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Book reviews

Metapopulation Biology — Ecology, Genetics and Evolution. Ilkka A. Hanski and Michael E. Gilpin (eds). Academic Press, San Diego. 1997. Pp. 512. Price £34.95, paperback. ISBN 0 12 323446 8

It is now six years since the editors' previous book on this subject appeared (Gilpin & Hanski, 1991). They state clearly in their preface that the current volume is not a second edition of that book but an entirely new work. Many authors have chapters in both books although the 1997 volume does have some new names on the contributors list. A comparison of the two books is interesting as it spans a period when the metapopulation approach rose from one of the buzz-words of the late 1980s to mainstream biology and, as Hanski and Simberloff point out in the first chapter, has seen a huge surge in publications.

Many things have remained from the previous volume. For example, the editors still feel the need to have explicit definitions of metapopulation words and phrases. Yet it seems they are fighting a losing battle. The pure or 'classical metapopulation' is a population of discrete populations that are characterised by local extinction and recolonization. However this 'correct' usage of the term metapopulation has had to be expanded somewhat and it now seems to apply to any set of populations that are somewhat isolated from each other yet linked through dispersal events.

The volume covers both theory and field studies. Despite the six-year gap the number of the latter is still rather small. This is understandable given the difficulties in collecting data over a wide area and through time. However, one of the claims made on the back cover is that the book 'serves as a valuable reference to conservationists'. I believe that much more hard evidence from real populations and more accessible and specific modelling is required before this will be the case.

There are several chapters dealing with the genetic and evolutionary consequences of metapopulations. I particularly enjoyed Barton and Whitlock's chapter on evolution and Hedrick and Gilpin's simple yet effective model exploring the interplay of colonization rate, founder size and local population size on the effective size of a metapopulation. These chapters and others reveal a slight switch of emphasis from the pure ecology of metapopulations to a more evolutionary view. This shift should be applauded.

Metapopulation biology has at least two 'paradigm relations'. One of these, island biogeography, is dismissed and buried in the first chapter. The other, landscape ecology, is proving to be a much more difficult cousin. The chapter by Wiens highlights the differences between the two approaches and shows how far apart they remain. The main reason for this is that the simplicity of the metapopulation idea with patches of suitable habitat in a sea (or desert) of unsuitable habitat is so much easier to model than the landscape approach where each habitat will have a different effect on survival and movement.

So has metapopulation biology lived up to expectations? Perhaps not just yet, but it now looms like a colossus, straddling biology from population and evolutionary genetics to population and community ecology.

Reference

GILPIN, M. AND HANSKI, I. 1991. *Metapopulation Dynamics: Empirical and Theoretical Investigations.* Academic Press, London.

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The Gene-for-Gene Relationship in Plant-Parasite Interactions. I.R.Crute, E.B.Holub and J.J.Burdon (eds). CAB International, Wallingford. Pp.427. Price £65.00 (US$120.00), hardback. ISBN 0 85199 154 5.

It was 25 years ago today that I first encountered the 'gene-for-gene hypothesis' (well, more or less). After a student career being exposed to zoology and the exotica of population genetics, I was suddenly plunged into the arcane world of plant pathology — a strange world where not only did much of the received wisdom seem to derive from a pre-Mendelian time, but also the dress-sense of many of its practitioners. Although Flor's demonstration of gene-for-gene interactions in the flax-flax rust system had become accepted, and had been demonstrated (or at least inferred) in upwards of a dozen plant host-parasite systems, practical plant pathology was still predominantly 'stamp-collecting' — be it the runic race-classifications of the crop pathologist, or the taxonomic musical-chairs, and proliferating 'special forms', of the field mycologist.

The decade following the Southern Corn Leaf Blight Epidemic of 1970 showed an increasing appreciation that the 'boom-and-bust' cycle, that characterized exploitation of major gene disease resistance in much of intensive agriculture, could be considered as a problem in evolution and consequently amenable to investigation using the tools of population genetics and population ecology. The existence of gene-for-gene interactions provided a ready justification for the simplifications of the modelling approach — indeed, if the gene-for-gene hypothesis had not existed, it is almost certain that it, or something like it, would have had to have been invented, simply to allow progress in modelling the genetics of epidemics. At the

same time, classical analysis of the genetics of resistance was receiving more interest, both to improve the efficiency of plant breeding and to uncover the mechanisms involved in the interaction between host and parasite. By the time we got into the 1980s, arguments about mechanisms had reached a Talmudic intensity.

It is perhaps not surprising that by the time the molecular biology revolution got under way in the early 1980s, gene-for-gene interactions (or at least simply inherited resistance with matching pathogenicity) should receive a disproportionate amount of attention because here we had apparently simple inheritance of traits, known genetics and commercial importance.

This volume is a collection of papers presented at a meeting held in December 1995, under the auspices of the British Society for Plant Pathology. It brings together these major strands of the investigation of gene-for-gene interactions, in three sections, 'I — Genetic Analyses and Utilization *(sic)* of Resistance', 'II — Population Genetics', and 'III — Cell Biology and Molecular Biology'. In total there are 22 papers — 25 years ago, one might have been hard-pressed to find 22 speakers, let alone an audience for such a meeting. It would appear that the study of gene-for-gene interactions has at last come of age and entered the mainstream of biology.

