

Biointensive IPM for Commercial Crops

Biointensive IPM for Commercial Crops

Chief Editor

Anil Kumar

*Assistant Professor-cum-Scientist
Department of Entomology
Sugarcane Research Institute
Dr Rajendra Prasad Central Agricultural University
Pusa-848125, Samastipur, Bihar, India*

Associate Editors

Ingle Dipak Shyamrao

*Assistant Professor-cum-Jr. Scientist
Department of Entomology
Birsa Agricultural University*

Sagar Tamang

*Subject Matter Specialist
(Plant Protection) Krishi Vigyan Kendra, Mulakhop,
Dayaldasi, Purba Medinipur, West Bengal – 721632*



AGROBIOS

Title: BIOINTENSIVE IPM FOR COMMERCIAL CROPS

Chief Editor

Anil Kumar

Assistant Professor-cum-Scientist, Department of Entomology, Sugarcane Research Institute,
Dr Rajendra Prasad Central Agricultural University, Pusa-848125, Samastipur, Bihar, India

Associate editors

Ingle Dipak Shyamrao

Assistant Professor-cum-Jr. Scientist, Department of Entomology, Birsa Agricultural University

Sagar Tamang

Subject Matter Specialist, (Plant Protection) Krishi Vigyan Kendra,
Mulakhop, Dayaldasi, Purba Medinipur, West Bengal – 721632

AGROBIOS (INDIA)

Managing Director: Dr. Updesh Purohit

Founder & Editor: Dr. S. S. Purohit

Services

Book Design & Layout: Yashee Computers

Illustrator & Printers: Agrobios Digitals

Cover Illustration: Reena



Published by:

AGROBIOS (INDIA)

Behind Nasrani Cinema

Chopasani Road, Jodhpur - 342003

Phone: +91-291-2643993

E. Mail: agrobiosinsia@gmail.com

website: www.agrobiosonline.com

This book contains information obtained from authentic and highly regarded sources. Every effort has been made to trace copyright holders and to obtain their permission for the use of copyright material. Reprinted material is quoted with permission, and sources are indicated. A wide variety of references are listed. Reasonable efforts have been made to publish reliable data and information, but the author and the publisher cannot assume responsibility for the validity of all materials or for the consequences of their use.

© (2021) All Rights Reserved (Author)

All rights reserved. No part of this book or part thereof, including title of the book may be reproduced or used in any format in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems—without the written permission of the author and publisher. The copyists shall be prosecuted.

ISBNs: 978-81-947480-4-5 (Hard Cover)

PRINTED IN THE INDIA

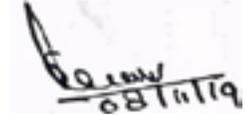


FOREWORD

Commercial crops are one of the most important components of Indian agriculture. In India, more than 65 percent of the population depends on agriculture. Commercial crops are an integral part of strategies to improve food security at farm household and offer income and employment opportunities to the rural youth. Some people engaged under cultivation of commercial crops and some are self-employed in agriculture for their livelihoods. The commercial crops played a vital role in GDP. Out of several factors affecting the production of commercial crops, insect pests played as one of the major constraints for sustainable production. Crop losses due to these harmful organisms are substantial and may be prevented or reduced by various combinations of insecticides. The success of pest management programmes is deciduous due to development of resistance to particular insecticides. More so, the intensive and indiscriminate use of pesticides leads to degradation of the environment, kills natural enemies, cause a resurgence of secondary insect pest and prone to the development of resistance in pests. Bio-intensive integrated pest management (BIPM) imparts ecological and economic sustenance into the agricultural design and decision-making system and also addressing public concern about environmental quality and food safety. An ecology-based BIPM has the potential of decreasing use of inputs like fuel, machinery and synthetic chemical. All the above inputs are energy-intensive and expensive, accosting financial and environmental risk. Minimizing the use of these inputs may hold promise in reducing the health hazards of clientele groups. In this context, the present book “**BIOINTENSIVE IPM FOR COMMERCIAL CROPS**” edited by Sri Anil Kumar as Chief Editor and Dr. Dipak Ingle and Dr. Sagar Tamang as Associate Editors, will be useful to teachers, researchers, students and extension workers.

