

PREFACE

We are excited by the review articles that have been contributed to this volume. Together, they provide an overview of current research activity and future research directions in the field of insect-plant interactions. This collection of reviews has had many excellent precedents (Karban & Baldwin, 1997; Agrawal *et al.*, 1999; Foundation, 1999; Tollrian & Harvell, 1999; Herrera & Pellmyr, 2002; Schoonhoven *et al.*, 2005; Schaller, 2008; Tilmon, 2008), but takes a more interdisciplinary approach.

Sections devoted to biochemical, genomic and ecological and evolutionary aspects of insect-plant interactions highlight the breadth of hypotheses and experimental approaches now being pursued, with plants and insects being given equal attention. This book complements, and should be read alongside, recent journal special issues on insect-plant interactions (Jander & Howe, 2008; Johnson, 2011; Agrawal & Heil, 2012). Applied aspects of insect-plant interactions and agricultural implications are well covered elsewhere and have not been included here. This volume is first and foremost focused on basic research and is expected to provide a valuable resource for experienced researchers, as well as a comprehensive introduction for postgraduate students.

Section 1 summarizes our state of knowledge on the biochemistry of insect-plant interactions, including plant signalling cascades (Chapter 1), herbivore-associated molecular patterns and effectors (Chapter 2), the sequestration of plant defence metabolites by insects (Chapter 3), and the perception of plant semiochemicals by insects (Chapter 4). Exciting discoveries have been made in these areas and future research is expected to identify additional insect effectors and herbivore associated molecular patterns (HAMPs) and their matching receptor proteins in plants as well as insect genes underlying detoxification of plant compounds, sequestration, and olfactory responses to plant odours. Progress in these areas is thought to be aided to a large extent by new generation sequencing techniques. Not included in Section 1 are chapters that describe the multitude of plant secondary compounds that have been implicated in insect-plant interactions. We refer the reader to an earlier Annual Plant Reviews volume on the biochemistry of plant secondary metabolism (Wink, 2010) and a recent review (Zhao *et al.*, 2013).

Section 2 focuses on advances in the genetics and genomics underlying insect-plant interactions. Chapters in this section deal with the transcriptional responses of plants to herbivory and herbivores to plant defences (Chapters

5 and 6), as well as the quantitative genetics of plant defence traits (Chapter 7). Transcriptional studies will increase as high-throughput sequencing of cDNA (RNA-seq) enable transcriptome measurements in non-model plants, insects and other interacting organisms at a very fine resolution (Wang *et al.*, 2009). RNA-seq also enables further inroads into proteome characterization of non-model organisms (Diz *et al.*, 2012; Lopez-Casado *et al.*, 2012). Protein profiles are closer to actual plant and insect phenotypes than transcript profiles. Therefore, proteomic studies, such as those of insect saliva and salivary glands (Chapter 2), are likely to become a widespread tool to study insect-plant interactions. Progress is also expected in an area not covered in this Annual Plant Reviews volume, namely that of transgenerational resistance and underlying epigenetic mechanisms (Rasmann *et al.*, 2012; Holeski *et al.*, 2012). Advances in DNA sequencing will also provide more sequenced genomes of interacting plants and insects, with the fully sequenced plant-herbivore-bacterial interaction of *Medicago truncatula*, *Acyrtosiphon pisum* and *Buchnera aphidicola* being a first great example (Whiteman & Jander, 2010). The emphasis in Section 2 is on plant-herbivore interactions. Readers interested in the genetics of plant-pollinator interactions, particularly the genetics of plant-pollination syndromes are referred to other recent reviews (Galliot *et al.*, 2006; Hermann & Kuhlmeier, 2011).

Section 3 comprises ecological and evolutionary aspects of insect-plant interactions, with reviews describing investigation of the cost-benefit paradigm (Chapter 8), plant-mediated interactions between insects (Chapter 9), variation of niche-breadth along altitudinal gradients (Chapter 10) and co-evolutionary theories (Chapter 11). These chapters stress the importance of investigating insect-plant interactions beyond individual interactions, but in the context of community dynamics and environmental gradients, as well as within fitness and phylogenetic frameworks. Related studies and reviews on co-evolution and niche-breadth have been published elsewhere and are recommended to interested readers (Agrawal *et al.*, 2009; Ali & Agrawal, 2012).

Our aim is to provide the reader with an up-to-date and current assessment of a rapidly progressing research field, to which we ourselves, contribute. We would like to express our sincerest thanks and gratitude to all the authors. In times where authorship on experimental articles earns greater rewards than authorship of book chapters, we did really appreciate these contributions. We also would like to thank all reviewers who provided constructive feedback on individual chapters, and Wiley-Blackwell for patiently extending submission deadlines for this book more than once.

We hope the reader enjoys his/her time reading this book,

The editors