

C. H. Walker

**ORGANIC
POLLUTANTS**

An Ecotoxicological Perspective



Contents

Preface	x
Acknowledgements	xii

PART 1 BASIC PRINCIPLES 1

CHAPTER 1 CHEMICAL WARFARE 3

1.1	Introduction	3
1.2	Plant–animal warfare	4
1.3	Toxins produced by animals and microorganisms	10
1.4	Man-made chemical weapons	12
1.5	Summary	13
1.6	Further reading	13

CHAPTER 2 FACTORS DETERMINING THE TOXICITY OF ORGANIC POLLUTANTS TO ANIMALS AND PLANTS 14

2.1	Introduction	14
2.2	Factors which determine toxicity and persistence	16
2.3	Toxicokinetics	18
2.4	Toxicodynamics	53
2.5	Selective toxicity	59
2.6	Potentiation and synergism	61
2.7	Summary	62
2.8	Further reading	63

CHAPTER 3	INFLUENCE OF THE PROPERTIES OF CHEMICALS ON THEIR ENVIRONMENTAL FATE	64
3.1	Introduction	64
3.2	Properties of chemicals which influence their fate in the gross environment	65
3.3	Models of environmental fate	67
3.4	Influence of the properties of chemicals on their metabolism and disposition	68
3.5	Summary	70
3.6	Further reading	71
CHAPTER 4	DISTRIBUTION AND EFFECTS OF CHEMICALS IN COMMUNITIES AND ECOSYSTEMS	72
4.1	Introduction	72
4.2	Movement of pollutants along food chains	73
4.3	Fate of pollutants in soils and sediments	75
4.4	Effects of chemicals at the population level: population dynamics	80
4.5	Effects of pollutants on population genetics	83
4.6	Effects of pollutants upon communities and ecosystems: the natural world and model systems	85
4.7	New approaches to predicting ecological risks presented by chemicals	87
4.8	Summary	87
4.9	Further reading	88
PART 2	MAJOR ORGANIC POLLUTANTS	89
CHAPTER 5	THE ORGANOCHLORINE INSECTICIDES	91
5.1	Background	91
5.2	DDT [1,1,1-trichloro-2,2-bis(<i>p</i> -chlorophenyl) ethane]	92
5.3	The cyclodiene insecticides	104
5.4	Hexachlorocyclohexanes	118
5.5	Summary	119
5.6	Further reading	120

CHAPTER 6	POLYCHLORINATED BIPHENYLS AND POLYBROMINATED BIPHENYLS	121
6.1	Background	121
6.2	Polychlorinated biphenyls	122
6.3	Polybrominated biphenyls	136
6.4	Summary	137
6.5	Further reading	137
CHAPTER 7	POLYCHLORINATED DIBENZODIOXINS AND POLYCHLORINATED DIBENZOFURANS	138
7.1	Background	138
7.2	Polychlorinated dibenzodioxins	139
7.3	Polychlorinated dibenzofurans	146
7.4	Summary	147
7.5	Further reading	147
CHAPTER 8	ORGANOMETALLIC COMPOUNDS	148
8.1	Background	148
8.2	Organomercury compounds	149
8.3	Organotin compounds	156
8.4	Organolead compounds	161
8.5	Organoarsenic compounds	162
8.6	Summary	163
8.7	Further reading	163
CHAPTER 9	POLYCYCLIC AROMATIC HYDROCARBONS	165
9.1	Background	165
9.2	Origins and chemical properties of PAHs	167
9.3	Metabolism of PAHs	167
9.4	Environmental fate of PAHs	169
9.5	Toxicity of PAHs	171
9.6	Ecological effects of PAHs	174
9.7	Summary	175
9.8	Further reading	176

CHAPTER 10	ORGANOPHOSPHOROUS AND CARBAMATE INSECTICIDES	177
10.1	Background	177
10.2	The OPs	178
10.3	Carbamate insecticides	196
10.4	Summary	202
10.5	Further reading	203
CHAPTER 11	THE ANTICOAGULANT RODENTICIDES	204
11.1	Background	204
11.2	Chemical properties	205
11.3	Metabolism of anticoagulant rodenticides	206
11.4	Environmental fate of anticoagulant rodenticides	207
11.5	The toxicity of anticoagulant rodenticides	208
11.6	Ecological effects of anticoagulant rodenticides	211
11.7	Summary	212
11.8	Further reading	213
CHAPTER 12	PYRETHROID INSECTICIDES	214
12.1	Background	214
12.2	Chemical properties	215
12.3	Metabolism of pyrethroids	216
12.4	Environmental fate of pyrethroids	218
12.5	Toxicity of pyrethroids	219
12.6	Ecological effects of pyrethroids	220
12.7	Summary	221
12.8	Further reading	221
PART 3	FURTHER ISSUES AND FUTURE PROSPECTS	223
CHAPTER 13	THE ECOTOXICOLOGICAL EFFECTS OF HERBICIDES	225
13.1	Introduction	225
13.2	Some major groups of herbicides	226
13.3	Agricultural impact of herbicides	228

13.4	Movement of herbicides into surface waters and drinking water	229
13.5	Summary	230
13.6	Further reading	232

**CHAPTER 14 DEALING WITH COMPLEXITY:
THE TOXICITY OF MIXTURES 233**

14.1	Introduction	233
14.2	Measuring the toxicity of mixtures	234
14.3	Shared mode of action – an integrated biomarker approach to measuring the toxicity of mixtures	235
14.4	Bioassays for toxicity of mixtures	241
14.5	Potential of toxicity in mixtures	242
14.6	Summary	244
14.7	Further reading	244

**CHAPTER 15 THE ENVIRONMENTAL IMPACT
OF ORGANIC POLLUTANTS:
FUTURE PROSPECTS 245**

15.1	Introduction	245
15.2	The design of new pesticides	246
15.3	The adoption of more ecologically relevant practices in ecotoxicity testing	248
15.4	The development of more sophisticated methods of toxicity testing: mechanistic biomarkers	250
15.5	Field studies	251
15.6	Ethical questions	252
15.7	Summary	252
15.8	Further reading	253

Glossary	254
References	258
Index	275