INTEGRATED PEST AND DISEASE MANAGEMENT IN GREENHOUSE CROPS

Developments in Plant Pathology

VOLUME 14

Integrated Pest and Disease Management in Greenhouse Crops

Edited by

R. ALBAJES

*University of Lleida,
Lleida, Spain*

M. LODOVICA GULLINO

*University of Torino,
Torino, Italy*

J. C. VAN LENTEREN

*University of Wageningen,
Wageningen, The Netherlands*

and

Y. ELAD

*The Volcani Center,
ARO, Bet Dagen, Israel*

CIHEAM

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CONTRIBUTORS

Ramon Albajes

Universitat de Lleida
Centre UdL-IRTA
Rovira Roure 177
25006 Lleida
Spain

Oscar Alomar

IRTA – Centre de Cabriils
Ctra. de Cabriils, s/n
08348 Cabriils, Barcelona
Spain

Richard R. Bélanger

University Laval
Dept. Phytopathologie – FSAA
Cité Universitaire
Québec G1K 7P4
Canada

Menachem J. Berlinger

Agricultural Research Organization (ARO)
Gilat Regional Experiment Station
Entomology Laboratory
Mobile Post Negev 85-280
Israel

Mohamed Besri

Institut Agronomique et Vétérinaire Hassan II
B.P. 6202
10101 Rabat-Instituts
Morocco

Sylvia Blümel

Institut für Phytomedizin (BFL)
Spargelfeldstrasse 191
P.O. Box 400
A-1226 Wien
Austria

Karel J.F. Bolckmans

Koppert Biological Systems B.V.
Veilingweg 17
P.O. Box 155
2650 AD Berkel en Rodenrijs
The Netherlands

Henrik F. Brødsgaard

Danish Institute of Agricultural Sciences
Research Centre Flakkebjerg
Dept. of Crop Protection
Research Group Entomology
DK-4200 Slagelse
Denmark

Cristina Castañé

IRTA – Centre de Cabriils
Ctra. de Cabriils, s/n
08348 Cabriils, Barcelona
Spain

Elzbieta Ceglarska

Debrecen University of Agricultural Sciences
Faculty of Agriculture
P.O. Box 79
6801 Hódmezővásárhely
Hungary

Norman D. Clarke

AI Solutions
47 Tomlin Crescent
Richmond Hill, Ontario L4C 7T1
Canada

Jesús Cuartero

Consejo Superior de Investigaciones
Científicas (CSIC)
Estación Experimental “La Mayora”
Agarrobo-Costa s/n
29750 Algarrobo-Costa, Málaga
Spain

Aleid J. Dik

Research Station for Floriculture
and Glasshouse Vegetables (PBG)
Kruisbroekweg 5
P.O. Box 8
2670 AA Naaldwijk
The Netherlands

Yigal Elad

Agricultural Research Organization (ARO)
The Volcani Center
Institute of Plant Protection
Dept. of Plant Pathology
P.O. Box 6
Bet-Dagan 50250
Israel

Deborah R. Fravel

USDA – Agricultural Research Service
Beltsville Agricultural Research Center
Biocontrol of Plant Diseases Laboratory
Bldg. 011A, Room 275, BARC-West
Beltsville, Maryland 20705-2350
USA

Stanley Freeman

Agricultural Research Organization (ARO)
The Volcani Center
Institute of Plant Protection
Dept. of Plant Pathology
P.O. Box 6
Bet-Dagan 50250
Israel

Dan Funck Jensen

The Royal Veterinary and
Agricultural University (KVL)
Dept. of Plant Biology
Plant Pathology Section
40, Thorvaldsensvej
DK-1871 Frederiksberg C
Copenhagen
Denmark

Rosa Gabarra

IRTA – Centre de Cabriels
Departamento de Protección Vegetal
Ctra. de Cabriels, s/n
08348 Cabriels, Barcelona
Spain

Abraham Gamliel

Agricultural Research Organization (ARO)
The Volcani Center
Institute of Agricultural Engineering
Bet-Dagan 50250
Israel

