

# Introduction to Plant Population Biology

---

Jonathan Silvertown

*Department of Biological Sciences  
The Open University  
Milton Keynes*

Deborah Charlesworth

*Institute of Cell, Animal and Population Biology  
University of Edinburgh  
Edinburgh*

FOURTH EDITION

# Contents

*Acknowledgements*, viii

- 1 Introduction, 1
  - 1.1 Plants, 1
  - 1.2 Population biology, 1
  - 1.3 Some consequences of being a plant, 10
  - 1.4 Summary, 17
  - 1.5 Further reading, 17
  - 1.6 Questions, 18
  
- 2 Variation and its inheritance in plant populations, 19
  - 2.1 Introduction, 19
  - 2.2 Types of trait, 20
  - 2.3 Genotype and phenotype, 22
  - 2.4 Quantitative inheritance, 23
  - 2.5 Discrete genetic variation, 29
  - 2.6 Mutation, 35
  - 2.7 Plant breeding systems and genetic variability: introduction, 37
  - 2.8 Consequences of inbreeding, outbreeding and asexual reproduction, 46
  - 2.9 Summary, 50
  - 2.10 Further reading, 52
  - 2.11 Questions, 52
  
- 3 Evolutionary and ecological genetics, 53
  - 3.1 Introduction, 53
  - 3.2 Gene and genotype frequencies without selection, 54
  - 3.3 Gene flow, 63
  - 3.4 Patterns of genetic diversity in plant populations, 74
  - 3.5 Natural selection, 76
  - 3.6 Summary, 90
  - 3.7 Further reading, 91
  - 3.8 Questions, 92

## CONTENTS

- 4 Intraspecific interactions, 93
  - 4.1 Introduction, 93
  - 4.2 Yield and density, 93
  - 4.3 Self-thinning, 96
  - 4.4 Size variation, 101
  - 4.5 The influence of neighbours, 105
  - 4.6 Size, density and fitness, 111
  - 4.7 Population regulation: density dependence, 113
  - 4.8 Summary, 119
  - 4.9 Further reading, 121
  - 4.10 Questions, 121
  
- 5 Population dynamics, 122
  - 5.1 Introduction, 122
  - 5.2 Demographic parameters, 123
  - 5.3 Annuals with no seed bank, 125
  - 5.4 Density-dependent dynamics, 127
  - 5.5 Seeds in the soil, 135
  - 5.6 Summary, 151
  - 5.7 Further reading, 152
  - 5.8 Questions, 152
  
- 6 Dynamics of age-structured and stage-structured populations, 153
  - 6.1 Introduction, 153
  - 6.2 Stochasticity, disturbance and recruitment, 153
  - 6.3 Population models with age and stage structure, 158
  - 6.4 Annuals with a seed bank, 163
  - 6.5 Perennials, 165
  - 6.6 Summary, 174
  - 6.7 Further reading, 176
  - 6.8 Questions, 176
  
- 7 Regional dynamics and metapopulations, 177
  - 7.1 Introduction, 177
  - 7.2 The classical metapopulation model, 179
  - 7.3 Regional dynamics of plants, 181
  - 7.4 Extinction, 185
  - 7.5 Genetic and evolutionary consequences of regional dynamics, 188
  - 7.6 Geographical range limits, 190
  - 7.7 Invasions, 191
  - 7.8 Phylogeography, 193
  - 7.9 Summary, 195
  - 7.10 Further reading, 196
  - 7.11 Questions, 196

- 8 Competition and coexistence, 198
  - 8.1 Introduction, 198
  - 8.2 The variety of interactions between plants, 198
  - 8.3 Competition, 201
  - 8.4 Coexistence, 223
  - 8.5 Summary, 239
  - 8.6 Further reading, 241
  - 8.7 Questions, 241
  
- 9 The evolution of plant life history: breeding systems, 242
  - 9.1 Introduction, 242
  - 9.2 Evolution of sex, 246
  - 9.3 Selection pressures on the selfing rate, 247
  - 9.4 Self-incompatibility, 252
  - 9.5 Evolution of separate sexes, 254
  - 9.6 Summary, 268
  - 9.7 Further reading, 269
  - 9.8 Questions, 270
  
- 10 The evolution of plant life history: reproduction, growth, senescence and death, 271
  - 10.1 Introduction, 271
  - 10.2 Reproductive maturity, 272
  - 10.3 Mast variation in seed crop size, 276
  - 10.4 Seeds, 279
  - 10.5 Clonal growth, 290
  - 10.6 Senescence and death, 294
  - 10.7 Life history strategies, 299
  - 10.8 Summary, 300
  - 10.9 Further reading, 301
  - 10.10 Questions, 302
  
- Appendix: Symbols and terms used in this book, 303
- References, 306
- Index, 337