

Progress in Biological Control

Volume 1

The titles published in this series are listed at the end of this volume.

Environmental Impacts of Microbial Insecticides

Need and Methods for Risk Assessment

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SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-90-481-6100-3 ISBN 978-94-017-1441-9 (eBook)
DOI 10.1007/978-94-017-1441-9

Cover photo:

A healthy late instar larva of *Hippodamia convergens* (Coccinellidae) eating and surrounded by *Metopolophium dirhodum* (rose-grain aphid) on oats. One aphid has been killed by an unidentified entomophthoralean fungal pathogen. (Photo by Jack Kelly Clark, courtesy University of California Statewide IPM Program)

Printed on acid-free paper

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Originally published by Kluwer Academic Publishers in 2003
Softcover reprint of the hardcover 1st edition 2003

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Dedication



This book is dedicated to Dr. Christopher J. Lomer (1957-2001). Chris initially served as co-editor of this volume presenting the contents of a symposium he helped organize for the 2001 meeting of the Society for Invertebrate Pathology, at Noordwijkerhout, Netherlands.

Chris was born in Oxford and received degrees from Cambridge, Imperial College and the University of London, basing his graduate studies on viral entomopathogens. Over his career, the majority of Chris' research was conducted overseas with early studies in the Seychelles and Indonesia. Chris became best known for his efforts from 1991-1999 working at the International Institute of Tropical Agriculture in Benin, Africa, developing *Metarhizium anisopliae* var. *acridum* for control of grasshoppers and locusts. He served as leader of this very successful programme from 1994. In 1999, Chris moved to Ankara, Turkey and then Copenhagen, Denmark, continuing his work developing pathogens for insect control.

Chris was an enthusiastic and inspirational insect pathologist who made valuable contributions to this discipline through his research, teaching, leadership, outreach, and insightful and synthetic communications. On a personal basis, Chris' joy in life, enthusiasm and optimism, humour and comradeship made him an exceptional colleague.

CONTENTS

Dedication	v
Contributors	ix
Preface	xi
SECTION I GENERAL FRAMEWORK	
1. Ecological risk assessment framework for biological control agents <i>H.M.T. Hokkanen, F. Bigler, G. Burgio, J.C. van Lenteren and M.B. Thomas</i>	1
SECTION II ENTOMOPATHOGENIC FUNGI	
2. Entomopathogenic fungi as classical biological control agents <i>A.E. Hajek, I. Delalibera Jr. and L. Butler</i>	15
3. Safety of Hyphomycete fungi as microbial control agents <i>S. Vestergaard, A. Cherry, S. Keller and M. Goettel</i>	35
4. Assessing the impacts of <i>Metarhizium</i> and <i>Beauveria</i> on bumblebees <i>H.M.T. Hokkanen, Q.-Q. Zeng and I. Menzler-Hokkanen</i>	63
SECTION III VIRAL INSECTICIDES	
5. Ecological impacts of virus insecticides: host range and non-target organisms <i>J.S. Cory</i>	73
SECTION IV ENTOMOPATHOGENIC MICROSPORIDIA	
6. Environmental safety of microsporidia <i>L.F. Solter and J.J. Becnel</i>	93
SECTION V BACTERIAL INSECTICIDES	
7. Environmental impacts of bacterial biopesticides <i>T.R. Glare and M. O'Callaghan</i>	119
8. The safety of bacterial microbial agents used for black fly and mosquito control in aquatic environments <i>L.A. Lacey and R.W. Merritt</i>	151
9. Environmental safety of inundative application of a naturally occurring biocontrol agent, <i>Serratia entomophila</i> <i>T.A. Jackson</i>	169

SECTION VI ENTOMOPATHOGENIC NEMATODES

10. Biocontrol nematodes 177
R.-U. Ehlers

SECTION VII GENERAL ASPECTS OF ENVIRONMENTAL RISK ASSESSMENT

11. Ecological insights into factors affecting the non-target impact of
microbial control agents 221
M. B. Thomas and L.D. Lynch
12. Regulatory requirements for ecotoxicological assessments of
microbial insecticides - how relevant are they? 237
S.T. Jaronski, M.S. Goettel and C.J. Lomer

- Index 261

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PREFACE

Biological pesticides are increasingly finding their place in IPM and increasing numbers of products are making their way to the marketplace. Particularly in China, Latin America and Australia, implementation is proceeding on a large scale. However, in the USA and Europe, registration procedures for insect pathogens to be used for insect control have been established that require low levels of risk, resulting in costs of retarding the implementation of microbial agents. This book provides a review of the state of the art of studies on the environmental impact of microbial insecticides. It originates from a Society for Invertebrate Pathology Microbial Control Division Symposium "Assessment of environmental safety of biological insecticides", organised in collaboration with the EU-ERBIC research project (FAIR5-CT97-3489). This symposium was initiated by Heikki Hokkanen and Chris Lomer, and was held at the SIP Annual Meeting in 2001 in The Netherlands.

The emphasis in this book is on large scale use of microbial agents for insect control, demonstrating how this use has been proceeding with minimal environmental impact. This book is intended to be of use to regulatory authorities in determining whether further studies in certain areas are necessary and how to conduct them if needed, or whether sufficient information has been collected already to permit full registration of many of these biological control agents.

It must be emphasised that biological control with native and exotic natural enemies has been practised for more than a century. This activity has resulted in long-term, economic and environmentally benign solutions to severe arthropod pest, disease and weed problems. In contrast with chemical control, there is limited evidence that biological control of insects and mites has resulted in negative environmental or health effects.

However, future biological control programmes will need to assess carefully the potential impact of introduced agents on non-target species and on ecosystems as a whole, in case ecological effects are subtle. Part of the evaluation should be a benefit risk analysis of both biological and chemical control. All groups of interest should have an opportunity to participate in the discussion and to contribute to the decision on whether or not to release biological control agents, and all should have the opportunity to be informed on the nature, benefits and risks of biological versus chemical control options.

A clear picture of the benefits and risks of biological control is required for increased implementation of this pest control method. Biological control has important positive features: it creates independence of the farmer from large chemical industries, promotes social cohesion because biological control methods are applicable everywhere, agents are usually not patented and are relatively easy to produce (do not demand large industry inputs). Biological control is very applicable for products with niche markets, small scale agriculture, specific product agriculture (e.g. eco-products)

and in rural areas; further, the health risks associated with chemical control do not exist with biological control agents. Safe forms of biological control in many cases may improve pest control efficiency, while at the same time resulting in a better quality of food (no pesticide residues) leading to a higher market price of the products. Meaningful and minimal regulatory requirements also result in incentives for (further) development of small-sized companies to produce biological control agents. Finally, replacement of chemical control by biological control has important positive socio-economic, humanitarian, environmental and ethical implications.

Reduction in usage of chemical pesticides substantially contributes to the conservation of natural resources and results in a considerable reduction of environmental pollution, thus preserving biodiversity. Reduction in pesticide production will reduce risks for workers in chemical industry and environmental risks due to transport and storage of chemical pesticides. Natural enemy production can be energy saving compared to pesticide production. Safe forms of biological control are thus contributing strongly to improvement of agricultural and natural environments, and should be encouraged and supported wherever possible. We hope that this book will guide and accelerate the development of entomopathogens in that direction.

Heikki Hokkanen and Ann Hajek, Helsinki and Ithaca in September 2003