



# Society for Invertebrate Pathology Newsletter

Volume 47 Issue 2

June, 2014

## Meeting Events:

### Sunday

Opening Mixer

### Monday

Founders' Lecture  
Plenary Symposium  
Concurrent Sessions  
Division Business Meetings

### Tuesday

Concurrent Sessions  
Boat trip on the Rhine River  
UNESCO World Heritage Site  
5K Run-Walk Around the  
Castle Rheinfels  
Medieval Barbecue at Rheinfels

### Wednesday

Concurrent Sessions  
Posters  
Division Business Meetings

### Thursday

Concurrent Sessions  
SIP Annual & Student Business  
Meetings  
Award Ceremonies and Banquet

## 47TH ANNUAL MEETING



MAINZ GERMANY 2014



Mainz Cathedral. Photo by Thomas Guthmann

**President**

Jørgen Eilenberg, Denmark

**Vice President**

Peter Krell, Canada

**Past President**

Leellen Solter, USA

**Secretary**

Patricia Stock, USA

**Treasurer**

Kelli Hoover, USA

**Trustees**

Surendra Dara, USA

Juan Jurat-Fuentes, USA

Regina Kleespies, Germany

Ed Lewis, USA

**Newsletter Editor**

Eric Haas-Stapleton, USA

**SIP Office**

Society for Invertebrate  
Pathology

PO Box 11 Marceline, MO 64658,  
USA

**Email:** [sip@sipweb.org](mailto:sip@sipweb.org)

**Web:** [www.sipweb.org](http://www.sipweb.org)

**Phone/Fax:** +1- 660-376-3586  
(USA)

**From the President**

Dear SIP Colleagues,

Could one imagine a better society to be president of than the SIP? For me the two years in office has been a fine way of serving the SIP, getting to know other colleagues and not at least, to learn how much effort is expected of many SIP Council officers, division and committee chairs, newsletter editor and other members to get the whole system to work. People were responsive and responsible, thus it was a pleasure to thanks to our Executive Secretary Cecilia Schmit for her efforts to solve all types of problems and participating at the Pennsylvania meeting in 2013.

From me a big thanks to the outgoing Council: Lee Solter acted as Past President, my mentor and coach, Kelli Hoover did efficiently the hard work as our Treasurer, and Patricia Stock was a great support as Secretary. The team of Trustees were always willing to assist and do a job when needed: Juan Luis Jurat-Fuentes, Regina Kleespies, Ed Lewis and Surenda Dara. Juan Luis and Regina will now leave council after four years, while Ed and Surenda will remain for another two years. As Past President I will for the next two years still be member of Council.

Once again, the Nomination Committee successfully nominated and elected an excellent set of new officers for 2014-2016: Peter Krell will as incoming President surely do an excellent job, the same to be said about the other incoming officers: Mary Barbercheck (Secretary), Stefan Jaronski (Treasurer), Albrecht Koppenhofer and Monique van Oers (Trustees). A big thanks for their willingness to serve the SIP, and also a big thanks to those who accepted a nomination but were not elected.

It seems that time is a bit on our side. Many have already registered for the upcoming Mainz meeting, and many oral and poster presentations will appear. I assume that with respect to quantity and quality the meeting will be a great success. And, not to forget, Mainz is a beautiful place for a meeting. Discussions and decisions about the venues of the next meetings will be done in Mainz.

The SIP economy is in balance. This is not at least due to the success by local meeting organizers to keep expenses low. SIP members are generally faithful and stay as members- please remember to renew your membership! ☺

How are we then with science? We often get back to this point. We do well and harbor both fundamental science, applied science and also innovation and commercial usage. By that, SIP is a great place for scientists who wish to have a broad perspective. However, we also have the challenge that even if young students attend our

**Table of Contents**

Meeting Events	1
From the President	2
2014 Founders' Lecture	3
Meeting Overview	5
Scientific Program	6
Remembrances	10
Book Reviews	11
Announcements	15
Photos from 2013 Meeting	16



meetings and present good studies, they may drift away since the professional title: 'Invertebrate Pathologist' may be perceived to be a bit narrow.

However, new areas may open for us. I had the pleasure this year to attend the first world conference about insects as food and feed in The Netherlands May 14-17 (<http://www.wageningenur.nl/en/show/Insects-to-feed-the-world.htm> ). As invited plenary speaker I gave an overview of insect pathogens in this context (one slide consisted of the SIP logo) and this presentation was well received. Here, I see some new research and job options here, provided that insects will be developed more for food and feed. We absolutely have something to offer.