Dimitris E. Goumas

Plant Protection Institute
P.O. Box 1802
71110 Heraklio, Crete
Greece

Don A. Griffiths

Novartis BCM Ltd
Aldham Business Centre
New Road, Aldham
Colchester, Essex
England CO6 3PN
United Kingdom

Avi Grinstein

Agricultural Research Organization (ARO)
The Volcani Center
Institute of Agricultural Engineering
P.O. Box 6
Bet-Dagan 50250
Israel

M. Lodovica Gullino

Università degli Studi di Torino
Dipartimento di Valorizzazione e Protezione
delle Risorse Agroforestali – Patologia Vegetale
Via Leonardo da Vinci 44
10095 Grugliasco (Torino)
Italy

Zoltan Ilovai

Ministry of Agriculture and
Regional Development
Plant Health and Soil Conservation Station
Coordination Unit
Plant Protection Department
P.O. Box 340
H-1519 Budapest
Hungary

William R. Jarvis

Agriculture and Agri-Food Canada
Greenhouse and Processing
Crops Research Centre
Harrow, Ontario N0R 1G0
Canada

Tom J. Jewett

Agriculture and Agri-Food Canada
Greenhouse and Processing
Crops Research Centre
Harrow, Ontario N0R 1G0
Canada

Sonja Sletner Klemsdal

The Norwegian Crop Research Institute
Plant Protection Centre
Fellesbygget, N-1432 Ås
Norway

Jürgen Köhl

DLO Research Institute for
Plant Protection (IPO-DLO)
Binnenhaven 5
P.O.Box 9060
NL- 6700 GW Wageningen
The Netherlands

Laurent Lapchin

INRA – Centre de Recherches d'Antibes
37, Boulevard du Cap
B.P. 2078
06606 Antibes Cedex
France

Robert P. Larkin

USDA – Agricultural Research Service
Beltsville Agricultural Research Center
Biocontrol of Plant Diseases Laboratory
Bldg. 011A, Room 275, BARC-West
Beltsville, Maryland 20705-2350
USA

Henri Laterrot

INRA – Centre d'Avignon
Unité de Génétique et d'Amélioration
des Fruits et Légumes
B.P. 94
84143 Montfavet Cedex
France

Sara Lebiush-Mordechi

Agricultural Research Organization (ARO)
Gilat Regional Experiment Station
Entomology Laboratory
Mobile Post Negev 85-280
Israel

Jerzy J. Lipa

Institute of Plant Protection
Dept. of Biocontrol & Quarantine
Miczurina 20
60-318 Poznan
Poland

Marisol Luis-Arteaga

Diputación General de Aragón
Servicio de Investigación Agroalimentaria
Ctra. de Montañana 177
Apdo. Correos 727
50080 Zaragoza
Spain

Robert D. Lumsden

USDA Agricultural Research Service
Beltsville Agricultural Research Center
Plant Sciences Institute
Biocontrol of Plant Diseases Laboratory
Rm 275 Bldg 011A BARC W
Beltsville, Maryland 20705-2350
USA

Nikolaos E. Malathrakis

Technological Education Institute of Heraklio
P.O. Box 140
71510 Heraklio, Crete
Greece

Giuseppe Manzaroli

Biolab. Centrale Ortofrutticola
Centro Servizi Avanzati per l'Agricoltura,
Soc. Coop. A.R.L.
Via Masiera Prima 1191
47020 Martorano, Cesena, Forlì
Italy

Nicholas A. Martin

New Zealand Institute for Crop & Food Research
Mount Albert Research Centre
120 Mount Albert Road
Private Bag 92 169
Auckland
New Zealand

Alberto Matta

Università degli Studi di Torino
Dipartimento di Valorizzazione e Protezione
delle Risorse Agroforestali – Patologia Vegetale
Via Leonardo da Vinci 44
10095 Grugliasco (Torino)
Italy

Graham A. Matthews

Imperial College of Science,
Technology and Medicine
International Pesticide Application Research
Centre (IPARC)
Dept. of Biology
Silwood Park, Ascot
Berkshire SL5 7PY
United Kingdom