I hope this publication will be of great value to those who are engaged in growing commercial crops. I appreciate the meticulous efforts of editors to souls out this useful publication in the present form.

Date: 08.11.2019

A handwritten signature in black ink, appearing to read 'A. K. Singh', written over a horizontal line. The signature is slanted and somewhat stylized.

(A. K. Singh)

*Director
Sugarcane Research Institute
Dr. Rajendra Prasad Central Agricultural University,
Pusa-848 125, Samastipur, Bihar*



PREFACE

Insect pest problem rapidly increases in current scenario due to changing climatic condition, indiscriminate use of insecticides which lead to decrease biodiversity of natural enemies. There is a need of the hour to create awareness for promoting environmentally sustainable agriculture practices.

The book, **Bio-intensive Integrated Pest Management for commercial crops** has been **planned with ten** chapters and the scope of each chapter has been specified by the author. BIPM as an approach of crop management, it is based on the integration of proactive and reactive strategies. These strategies help to minimize the dependence on chemical pesticides and aim at enhancing biodiversity.

It is our great pleasure to express our sincere thanks to the publisher, **Agrobios (India)**, Jodhpur for systemically producing this book with quality within a period.

It is earnestly hoped that the book will be useful reading to all those who are interested in Bio-intensive Integrated Pest Management for commercial crops.

We request all the readers for rendering valuable suggestions for future improvement of this edition.

Date: 08.11.2019

Chief Editor
Anil Kumar

CONTENTS



1. Scope and Importance of Commercial Crops	1
I. Introduction	1
II. Scope and Importance of Agriculture	2
III. Major Categories of Crops in India	4
IV. Food Crops	5
V. Cash crop or commercial crop	6
VI. Fibre Crops	11
VII. Conclusion	14
VIII. References	14
2. Bio-intensive Integrated Pest Management	17
I. Component of Bio-intensive IPM	17
II. Proactive Strategies	17
1. Cultural Controls Strategies	18
III. Reactive Strategies	20
1. Biological control	20
2. Physical Control	21
3. Mechanical Control	22
IV. Bio-pesticidal Control Strategies	24
1. Botanical Insecticides	24
2. Microbial and EPN Insecticides	25
V. References	25
3. Bio-intensive Integrated Pest Management of Cotton	27
I. Introduction	27
II. Major Pests of Cotton	28
III. Factors Influencing Abundance	30
IV. Promising Components of Eco-friendly Pest Management	31
V. References	35
4. Bio-intensive Integrated Pest Management of Jute	37
I. Introduction	38
II. Succession of Insect Pests in Jute	40
III. Major Insect Pests	40
1. Indigo Caterpillar, <i>Spodoptera litura</i> Hubner (Noctuidae: Lepidoptera)	40
2. Grey Weevil: <i>Mylocerus discolor</i> Bohemam (Curculionidae: Coleoptera)	42