Have a nice summer and see you in Mainz



## Founders' Lecture Award

### Founders' Lecture by Dr. Trevor Jackson



**Dr. Trevor Jackson, Founders' Lecturer**

Dr Trevor Jackson studied Horticultural Science at Lincoln University, New Zealand where he developed an interest in biological control and IPM. After a period of work and travel experiencing the real pest problems affecting small farmers he returned to university for his MSc studies at Imperial College, University of London, and later returned to Lincoln University for his PhD study. On starting his first research position with the Research Division of the New Zealand Ministry of Agriculture in 1980 he was confronted with the question of why pasture pest problems seem to disappear and whether factors causing the disappearance could be harnessed in some way. The result was a rapid immersion in insect pathology, with help from many SIP members, as field surveys revealed that the target pest – the New Zealand grass grub *Costelytra zealandica* – could be infected by about 30 different pathogenic micro-organisms. The most important of these was a novel bacterial pathogen *Serratia entomophila* which frequently caused epizootics of disease in established beetle populations. Trevor was fortunate to spend 6 months at the BBA in Darmstadt Germany in 1985

where he first met Dr Huger who helped elucidate the pathology of this novel disease. On returning to New Zealand, Trevor founded the Microbial Control Group at MAF/AgResearch Lincoln with Maureen O'Callaghan and Travis Glare. The group developed *Serratia entomophila* as New Zealand's first indigenous microbial control which has been marketed in liquid (Invade™) and granule formulations (Bioshield™).

Building on the research with *C. zealandica*, Trevor developed and worked with a network of researchers specialising in diseases of the *Scarabaeidae* and, together with Travis Glare, published the first book on the topic and has organised numerous seminars, symposia and workshops on this theme. Success with formulating and commercialising *S. entomophila* led to establishment of an internationally recognised microbial products laboratory at AgResearch, Lincoln which has worked on stabilisation of a range of microbes into products for use as biopesticides, bioinoculants and probiotics for animal and human health.

Trevor has been a long standing member of SIP, and has served as a Trustee as well as being active in the Microbial Control and Bacteria Divisions. He has published more than 120 papers and book chapters on insect pathology, ecology, pest management and microbial control, contributed to more than 5 patents on microbial formulations and has led major projects on Microbial Product development. Trevor is a member of science advisory bodies for the Malaysian Oil Palm Board and Marrone Bio Innovations. His current work is focused on the application of microbial control and pest management for the development of sustainable agriculture for the benefit of small farmers through projects in Latin America, Asia and the Pacific.



**Dr. Alois Huger,  
Founders' Honoree**

### **Founders' Lecture In Recognition of Dr. Alois Huger**

Dr Alois Huger was born on the 23th of June, 1928 in rural Bavaria, Germany, where he grew up in a farming community. Despite the disruptions of war he was able to enter the Ludwig Maximilian University of Munich where he was impressed by Professor Dr. K. von Frisch's ground breaking work on the language of bees which he was able to assist as part of his undergraduate studies. Dr Huger moved on to PhD studies on the symbiotic relationships of stored products insects with microbes under Prof. Dr. A. Koch, head of the Paul-Buchner-Institute for Experimental Symbiosis Research. He was awarded his PhD at Munich University in 1956 and, in addition to his work on symbiotic associations of insects and microbes, developed a keen interest in insect pathology and its potential for biological control.

In 1957, Dr Huger joined the Institute for Biological Control at Darmstadt. At the Institute, he established a section for cyto- and histopathology as well as providing diagnosis of arthropod diseases. His specialization at this stage was the study of protozoan diseases of arthropods. An early highlight of his career was to participate in the 1st International Conference on Insect Pathology and Biological Control in Prague in 1958 where he presented his research and met leading scientists like Prof. Steinhaus, Drs. Weiser, Bergold, and others.

In 1963 Dr Huger was invited by the South Pacific Commission to look for a natural control agent for the coconut palm rhinoceros beetle, *Oryctes rhinoceros*, which was devastating palms in the Pacific. During this engagement he carried out intensive diagnostic studies on *Oryctes* field populations in Malaysia, Borneo, and Samoa and discovered a new virus disease which was able to be introduced for biocontrol into the Pacific islands with dramatic results. In 1982 he discovered the coleopteran active *B.t. subsp. tenebrionis* from dead larvae and pupae of the yellow mealworm, *Tenebrio molitor* which has proven to be especially active against chrysomelid larvae. Dr Huger's career has been marked by the careful use of histology to elucidate microbial structure and pathological events. These include definition of the structure of locust microsporidium *Nosema locustae*, clarification of the role of bacteria as the "son-killer" in the parasitoid wasp *Nasonia (Mormoniella) vitripennis*; elucidation of the amber disease process in *C. zealandica* larvae caused by *Serratia spp.*

Dr Huger has published more than 100 scientific papers. In 1989 he was awarded the First Class Federal Merit Order by the German Government in recognition of his scientific achievements. Since retirement in 1993 he has remained active with his Darmstadt colleagues, including publication of 55 years of diagnostic research on arthropod diseases gained from more than 2000 accessions!

Dr Huger has always willingly helped colleagues, especially younger scientists, and with his thorough approach has shown us the importance of understanding the microbial/host interaction and how this can be illustrated through the use of microscopy and histopathology.

# 47<sup>th</sup> Annual Meeting of SIP in Mainz, Germany

## Meeting Overview

### Scientific Program

The list of scheduled plenary session, symposia and workshops of the SIP 2014 meeting is presented in this Newsletter and is also available on-line at the Meeting Web Site. The printed Program and Abstract book will be available only to those registered for the meeting. Details will be provided as soon as the program is finalized.

### Presentations

Contributed oral presentations will be limited to 12 minutes with additional 3 minutes for discussion. Because of concurrent sessions, moderators are asked to keep to the scheduled times. Digital projection and PC computer equipment will be provided. Invited speakers in the Plenary Session and Division Symposia will have 25 minutes with 5 minutes for discussion. Some presentations in the Bacteria, Fungi and Microbial Control Symposia, respectively, are scheduled for 12+3 minutes only. Be sure to check with the organizer of your symposium and/or the program for your time slot.

