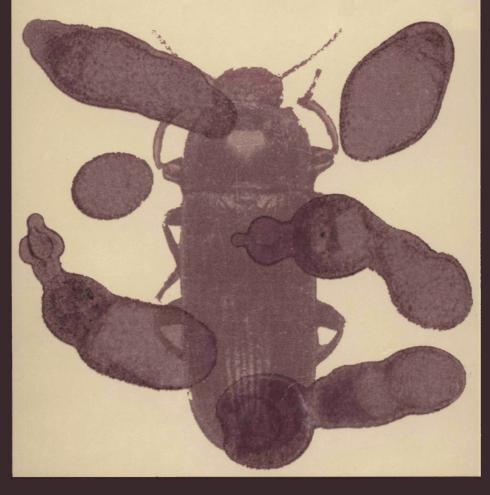
Parasitology

Symposia of the British Society for Parasitology Volume 35

Parasite-insect interactions: reciprocal manipulation

EDITED BY HILARY HURD and RICHARD LANE

CO-ORDINATING EDITOR L. H. CHAPPELL



CAMBRIDGE UNIVERSITY PRESS

Subscriptions may be sent to any bookseller or subscription agent or direct to the publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, UK. Subscriptions in the USA, Canada and Mexico should be sent to Cambridge University Press, Journals Department, 40 West 20th Street, New York, NY 10011-4211, USA. All orders must be accompanied by payment. The subscription price (excluding VAT) of volumes 116 and 117, 1998 is £338 (US \$586 in the USA, Canada and Mexico), payable in advance, for twelve parts plus supplements; separate parts cost £31 or US \$53 each (plus postage). EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country's rate. VAT registered subscribers should provide their VAT registration number. Japanese prices for institutions are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan. Prices include delivery by air. Periodicals postage paid at New York, NY and at additional mailing offices. POSTMASTER : send address changes in USA, Canada and Mexico to *Parasitology*, Cambridge University Press, 110 Midland Avenue, Port Chester, New York, NY 10573-4930, USA.

ISBN 0 521 64425 9

Front Cover Illustration: Stages in the development of metacestodes of the rat tapeworm, Hymenolepis diminuta together with the intermediate host, Tenebrio molitor. Original photograph by Gerald Burgess and Hilary Hurd, Keele University.

© Cambridge University Press 1998

The Edinburgh Building, Cambridge CB2 2RU, United Kingdom 40 West 20th Street, New York, NY 10011–4211, USA 10 Stamford Road, Oakleigh, Melbourne 3166, Australia

Printed in the United Kingdom at the University Press, Cambridge

Parasitology

Symposia of the British Society for Parasitology Volume 35

Parasite-insect interactions: reciprocal manipulation

EDITED BY HILARY HURD and RICHARD LANE

CO-ORDINATING EDITOR L. H. CHAPPELL



Contents

List of	contrioi	itions

Evolution and phylogeny of behavioural manipulation of insect hosts by	
parasites	S 3
Summary	S 3
Introduction	S 3
Diversity of insect-parasite interactions	S 4
And the winner is	S 4
Phylogenetic approaches	S6
Conclusion	S 8
Acknowledgements	S 9
References	S 9

v

S1

S29

S29

S29

Parasite manipulation of insect reproduction: who henefits?

reproduction: who benefits?	S13
Summary	S13
Introduction	S13
The rat tapeworm/insect intermediate host	
model	S15
Events in the fat body of infected beetles	S15
Events in the ovary	S16
Endocrine regulation of vitellogenesis	S16
Evaluation of the adaptive nature of	
curtailment of host reproduction	S18
Conclusion	S19
Acknowledgements	S19
References	S19

tsetse	S23
Summary	S23
Introduction	S23
Materials and methods	S23
Flies	S23
Trypanosomes	S23
Fly infection and survival	S23
Results and discussion	
Salivary gland infection, fly sex and	
survival	S23
Survival under field conditions	S26
Mechanisms of parasite-induced mortality	S26
Vectorial capacity of tsetse	S27
Acknowledgements	S27
References	S27

The coevolution of host resistance and	
parasitoid virulence	
Summary	
Introduction	

