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Book review

The Epidemiology of Plant Diseases (2nd Edition). Edited by B.M. Cooke, D. Gareth Jones and B. Kaye. 2006. 576 pp. Springer, The Netherlands. ISBN 1-4020-4579-4 (Hardcover), €164.95/£127.00; ISBN 1-4020-4580-8 (Softcover), €79.95/£61.50.

There are 20 chapters in this book written by 33 contributors, 19 of which are from the UK; these include undisputed leaders in their respective fields. The chapters are split into two sections; the first describes overall concepts, whilst the second concerns case studies. The conceptual chapters start with diagnostics, then disease assessment. The following chapters look at different aspects of the disease cycle: pathogenicity, virulence (mainly avirulence), resistance, ecology and general considerations of how this wealth of information can be used to help the farmer or advisor. One chapter concerns the dissemination of information (which one might subtitle 'sources of information for writing the introduction to a thesis'). I am not going to comment on each chapter but have concentrated on those I feel I can have a sensible opinion of; I am more wary of stating an opinion about those areas I know less well. There is a distinct northern European flavour to the examples chosen (though see the last four chapters), and I found no reference to diseases of forest trees, temperate or tropical. I see the chapters of Part 1 as much a stimulation for further research as a review of current knowledge.

The first overview (Chapter 1 – Fox and Narra) concerns diagnostics. If you are going to study the dynamics of a pathogen in the field, then you need to know what you are looking for, and how to distinguish it from other organisms. If you work with barley powdery mildew then you do not have a problem in identifying the pathogen and distinguishing it from other organisms, though assessing the disease does present some challenges (Chapter 2 – Cooke). There are many pathogens out there that are difficult both to identify and, as a consequence, to assess. Fox and Narra cover conventional and biochemical/molecular methods well. I do, however, have an editorial gripe; whereas the sections on conventional and immunological methods for assessment have useful numbered headings, the DNA (and RNA) methods run together so that PCR and hybridisation are lumped under DNA. However, the pros and cons of the methods chosen are presented in a clear way, which will help the student make informed choices depending on what they need to do, and present the many pitfalls students may encounter in trying to do it. This list of methods is not exclusive but does represent the most used. It is clear that if you wish to develop models for understanding disease development *per se*, you would not want to choose a difficult pathogen. Others would have to base their choices of method on the possible rather than model systems since they need to solve real problems in the real world. They will be inspired. However, one comment irritates: 'the once familiar names of the pathogens of even some very common diseases are perpetually and unnecessarily being replaced', which I rather think misses the point of taxonomical revision. As a molecular biologist and geneticist I like to know the relationships between organisms and see the real benefits of realising that *Ralstonia solanacearum* is no longer *Pseudomonas*; I saw a visiting scientist in a laboratory where I once worked fail to get the vectors that worked perfectly in the gamma-proteobacteria *Pseudomonas syringae* and alpha-proteobacteria *Rhizobium* to work in the then *P. solanacearum* (*sic*), now known to be a beta-proteobacteria. One just has to think of the mess in the taxonomy of genera such as *Rhizoctonia* and *Colletotrichum*. That familiar names like *Erysiphe graminis* have disappeared is no loss when considering the benefits of understanding the differences between the powdery mildew fungi. The chapter finishes with a look into the crystal ball, and the benefits of kit detection methods. We have seen the benefits in human and veterinary pathology. Now it is our turn! I am not going to comment on Cooke's chapter other than to say that I was stimulated into thinking about problems I have not yet needed to cope with myself, and that this chapter is particularly suited for teaching purposes. Brown (Chapter 3) also gives an excel-

lent account of surveys of avirulence and fungicide resistance. However, despite my personal interest in cereals, and their undoubted importance in agriculture, I would like to have seen a discussion of the problems associated with the more difficult soil-borne diseases in this general chapter.

