

assumptions underlying the 'high-dosage/refuge' strategy for managing resistance to Bt toxins in Bt-expressing crops are by no means inviolable.

The papers presented here are well written and the arguments presented are clearly expounded. This is as well since the information content of most presentations is high and the effort of concentrated reading correspondingly great. This volume will become a valuable reference for those working in the field but it is not a book for beginners. All papers assume familiarity with the basic biochemical mechanisms of action of the insecticides and of resistance to them and little concession is made to those without such knowledge. However, for readers actually working in the areas described here the material presented in this book will reward their attention by strengthening their grasp on familiar material and by introducing them to the unfamiliar, from areas of expertise other than their own.

Alan G. Clark

References

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The biology of mosquitoes: volume 2, sensory reception and behaviour. By A.N. Clements (Wallingford, CABI Publishing, 1999) 740 pp. Hard cover £95.00 (US\$175.00). ISBN 0 85199 313 3.

It is over 100 years since mosquitoes were first recognized as vectors of human disease and when our unforgiving attitude to these erstwhile nuisance insects hardened still further. Since then, a huge array of researchers from many disciplines has invested immense effort into investigating almost every aspect of the natural history of these insects, generating a vast wealth of literature along the way. Because this research has included much on the activity of mosquitoes in proximity to humans and animals on which they feed in addition to activities remote from the host, studies into mosquito biology have been made by scientists from diverse disciplines, ranging from medical doctors to aquatic biologists. Consequently, the published literature is scattered across a range of journals not always immediately accessible to a single researcher and, as the quantity of such published material continues to increase dramatically, the role of review texts such as this one has become increasingly important. Moreover, this already diverse cohort of researchers has expanded further over the past fifteen years with the arrival of the molecular biologists, and the need for a reference text for mosquito biology is now greater than ever. Alan Clements' *Biology of Mosquitoes* fills this need, more than adequately.

This is the second of Clements' projected three volumes, which set out to synthesize the literature on mosquito biology. The first volume was published in 1992 and covered

development, nutrition and reproduction, and the third which is already in preparation, has been subtitled 'dormancy, survival, speciation and evolution'. Volume two contains 17 chapters (numbered to follow that of the first volume) and includes substantial sections on circadian rhythms, the sensory and copulatory apparatus and their function in flight, blood and sugar location, mating and oviposition, exogenous factors such as climate, various geophysical parameters, host cues and environmentally-derived odours and their effect upon host location and oviposition.

As in the excellent volume 1, this volume has exhaustively and comprehensively reviewed its range of topics, painstakingly drawn from an inordinately wide sweep of the literature (there are 74 pages of references). Most notably, as stated in the Preface to the volume, the author has given priority to results from field investigations, and has avoided his own speculation throughout to avoid being quoted as fact.

The volume is extraordinary in its level of completeness. The chapter on the antennae and hearing covers everything from the structure of the auditory organs, through the characteristics of sound signals, to theories of sound location, with references dating from 1874. Similarly, across various chapters the volume covers everything pertaining to mosquito olfactory responses, ranging from the structure and distribution of the sensillae, how the physiological state affects responses to host and other cues, and finally the sources and characteristics of host kairomones and how they disseminate in plumes. The final extensive chapter on egg laying runs to over 90 pages.

Mosquitoes are arguably the model insect for most studies on vector insects, and there has probably been more published on these insects than any of the other major vector groups. Thus the volume is likely to serve as a starting point for many more entomologists (and parasitologists, ecologists, etc.) than just those who specialize in mosquitoes. The volume is filled with excellent illustrations and the text is simple and coherent, making every topic accessible to readers from every discipline.

Together with the first volume, this will become a definitive reference for mosquito research and when the third volume finally appears, the set will provide an information source unmatched in probably any other group of insects. Few would attempt what Professor Clements has done, and fewer still would have achieved it. I cannot imagine anyone in the field of vector biology or medical entomology, however knowledgeable or distinguished, who would not regard this text as an essential, though costly, addition to their library.

P.J. McCall

Tsetse biology and ecology: their role in the epidemiology and control of trypanosomiasis. By Stephen G.A. Leak (CABI Publishing, 1999). 592 pp. Hard cover £65.00 (US\$120.00). ISBN 0 85199 300 1.

The last major attempt to bring together current knowledge of tsetse biology and ecology was Mulligan's *The African trypanosomiasis*, published in 1970, and the last text

specifically on the biology of tsetse was Buxton's *The natural history of tsetse flies* published in 1955. There has been a tremendous increase in our understanding of tsetse biology since these two books were published and so, this new publication, with the title words 'Tsetse Biology and Ecology' prominently displayed on its cover, promises to be both timely and of interest to both specialist and general entomologists alike.