### PowerPoint Slide Presentations

Speakers are strongly encouraged to upload their PowerPoint presentations between July 14 and July 31 using the Meeting Web Site. When uploading your presentation file or folder, please follow the instructions on naming the file as they are described on the Meeting Web Site.

Details will be posted on the Meeting Web Site by early July. All oral contributions must be uploaded at least 24 hours before the scheduled slot at the File Upload Station at the Registration Desk.

Before uploading files, please check the presentation for any incompatibilities between PC and Mac computers or software other than PowerPoint 2010 for PC. There will be opportunity to review presentations in the File Upload Station at the Registration Desk prior to giving your presentation. Please bring a back-up of your presentation on a memory stick. If presentations contain video clips, please place the video clip file in the same folder as the PowerPoint file and upload the entire folder. Be sure to label the folder, the PowerPoint file, and the movie clips with the speaker's name in case they get separated during uploading.

PowerPoint 2010 (Microsoft 2007) or compatible version will be provided at the conference.

The digital projectors will have a 600x800 resolution. Be sure to select a standard font to ensure compatibility (e.g. Arial, Times New Roman, Palatino). The PowerPoint files will load faster if the images in the file are kept to a minimum. We recommend a resolution of 200 dpi for scanned or embedded images in your presentation.

### Poster Presentations

Posters should be no larger than 980 mm (3.2 ft) wide by 1200 mm (3.9 ft) tall. Pins for poster boards will be provided.

Posters should be set up in the Philosophicum building next to P1 to P5, where the sessions will take place, by 14:00 on Monday, August 4, and removed by 17:00 on Thursday, August 7.

Boards will be labeled by division and poster number. Authors should be available at their poster for discussion during the scheduled time slot. There is a single poster session for all divisions on Wednesday 16:30 to 18:30.

# 47<sup>th</sup> Annual Meeting of SIP in Mainz, Germany

## Scientific Program

### FOUNDERS' LECTURE

*Presented by Jim Bechel*

*Trevor Jackson in Honor of Alois Huger*

### PLENARY SYMPOSIUM

#### Microbial control - from bench to business

*Organized by Ralf-Udo Ehlers*

- "Potentials for utilizing and controlling insect pathogens" *Richou Han*
- "Story of an African firm: 10 years in the biopesticide business – lessons learned along the way" *Sean Moore*
- "A Roadmap to the Successful Development and Commercialization of Microbial Pest Control Products for Control of Arthropods" *Willem Ravensberg*
- "Title to be announced." *Sebastian Bachem*

**August is  
summer-time in  
Mainz!**

Average high temperature is 26°C/ 79°F and low temperature is 14°C/ 57°F. Sustained rain is unlikely, but thunderstorms may form in the evening.

### DIVISIONAL SYMPOSIA

#### Bacteria Division

##### Structure and function of novel insecticidal toxins

*Organized by Ken Narva and Colin Berry*

- "Structural and biophysical characterization of Cry34Ab1 and Cry35Ab1" *Matt Kelker*
- "Cry5 and other 3-domain toxins" *Rafi Aroian*
- "Insights into the structures of non-3-domain toxins through structural modeling" *Colin Berry*
- "Novel MTX Toxins for Insect Control" *Yong Yin*
- "Insecticidal toxins from *Photorhabdus luminescens* and *asymbiotica*, targeting the actin cytoskeleton and GTP-binding proteins" *Thomas Jank*
- "Molecular basis of parasporin-2 action toward cancer cells" *Sakae Kitada*

#### Diseases of Beneficial Invertebrates Division

##### Emerging tools for Aquatic Pathogen Discovery and Description *Organized by Grant Stentiford and Spencer Greenwood*

- "Emergence of EMS/AHPND in the global shrimp farming industry" *Loc H. Tran*
- "Environmental DNA and aquatic animal health - ground-truthing an emerging technology" *K. Fraser Clark*
- "Environmental DNA as a tool for detection and identification of aquatic parasites: known unknowns and just plain unknowns" *Hanna-Leena Hartikainen*
- "The Next Generation of Crustacean Health: Disease Diagnostics Using Modern Transcriptomics" *Grant Stentiford*

## Microbial Control Division

### Developments/issues in the regulation of microbial products: harmonization across jurisdictions

Organized by Roma Gwynn David Grzywacz

- “The authorisation and regulation of microbial biopesticides: why bother?” [David Chandler](#)
- “Registration of biopesticides in the EU: a company perspective” [Philip Kessler](#)
- “Biopesticide registration a company perspective and how registration influences BP R&D approach of companies, North America perspective” [Jarrod Leland](#)
- “Registration of biopesticides: how research can be structured to suit microbial registration needs and promote the commercial development of new biopesticides” [Roma Gwynn](#)
- “Current developments and issues on regulation of biopesticides - lessons from Rebecca project, comparison of EU and USA systems” [Sabine Asser-Kaiser](#)