It would be tedious in the extreme to go through this collection of essays one by one, so I shall restrict myself to some general impressions. Between them, the five papers in the first section give a good overview of the state of the genetics of resistance, although Adrian Newton's brief review of cultivar mixtures seems a little out of place here. Certainly by the time you have waded through these contributions, you would have a good feel for the state of the field and even if your favourite plant, or gene, is treated superficially, there are enough references to get into the literature.

The second section is the most wide-ranging, covering empirical studies of the structure of pathogen populations in support of agriculture, models of both agricultural and natural pathosystems, through to the field study of the genetics of host-parasite interactions in natural ecosystems. All of the current conceptual, analytical and experimental tools of modern population genetics, epidemiology and molecular ecology are on display. Perhaps the most refreshing aspect of these papers is that it appears that the suffocating hegemony of Vanderplankian orthodoxy appears finally to have been thrown off – I could only find one reference to Vanderplank among the nine contributions.

About halfway through the eight papers of the final section, I started getting feelings of *déjàvu* — proliferating gene designations and yet more elaborate and competing models of infection mechanisms — sensing that, after a generation, 'stamp-collecting' has returned. This is not to say that the science in these papers is not good, most of it is mind-bogglingly excellent, but it did strike me that in this explosion of information we might just be losing sight of the wood for the trees, although this may merely be the reaction of someone who could never really get to grips with physiological plant pathology.

By the time I arrived at the final paper, I had begun to ask myself whether we have any better understanding of gene-for-gene systems than when their study was an obscure and idiosyncratic corner of plant pathology. Certainly, the advances in mapping techniques make it easier to map resistance genes, and pathogenicity genes in some systems, and our understanding of the dynamics of gene-for-gene systems has improved by leaps and bounds. But what of the molecular dissection of the physiology of the interactions? In the last paper, I began to see the light … if we know what the critical components conferring resistance are, then plants can be engineered to carry and express them! However, the authors state that 'There are remarkably few organisations with the capabilities to create, test, produce, sell and deliver competitive transgenic seed products. Out of the hundreds of seed companies in existence today, less than ten have these capabilities' and go on to warn of the economic, political and social consequences that may follow the opening of this Pandora's Box.

I slid sideways into gene-for-gene systems, at a time of considerable concern about the durability of disease resistance conferred by major genes, and to a large extent this has coloured my approach to these essays. All the way through this book, I kept asking myself whether the fantastic progress reported in its pages has had any effect on practical crop cultivation and the answer has to be a slightly qualified 'no'. Throughout the developed world, the cultivation of crops is still predominantly that of single variety monoculture, at any one time there are relatively few resistance genes being exploited in any one crop (genetic vulnerability), and successful crop varieties continue to be based on a relatively narrow genetic base deriving from the economic breeding necessity of 'crossing the best with the best'. Inevitably, there will be the serendipitous occurrence of major gene resistance that does not 'break down', for example *mlo* in barley, which is covered in some detail here, but the old hazards still remain. The promise of the technological progress of 'transgenics' will not, on the evidence presented here, alter this state of affairs. If I have a disappointment with this collection of papers it is that, with a few notable exceptions, the perspective of the practical agricultural necessity of studying gene-for-gene systems has been lost, or at least diminished.

Finally, though, I would like to thank Ian Crute, Eric Holub and Jeremy Burdon for producing such an excellent book. The meeting on which it is based must have been exciting and tremendous fun — I am sorry that I missed it!

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Genes VI. Benjamin Lewin. Oxford University Press, Oxford. 1997. Pp.1280. Price £29.95, paperback. ISBN 0 19 857778 8.

To have arrived at the sixth edition of this popular text speaks volumes for its position and the tenacity of the author. I came in when there was *Gene Expression* and that book helped me into the world of genes. Eventually *Genes* arose and it has been in essentially the same format for these six editions. It represents one of the few single-authored texts remaining, many having started with a single author but later becoming a cooperative effort.

The content of the text has altered in the change from *V* to *VI*. Whereas there was a division between prokaryotic and eukaryotic data the text now attempts to combine both to make a coherent, unified story. Some stories remain separate, e.g. gene expression. The tenor of the book remains mainly molecular biological with an infusion of cell biology, DNA to development, not unlike some other texts in this area of science. However *Genes VI* remains ahead of the pack and still has some unique features. Many graduate students still reference the section on gene numbers.

Now the real question to ask is whether the title of the book is an accurate description of the contents? Certainly the majority is concerned with genes, their organization and expression and the section on growth, cancer and development could be justified by saying that these are the sum of gene expression in cells. What would we like to see included ? There is now DNA sequence data from a variety of organisms that needs careful analysis. This would make a great contribution to the text. How many genes? What sort? What are missing? Where are they? These are the questions of our time. *Genes VI* will be the course book in our modular world of education; I hope that it will be the comfy pair of trainers that real textbooks become. The choice of purple as the cover colour is great.

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Books received

The Role of Genetics in Conserving Small Populations. T. E. Tew, T. J. Crawford, J. W. Spencer, D. P. Stevers, M. B. Usher and J. Warren (eds). Joint Nature Conservation Committee, Peterborough. 1997. Pp. 203. Price £40.00, paperback. ISBN 1 86107 438 7.

Mechanisms of Transcription (Nucleic Acids and Molecular Biology 11). Fritz Eckstein and David M. J. Lilley (eds). Springer-Verlag, Berlin. 1997. Pp. 327. Price £95.50, hardback. ISBN 3 540 62397 3.