3.	Stem Weevil: <i>Apion corchori</i> Marshall (Curculionidae: Coleoptera)	44
4.	Yellow Mite: <i>Polyphagotarsonerus latus</i> Banks (Tarsonemidae: Acarina)	47
5.	Mealybug: <i>Phenacoccus solenopsis</i> Tinsley (Pseudococcidae: Homoptera)	50
6.	Semilooper: <i>Anomis sabulifera</i> Guenee (Noctuidae: Lepidoptera)	52
7.	Jute Hairy Caterpillar: <i>Spilosoma obliqua</i> Walker (Noctuidae: Lepidoptera)	54
IV.	Minor Pests of Jute.	56
1.	Stem Girdler: <i>Nupserha bicolor</i> Dutta (Lamiidae: Coleoptera)	56
2.	Red Mite: <i>Oligonychus coffeae</i> Nietner (Tetranychidae: Acari)	57
V.	New Insect Pests	58
1.	Gram Caterpillar: <i>Helicoverpa armigera</i> (Noctuidae: Lepidoptera)	58
2.	Safflower Caterpillar: <i>Condica capensis</i> Guenee (Noctuidae: Lepidoptera)	59
3.	Green Semilooper: <i>Amyna octa</i> Guenee (Noctuidae: Lepidoptera)	60
4.	Tussock Hairy Caterpillar: <i>Dasychira mendosa</i> Hubner (Lymantriidae: Lepidoptera)	61
5.	Mesta Hairy Caterpillar: <i>Euproctis scintillaus</i> Walker (Lymantriidae: Lepidoptera)	62
6.	Leafwebber: <i>Homona sp.</i> Meyrick (Tortricidae: Lepidoptera)	63
VI.	New Reports of Natural Enemies on Insect Pests of Jute	64
1.	<i>Protapanteles obliquae</i> (Wilkinson) (Braconidae: Hymenoptera)	64
2.	<i>Meteorus spilosomae</i> Narendran and Rema (Braconidae: Hymenoptera)	66
3.	Tachinid Fly: <i>Sisyropa spp.</i> (Tachinidae: Diptera)	66
4.	<i>Parachremylus</i> Spp. (Braconidae: Hymenoptera)	67
5.	<i>Aenasius arizoensis</i> , Hayat (Encyritidae: Hymenoptera)	67
6.	Nuclear Polyhedrosis Virus (NPV)	69
VII.	Integrated Pest Management in Jute with Special Reference to Bio-intensive Approaches	69
VIII.	References	70

5. Bio-intensive Integrated Pest Management of Sugarcane	73
I. Introduction	73
II. Major Insect Pest of Sugarcane	74
1. Root Borer: <i>Emmalocera depressella</i> (Swinhoe) (Pyralidae: Lepidoptera)	74
2. Shoot Borer: <i>Chilo infuscatellus</i> Snellen (Crambidae: Lepidoptera)	75
3. Internode Borer: <i>Chilo sacchariphagus indicus</i> (Kapur) (Crambidae: Lepidoptera)	76
4. Top Borer: <i>Scirpophaga excerptalis</i> Walker (Pyralidae: Lepidoptera)	76
5. Stalk Borer: <i>Chilo auricilius</i> Dudgeon (Crambidae: Lepidoptera)	78
6. Plassey Borer: <i>Chilo tumidicostalis</i> (Hampson) (Crambidae: Lepidoptera)	79
7. Sugarcane Leaf Hopper: <i>Pyrilla perpusilla</i> Walker (Lophopidae: Homoptera)	80
8. Whitefly: <i>Aleurolobus barodensis</i> (Aleyrodidae: Hemiptera)	81
9. Sugarcane Woolly Aphid: <i>Ceratovacuna lanigera</i> (Aphididae: Hemiptera)	82
10. Scale Insects: <i>Melanaspis glomerata</i> (Diaspididae: Hemiptera)	83
11. Mealy bug:: <i>Saccharicoccus sacchari</i> (Pseudococcidae: Hemiptera)	84
12. Termites: <i>Odontotermes obesus</i> Rhamb (Termitidae: Isoptera)	86
III. Biointensive IPM	87
1. Cultural Strategies	87
2. Mechanical and Physical Strategies	87
3. Biological Strategies	88
IV. Reference	88
6. Bio-intensive Integrated Pest Management of <i>Spodoptera litura</i> in Sugarbeet	91
I. Introduction	92
1. Systemic position of <i>S. litura</i>	94
2. Symptom of damage	95
3. Life cycle and Biology	96
II. Bio-intensive integrated pest management	98
1. Cultural Practices	98
2. Biological Control	98
3. Mechanical Control	99