## Fungus Division

### Chemical ecology in Arthropod fungi interactions

Organized by Ingeborg Klingen

- “Conifer - bark beetle - fungus interactions” [Tao Zhao](#)
- “Carbon dioxide as an orientation cue for western corn rootworm and wireworm larvae - implications for an attract and kill approach using entomopathogenic fungi” [Stefan Vidal](#)
- “Searching behavior of two predators species in the presence of entomopathogenic fungal spores” [S.K. Jacobsen](#)
- “How *Fusarium graminearum* influences insect-plant interactions” [Jassy Drakulic](#)
- “Plant-microorganism interactions that shape host-plant selection in the grapevine moth” [Marco Tasin](#)
- “Effect of host plant on aphid susceptibility to the fungal pathogen Pandora neoaphidis” [Cezary Tkaczuk](#)

## Microsporidia Division

### Microsporidiology: Advances in Europe

Organized by Elke Genersch

- “A new intracellular parasite is a missing link between fungi and microsporidia” [Karen Haag](#)
- “Parasite takes fly - A Drosophila model of Microsporidia infection” [Sebastian Niehus](#)
- “White Sea metchnikovellids: morphology, life cycles; potential ancestral features of microsporidia” [Yuliya Sokolova](#)

## Nematode Division

### Above- and below-ground interaction, root-shoot interaction, chemical signaling

Organized by Raquel Campos Herrera and Fatma Kaplan

- “Small molecule signals in nematodes - common motifs and species specific modifications” [Stephan von Reuss](#)
- “Olfactory plasticity in entomopathogenic nematodes” [Elissa Hallem](#)
- “Multiple consequences of belowground herbivore induced volatile signals” [Jared G. Ali](#)
- “Root zone chemical ecology; new techniques for below ground sampling and analyses of volatile semiochemicals” [Hans Alborn](#)

## Virus Division

### Small non-coding RNAs as regulators of insect host-virus interactions and immunity

Organized by Sassan Asgari

- “Role of cellular and virus-encoded microRNAs in insect host-virus interactions” [Sassan Asgari](#)
- “Sensing viral RNA in *Drosophila melanogaster*” [Carine Meignin](#)
- “Small RNA-directed antiviral immunity in disease-vector mosquitoes” [France Kevin Myles](#)
- “Controlling viral infection in insects” [Raul Andino](#)

## CROSS DIVISIONAL SYMPOSIUM

### Bacteria and Diseases of Beneficial Insects Divisions

#### Host - pathogen ecology at the molecular level: Gene regulation and environment sensing

Organized by Christina Nielsen-LeRoux and Elke Genersch

- “The interplay of *Bacillus thuringiensis* quorum sensing systems during infection” Didier Lereclus
- “The interplay of *Paenibacillus larvae* with honey bee larvae during infection” Elke Genersch
- “Antimicrobial defense and persistent infection in insects revisited” Jens Rolff
- “Oyster Intraphagosomal induced expression of *Vibrio splendidus* factors” D. Destoumieux Garcon

## SPECIAL SYMPOSIUM

### Host–Parasite Coevolution

Organized by Joachim Kurtz

- “Escaping parasite manipulation: Apoptosis and host-parasite co-evolution in *Apis mellifera*” Christoph Kurze
- “Overcoming external immunity: An increase in virulence as a result of host-parasite coevolution in *Beauveria bassiana*” Charlotte Rafaluk
- “Rapid adaptation of *Bacillus thuringiensis* to its nematode host *Caneorhabditis elegans*” Hinrich Schulenburg
- “Intra-host parasite interactions between co-infecting *Bacillus thuringiensis* strains” Rebecca Schulte
- “Experimental evolution *in silico*: host-parasite coevolution versus parasite adaptation” Jakob Strauss
- “Immune priming with *Bacillus thuringiensis* in *Tribolium castaneum*” Joachim Kurtz
- “Rapid reciprocal adaptation between the red flour beetle and *Bacillus thuringiensis* bacteria during experimental coevolution” Barbara Milutinovic
- “Means of fast virulence adaption: the plasmid and prophage equipment of selected *Bacillus thuringiensis* strains” Heiko Liesegang

## WORKSHOPS

### Bacteria Division

#### Non-target effects on biological pesticides transgenic crops

Organized by William Moar and Ken Narva

- “Your right to know what you eat: on the occurrence of viable *Bacillus thuringiensis* in commercial food products” Brian Federici
- “Environmental risk assessment of genetically engineered crops for spiders” Michael Meissle
- “Conclusions from 10 years of accumulated evidence from publicly funded field trials research with Bt-maize in Germany” Stefan Rauschen
- “The impact of herbicide tolerant crops on non-target organisms” Ramon Albajes

### Nematode Division

Organized by Glen Stevens and Patricia Stock

- Invertebrate Pathogens in the Classroom: Current Status and Future Challenges

### Microsporidia Division

- “An open discussion on the advances of microsporidia research in Europe”

### Student Workshop

- “How to write a paper”

## BUSINESS MEETINGS

- Monday 20:00 - 21:30 will have Microbial Control, Diseases of Beneficial Insects and Microsporidia Division Business Meetings
- Wednesday 20:00 - 21:30 will have Virus, Bacteria, Nematodes and Fungus Division Business Meetings.
- Thursday 10:30 - 12:30 will have SIP Annual Business Meeting.
- Thursday 16:00 - 16:30 will have the Student Business Meeting

*In addition, there will be concurrent scientific sessions with short oral presentations and posters*

Please, check the conference website for updates: <http://www.sip2014.mainz.jki.bund.de/>

### Newly Elected Council Members

At the business meeting, we will officially welcome the incoming officers: Johannes Jehle (Vice President), Mary Barbercheck (Secretary), Stefan Jaronski (Treasurer), Albrecht Koppenhöfer and Monique van Oers (Trustees).

