

## BOOK REVIEWS

### Annual Review of Entomology, 2022.

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The *Annual Review of Entomology* presents a wide range of updated research and development information of the insect world. Scientists, young and old alike, are inspired by the quality of articles published in it that cover a broad spectrum of disciplines across systematics, ecology and behaviour, physiology and biochemistry, genetics and molecular biology, pest biology, control and management, and many more fascinating aspects of a variety of insects. This volume contains 24 review articles by 63 authors mostly from USA and Europe, and a few from China.

The volume features a range of subjects covering fascinating aspects of the world of insects. These include reviews on career-long dedication and achievements of two scientists (Li and Seeley). The insect groups covered are cicadas (Simon *et al.*), ants (Lee and Yang, Xu *et al.* and Fox and Adams), wasps (Vorburger *et al.* and Poelman *et al.*), beetles (Salem and Kaltenpoth, and Campbell *et al.*), aphids (Abbot *et al.*), and weevils (Pope and Roberts). Other articles on *Drosophila*, the toolbox of entomological genetics (Promislow *et al.* and Keeseey and Hansson), chemical sequestration (Beran and Petschenka) and parasitism (Ode *et al.* and Vorburger) provide insights into amazing phenomena that only insects are endowed with. The volume also provides articles of applied importance. These include invasive insect pests like ants (Xu *et al.*), symbiosis between bacteria and insects (Salem and Kaltenpoth), molecular mechanism of resistance in insect to insecticides (Nauen *et al.*), agriculture pests (Han *et al.* and Walsh *et al.*) and forest management (Marini *et al.*).

The autobiography by Liying Li documents novel methods of promoting biological control of insect pests. These comprise development of artificial eggs made of insect wax capsule filled with insect hemolymph and chicken yolks for *Trichogramma* parasites, mass rearing of insect predators on artificial food and introducing rearing methods of entomopathogenic nematodes. These studies immensely contributed to insect pest control and safety of environment from the toxic effects of chemical pesticides. A self-motivating study of honeybee life by Thomas D. Seeley led him to

document how does a honeybee colony works as a unit to allocate its workers among flower patches and choosing nesting sites in hollow trees, and how does a honeybee colony work as a social unit for gene survival. These studies embody life-long dedication of individuals to unravel nature's truth hidden in the lives of insects.

Invasion of exotic organisms to new geographical areas is a major issue in the emergence of several pests and extinction of beneficial insects. Xu *et al.* have dealt with this subject through invasive ant species most of which are destructive in agriculture and forests, and can alter the micro-ecosystem. Intensive knowledge and understanding of the biosecurity spectrum is documented in this article, which should be helpful to forest and agriculture entomologists. Unfortunately, the article does not include information from India, which is home to many invasive ant species. The review by Lee *et al.* on the biology and management of long-legged invasive ant, *Anoplolepis gracilipes* partly fills the information gap by providing a worldwide checklist of its distribution and impact on the environment. This ant species is a predator of several terrestrial invertebrates, small vertebrates and plants. The review addresses the issue of pest management through biological control and other non-chemical methods. Young entomologists are likely to benefit most by the lucid writing of this review providing helpful explanation of all the scientific terms.

Promislow *et al.* provide an integrated knowledge of ageing in insects, *Drosophila* in particular, covering aging patterns among insects, developmental and physiological aspects, and molecular mechanism. This is a good attempt to foster a broad synthesis of independent bodies of works. It can serve the insect-dependent industry well by regulating senescence of beneficial insects. This area remains understudied and has ample scope for research across types of insects.

Insect resistance to pesticides has been one of the key areas of research in last three decades. By now, a large body of information exists which has helped the entomologists and plant protection scientists in the selection of insecticides from several options and control methods. Nauen *et al.* provide an illuminating account of insect cytochrome P450 monooxygenases-mediated insect resistance. This knowledge is already in practice to safeguard the health of important beneficial insects, and provides new opportunity of making suitable mole-

cular alterations in the insect enzyme to augment detoxification of harmful chemicals.

Insect hyperparasitoids are an important part of the food web in the biological control of insect pests. Poelman *et al.* document the ecology of these miniscule insects using multiple examples, and explain the role of volatile molecules released by plant hosts and primary parasitoids in mediating their relations. This article questions the negative impact of hyperparasitoids in biological control of insect pests given their status as an enemy of insect pest enemies. This is particularly true in cases where a single primary parasite species has multiple hyperparasitoid species.

The review by Beran and Petschenka on insect sequestration of plant defence compounds and use of these in their own defence is rather disappointing, because of incomplete coverage of the vast body of existing information. The authors have restricted the review to insect-plant co-evolution. There is a large information gap on the prospective potential of understanding the molecular basis of insect adaptation to plant selection with defence compounds and its role in crop management. In the tropical world where there is high biodiversity, crop management with emphasis on pest prevention is often a better strategy for crop protection from pests. Advanced studies are urgently required in different ecosystems to fill this gap in knowledge.