4. Chemical Control	99
III. References	99
7. Bio-intensive Integrated Pest Management of Tea	101
I. Introduction	101
II. Insect Pests of Tea	102
1. Lepidoptera	102
2. Hemiptera	111
3. Thysanoptera	117
4. Coleoptera	118
5. Isoptera	119
6. Diptera	120
7. Orthoptera	120
III. Major Mite Pests of Tea	121
1. Red Spider Mite: <i>Oligonychus coffeae</i> Nietner	121
2. Scarlet Mite: <i>Brevipalpus phoenicis</i>	122
3. Purple Mite: <i>Calacarus carinatus</i>	123
4. Pink Mite/Orange Mite: <i>Acaphylla theae</i>	123
5. Broad Mite/Yellow Mite	123
IV. Integrated Biointensive Management of Tea Pests	124
1. Cultural Control	124
2. Mechanical and Physical Control	125
3. Biological Control	126
4. Chemical Control	128
V. References	129
8. Bio-intensive Integrated Pest Management of Coconut Trees	133
I. Introduction	133
II. Biointensive Integrated Pest Management	133
III. Insect Pests of Coconut Trees	134
1. Major Insect Pests	134
2. Minor Insect Pest	134
3. Rhinoceros Beetle: <i>Oryctes rhinoceros</i>	134
4. Red Palm Weevil: <i>Rhynchophorus ferrugineus</i>	135
5. Black Headed Caterpillar: <i>Opisina arenosella</i>	136
6. Coconut Eriophyid Mite: <i>Aceria guerreronis</i>	137
7. Rugose Spiralling Whitefly (<i>Aleurodicus rugioperculatus</i> Martin)	138
8. White Grub: <i>Leucopholis coneophora</i>	140
9. Slug Caterpillar: <i>Parasa lepida</i> and <i>Contheyla rotunda</i>	140
10. Scale Insect: <i>Aspidiotus destructor</i>	142
11. Mealy bug: <i>Pseudococcus longispinus</i>	142

12. Termite: <i>Odontotermes obesus</i>	143
IV. Bio-intensive Integrated Pest Management	144
1. Rhinoceros Beetle (<i>Oryctes rhinoceros</i>)	144
2. Red Palm Weevil (<i>Rhynchophorus ferrugineus</i>)	145
3. Black Headed Caterpillar: <i>Opisina arenosella</i>	146
4. Eriophyid Mite: <i>Aceria guerreronis</i>	148
5. Spiralling Whitefly: <i>Aleurodicus rugi operculatus</i>	149
6. White Grub: <i>Leucopholis coneophora</i>	150
7. Slug Caterpillar: <i>Parasa lepida</i> and <i>Contheyla rotunda</i>	151
8. Scale Insect; Aspidiotus Destructor	152
9. Mealy bug;: <i>Pseudococcus longispinus</i>	154
10. Termite: <i>Odontotermes obesus</i>	155
V. References	156
9. Bio-intensive Integrated Pest Management of Groundnut	159
I. Introduction	159
II. Defoliators	160
1. Red Hairy Caterpillar	160
2. Leaf Miner	161
3. Tobacco Caterpillar	161
4. Gram Pod Borer	162
III. Borers	163
1. Pod Borer (Ear Wig)	163
2. Bud Borer	163
3. Stem Borer	164
IV. Sap Feeders	164
1. Pod Bug	164
2. Aphids	164
3. Jassid	165
4. Thrips	165
V. Root Feeders	166
1. Termites	166
2. White Grub	167
VI. Future Prospects of BIPM	167
VII. References	168
10. Bio-intensive Integrated Pest Management of Rapeseed and Mustard	169
I. Introduction	169
II. Mustard Aphid	170
1. Systemic Position	170
2. Distribution	170
3. Symptom of Damage	170

4.	Seasonal Incidence	171
5.	Biology	172
6.	Bio-intensive Integrated Pest Management (BIPM)	172
III.	Painted Bug	172
1.	Systemic Position	172
2.	Distribution	173
3.	Symptom of Damage	173
4.	Seasonal Incidence	173
5.	Biology	173
6.	Bio-intensive Integrated Pest Management (BIPM)	173
IV.	Mustard Sawfly	174
1.	Systemic Positions	174
2.	Distribution	174
3.	Seasonal Incidence	174
4.	Symptom of Damage	174
5.	Biology	174
6.	Bio-intensive Integrated Pest Management (BIPM)	175
V.	Mustard Leaf Miner	175
1.	Systemic Positions	175
2.	Distribution	175
3.	Damaging Symptom	175
4.	Biology	176
5.	Bio-intensive Integrated Pest Management (BIPM)	176
VI.	Diamondback Moth	176
1.	Systemic Positions	176
2.	Distribution	176
3.	Damaging Symptom	176
4.	Biology	176
5.	Bio-intensive Management	177
VII.	Bihar Hairy Caterpillar	177
1.	Systemic Positions	177
2.	Distribution	177
3.	Damaging Symptom	177
4.	Biology	178
5.	Bio-intensive Management	178
VIII.	Reference	178