### 5K Run - Walk

Be sure to sign up for the 5K run/walk for Tuesday evening, which will be held close to the Castle "Rheinfels", just before the BBQ. As the area is hilly, it will be a challenging country trail of about 4.5 km but with an altitude profile of 2 x 90 m. The trail follows through meadows and a small forest and you will enjoy a beautiful view of the Middle Rhine Hills.

You will be able to take a shower after the run in two common shower areas (2 x 4 showers). Towels will be provided.

### Public Transportation from the Airport to the Hotels and Meeting Site

We will set up a Welcome Desk at the Frankfurt/Main Airport (Terminal I, Arrival C/Exit 8) on Saturday, August 2, from 10:00 to 17:00 and on Sunday, August 3, 10:00 to 16:00. There, we provide information for public transportation and help after your flight.

The registration fee for attendants and companions includes a 6-day ticket for free public transportation in Mainz and Wiesbaden. It also provides you free entrance to the Gutenberg Museum and the Museum of Natural History in Mainz.

## Remembrances

IN MEMORIAM: Constantin Vago (1921 – 2012)

Dr. Constantin Vago was born in 1921 in Debrecen, Hungary and passed away on 6 February, 2012 in Alès, France. Dr. Vago received his PhD at the University of Debrecen in 1943 and pursued studies under Nobelist Albert Szent-Gyorgyi. He later received the Doctor of Sciences degree at Montpellier, France in 1956. Over his long career he was Director of Research at INRA, Director of the Laboratory of Comparative Pathology in the Faculty of Sciences at Montpellier, Director of the Center for Research on Vector Pathology with the World Health Organization, and Director of the Laboratory of Comparative Pathology of Invertebrates at EPHE in Montpellier. He was later named Honorary Professor at the University of Sciences of Languedoc at Montpellier and Honorary Professor at the Center for Research on Comparative Pathology at INRA-CNRS-USTL-EPHE. He received many awards, including the French Legion of Honor, the National Order of Merit, membership in the Academy of Agriculture of France, and election to the French Academy of Sciences in 1971.

Dr. Vago's scientific work which began in the early 1950's included studies of comparative pathology, ecopathology, and the evolution of the pathogenic process. His early studies on oncogenes were groundbreaking. His research on diseases of invertebrates covered a very wide field, ranging from early discoveries of viruses, to rickettsia, mycotoxins, and fungi. His work covered not only diseases of insects but also of other invertebrates, including molluscs, spiders, scorpions and crustaceans. He was an early pioneer in insect cell culture and edited the two volume book, "Invertebrate Tissue Culture" in 1971.

Dr. Vago served the Society for Invertebrate Pathology in many ways. He met with Edward Steinhaus during Dr. Steinhaus's trip to Europe in the mid-1950's, and served as our third President in 1970-72. He delivered the Founders' Lecture honoring Louis Pasteur in 1988. At our meeting in 1994, Dr. Vago himself was honored by Dr. Lois Miller with the Founders' Lecture.

Dr. Constantin Vago indeed had a great and important impact upon our field which continues to this day.

Information from Institute of France, Academy of Sciences.