Two reviews on bacterial symbiosis in insects in a single volume indicate the growing knowledge in this area and its role in specialization of insect-host relationships. Salem and Kaltenpoth document symbiosis patterns found in diverse beetles and their intrinsic role in niche specialization. Vorburger documents symbionts in host-parasitoid specialization, largely drawing examples from aphid hosts. Beetles derive their symbionts mostly from diverse food sources ranging from soil, wood, other insect preys and plant food, whereas aphid-symbiont association is largely heritable and has an evolutionary role in the selection and specialization of parasitoids. Both the reviews are important in understanding the importance of symbiosis in regulating insect life cycle and adaptation in the respective environments. Excellent studies show that symbiosis is an intrinsic feature in the life of insects, and contributes to the complex relationships at physiological and molecular levels.

The review by Han *et al.* on the prevailing concepts of bottom-up approach in agroecosystems and its impact on arthropod

pest management is a compilation of several studies that support the ecological relationship of crop-pest management. This approach advocates that agriculture has evolved rapidly in time and space and this has affected the insect-plant food association, including the natural enemies of insect herbivores. Any desirable effect in pest management, therefore, requires adequate understanding of the agriculture landscape and conditions associated with its development. An alternative approach to this is top-down forces that emphasize use of biological control agents in pest management. Both approaches contribute to integrated pest management in large parts of tropical Asia and Africa.

Cicadas (13- and 17-yr periodicals) are among the most studied insects in evolution and ecology. Sound character, behaviour and long periodicity of their mass emergence in most species make these insects special in their host plant association, biogeography, and living in allopatric, sympatric or parallel species groups. Occasional inter-species breeding in the long rhythmic cycle showing minute to very small variations in sound pitch allows individuals of closely related species to share a common environment. Results have shown parallel evolution in such species. This and other major reviews on cicadas in general, and *Megacicada* species in particular, suggest reproductive boundaries and reproductive character displacement as a strong means of maintaining reproductive isolation. Most species are sympatric, with widely separated species being allopatric showing continuum in their distribution range. Gene-flow studies among sympatric or allopatric populations tend to be directional, and this shows why cicadas use sound as a major character of isolation.

A review of this volume will be incomplete without highlighting the article by Walsh *et al.* on insecticide resistance evolution among heliothis insects. Results from studies in Australia, China, India, the United States and parts of South America on six species clearly suggest that *Helicoverpa armigera* is the most resistant on almost all crop, including *Bt*-cotton and *Bt*-brinjal, followed by lower level of resistance recorded in *Helicoverpa zea* and four other species. None of these species was a serious crop pest before the introduction of chemical pesticides in early 1950s

and 1960s. However, with the spread of agriculture and application of chemical insecticides, populations of these insects developed detoxifying genes that provided them resistance against insecticides and plant defence compounds. Obviously, these insects possess genetic and biochemical abilities that make them tolerant to ever-changing chemical pesticides and crops embedded with toxins produced by *Bacillus thuringiensis*. Results show that crop selection accompanied by application of new generation plant-origin insecticides, to some extent, provide answers to detoxifying enzymes present in the resistant populations. The authors claim that it is important to rely more on crop management with careful monitoring of alternative refuse plants that can reduce population incidence.

This volume of the *Annual Review of Entomology* is a treasure of advances in knowledge in insect science and deserves appreciation for the contributions by the editor, co-editors and various authors.

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**Learning GIS using Open Source Software: An Applied Guide for Geo-spatial Analysis.** Kakoli Saha and Yngve K. Frøyen. Francis Group, 4 Park Square, Milton Park, Abingdon, Oxon OX 14 4RN, UK and Routledge, an imprint of Taylor & Francis Group, 605, Third Avenue, New York, NY 10158, USA. 2022. xiv + 226 pages. Price: £ 120.00.

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Open-source GIS platforms such as quantum GIS (QGIS) are widely used nowadays. As open-source platforms offer most of the functionality of the pricy commercial packages, academic programmes teaching GIS concepts and usage have benefitted from such open-source packages in the classrooms and laboratories. In addition to academia, several Government organizations and non-governmental organizations have deployed their spatial databases and planning platforms using resources from open-sources, and the number of organizations

adopting open source solutions is steadily increasing.

In this context, this book addresses an important and relevant need by providing learners with an excellent reference for a complete exposure to the fundamental GIS concepts through the use of open-source GIS platforms. A key feature of the book is that, in addition to the core concepts, the steps required to implement the concepts through QGIS are documented in a tutorial form. This enables a reader to get hands-on practice on the concepts, which is important for the effective learning of GIS.

The contents of the book are well structured. After the introduction and coverage of the history of GIS in India, each of the key concepts such as special referencing, generation of data, analysis techniques, etc. required to implement a GIS solution is covered in a logical sequence. The coverage of the concepts is appropriately detailed for students and practitioners who are learning GIS for the first time. The stepwise instructions and extensive illustrations make it easy for the learners to execute each step and learn about the usage of the platform as well as the underlying requirements. As only broad view of concepts is presented for learners, for those who need more detailed information on the concepts, references are specified at the end of each chapter.

In addition to covering the concepts and usage, the final chapters of the book present applications of the open-source platform for access analysis and location planning. Although the applications of GIS are multifarious, these chapters give reasonable exposure to a learner on the process of analysing and transforming data from their basic representation to the integrated format needed for decision and policy support.

While there are other books on QGIS, they mainly focus on the effective usage of the platform and not on the fundamental concepts. As this book integrates both aspects at an introductory level, it will be a valuable resource for teachers, students and practitioners looking for a structured introduction to GIS concepts and its usage through an open-source platform.

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