

Biological and Molecular Approaches in Pest Management

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Preface

Despite great advances in agricultural productivity and economic well-being in much of the world over the past 50 years, food insecurity and poverty continue to be serious issues in many regions of the world. Since most of the cultivable land is already under cultivation, future increases in food, feed and fibre production have to be achieved with increased productivity and improved crop protection. Ironically, more than a third of the global agricultural production is lost to the activity of animal pests and diseases. Further, the losses are significantly higher in the tropical areas where the food shortages are already serious. The strategy of exclusive reliance on chemical pesticides for minimizing crop losses caused by pests has led to human health and safety hazards and caused a number of ecological and economic problems. The concept of integrated pest management was propounded to minimize these side-effects. But in spite of its inspirational value, most IPM programmes still include economic threshold level based application of chemical insecticides as a major input. In this context, the wide range of biological and molecular approaches discussed in 15 Chapters in this book offer a plethora of environmentally benign alternatives to these chemical insecticides.

The introductory Chapter outlines the role of molecular techniques in improving the efficacy of a diverse range of pest management options including genetically engineered plants, insects and microorganisms as well as host plant resistance and chemical insecticides. The second Chapter discusses the role the biotechnological approaches have played in development of rice genotypes resistant to planthoppers. The third Chapter highlights the importance of molecular taxonomy in studies on fruit flies. The RNAi has emerged as a powerful gene-silencing technique and its potential for utilization in pest management is revealed in Chapter 4. The persistence of pesticide residues in the environment poses significant ecological risks. Bioremediation is emerging as the method-of-choice for dealing with such residues and its potential is explored in Chapter 5.

Insects, like other organisms, are prone to diseases caused by a diverse range of microorganisms. The exploitation of these microbes as a tool in pest management offers immense possibilities which are highlighted in Chapter 6. The gall midge, a major pest of rice, is notorious for evolving new biotypes to overcome plant resistance genes. Chapter 7 explains how an understanding of the molecular basis of these interactions can help in development of durable gall midge resistant genotypes. The wide range of molecular markers and their applications in entomological research are concised in Chapter 8. The success story of *Bt* cotton which has transformed India from a net importer to a major exporter of 'white gold' is highlighted in Chapter 9. The potential of biotechnological techniques in developing pest-resistant fruit plants is outlined in Chapter 10.

Insects being highly versatile organisms have the ability to develop resistance to any pest management tactic which exerts sufficient selection pressure on their populations. Chapter 11 focuses on the strategies for management of resistance in insects to microbial control agents. Chapters 12 and 13 highlight the role of biological and molecular approaches in management of mites and *Conogethes* spp., respectively. Bee diseases and pests present a serious challenge to commercial apiculture. The utilization of molecular techniques for precise identification of these organisms is explained in Chapter 14. There is now a wide array of techniques available to replace the use of conventional insecticides in IPM programmes. But it is essential that all the non-chemical approaches are combined within the framework of IPM. The emergence of bio-intensive IPM as the preferred alternative to conventional IPM is explained in the concluding Chapter of the book.

It is hoped that the book will fill the wide gap in literature on utilization of biotechnological approaches in bio-intensive IPM as an alternative to chemical insecticide based IPM for sustainable insect pest management in future. We trust that you, the reader, will find the subject matter interesting and informative. We hope that this compilation answers questions you might have, and serves to stimulate further development of this fascinating science of pest management.

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