
Trends in Insect Molecular Biology and Biotechnology

Dhiraj Kumar • Chengliang Gong
Editors

Trends in Insect Molecular Biology and Biotechnology

 Springer

Editors

Dhiraj Kumar
School of Biology and
Basic Medical Sciences
Soochow University
Suzhou
China

Chengliang Gong
School of Biology and
Basic Medical Sciences
Soochow University
Suzhou
China

ISBN 978-3-319-61342-0 ISBN 978-3-319-61343-7 (eBook)
<https://doi.org/10.1007/978-3-319-61343-7>

Library of Congress Control Number: 2017964663

© Springer International Publishing AG, part of Springer Nature 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Insects are one of the versatile groups of the animal kingdom with a large population and are long since attracting researchers to disclose their molecular biology and use them for the benefit of humankind. Several traditional insects such as silkworms, honey bee, lac, *Drosophila*, termites, etc. are genetically and economically important and are the best invertebrate animal models. In the modern era of genetic engineering, these insects open a new horizon in the molecular biology with a multidisciplinary approach. Additionally, insect-derived products are widely used in biomedical and biotechnology industries. In this book, we made an effort to club together various recent aspects of insect molecular biology, including insect genomics, proteomics, virology, noncoding RNA, nano-biotechnology, recombinant insect products, and their applications in modern research. Therefore, this volume will certainly help academics and scientists to better understand and carry out research on insect genomics, proteomics, and transgenics and their utilization. The first section of this book comprises topics on insect molecular marker-assisted selection in breeding, molecular mechanism of communication, monocyclic aromatic hydrocarbons (MAHs)-induced toxicity, molecular studies of evolution, long noncoding RNA discovery, and pathogen-driven proteomics of various insects. The second part describes the role of viral lytic polysaccharide monoxygenase, antiviral mechanism, and RNAi as a novel tool for crop protection. The third section deals with the application of recombinant insect products and chitinolytic enzymes, the role of insects in forensic science, and genome research on *Cordyceps*, including information on nanotechnology application in insect molecular biology. The content of the book will also provide a common platform for the molecular entomologist and biotechnologist to develop novel, significant, and accessible approach for mankind across the world.

Suzhou, China
Suzhou, China

Dhiraj Kumar
Chengliang Gong

Acknowledgements

It is a great privilege to express my humble gratitude to all the contributing authors of this book, who not only provided support but also read, wrote, offered comments, and allowed me to quote their remarks and assisted in the editing, proofreading, and design. I am extremely thankful to my co-editor Prof. Chengliang Gong, Soochow University, China, for his collaboration, contribution, critical review, and suggestions. Without his help and sincere efforts, it was not possible to complete this book.

I feel elevated to express my deep sincere regards and a profound sense of gratitude to Prof. Jose L. Cenis, Spain, Dr. Venkatesh Kumar R., and Dr. Rajesh Kundapur for their encouragement, persistence, and constructive and critical suggestions, throughout the tenure of my book editing. It was their aptness and precision in perception that helped me in completing the book.

There are no words to convey my emotions and gratitude to my respected parents, Shri Jiya Lal and Smt. Rita Devi, for their moral support, love, inspiration, and blessing to make this volume happen. I express my special thanks to Dr. Madhavi, India, who always motivated and helped me to complete this assignment in the form of a book.

Contents

Part I Insect Genomics and Proteomics

- 1 Molecular Marker-Assisted Selection Breeding in Silkworm, *Bombyx mori*** 3
Rajendra Mundkur and E. Muniraju
- 2 Molecular, Neuronal, and Behavioral Mechanism of Communication Among Insect Species: A Review** 35
Iswar Baitharu, Sabita Shroff, and Jayanta Kumar Sahu
- 3 Monocyclic Aromatic Hydrocarbons (MAHs) Induced Toxicity in *Drosophila*: How Close How Far?** 53
Mahendra P. Singh and Ranjana Himalian
- 4 Tracing of Evolution in Silkworm, *Bombyx mori* L., on the Basis of Molecular Studies** 67
E. Muniraju and Rajendra Mundkur
- 5 Long Noncoding RNA: Disclosing New Horizon in the Molecular World of Insects** 85
Dhiraj Kumar, Xiaolong Hu, Rui Guo, Renyu Xue, Guangli Cao, and Chengliang Gong
- 6 Pathogen-Driven Proteomic Changes in Hemolymph of Nuclear Polyhedrosis Virus-Infected Silkworm *Bombyx mori* L.** 103
M. Sayed Iqbal Ahamad, Neetha N. Kari, and Shyam Kumar Vootla

Part II Molecular Based Studies of Insect Pathology

- 7 Analysis of the Viral Lytic Polysaccharide Monooxygenase Fusolin and Its Potential Application to Pest Control** 129
Wataru Mitsuhashi
- 8 Antiviral Mechanism of Serine Protease in Various Insects.** 143
Jyoti Verma

9	Preventive, Diagnostic and Therapeutic Applications of Baculovirus Expression Vector System	163
	Neeraj Kumar, Deepak Pandey, and Ashutosh Halder	
10	Insect RNAi: Integrating a New Tool in the Crop Protection Toolkit	193
	Leela Alamalakala, Srinivas Parimi, Navid Patel, and Bharat Char	
11	Egg-Laying Behaviour of <i>Caryedon serratus</i> (Olivier) on the Essential Oils of <i>Skimmia anquetilia</i>	233
	Manjul Gondwal, Bhanu Pratap Singh Gautam, and Navneet Kishore	
 Part III Functions and Applications of Insect Derived Products		
12	Research Advancement of Insect Origin Fungus <i>Cordyceps</i>	253
	Zhungua Pan	
13	Application of Recombinant Insect Products in Modern Research: An Overview	283
	Mohd Yusuf	
14	Structure, Regulation, and Potential Applications of Insect Chitin-Metabolizing Enzymes	295
	Manish Kumar, V. Vivekanand, and Nidhi Pareek	
15	Correlation of Insects with Forensic Sciences	317
	Mian Sahib Zar and Moli Huang	
16	Nanoparticles as Precious Stones in the Crown of Modern Molecular Biology	331
	M. Rajesh Kumar and P. Joice Sophia	
17	Nanotechnology and Its Impact on Insects in Agriculture	353
	Prashant Singh, Kamlesh Kumari, Vijay K. Vishvakarma, Sangita Aggarwal, Ramesh Chandra, and Anita Yadav	

About the Editors



Dr. Dhiraj Kumar completed his post-doctorate at the Molecular Biology Laboratory, School of Biology and Basic Medical Science, Soochow University, China, and selected as a visiting scientist in the prestigious Talented Young Scientist Programme of the Chinese Government. He also worked as an Assistant Professor at the Department of Zoology, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur (C.G.), India. Dr. Kumar received a young scientist award and an outstanding paper award for his research contributions in biological science. He has published numerous research papers in renowned international journals including those from the Nature Publishing Group and has filed a patent for his new innovation. Presently Dr. Kumar's research is focused on metagenomics, transgenic technology, and biomedical science.



Dr. Chengliang Gong is currently serving at Soochow University, China, as a Professor and Dean of the Department of Applied Biology, School of Biology and Basic Medical Science. He is also Vice President of the Sericultural Society of Jiangsu Province, China. Prof. Gong has carried out over forty research projects as a PI funded by various research funding organizations of China and has published more than fifty research papers in international journals. He has also obtained ten patents as the first inventor. His major research interests are in the areas of genetic manipulation, molecular biology, biochemistry, and pathology of insects and aquatic animals.