Evolutionary Ecology of Parasites

second edition

Robert Poulin

PRINCETON UNIVERSITY PRESS . PRINCETON AND OXFORD

Contents

	Preface	ix
1	Introduction	1
	1.1 The Evolutionary Ecology Approach	- 2
	1.2 Scope and Overview	4
2	Origins of Parasitism and Complex Life Cycles	8
	2.1 Transitions to Parasitism	8
	2.2 Specialization of Parasites	11
	2.3 Complex Life Cycles: Historical Contingency or Adaptation?	14
	2.3.1 Increases in Life-Cycle Complexity	14
	2.3.2 Abbreviation of Complex Life Cycles	21
	2.4 Evolutionary Consequences of Complex Life Cycles	25
	2.4.1 Transmission and Infection	26
	2.4.2 Sexual Reproduction	35
	2.5 Conclusion	40
3	Host Specificity	41
	3.1 Measuring Host Specificity	41
	3.2 Host-Parasite Coevolution and Host Specificity	48
	3.2.1 Macroevolutionary Patterns	48
	3.2.2 Microevolutionary Processes	54
	3.3 Determinants of Host Specificity	60
	3.4 Observed Patterns of Host Specificity	63
	3.5 Conclusion	69

.

.

vi | Contents

4	Evolution of Parasite Life-History Strategies	70
<u> </u>	4.1 Phenotypic Plasticity and Adaptation	71
	4.2 Parasite Body Size	73
	4.2.1 Changes in Size as Adaptations to Parasitism	73
	4.2.2 Correlates of Body Size	79
	4.2.3 Sexual Size Dimorphism in Parasites	85
	4.3 Parasite Age at Maturity	87
	4.4 Egg Production in Parasites	88
	4.4.1 Correlates of Fecundity	89
	4.4.2 Trade-offs and Strategies of Egg Production	90
	4.5 Conclusion	95
5	Strategies of Host Exploitation	96
<u> </u>	5.1 The Evolution of Virulence	97
	5.1.1 The Theory	98
	5.1.2 Empirical Tests	102
	5.2 Parasitic Castration and Host Gigantism	110
	5.3 Manipulation of Host Behavior by Parasites	114
	5.3.1 Adaptive Manipulation?	115
	5.3.2 Evolution of Host Manipulation	121
	5.3.3 Host Manipulation in a Multispecies Context	126
	5.4 Manipulation of Host Sex Ratio by Parasites	130
	5.5 Conclusion	132
6	Parasite Aggregation: Causes and Consequences	134
	6.1 Measuring Parasite Aggregation	135
	6.1.1 Indices of Aggregation	135
	6.1.2 Problems with the Measurement of Aggregation	139
	6.2 Natural Patterns of Aggregation	141
	6.3 Causes of Aggregation	144
	6.4 Consequences of Aggregation	150
	6.4.1 Effective Population Size and Genetic Diversity	151
	6.4.2 Sex Ratio	154
	6.4.3 Macroevolutionary Phenomena	158
	6.5 Conclusion	159
7	Parasite Population Dynamics and Genetics	160
	7.1 Models of Parasite Population Dynamics	161
	7.2 Density-Dependent Regulation	166
	7.3 Selected Examples of Population Studies	172
	7.3.1 The Cestode Bothriocephalus acheilognathi	172
	7.3.2 The Nematode Cystidicola cristivomeri	173
	7.3.3 The Nematode Cystidicoloides tenuissima	174
	7.3.4 The Acanthocephalan Acanthocephalus tumescens	175

-

	7.4 Patterns of Parasite Abundance	177
	7.5 Genetic Structure of Parasite Populations	179
	7.6 Conclusion	186
	laterations hat was Consistent and the Devente Alight	
Ŏ	Interactions between Species and the Parasite Niche	188
	8.1 Numerical Responses to Competition	189
	8.2 The Parasite Niche	194
	8.3 Functional Responses to Competition	195
	8.4 Evolutionary Niche Restriction	203
	8.5 Conclusion	207
9	Parasite Infracommunity Structure	209
<u> </u>	9.1 Species Richness of Infracommunities	210
	9.2 Nestedness in Infracommunities	215
	9.3 Species Associations among Infracommunities	220
	9.4 Species Recruitment and Infracommunity Structure	224
	9.5 Species Abundance and Biomass in Infracommunities	227
	9.6 Conclusion	231
10	Component Communities and Parasite Faunas	233
Ľ	10.1 Richness and Composition of Component Communities	233
	10.2 Evolution of Parasite Faunas	241
	10.3 Species Richness of Parasite Faunas	245
	10.4 Biogeography of Parasite Diversity	253
	10.5 Host Specificity and the Composition of Parasite Faunas	257
	10.6 Conclusion	260
[1]		
$[\Pi]$		262
	11.1 Environmental Changes and Parasite Evolutionary Ecology	263
	11.2 Parasite Control and Parasite Evolutionary Ecology	265
	11.3 Future Directions	267
	References	271
	Index	325