Quirico Migheli

Università degli Studi di Torino
Dipartimento di Valorizzazione e Protezione
delle Risorse Agroforestali – Patologia Vegetale
Via Leonardo da Vinci 44
10095 Grugliasco (Torino)
Italy

Enrique Moriones

Consejo Superior de Investigaciones
Científicas (CSIC)
Estación Experimental “La Mayora”
Algarrobo-Costa s/n
29750 Algarrobo-Costa, Málaga
Spain

Giorgio Nicoli

Università di Bologna
Istituto di Entomologia "Guido Grandi"
Via Filippo Re, 6
40126 Bologna
Italy

Timothy M. O'Neill

ADAS Arthur Rickwood
Mepal
Ely
Cambs CB6 2BA
United Kingdom

Jean-Claude Onillon

INRA – Centre de Recherches d'Antibes
Laboratoire de Biologie des Invertébrés
Unité de Recherches sur les Parasitoïdes
d'Aleurodes
37, Boulevard du Cap
B.P. 2078
06606 Antibes Cedex
France

Timothy C. Paulitz

McGill University
Faculty of Agricultural and
Environmental Sciences
Dept. of Plant Science
Macdonald Campus of McGill Univ.
21,111 Lakeshore
Ste. Anne de Bellevue
Québec H9X 3V9
Canada

Jean-Michel Rabasse

INRA – Centre de Recherches d'Antibes
Unité de Biologie pour la Santé
des Plantes et l'Environnement
37, Boulevard du Cap
B.P. 2078
06606 Antibes Cedex
France

Pierre M.J. Ramakers

Research Station for Floriculture
and Glasshouse Vegetables
Kruisbroekweg 5
Postbus 8
2670 AA Naaldwijk
The Netherlands

David J. Rhodes

Zeneca Agrochemicals
Fernhurst Haslemere
Surrey GU27 3JE
United Kingdom

Jordi Riudavets

IRTA – Centre de Cabrils
Ctra. de Cabrils, s/n
08348 Cabrils, Barcelona
Spain

J. Leslie Shipp

Agriculture and Agri-Food Canada
Greenhouse and Processing
Crops Research Centre
Harrow, Ontario N0R 1G0
Canada

Dan Shtienberg

Agricultural Research Organization (ARO)
The Volcani Center
Institute of Plant Protection
Dept. of Plant Pathology
P.O. Box 6
Bet-Dagan 50250
Israel

Peter H. Smits

Research Institute for
Plant Protection (IPO-DLO)
Binnenhaven 5
P.O. Box 9060
6700 GW Wageningen
The Netherlands

Elefterios C. Tjamos

Agricultural University of Athens
Dept. of Plant Pathology
Iera Odos 75
Votanikos 11855, Athens
Greece

Maria Grazia Tommasini

Biolab. Centrale Ortofrutticola
Centro Servizi Avanzati per l'Agricoltura,
Soc. Coop. A.R.L.
Via Masiera Prima 1191
47020 Martorano – Cesena, Forlì
Italy

Arne Tronsmo

Agricultural University of Norway
Dept. of Biotechnological Sciences
P.O. Box 5040
1432 Ås
Norway

Jan Dirk van Elsas

Research Institute for Plant Protection (IPO-DLO)
Binnenhaven 5
P.O. Box 9060
6700 GW Wageningen
The Netherlands

Joop C. van Lenteren

Wageningen Agricultural University
Laboratory of Entomology
Binnenhaven 7
P.O. Box 8031
6700 EH Wageningen
The Netherlands

Machiel J. van Steenis

Brinkman B.V.
Woutersweg 10
P.O. Box 2
NL-2690 AA 's-Gravenzande
The Netherlands

Soledad Verdejo-Lucas

IRTA – Centre de Cabrils
Ctra. de Cabrils, s/n
08348 Cabrils, Barcelona
Spain

Leslie R. Wardlow

L.R. Wardlow Ltd
Horticultural Pest Advice
Miranda, Marsh Lane, Ruckinge
Ashford, Kent TN26 2NZ
United Kingdom

Eizi Yano

National Institute of
Agro-Environmental Sciences
Division of Entomology
Kannondai 3-1-1, Tsukuba
Ibaraki 305-8604
Japan

FOREWORD

The International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), established in 1962, is an intergovernmental organization of 13 countries: Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey.

