The evolutionary ecology of ant–plant mutualisms
The Evolutionary Ecology of Ant-plant Mutualisms
Andrew J. Beattie
Frontmatter
More information
The evolutionary ecology of ant–plant mutualisms

ANDREW J. BEATTIE
Northwestern University
To my mother and father, Christine, and Helena
# Contents

*Preface*  
_page ix*

1 **Introduction**  
1

2 **Origins and early evolution of ant–plant mutualisms**  
   Ants and plants in the Cretaceous  
   The impact of the ant’s mode of feeding  
   The impact of social organization  
   Early ant–plant habitats  
   8

3 **Plant protection by direct interaction**  
   Ant nests and domatia  
   Food bodies  
   Extrafloral nectaries  
   A closer look at ant guards and extrafloral nectaries  
   21

4 **Plant protection by indirect interaction**  
   Homopterans  
   Lepidopterans  
   Summary and conclusions  
   54

5 **Myrmecotrophy**  
   66

6 **The dispersal of seeds and fruits by ants**  
   The predator-avoidance hypothesis  
   The competition-avoidance hypothesis  
   The fire-avoidance hypothesis  
   The dispersal-for-distance hypothesis  
   The nutrient hypothesis  
   Assessment of the hypotheses  
   The distribution and variability of ant dispersal  
   The ants that disperse seeds  
   73
viii  

Contents

7  Ant pollination  96

8  Food rewards for ant mutualists  110
   Ant nutrition  110
   Elaiosomes  113
   Extrafloral nectar  115
   Food bodies  118
   Rewards offered by homopterans and lycaenid larvae  119
   Ant rewards: supply and demand  120

9  Variation and evolution of ant–plant mutualisms  128
   Generalist versus specialist  130
   Selection and fitness  131
   Pathways to mutualistic interaction and coevolution  138

References  146
Index  177
Preface

The natural history of ant–plant mutualisms has fascinated Western scientists for roughly two centuries. During this time it has become clear that the ways in which plants manipulate ants, and vice versa, can be so complex and subtle as to severely stretch the credence of the observer. The early natural historians described ant–plant relationships in superb detail, but generally inferred that a given relationship was mutualistic from anatomical, morphological, or behavioral data alone. Experimental verification was the exception rather than the rule. Although the experimental approach was tried by a few early workers, such as von Wettstein (1889), its impact was not dramatic until the publication of Janzen’s seminal work on acacia ants about twenty years ago. This pioneering research has since been followed by many excellent experimental field studies embracing a variety of ant–plant mutualisms from many kinds of environments. Our knowledge of the selective pressures that produce the mutualistic response, the dynamics of the ant–plant interactions, the benefits to the plants and the ants, and the ways that mutualisms evolve has been vastly improved. At the same time, ant–plant mutualisms are extremely numerous and varied, and so far only a very few cases have been adequately analyzed. As a consequence, generalizations from limited data often have to be made. Whether or not this is wise will be revealed as new studies are published.

Ideas and syntheses generally enter the mind as a result of the stimulation of colleagues. I have been fortunate in having been at the receiving end of a great deal of stimulation, especially from Bob Abugov, Lin Chao, David Culver, Fran Hanzawa, Carol Horvitz, Dennis O’Dowd, Doug Schemske, Bob Taylor, and Christine Turnbull. Carol Horvitz, Doug Schemske, Dennis O’Dowd, and Herbert and Irene Baker have kindly allowed me to use some of their unpublished data. Comments and criticisms by Lin Chao, David Culver, Carol Horvitz, and Dennis O’Dowd of early drafts of various chapters have led to enormous improvements in the manuscript. I thank them for all the time and effort they put into
Preface

their tasks, but urge the reader not to blame them for any errors that remain.

Tracy Ramsey typed the manuscript with great skill and patience. My wife, Christine Turnbull, made an excellent job of the illustrations and was also a constant and crucial source of encouragement.