LIST OF CONTRIBUTORS



1. **Alam, Tanweer**
Department of Entomology
Tirhut College of Agriculture
Dholi, Muzaffarpur,
Bihar Email:
2. **Chand, Hari**
Assistant professor-cum-
Scientist
Department of Entomology
SRI, Dr. Rajendra Prasad
Central Agricultural
University
Pusa, Samastipur
(Bihar)-848 125
3. **Das, Susanta Kumar**
Assistant Professor
Department of Entomology
College of Agriculture
OUAT, Bhubaneswar, Odisha
4. **Gajbhiye, Rupesh**
Department of Entomology
and Agricultural Zoology
Institute of Agricultural
Sciences
Banaras Hindu University,
Varanasi
Email: rupeshnilu90@
gmail.com
5. **Jadhao, P. B.**
Department of Entomology
Dr. P.D.K.V., Akola
Email: pbjadhao203@
gmail.com
6. **Kumar, Abinav**
Institute of Agricultural
Sciences
Banaras Hindu University
Varanasi (UP)
7. **Kumar, Anil**
Assistant Professor-cum-
Scientist
Department of Entomology
Sugarcane Research Institute
Dr. Rajendra Prasad Central
Agricultural University
Pusa-848125, Samastipur,
Bihar, India
8. **Kumar, Navnit**
Assistant Professor-cum-
Scientist
Sugarcane Research Institute
Dr. Rajendra Prasad Central
Agricultural University
Pusa-848125, Samastipur,
Bihar, India
9. **Mall, Ashutosh**
Indian Institute of Sugarcane
Research
Lucknow-226 002
10. **Mishra, Varucha**
Indian Institute of Sugarcane
Research
Lucknow-226 002

11. **Mukherjee, U.**
Department of Entomology
Tirhut College of Agriculture
Dholi, Muzaffarpur, Bihar
Email: umento781@gmail.com
12. **Pal, S.**
Professor, Department of
Entomology
Uttar
BangaKrishiViswavidyalaya
Pundibari-736165, Cooch
Behar, (W.B.), India
13. **Rai, Chandreshwar Prasad**
Sr. Technical Officer
Department of Entomology,
SRI
Dr. Rajendra Prasad Central
Agricultural University
Pusa, Samastipur
(Bihar)-848 125
14. **Rai, Priyanka**
Insect Biochemistry and
Molecular Biology Laboratory
Department of Zoology
University of North Bengal.
15. **Rath, Ladu Kishore**
Professor, Department of
Entomology
College of Agriculture
OUAT, Bhubaneswar, Odisha
16. **Saha, Dhiraj**
Insect Biochemistry and
Molecular Biology Laboratory
Department of Zoology
University of North Bengal.
email: dhirajsaha@nbu.ac.in;
dhirajsaha.nbu@gmail.com
17. **Saha, Swati**
Scientist
ICAR-IARI Regional Station
Pune, Maharashtra
18. **Saha, Tarak Nath**
Senior Scientist
ICAR-DFR
Pune, Maharashtra
19. **Santeshwari**
Indian Institute of Sugarcane
Research
Lucknow-226 002
Email: sanfrmvn@gmail.com
20. **Shyamrao, Ingle Dipak**
Department of Agril.
Entomology
Birsa Agricultural University
Kanke, Ranchi- 834 006
21. **Tamang, Sagar**
Subject Matter Specialist
(Plant protection)
Purba medinipur KVK
Mulakhop Nandakumar,
721632
Bidhan Chandra Krishi
Viswavidyalaya
Indian Council of
Agriculture Research
22. **Varman, Ravi C**
Department of Entomology
Dr. Rajendra Prasad Central
Agricultural University
Pusa (Samastipur)
Bihar-848125