Four institutes (Bari, Italy; Chania, Greece; Montpellier, France; and Zaragoza, Spain) provide postgraduate education at the Master of Science level. CIHEAM promotes research networks on Mediterranean agricultural priorities, supports the organization of specialized education in member countries, holds seminars and workshops bringing together technologists and scientists involved in Mediterranean agriculture and regularly produces diverse publications including the series *Options Méditerranéennes*. Through these activities, CIHEAM promotes North/South dialogue and international co-operation for agricultural development in the Mediterranean region.

Over the past decade, the Mediterranean Agronomic Institute of Zaragoza has developed a number of training and research-supporting activities in the field of agroecology and sustainability of agricultural production systems. Some of these activities have been concerned with the rational use of pesticides and more particularly with the implementation of integrated control systems in order to gain in efficacy and decrease both the environmental impact and the negative repercussions for the commercialization of agricultural products. Stemming from the organization of a course on “Integrated Pest and Disease Management in Protected Crops”, and as a consequence of the enthusiasm of the lecturers who took part in the course and its scientific co-ordinators, we decided to publish a book based on the contents of the course to provide professionals interested in updating their knowledge with a comprehensive vision of the state of the art of IPM.

Several objective reasons convinced us of our decision. On one hand, the growing economic and social importance of protected crops in the countries of the Mediterranean area. On the other, the fragility of the ecosystems on which they are grown, very often close to areas of urban concentration and tourist development. Therefore, integrated management must be incorporated into the present production systems and appropriate research and experimentation programmes must be developed in order to generate a pest and disease control technology adapted to the ecological conditions and predominant species in each circumstance. We felt that this book could contribute in this task. The Mediterranean Agronomic Institute of Zaragoza has experience from similar publications arising from their professional-training programmes and this also encouraged us to undertake this ambitious project.

The magnitude of our ambition only became clear to us when, compiling the book, we were confronted with the large number of authors, their diverse specialities and origins (from researchers to extensionists, from both the public sector and private firms), and the multidisciplinary nature of the approach, addressing both basic and applied aspects. Accommodating such diversity into the different parts of the book has been our most difficult task. Therefore, it is with great satisfaction and gratitude that we acknowledge and thank the editors, R. Albajes, M.L. Gullino, J.C. van Lenteren and Y. Elad for their inspired and efficient work in orienting and co-ordinating the book. Likewise, we would like to express our gratitude to each and every one of the 62 authors for their contribution to this team effort.

The design and development of this book are yet another example of the results that can be achieved through co-operation, and as such, contributes to CIHEAM’s objective of promoting co-operation for the development of the agro-food sector in the

Mediterranean area. We hope this example will encourage the same co-operative attitude amongst readers.

Finally we should like to express our satisfaction of the efficacious collaboration from Kluwer Academic Publishers and wish to thank them for their interest in this project.