In general, I think these introductory chapters fulfill their purpose in providing a depth not provided by an undergraduate textbook such as that by Agrios (2005), but there is an inconsistency of treatment. For example, Struck (Chapter 4) describes much of our knowledge of the molecular genetic basis of pathogenicity and describes the life-style strategies used by fungi and Oomycetes, (biotrophy versus necrotrophy) but does not consider bacteria or the recent and predicted advances that the many genome projects and microarray technologies afford. Not all pathogens fall precisely into these life-style categories and there is an area of research to understand the biology of those organisms that are conventionally lumped as hemibiotrophs (a word absent from the index) but which probably covers several phenomena. Nevertheless, I like this chapter and may use it for my own teaching. There is no equivalent chapter on defence mechanisms or the nature of resistance, areas where there have been many recent advances. What physiological mechanisms lie behind the terms horizontal and vertical resistance? Induced resistance is covered, albeit scantily. Deadman (Chapter 5) continues to talk of virulences, in concordance with the traditions of the field of epidemiology. The molecular basis of avirulence is now fairly well understood, and it is clear that the avirulence function is a property defined by the plant, and not a special gene for recognition defined by the pathogen. The roles of these genes for the pathogen themselves generally lie in pathogenicity, 'real' virulence or aggressiveness. Epidemiologists need to be reminded of this, and I find it misleading and confusing to talk of virulence genes when the term virulence in this sense means the loss of the property of being recognised by the host which happens to possess the appropriate resistance gene.

I feel less qualified to comment on the six more epidemiological chapters. The choice of subjects would appear to complement each other, and there are very few overlaps. Some chapters lay the theoretical framework, others address the practical application of epidemiological approaches. I often wonder how much the field of plant disease epidemiology benefits from and contributes to mainstream ecological research. Shaw (Chapter 7) compares disease epidemiology to grassland ecology, and McCartney et al. (Chapter 6) to the dynamics of the UK foot and mouth disease epidemic. I learnt from reading them and can relate to the problems addressed, but do not have the mathematical understanding to use them. This suggests to me that these chapters would be useful for teaching advanced courses.

The second section of the book concerns case studies. Four chapters concern seed, soil, wind and rain-splash as the means of dispersal of pathogens and as sources of epidemics. They are well-written and seem to cover their subjects well. The seed chapter also considers a virus disease. The final four chapters counter the cereal disease bias of the overview by considering four contrasting examples: potato late blight, apple scab, diseases of onion and cassava mosaic virus. The late blight chapter seems to cover most aspects, though very little is written about the substantial efforts put into understanding the molecular basis for interactions.

As a professor of plant pathology trained in genetics in the pre-molecular era, where population genetics was an important component in my studies, I have learnt a lot of real plant pathology. In terms of intended audience, I would recommend this book for four groups. The first is advanced undergraduate students and postgraduates starting a research project (or seeking stimulation for their literature review), both those where their project requires an understanding of the pitfalls associated with assessing and monitoring diseases in the field as well as the lucky few who are trying to introduce new sources of disease resistance to a receptive audience. The second group are teachers of advanced courses; however, I think that though inspiring, the subject matter covered is too large and the treatment perhaps too variable for an undergraduate course textbook in plant disease epidemiology. In my view, the book's use for a course in advanced plant pathology would need to be supplemented by molecular books such as those by Dickinson (2003) or Talbot (2004). Also, some authors have written chapters for a textbook, others are more reviews of specific areas.

A third group might be considered by some as being of minor importance – people like me who need their minds broadening in order to under-

stand the state of the art of the non-molecular, non-genomic real world where plant diseases cannot be studied in Arabidopsis alone. This group should not be frightened by the title. I hope the information presented in this book will encourage a marriage of epidemiology and post-genomics into a systems biology for plant pathology.

The fourth group are the least accessible audience – agricultural advisors including the industry who do not have the time or resources to read the book. There are many pearls of wisdom here that should be implemented in practical agriculture. Finckh and Wolfe (Chapter 10) have pertinent comments on this: a take-home message from their plea is that we need be more vociferous in the appropriate media about the importance of plant diseases. It is interesting to note that there are relatively few references in this book on Fusarium diseases of cereals which have a serious impact on human and livestock health, whereas the index references to *Blumeria graminis* (my favourite pathogen) and again to powdery mildew fill nearly a whole column each.

In conclusion, I find this a fine, yet by its very nature, uneven book. It is a mixture of a text book and advanced treatise with many fine chapters written by real experts covering topics relevant to the title. It will be a valuable addition to the personal library of crop pathologists and will be inspiring for molecular pathologists, starting at the level of the research student.

David B. Collinge
Department of Plant Biology
The Royal Veterinary and Agricultural University
(KVL), DK-1871
Frederiksberg, Copenhagen
Denmark
E-mail: dbc@kvl.dk