Resistance and virulence	S30
Questions about coevolution	S30
Insects other than Drosophila	
Examples from biological control	S31
Pupal parasitoid of houseflies	S31
Pea aphid and its parasitoid	S31
Drosophila	S32
Natural history	S32
Genetic variation: isofemale lines	S33
Genetic variation: selection experiments	S34
Trade-offs	S35
Costs of successful resistance	S36
Cross resistance and cross virulence	S36
Parasitoids and Drosophila behavioural	
polymorphisms	S36
Geographical patterns and local adaptation	S37
Cross-species comparisons	S39
Physiological basis of differences in	
resistance and virulence	S39
Genetic basis of difference in resistance	
and virulence	S40
Conclusions and further areas of study	S40
References	S41

Coevolutionary interactions between

host life histories and parasite life

cycles	S47
Summary	S47
Introduction	S47
A brief review	S47
Edhazardia aedis vs Aedes aegypti	S49
Effect of the host's life-history on the	
parasite's transmission and virulence	S50
Selection pressure of parasite on host's	
life-history	S52
Conclusions	S54
References	S54

Modulation of immune responses to parasitoids by polydnaviruses

parasitoids by polydnaviruses	S57
Summary	S57
Introduction	S57
Polydnavirus gene products	S58
Effects on phenoloxidases	S61
Role of parasitoid venoms	S61
Parasite immunoevasion tactics	S61
References	S62

Displaced tick-parasite interactions at	
the host interface	S65
Summary	S65
The vector-borne Parasite Triangle	S65

Contents

Reciprocal vector-host interactions	S65
Co-feeding parasite transmission	
Saliva-activated transmission (SAT)	
Role of skin in virus transmission	S70
Model for non-viraemic virus transmission	
Reciprocal tick-parasite interactions at the	
host interface	S7 0
Future challenges	S71
References	

The neglected saliva: medically important toxins in the saliva of	
human lice	S73
Summary	S73
Introduction	S73
Salivary components of blood-sucking insects	
other than lice	S73
Salivary components of human lice	S74
Erythematous, anticoagulant and	
immunoactive functions in lice saliva	S74
Recent studies on lice salivary glands	S75
Vasodilatory activity	S75
Anticoagulants	S 76
Immunoreactive components	$\mathbf{S76}$
Parasites as targets of their own salivas and	
venoms	S77
Microbial alteration of blood-sucking	
behaviour	S77
Medical relevance of lice salivary activities	S78
Pharmaceutical interest in bioactive salivary	
components	S78
Acknowledgements	$\mathbf{S78}$
References	S78

Plasmodium ookinete development in the mosquito midgut: a case of	
reciprocal manipulation	S83
Summary	S83
Introduction	S83
Development of Plasmodium ookinetes	S84
Expression of ookinete-specific genes	S85
Ookinete interaction with PM	S85
Invasion of the PM	S86

Survival of ookinetes in the gut lumen	S87
Structure of the mosquito midgut epithelium	S88
Ookinete invasion of mosquito midgut	
epithelium	S88
Ookinetes and mosquito antimicrobial	
immunity	S89
Ookinete-midgut interaction and targets for	
malaria transmission-blocking strategies	S90
Acknowledgements	S90
References	S90

The biology of *Plasmodium falciparum* transmission stages

transmission stages	S95
Summary	S95
Introduction	S95
Gametocyte morphology	S96
Molecular biology of the gametocyte	S97
DNA synthesis	S97
Transcription	S98
Translation	S98
Sex determination	S98
Metabolism	S99
Ionic regulation and transport	S99
Gametocyte sequestration	S100
Gametocyte infectivity	S102
Human immunity	S102
Antimalarial drugs	S103
Cohabitation	S103
Gametocyte diversity and sex	S103
Conclusions	S104
Acknowledgements	S105
References	S105

Wolbachia as a possible means of

driving genes into populations	S111
Summary	S111
Cytoplasmic incompatibility in Culex	
mosquitoes	S111
The dynamics of Wolbachia in insect	
populations	S112
Possible use of Wolbachia to drive genes for	
inability to transmit malaria into	
Anopheles populations	S114
References	S115