Chemical Ecology of Insects 2

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Preface

The first volume of *Chemical Ecology of Insects* was published ten years ago. Then this field was characterized by rapidly expanding knowledge of the chemical structures used by insects in a variety of tasks: communication, defense, and finding and identifying resources. In parallel, the plant and animal resources exploited by insects were documented to invest in chemicals to manipulate insects' behavior and physiology. The ecological complexities of these interactions, however, were often unapparent. For example, although odor plumes were known to have considerable fine-scale structure, the significance of such wispiness to the orientation maneuvers of flying insects was not suspected. Similarly, although a few early studies implicated learning in the recognition by wasp parasitoids of chemical cues from their prospective hosts, the widespread nature of this phenomenon remained to be uncovered. These examples illustrate the point that our understanding of the ecology of interactions mediated by these chemicals often lagged behind our ability to characterize the chemicals themselves.

The current volume brings together a narrower selection of reviews than did its predecessor. Our intent has not been to span the entire field of insect chemical ecology—given the growth of knowledge in this area, such a task now would of necessity cover topics superficially. Instead, we have selected topics that offer a perspective on some of the most interesting advances in insect chemical ecology. We encouraged the authors to provide proximate examinations of the ways in which chemical cues modify ecological interactions and to speculate when feasible on the ultimate selective forces that maintain and may have molded these relationships.

Chapter 1 offers a compelling case for abandoning a "chemocentric" approach to understanding how insects react to chemical cues, and instead for developing assays that account for the integration of sensory modalities in behavior output. Chemoreception and integration also are considered in two chapters of the widespread role of prior experience in host finding and acceptance. Chapter 2 reviews the effects of epxerience in host acceptance by herbivores, and Chapter 3 examines how experience modifies searching for and accepting of a host by parasitoids. Chapter 4 considers the topic of detecting and then locating chemical resources, offering new perspectives on the diversity of strategies available.

The complexities of plant-insect interactions are reviewed in the cases of bark beetles (Chapter 5) and *Pieris* butterflies (Chapter 6). The last section focuses on insect-insect interactions. The behavioral ecology of trails and territories in social insects is examined in Chapter 7, and in Chapter 8 the role of chemical signals in nest-mate and mate recognition is analyzed. Chapter 9 details a specialized example of chemical communication and its exploitation: pheromones of true bugs and their use by parasitoids as kairomones. In Chapter 10 cases of chemical espionage and deceit among inquilines and slavemakers offer the most complex examples of the exploitation of chemical signals.

One value of such reviews lies in their identification of the boundaries of our current knowledge and the prospect of identifying the most profitable areas in which we should expect these topics to develop. A consensus in these reviews may be that assays of insect behavior conducted in the field or incorporating a realistic simulation of field conditions will prove instructive to establishing natural patterns of response and variation in behavior. In turn, these observations can help identify the most relevant cues to incorporate into laboratory tests that seek to partition the importance of chemical and other sensory inputs.

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