*Elizabeth W. Davidson*



Constantin Vago in 1971



C. Vago, E. Steinhaus and A. Scheck

## Book Reviews

### ***Insect Resistance Management, Second Edition: Biology, Economics, and Prediction***

**Author:** David Onstad

**Publication date:** December 2013

**Publisher:** Academic Press

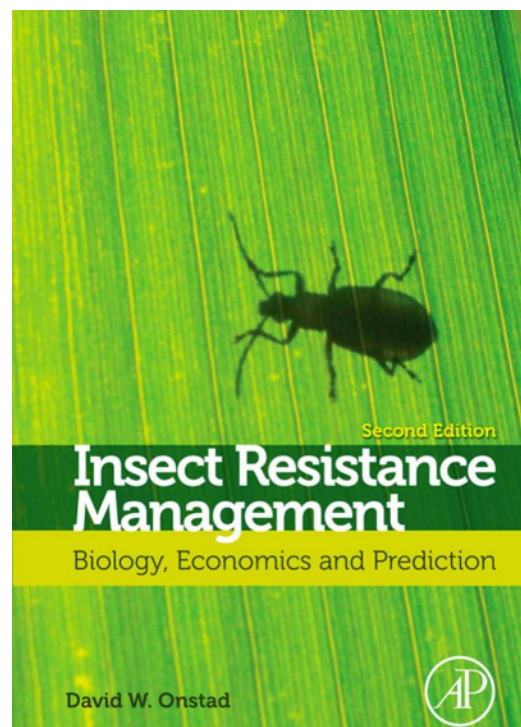
**ISBN-13:** 978-0123969552

**Price:** US\$ 100

**Pages:** 560

The development of insect resistance is usually considered as the main threat to the sustainable commercial use of entomopathogens for insect control. Insect resistance management (IRM) may be described as a science-based procedure to delay evolution of pest resistance and its negative socioeconomic and ecological impacts. The first edition of “Insect Resistance Management: Biology, Economics and Prediction” published in 2007 has been considered by many as the authoritative reference in the field, and at the time, the only available comprehensive book on IRM. Since then, our understanding of the biology, ecology, and socioeconomical aspects of insect resistance, as well as the number of practical arthropod resistance cases have increased significantly. These recent advances in this dynamic field are well documented and explained in the second edition of the book, which is also edited by David Onstad, a widely recognized expert in IRM and its application, especially in the area of insect-resistant transgenic crops. A comprehensive team of renowned experts from academia and industry are authors in the 16 chapters included in the book, which include chapters describing essential biological principles affecting selection of resistance (mostly detailed on chapters 3, 5 and 12), socioeconomic aspects of IRM (chapter 2), the development of predictive tools (chapter 14), and documenting practical examples of IRM application to specific systems. While resistance to insect-resistant transgenic crops is used as a model for IRM throughout the book (especially in chapters 4 and 10), chapters dedicated to entomopathogens and parasitic arthropods of insects (chapter 8), negative cross-resistance (chapter 11), and integrated pest management and IRM (chapter 16) are also of direct relevance to researchers working on insect pathology. More importantly, the book has an extensive breath of coverage, from molecular biology and mathematical modeling to economics and human behavior.

The book opens with a chapter in which the Editor introduces IRM and defines major themes to be considered to advocate for preventative, rather than reactive, IRM approaches. These themes are then further discussed and expanded throughout the book. The second chapter is of great educational value to biologists, as it focuses on socioeconomical aspects of IRM that while critical to IRM, are rarely understood by researchers. This chapter explains the value of preserving insect susceptibility within the context of economic models and policies considered by government and stakeholders at the time of making decisions directly relevant to IRM. In chapter 3, a group of international experts review the current knowledge on the molecular biology of insect resistance, including section describing current contributions and the potential to generate critical information through the application of –omic approaches. The text includes very descriptive figures and specific examples of resistance mechanisms against diverse insecticides that help understand the biological complexity underlying the development of insect resistance. Chapter 4 is an excellent and detailed review on the mode of action and resistance mechanisms against plant incorporated protectants (PIPs) in transgenic crops. While the main focus of the chapter is on insecticidal proteins from *Bacillus thuringiensis* (Bt), upcoming



PIP technologies, such as RNA interference (or RNAi) are also considered. In chapter 5, population genetics concepts and their relevance to resistance evolution are introduced and explain with examples. A number of concepts and their relevance to resistance evolution are introduced and explain with examples. A number of specific ecological and biological variables affecting resistance evolution are considered and discussed, such as landscape structure, selection pressure, fitness costs or genetic interactions. These concepts are clearly explained and put into context by the use of examples. Chapters 6 to 9 present and discuss cases of IRM applied to reported cases of arthropod resistance to pesticides (chapter 6), crop rotation (chapter 7), entomopathogens (chapter 8) or crops (chapter 9). Chapter 6 is focused on ectoparasites, including the most relevant pests of health and/or veterinary importance, such as mosquitoes, mites, ticks or flies. The information presented clearly identifies commonalities in issues resulting from resistance in these arthropod species, as well as similarities in IRM approaches that may be effective. Chapter 7 describes IRM in the context of a cultural practice (crop rotation), focusing on the case of resistance in *Diabrotica* corn-rootworm beetles. Information on the biology of that pest, current control methods and issues, and predictive assessments are also discussed. While chapter 8 is possibly the most directly relevant to insect pathologists, chapter 4 also discusses the use of PIPs from an entomopathogen (Bt). As noted by the author, although resistance to entomopathogens or natural enemies is rarely observed outside the laboratory setting, the increasing use of entomopathogens and other biological control agents and the need for disease management in beneficial insects highlight the importance of IRM in resistance to infectious pathogens. The chapter includes an overview of reported resistance cases to entomopathogens and parasitoids and focuses more extensively on resistance to the *Cydia pomonella* granulovirus (CpGV) and *Drosophila melanogaster* resistance to *Asobara* parasitoids as examples. In chapter 9 a number of case studies on host-plant resistance in traditional and transgenic crops are reviewed and discussed. Several cases of arthropod resistance to diverse crops are discussed in the context of resistance evolution and management practices. Examples of transgenic crops are focused on plants producing Bt proteins as PIPs. Chapter 10 discusses the role of the environment (landscape heterogeneity) on resistance evolution and IRM, with a focused on the bollworm-Bt cotton system as model. Insights from simulation models as well as empirical studies are extensively presented to convey the consequences of landscape diversity, in terms of both spatial and temporal structure, for evolution and management of resistance. Timely concepts for IRM in *Bt* crops, such as the use of natural refugia or seed mixtures, are well discussed. Chapter 11 is focused on cases of negative cross-resistance, which although dominated by resistance to synthetic pesticides, it also includes cases of resistance to Bt insecticidal proteins resulting in negative cross-resistance to alternative *Bt* proteins or synthetic pesticides. In fact, the use of pyramided *Bt* crops producing *Bt* proteins with diverse mode of action and refugia is discussed as an example of the applicability of negative cross-resistance to IRM. In the following chapter (12) the effect of natural enemies on selection for resistance and IRM is discussed. One of the examples discussed is the effect that natural enemies can have on selection for resistance to Bt crops, as demonstrated by simulation models, and *Bt* pesticides. Chapter 13 discusses the effect of human behavior (adoption and compliance with IRM mandates) in the success of IRM practices. More specifically, the chapter uses compliance with current IRM mandates for Bt crops as a model to demonstrate the importance of human behavior for IRM success, advocating for the importance of enforcing public policies towards successful IRM. Predictive models and their importance in managing resistance are discussed in chapter 14. A very educating example of an uncertainty analysis model and the meaning of its results are clearly explained. Chapter 15 is focused on assessing the susceptibility of target insect pests to toxins through resistance monitoring, and its relevance for effective IRM practices. Diverse methods to quantifying tolerance are explained, practical issues related to resistance monitoring programs presented, and examples of current monitoring programs reviewed. The last chapter (16) is focused on integrated pest management (IPM) as a necessary tool to help manage insect resistance. Several case studies are described, and more importantly, specific recommendations guiding the improvement of current IRM practices in the future, including incorporating IPM.