Miguel Valls
Director
Mediterranean Agronomic Institute of Zaragoza, Spain

PREFACE

This book originated from an international course that was organized on “Integrated Pest and Disease Management in Protected Crops” at the Mediterranean Agronomic Institute of Zaragoza of the CIHEAM. Thirteen guest speakers lectured to some thirty participants, and the idea of publishing the contributions to the course arose as a result of their enthusiasm. The project soon became more ambitious with the purpose of enriching the publication’s objectives and contents. Thus, the variety of ways in which protected crops are cultivated world-wide demanded the collaboration, not only of European authors, but of authors from all those regions that have developed the greenhouse crop industry. Likewise it was necessary, on this occasion, to count on the multi-disciplinarity of integrated control, therefore new entomologists and plant pathologists working in different disciplinary environments, such as ecology, molecular biology, statistics, information systems and plant breeding, were incorporated into the project. It was also considered necessary to count on the collaboration of specialists from the public and private sectors involved in the different links of the chain necessary for the technological innovation of integrated control: researchers, extensionists, natural enemy producers, consultants. This diversity of authors is probably what we are most satisfied with as editors. Nevertheless, this has also complicated the edition work as we have tried to keep a maximum of homogeneity without falling into too much uniformity. As the basic elements of integrated control need to make use of local conditions favourable to pest and disease control, one cannot expect the points of view, practices, even scientific backgrounds to be common throughout all the chapters of the book when very often the authors work in areas which are geographically very different. Whenever possible, we have entrusted each chapter to authors whose activity and perspectives could be complementary: entomologists together with pathologists, from both public and private sectors, differentiated geographical areas, etc. It is our sincere belief that no text published to date has offered such a diverse yet integrated approach to pest and disease control in greenhouse crops.

The book opens with an initial chapter describing the scenario where integrated pest and disease control operates, that is, the greenhouse and its environment. Ensuing chapters provide the basic strategies and tactics of integrated control, with special reference to greenhouse crops. Further chapters include the different facets of biological pest and disease control – its scientific bases, its development in practice, its commercialization and quality control. The pre-eminence of biological control in the book is not surprising since without a doubt it is the cornerstone of integrated insect pest control and is also becoming increasingly more important in disease control. The concluding chapters of the book show us the present situation of integrated pest and disease control in the most important greenhouse crops world-wide. This final section opens with a chapter discussing the technology transfer process from research to the consumer; this chapter is by no means superfluous, as the lack of an efficient technology transfer is often the main cause of the slow adoption of integrated control.

This book is neither a manual nor a guide. We have attempted to provide post-graduate and professional readers already familiar with the subject, with a means to acquire deeper knowledge on integrated control of pests and diseases in greenhouse crops and furthermore suggest possible roads to take in future tasks. It is evident, however, that each situation and each problem requires a particular solution. Integrated control in greenhouses first developed in England and The Netherlands in the 60s. The success reached in both countries led the research, extension and application of this type of control system to become generalized throughout northern Europe in the 70s and 80s.

This experience, so positive in the North of Europe, stimulated the adaptation of integrated systems for other areas such as the Mediterranean, North America, Oceania and Asia at various rates and degrees of success. It has been shown that a mere transposition of northern European solutions is not valid in other parts of the world. Each new situation demands further research, development, extension, training and new forms of application. Without this local effort, it will be very difficult for integrated control to progress at a faster rate. We trust that this work will contribute to stimulating and guiding this effort.

We have many people to thank. The Mediterranean Agronomic Institute of Zaragoza organized and hosted the course that gave rise to this book and subsequently undertook the co-ordination of the edition and technical editing. Had we not been able to count on their experience, professionalism and enthusiasm, we would not have been able to embark on this endeavour. The participants in the mentioned course have also permitted us to enrich the content of this work with their suggestions and constructive criticism. The authors have shown at all times a great patience and comprehension on reacting to our requests and revisions with good will and wisdom. The IOBC/WPRS, "International Organization for Biological and Integrated Control of Noxious Animals and Plants, West Palaearctic Regional Section" likewise deserves a special mention of gratitude. In two of their working groups on "Integrated Control in Greenhouse Crops", these editors and many of the authors have been collaborating and continue to do so, thus facilitating the edition of the book.

To publish a book is an arduous task. The mere conviction of the need to divulge and teach what has been learnt from others and our own sense of duty can compensate such an undertaking. Fortunately, we are convinced that the effort of the hundred people who have collaborated, in one way or another, in this book has been worthwhile. Another decisive stimulant for this endeavour was the realization of the growing need to incorporate integrated systems of protection from arthropod pests and diseases for the thousands of hectares of protected crops in the world. Both the fruit, vegetable and ornamental plant markets and the technical and economic efficiency of crop protection require these integrated control systems.

Ramon Albajes
M. Lodovica Gullino
Joop C. van Lenteren
Yigal Elad