

# CONTENTS

Preface to second edition	viii
Foreword to first edition	x
1 An overview of insect ecology	1
1.1 Introduction	1
1.2 History of ecology and entomology	1
1.3 Ecological associations	2
1.4 The Insecta	2
1.5 Fossil history and insect evolution	5
1.6 Habits of insects	10
1.7 Numbers of insects: species richness	11
1.8 Variations in species number	14
1.9 The number of insects: abundance	22
1.10 Insects and humans	29
1.11 Conclusion	32
2 Insects and climate	33
2.1 Introduction	33
2.2 Temperature	33
2.3 Daylength (photoperiod)	40
2.4 Rainfall	41
2.5 Wind	47
2.6 Climate change	54
2.7 Conclusion	60
3 Insect herbivores	61
3.1 The trouble with plants as food	61
3.2 Feeding strategies of herbivorous insects	64
3.3 Plant defenses	65
3.4 Plant hybrid zones and defense against herbivores	94
3.5 When is a defense not a defense?	95
3.6 Costs of resistance and tolerance to herbivores	95
3.7 Overcompensation	98
3.8 Plant defense under elevated carbon dioxide	100

4	Resource limitation	103
4.1	The importance of resource limitation on insect populations	103
4.2	Competition for limited resources	106
4.3	The niche concept	108
4.4	Theoretical approaches to the study of competition	109
4.5	Competition among insects in experimental and natural populations	113
4.6	Competition among insects other than herbivores	131
5	Natural enemies and insect population dynamics	135
5.1	Introduction	135
5.2	The variety of natural enemies	135
5.3	The impact of natural enemies on insect populations	138
5.4	Modeling predator–prey interactions	148
5.5	Synthesis: combining the impacts of natural enemies and other factors on insect population dynamics	163
5.6	Conclusion	178
6	Evolutionary ecology	180
6.1	Introduction	180
6.2	Life history strategies	180
6.3	Sexual strategies: optimizing reproductive potential	185
6.4	Life history variations with region	194
6.5	Coevolution	196
6.6	Sequestration of plant secondary metabolites	229
6.7	Deme formation and adaptive genetic structure	235
6.8	Extreme ways of life	239
7	Physiological ecology	250
7.1	Introduction	250
7.2	Food and feeding in juveniles	250
7.3	Food and feeding in adults	256
7.4	Metabolism	258
7.5	Respiration	262
7.6	Excretion	266
7.7	Water relations	268
7.8	Development: ecdysis and pupation	271
7.9	Reproduction	274
7.10	Conclusion	279
8	Insects in ecosystems	280
8.1	What is ecosystem ecology?	280
8.2	A few fundamentals of ecosystem ecology	280
8.3	Insects and the terrestrial carbon cycle	283
8.4	Leaf-shredding insects and stream ecosystems	288
8.5	Insect defoliators and the cycling of nutrients	291
8.6	Insects, plant community structure, and succession	295
8.7	Conclusion	302
9	Biodiversity	303
9.1	Introduction	303

9.2	Measuring biodiversity	303
9.3	Patterns in insect diversity	317
10	Insect conservation	342
10.1	Introduction	342
10.2	Status and trends in insect diversity	342
10.3	Threats to insects	353
10.4	Conservation and restoration	365
10.5	Prospects for insect conservation	378
11	Insects and diseases	379
11.1	Introduction	379
11.2	Diseases and pathogens	379
11.3	Pathogen spread	380
11.4	Vector ecology	384
11.5	Vector dispersal	387
11.6	Pathogen transmission	389
11.7	Effects on the vector	392
11.8	Epidemiology: the spread of disease	397
11.9	Human activities and vectors	399
11.10	Vector control	403
11.11	Case studies	409
11.12	Conclusion	427
12	Insect pest management	429
12.1	Introduction	429
12.2	The concept of "pest"	429
12.3	Why pest outbreaks occur	430
12.4	Ecological pest management	443
12.5	Biological control	450
12.6	Chemical control	475
12.7	Integrated pest management	497
	References	514
	Taxonomic index	597
	Subject index	602

Colour plate section appears between pp. 310 and 311