The book is easy to read and the language is very accessible to non-specialists, so it should be considered a very valuable reference for students and professional researchers interested in IRM, including insect

pathologists involved in the use of entomopathogens for pest control. The extensive list of references provided in each chapter serves as an easy access to the most up-to-date information in the field. The book is very reasonably priced (less than \$100 US) considering the breadth of coverage on the subject and that it is authored by widely recognized experts on the subject who have done an excellent job in summarizing previous research and identifying future goals of IRM.

Juan Luis Jurat-Fuentes  
[jurat@utk.edu](mailto:jurat@utk.edu)  
Associate Professor  
Department of Entomology and Plant Pathology  
The University of Tennessee  
Knoxville, TN

### ***Mass production of Beneficial Organisms – Invertebrates and Entomopathogens***

**Edited by:** Juan A. Morales-Ramos, M. Guadalupe Rojas & David Shario-Ilan

**Publication date:** November 2013

**Publisher:** Academic Press

**ISBN-13:** 978-0123914531

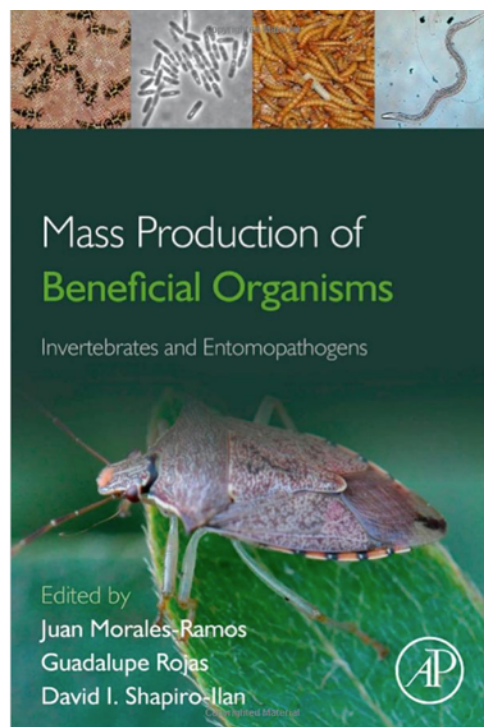
**Price:** US\$ 125

**Pages:** 764

This book covers the topic of large scale production of a huge range of insects and entomopathogens, plus some useful additional topics covering areas such as diet development, quality assurance and formulation. The book comes in hard cover, but can also be accessed via science direct with each chapter downloadable as a pdf file (<http://www.sciencedirect.com/science/book/9780123914538>).

The book is divided into three sections, Section I deals with production of beneficial arthropods for use in biological control. Individual chapters review production of Coleopteran predators; Heteropteran predators; *Bemisia* parasitoids; stem-galling wasps (*Tetramesa romana*) for weed control, development of artificial diets, life tables and methods of quality assurance for parasitoids and predators. Section II, covers production of entomopathogens, an area with which I am far more familiar and includes chapters on nematodes, fungi, bacteria and viruses, plus a review of production systems in less industrialized countries, and the principles of formulation of bioinsecticides. This section is probably of most interest to SIP members and I have made some more detailed comments on these chapters later in this review. The final Section (III) covers the fascinating world of production of insects for food, and ecological purposes. Individual chapters cover production of insect protein for fish; insects as food for insectivores; insects for human consumption; solitary bees for pollination and earthworm culture.

It is hard to imagine a single person for whom all the chapters in this book would be relevant, but as a reference point for information on starting up production in any of the areas covered, this book would be a useful source of updated information. Looking in more detail at Section II (mass production of entomopathogens), a common theme throughout this section is the lack of publicly available information on current commercial production methods and techniques. Regardless of the entomopathogen group,



commercial producers have their own closely guarded secrets to achieving economic yields. Of course, this is common practice in any industry, and for biopesticide producers one could argue that production methods and formulation are the only areas that can in reality be kept proprietary. After all, the specific strains or isolates that make up a given commercial biopesticide instantly become widely available once commercial sales have commenced. Other than regulatory hurdles (which don't exist for nematodes), production methods and formulation are among the only elements that protect a company from competitors.