The book is split into four parts. The first three sections, each of ~150 pages, consider: tsetse biology and ecology, epidemiology, vector control and the fourth and final section, which seems to be almost an afterthought, is just 10 pages on the use of trypanocidal drugs to control the disease. The book ranges from detailed aspects of tsetse and trypanosome physiology to the origins of cattle in Africa and thus aims to cover a massive amount of work.

In typical textbook style, Dr Leak starts with descriptions of tsetse taxonomy, anatomy and basic physiology. This section is well supported by reference to the literature and the entire text cites ~2000 references. Consequently Dr Leak's text is a very useful starting point and guide to the tsetse literature.

Chapter Four is concerned with tsetse physiology and commences with the processing of the bloodmeal and then runs through water balance, reproductive physiology, a page on the nervous system and then concludes with a short piece on pteridines. The physiology of vision, olfaction, nutrition and diel regulation of activity – the very areas where research concerned with tsetse physiology has made tremendous advances – are curiously absent from the chapter. In the event, much of the information is in the book but scattered elsewhere in various sections. So, for example, aspects of tsetse vision occur in chapters six (Sampling tsetse populations), eight (Behavioural ecology) and Chris Green's important contributions on colour vision finally get a mention on page 362 in chapter 16 (Traps and targets). Similarly the work on olfaction, or movement, or the convoluted debate on various aspects of feeding physiology are scattered through the book.

One can appreciate Dr Leak's dilemma. Some of the most significant advances, especially those relating to the behaviour and physiology of feeding, have provided not only fascinating insights into tsetse biology but have also had profound effects on methods of tsetse control. So the book is never quite sure whether to tell a story about an animal or about the effects and control of a disease. Jordan (1988) has already written an excellent textbook on the control of trypanosomiasis, and CABI are about to publish a major multi-author textbook on the trypanosomiasis. Consequently, I think it would have been more useful to have produced a text more focused on the biology and ecology of the tsetse fly.

The huge range of topics considered by a single author has led to other problems. At many points, results from various studies of tsetse biology are described but there is no real insight as to what it all means. So although much seems to be here, the reader does not necessarily get a sense of the implications of the various findings. Many of the topics covered are themselves the subjects of a lifetime's work and so it is perhaps doubtful as to whether a single author can really do justice to it all.

The best sections of the book are those concerned with trypanosomiasis and tsetse's role in its epidemiology and control, and I suspect that Dr Leak was more comfortable

with these sections rather than those concerned with tsetse physiology and behaviour. For instance, the various knotty, and hence interesting, controversies in our understanding of feeding and reproductive strategies, are mentioned but the author does not really attempt to unravel the tangled web of evidence and hence provide the reader with a considered and well argued overview. However, similar controversies in the area of disease epidemiology and tsetse control, such as the role of mechanical transmission for instance, are clearly and authoritatively presented, and the author adds to the debate with his own insights. The control of trypanosomiasis by drugs is undoubtedly the most extensively used method of controlling the disease and yet it receives a relatively short and cursory consideration. Similarly, the section concerned with the use of aerial applications of insecticide against tsetse does not reflect the sophistication and impact of this technique. However, while the book is not without its flaws, it has much to commend it, especially as a reference for practitioners of veterinary entomology and parasitology in the tropics.

Steve Torr

Ecology of insects. Concepts and applications. By M.R. Speight, M.D. Hunter and A.D. Watt (Blackwell Science: Oxford, 1999). 360 pp. Soft cover. £26.50. ISBN 0 865427453.

Ecology of insects does as its name suggests, by presenting pure and applied ecology, theory and practice. It is targeted at undergraduates particularly, but would be a valuable reference for postgraduates and researchers new to the field. This book provides examples of how good insects are at illustrating general concepts in ecology. I thoroughly recommend this book, particularly as an undergraduate course text, as it covers the subject area, is nicely presented and very readable.

Through the book's 10 chapters, there is very good coverage of the ecology of insects and by discussing 'pure' ecology (concepts) in the first half of the book, the scene is set for the discussion of the more applied aspects as later chapters. After an initial 'Overview' of the breadth of the subject area (a good scene setter), the authors discuss 'Insects and Climate', 'Insect Herbivores' which largely concentrates on plant defence, and 'Resource Limitation' (e.g. competition, the niche concept). In these two later chapters, there was relatively little discussion of the quality and quantity of food resources, I would have liked to have seen more of a balance between the effects of variation in 'food' and the undoubted importance of defence in affecting insect performance per se. Further conceptual chapters discuss 'Natural Enemies and Population Dynamics' (a good overview of an often difficult subject), and 'Evolutionary Ecology' (e.g. life history and sexual strategies, co-evolution) with broad scope, but could benefit from a concluding section (as in other chapters), especially as the latter chapter is split by the colour plates in the middle of the book. 'Insects in Ecosystems' is the seventh and shortest chapter. This does, however, cover many points (e.g. ecosystem processes, decomposers, shredders, termites) but does not explicitly deal with the developing concept of ecosystem engineers.