Pest and Vector Control

As ravagers of crops and carriers of diseases affecting plants, humans and animals, insects present a challenge to a growing human population. In *Pest and Vector Control*, Professors van Emden and Service describe the available options for meeting this challenge, discussing their relative advantages, disadvantages and future potential. Methods such as chemical and biological control, environmental and cultural control, host tolerance and resistance are discussed, integrating (often for the first time) information and experience from the agricultural and medical/veterinary fields. Chemical control is seen as a major component of insect control, both now and in the future, but this is balanced with an extensive account of associated problems, especially the development of pesticide-tolerant populations.

Pest and Vector Control

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Preface

For nearly 30 years, generations of students of crop protection have used a slim volume, written by one of us (HvE), and first published in the *Studies in Biology* Series entitled *Pest Control and its Ecology* (1974) and later revised with the title simplified to *Pest Control* (1989).

When the time came for a 3rd edition, the publisher (in the form of Ward Cooper of Cambridge University Press) asked that the book be enlarged and expanded to include areas of applied entomology not included previously, particularly the control of insects of medical and veterinary importance.

Fortunately we had been undergraduates together in the Department of Zoology and Applied Entomology at Imperial College, graduating in 1955 and, although agricultural and medical entomology led our respective careers in different directions immediately thereafter, we have remained in contact and firm friends ever since. The co-authorship of the new enlarged edition was therefore never in doubt!

Like Pest Control (1989), this book is also limited to the control of arthropods; we felt that amplifying the title would make the latter cumbersome if more descriptive.

We think the result is a book unique in the width of its coverage of the control of problem insects. We have not only covered insects of agricultural, stored product, medical and veterinary importance, but we have included the full range of control methods, including some which will be unfamiliar to most readers. These follow a general introduction on how insects interact with man and a 'rough guide' to the essentials of animal population dynamics as necessary to understand how insect problems arise. In then going through the different control methods, we give our opinion on their advantages and

limitations as well as their relative importance and where they are going in the future. Even those still on the research bench, and those we suspect may not be going anywhere, are included. This is because we wish to explore the rich variety of man's ingenuity in his battle against insects and make it clear that contributions have come from unexpected quarters, e.g. the physics of spectral absorption of different glasshouse cladding materials and the design of machines for paint-spraying metal grids. Another rather unusual feature of our book is that we not only include the components and principles of pest management but, in our final chapter, also explain how the different components may be combined and integrated into pest management programmes.

Now anyone in either the agricultural or medical entomology field will know that 'never (or only very rarely) the twain shall meet'. Conferences or day-meetings on the two entomological disciplines attract totally different audiences, who hardly read each other's textbooks or scientific papers. We are ourselves examples of this; we believe we have never attended the same meeting or conference. Even the indispensable applied entomology abstracting journal, the *Review of Applied Entomology*, was split into two distinct annual volumes (*Agricultural* and *Medical and Veterinary*) as long ago as 1913.

Combining the two areas of entomology in a single book has previously rarely been attempted, and we quickly discovered a major difference as to how pest control is subdivided in our two disciplines. In agriculture there are many crops, with several major pests on each; control is usually practised on the clearly defined area of the crop. In medical/veterinary entomology, by contrast, the types of problems are fewer, but nevertheless some of the problems involve really serious diseases transmitted by arthropods to very large populations of humans or livestock. Control of the vectors often is not on the attacked target (a human or animal) but carried out in the wider environment of that target, an environment which is usually heterogeneous and may be on a very large (e.g. regional or countrywide) scale.

The result of these contrasts is that, whereas a text on pest control in agricultural entomology is divided by control approach (chemical, biological, cultural etc.), control in medical/veterinary entomology is usually focused on the several different methods needed for control of a particular disease (e.g. control of malaria, sleeping sickness), and then how much each control method contributes.

We took the decision to follow the agricultural model and integrate into this approach the relevant examples from the medical/veterinary field. Nevertheless, some topics proved impossible to treat in this way. So there are, for example, separate sections in Chapter 13 for the two disciplines on thresholds

and insect monitoring and forecasting. The reader will quickly find other such examples.

However, one advantage of trying to integrate our material is that the links of agriculture with human and veterinary diseases are easy to recognize, and we have stressed these links wherever possible. For example, increased rice cultivation to feed an increasing population inevitably creates places for mosquitoes to breed, and intensive and extensive spraying of cotton with insecticide can sometimes result in insecticide resistance in malaria vectors.

We have had some difficulty in knowing how we should deal with the various active ingredients of insecticides. These chemicals are currently under intense scrutiny in relation to safety to human health and the environment; many have been banned or withdrawn by the manufacturer. Unfortunately, the position changes almost daily and differs between countries. Anti-cholinesterase compounds (particularly the organophosphates) are primary targets for this scrutiny, yet of all the chemical groupings they are the best example of the variety of routes to the target. We have therefore mentioned the compounds which best illustrate the properties of insecticides and the variations found between active ingredients. We hope we have not suggested that any compound universally banned is still available, while the corollary is that mention of a chemical in this book cannot be taken to mean that it is available and recommended for use for all situations, and in whatever country the reader is located.

Repetitions, and exactly where subject matter is treated and in which chapter, are always problematic with a book of this kind. For example, genetically engineered crops expressing the *Bacillus thuringiensis* toxin are an example of genetic manipulation (Chapter 9) which also represents a delivery system for an insecticide (Chapter 4) which is derived from an insect pathogen (Chapter 8) and gives the crop plant resistance to insect attack (Chapter 11) with implications for pest management (Chapter 13)! Where necessary we have accepted some repetition, but have indicated where a more extensive treatment of the topic can be found in the book. In other places, we have attempted to explain why a topic is not discussed there, again pointing out the relevant chapter.

Chapter 12 needs some comment. As well as bringing together a miscellany of insect control methods for which there was no obvious home elsewhere, we have a section on 'Other topics'. These are not methods of control, but are relevant to such methods. There are legal requirements to control some insects or prevent their spread – topics we do regard as insect control – and also legislation on, for example, which insecticides may be used and how they

may be used – this we do not regard as insect control, but it is clearly highly relevant. Similarly, controlling mosquitoes is clearly insect control, yet it is only a part of the management of malaria and so we felt it not inappropriate to mention briefly the use of drugs, a very important component of malaria, but not of mosquito, control. Involving the local community in what control is required and how best to implement it (community participation) is a further 'Other topic'.

The earlier editions of this book referred to at the start of this Preface gave guidance to general reading. In this volume, additional literature sources have been mentioned in the text, sometimes because we have taken a table, figure or quotation from that source. For the sake of simplicity, we have combined the literature cited in the text into one bibliography which also contains our suggested general reading, usually books or reviews, not mentioned in the various chapters.

We have enjoyed working together on the book, and have benefited greatly from learning much more about each other's discipline. We have relied greatly on our own experience during our careers and information acquired during discussions with colleagues and at conferences. Our aim has been to keep the book readable, hoping our enthusiasm for the subject permeates its pages. We have therefore not held back from including stories we enjoy or find bizarre, even if these make the balance of detail given to different topics somewhat unequal.