So, what do these chapters offer, if not insider knowledge on commercial production methods? Well, as far as fungi are concerned, Jaronski's chapter, on state of the art production of entomopathogenic fungi, presents a comprehensive review that replaces Bartlett and Jaronski, 1988 and updates Feng *et al*, 1994 and Jenkins and Goettel, 1997. Whilst the bulk of the chapter understandably focuses on production methods for *Beauveria* spp. and *Metarhizium* spp, Jaronski also presents sections on production of *Isaria*, *Hirsutella*, *Aschersonia Nomuraea*, *Lecanicillium*, *Culicinomyces* and the less commonly reviewed groups, *Laganidium giganteum*, *Leptolegnia chamani*, *Coelomomyces* spp., Entomophthorales, and Microsporidia. It is a comprehensive and well organized review. Further to this chapter, Grzywacz *et al* also cover production of fungi in less industrialized countries (LICs), they provide detailed descriptions of two relatively large-scale production units for *Metarhizium* spp. in Benin and Trinidad and Tobago, respectively. This chapter also provides a detailed review of *in vivo* production of Baculoviruses in LICs. However, this chapter does not provide any detailed information on production of nematodes or bacteria.

Reid *et al* reviews the current status of virus production in industrial countries and provides detailed discussion on techniques for both *in vivo* and *in vitro* production. This is a highly informative chapter that provides a good introduction to entomopathogenic virus biology, along with details on isolate maintenance, media development and composition, and bioreactor processes.

Production of entomopathogenic bacteria, specifically *Bacillus thuringiensis* and *Lysinibacillus (Bacillus) sphaericus*, is covered by Couch and Jurat-Fuentes. Whilst the chapters on other entomopathogens dealt with multiple production techniques and technologies, this chapter provides a straight forward overview of production in liquid fermentation, down-stream processing, formulation and quality assurance for this pathogen group.

Shapiro-Ilan *et al*, review production of entomopathogenic nematodes. They discuss *in vivo* production, *in vitro* production in solid culture and *in vitro* production in liquid culture along with a comparison of these methods and a discussion on strain selection, improvement and stability.

Finally, a chapter on formulation of entomopathogens is presented by Behle and Borthisel. This chapter really is more of a general overview, as it does not get into specifics of formulation components, but provides general information on the goals and biological considerations for formulations across all pathogen groups. This chapter does not provide a 'formulation cookbook' but rather introduces the reader to the important elements for consideration during formulation development.

Nina Jenkins  
Penn State Department of Entomology  
University Park  
PA 16802, USA

## Announcements

### SIP WEBSITE UPDATES

For website additions, deletions, corrections and exciting news(!), please contact Lee Solter, [lsolter@illinois.edu](mailto:lsolter@illinois.edu)

### Submit a Symposium Proposal or Plenary Speaker Nomination for ICE 2016

The XXV International Congress of Entomology with the theme of "Entomology without Borders" will be held September 25-30, 2016 in Orlando, Florida, USA.

[www.ice2016orlando.org/](http://www.ice2016orlando.org/)

To ensure that invertebrate pathology is well represented at this meeting, members of SIP are strongly encouraged to submit nominations for plenary speakers via the web site (deadline October 1, 2014), and symposium proposals in the areas of biological control and pathology. **The deadline for symposium proposals is March 2, 2015.** One North American and one international co-chair are required for each symposium. Each attendee will be allowed only one presentation of any type (invited paper, contributed paper, or poster) because between six- and nine- thousand delegates are expected at this meeting.

### Auction at the Annual Meeting

We are planning for another exciting and fun auction at our upcoming SIP meeting in Mainz, Germany. If you have any items that you would like to donate for the auction, please let us know. The funds go to help pay for student travel awards and other SIP expenses. Items can be anything insect or invertebrate pathology related: a useful book, photos, prints, previous SIP T-shirts (unused), or anything you think the SIP Consortium might bid to the moon. Your donation can be left at the meeting registration desk. Thank you for your generosity.

The poster for the International Symposium on Fungal Stress (ISFUS) features a central cartoon fungus character with a smiling face. Surrounding the character are various icons representing different stressors: a sun, a factory with smoke, a salt container, a chemical structure, a radiation symbol, an alkali acid symbol, a biohazard symbol, a poison symbol, and a no oxygen symbol. The text on the poster includes:

**International Symposium on Fungal Stress**  
**ISFUS®**  
October 25 to November 1<sup>st</sup>, 2014  
Universidade do Vale do Paraíba  
São José dos Campos, SP, Brazil  
[isfus2014@live.com](mailto:isfus2014@live.com)  
<http://www.univap.br/isfus>

The logo of the Instituto de Pesquisa e Desenvolvimento (P&D) is also present in the bottom right corner.

## Memories from the SIP Meeting in Pittsburgh



Elke Genersch enjoying the banquet night with Gillian Hertlein (left) and Lena Poppinga (right).



Dietrich Stefan cooling off after some hot dancing!



Jarrold Leland leads the band into the morning (check the time on his watch!)



Rich Humber, Thiago Castro, Ingebord Klingen & Italo Delalibera take a moment to get flashed!



Disco rules on the river cruise!



Selfie caught