior aspect.	"
49	Genitalia of adult female, ventral aspect.	"
50	Internal anatomy of male 7th instar larva, lateral aspect.	"
51	Internal anatomy of female 7th instar larva, lateral aspect.	"
52	Internal anatomy of male pupa at seven days, lateral aspect.	"
53	Internal anatomy of female pupa at seven days, lateral aspect.	"

<u>Figure</u>		<u>Following page</u>
54	Prothorax of adult male, posterior internal aspect.	46
55	Mesothorax of adult male, posterior internal aspect.	"
56	Metathorax of adult male, posterior internal aspect.	"
57	Internal anatomy of adult male, lateral aspect.	"
58	Central nervous system of adult male, dorsal aspect.	"
59 A	Brain of adult male, dorsal aspect.	
B	Brain of adult male, anterior aspect.	
C	Brain of adult male, lateral aspect.	"
60 A	Prothorax of adult female, posterior internal aspect.	
B	Mesothorax of adult female, posterior internal aspect.	
C	Metathorax of adult female, posterior internal aspect.	"
61	Internal anatomy of adult female, lateral aspect.	"
62	Left longitudinal tracheal trunk of adult female, lateral aspect.	"
63	Central nervous system of adult female, dorsal aspect.	"
64 A	Brain of adult female, anterior aspect.	
B	Anterior sympathetic nervous system of adult female, dorsal aspect.	"



<u>Figure</u>	<u>Following page</u>
65	Percentages of larval instars collected monthly at Palmerston North from November 1966 to August 1967. 53
66 A	Weekly mean temperatures recorded in the laboratory during larval growth.
B	Weekly mean temperatures in the field during larval growth. 54
67	Weekly mean relative humidity recorded in the laboratory and in the field during larval growth. "
68	Weekly mean duration of bright light ( including electric light ) in the laboratory and weekly mean duration of bright sunshine in the field during larval growth. "
69	Monthly rainfall during larval growth. "
70	Growth curves of male and female larvae and their cases in the laboratory and in the field at Massey University, 1967. 55
71	Emergence of male imago. 58
72	Emergence of female imago, dorsal aspect. "
73	Copulation of imagoes as observed in the breeding cage. "
74	Life cycle observed at Palmerston North, 1966-67. <u>Page</u> 60
75	Attitude of first instar larva. A. with tail <u>Following page</u> elevated, B. with tail pendant. 67
76	Temperatures recorded in breeding cages during case building experiments. 71

<u>Figure</u>		<u>Following page</u>
77	Larva in nylon netting-tube.	72
78	Cases of different instar larvae collected from host plant, <u>Juniperus squamata</u> A. First instar case, B. Second instar case, C. Third instar case, D. Fourth instar case, E. Fifth instar case, F. Sixth instar case, and G. Seventh instar case.	74
79	Compound cases of larvae. A. Single case attached, B. Two cases attached, and C. Three cases attached.	"
80	The method of case building by larva illustrated diagrammatically.	75
81 A	Secondary case of third instar larva.	
B	Secondary case of fifth instar larva.	76
82	Weight loss of larvae in case building experiments.	77
83	Effect of the case on the mean water loss of larvae.	79

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Numbers of setae of different instars observed at Palmerston North, 1967.	11
2	Differences between internal structures ( excluding reproductive system ) of male and female pupae.	30
3	Differences between internal structures ( excluding reproductive system ) of male and female imagoes.	38
4	Measurements of the 7 instars reared in the field at Palmerston North, 1967.	51
5	Head capsule increase factor of larvae reared in the field.	52
6	Number of crochets per proleg in four larvae of 1st and 7th instars collected at Palmerston North, 1967.	53
7	Stadia of larvae reared in the laboratory and in the field at Palmerston North, 1967.	56
8	Duration of pupal stage determined from larvae collected in the field at Palmerston North, 1967.	58
9	Host plants recorded at Palmerston North in 1966-67.	62
10 A	Distribution of larval cases in <u>Cytisus scoparius</u> ( Scotch broom).	63
B	Comparison of distribution of larval cases between north and south sides of host plants.	64
C	Comparison of distribution of larval cases between upper and middle thirds of host plants.	65

<u>Table</u>		<u>Page</u>
10 D	Comparison of distribution of larval cases between lower and middle thirds of host plants.	66
E	Comparison of distribution of larval cases between upper and lower thirds of host plants.	67
11	Time required by larvae to repair cases which were cut throughout the length on one side.	68
12	Duration of life of larvae after case removal.	77
13	Effect of the case on the water loss of larvae.	78
14	Comparison of amounts of weight loss by larvae under different conditions.	79
15	Percentage of parasitised larvae recorded at Palmerston North from 26 November, 1966 to 26 June, 1967.	83
16	Percentage of parasitised pupae recorded at Palmerston North from 26 November 1966 to 26 June 1967.	84

## CHAPTER I

### INTRODUCTION

Liothula omnivora, one of the two known casemoths endemic to New Zealand, belongs to the Lepidopteran family Psychidae. It is distributed throughout the country, and can be found on a large number of host plants (see later). The other N.Z. casemoth, Orophora concolor, has been found on Wild Irishman and cassinias in the river beds of the South Island (Miller, 1955).

L. omnivora was first described by Fereday in 1878, but Meyrick (1890) transferred it to the genus Oiketeticus (Guilding, 1827) misspelling it Oeceticus. Dr. Allan Watson (1967, pers. comm.) of the British Museum (Natural History) considers that this species should belong in the genus Liothula and the writer has adopted Watson's view in calling it L. omnivora. The type of L. omnivora is in the Canterbury Museum, Christchurch (Entomologische Beihefte 4, Horn and Kahle, 1937). Descriptions of the external morphology of the adult male and female have been made by Fereday (1878), Meyrick (1890) and Hudson (1928). Fereday and Hudson also described the larva, the pupa has been described by Hudson and Quail (1901), and the appearance of the egg briefly noted by Hudson.

Smith (1898) observed the locomotion of the larvae in his house and Hudson (1928) made observations on case repairing by larvae. Hudson (1928) also described the larval case, observed the suicidal crushing of adult males in captivity and the helpless condition of

the adult females and was the first person to describe briefly the life history of this species. He recorded four insect parasites and Gourlay (1930) also recorded four including two species not found by Hudson. Miller (1955) noted that the Maoris called L. omnivora by the names Kopa (to shut), whare atua (spirit house) or Raukatauri (flute of the goddess of music, Raukatauri).

This species is of little or no economic importance although Gaze (1891) reported that larvae defoliate and ring branches of currant plants, Miller (1917) found that larvae do minor damage to the leaves of N.Z. flax, and Clark (1932) observed a slight amount of damage was caused to Pinus radiata by larvae feeding upon the needles.

In this study, the anatomy, life history, general biology, case building, case function and studies on insect parasites have been undertaken.