Book Reviews

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Chemical Ecology for the Next Generation

Haynes, Kenneth F., and Jocelyn G. Millar, editors. 1998. **Methods in chemical ecology.** Volume 2. Bioassay methods. Chapman and Hall, New York. xx + 406 p. $115.00, £78.25, NLG 260.00, ISBN: 0-412-08041-9 (alk. paper).

Chemical ecology, the study of chemically mediated species interactions, is an exciting and rapidly growing area of research. Recent advances involve the understanding of chemical mechanisms of interactions in the context of field experiments. This linkage is yielding fascinating insights into 1) the natural history of chemically mediated species interactions (i.e., the series of papers on chemical defense in insects spearheaded by T. Eisner), 2) the importance of chemically mediated interactions in structuring ecological communities (i.e., work by M.E. Hay et al.), and 3) the prediction and manipulation of chemically mediated interactions in an applied context (see the recent deluge of work on the use of the BT toxin in agriculture).

The interdisciplinary nature and recent emergence of chemical ecology necessitate a discussion of appropriate bioassay methods, the focus of this book. Bioassays are an essential component of chemical ecology because they represent a link between a particular compound(s) and the species interactions of interest. Haynes and Millar are successful in assembling a diverse volume that covers methods in the chemical ecology of organisms ranging from marine microorganisms, plant pathogens, and insects, to amphibians, mammals, and fish. The chapters of the book are well written, illustrative, and most importantly, have lengthy bibliographies referring to classic literature as well as cutting edge studies in the respective fields.

Bioassays are a particularly challenging component of chemical ecology, in part because the researcher is often attempting to isolate particular chemicals involved in behaviors or interactions as complex as courtship, host finding, and defense. The reductionist approach is thus coupled with the ecology of whole organisms. Throughout the book, the authors emphasize the importance of realism when conducting bioassays and offer several suggestions: 1) Are the chemicals being assayed at relevant concentrations? For example, it is argued that most compounds are attractive or stimulatory at some concentrations, but toxic or inhibitory at other concentrations. 2) Are the bioassay organisms ecologically relevant? Brine shrimp are emerging as a model organism for many types of bioassays, yet the interpretation may be difficult because of the lack of context (i.e., feeding terrestrial herbivores is different than bathing brine shrimp with a particular compound—their respective sensitivity is also probably different). 3) Are the assay organisms able to behave naturally, or are they focused on trying to escape the experimental arena? Obviously, the oviposition preference of a stressed butterfly crammed in a film container is going to be altered compared to one foraging at will in the field. As fundamental as these questions seem, the authors of the book suggest that there is still a general lack of adherence to such relevant conditions in most bioassays. Still, the recommendations for realism are made in a practical context, and readers should find the balanced creative solutions presented in the book quite useful. Authors also discuss the philosophy of conducting bioassays, illuminating the benefits and limitations of the approach within the context of what can and cannot be learned.

The seven chapters are focused around taxonomic groups, and a broad array of interactions is covered. A recurring theme in the book, across chapters involving both vertebrates and invertebrates, is predator-prey interactions, and the role of chemical communication in mediating these interactions. Chapters by M.E. Hay and colleagues (marine and freshwater interactions), J.D. Hare (insects), and R.T. Mason et al. (reptiles and amphibians) are particularly insightful in bringing out relevant questions of modern interest, pointing out the missing links, and describing methods for future study. The controversial role of chemistry in plant-plant allelopathy is covered by J.T. Romeo and J.D. Weidenhamer. Although allelopathy has been of long standing interest, few studies have adequately demonstrated its role in plant ecology, and the authors do a great service by laying out necessary and sufficient conditions for demonstrating allelopathy. Two groups which have been extensively studied in chemical ecology, and which will continue to receive attention, but were not covered in this volume are the social insects and freshwater cladocerans. As a group of interactions, the chemical ecology of mutualisms (i.e., pollination, myrmecophily, frugivory) is still poorly understood and is not well represented in the book.

Although it is hard to imagine reading this volume cover to cover, or even using it as the basis for a discussion group, its value lies in the detailed account of methods and references in chemical ecology across disparate areas of organismal biology. Beginning graduate students as well as established researchers will benefit from using individual chapters from this volume as a springboard for interdisciplinary research that will link an understanding of the chemical basis of interactions with real processes in the field.

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