

Preface

Biological control using biopesticides based on *Bacillus thuringiensis* and *Lysinibacillus sphaericus* has been employed for almost five decades in countries such as Brazil for the control of agricultural pests and vectors of tropical disease. Professionals in the academic community have undertaken in-depth studies on a variety of potential biological control agents including fungi, bacteria, viruses, helminths and others. As a result of these studies commercial products have been developed for use in the field. A great advantage of these products is that they show few of the undesirable, nonspecific, activities associated with more traditional insecticides that affect many arthropods not implicated in crop destruction or the spread of etiological agents of human or animal disease. Continuing research and dissemination of results will further the development of new products.

This publication by Springer highlights the scientific and technical progress made on two of the most important biocontrol agents – the bacteria *Bacillus thuringiensis* and *Lysinibacillus sphaericus*. Brazil is such a major user of biological control agents that much of this book concentrates on the characterization, development and commercialization of these bacteria. Much of the information presented does, of course, have relevance on a worldwide stage. The seventeen chapters have been written by a body of highly experienced scholars, professors, scientists and researchers. Five of them have been written by experts from outside of Brazil.

In addition to natural selection increasing the range of bacteria effective as biocontrol agents, the contents of this book deal with how studies on the physiology, biochemistry, general biology, and cellular and molecular biology aspects of the considered bacteria can help us develop improved products. The characterization and current classification of *Bacillus thuringiensis* toxins are addressed, which provide a useful framework for the optimization of the entomocidal principles required for their successful use in the control of pests and vectors of human diseases.

Aside from the toxins, the characterization of *Bacillus thuringiensis* serovars by AFLP microsatellites, rep-PCR, and more recently genomic sequencing, is described. Such technologies greatly enhance our ability to identify new potential products and to understand, and potentially manipulate, the virulence of particular strains. The expression of insecticidal genes in baculovirus, or in plants, provides an

alternative way to study, and employ, the encoded proteins. In addition, understanding the interaction of the insect with the virulence factors of the bacterium, allied to the spectrum of activity of *Bacillus thuringiensis* in relation to the main orders of insect pests, provide useful information for the control of agricultural and agroforestry crops. Another important chapter show the expression of Cry proteins in insect cells using recombinant baculoviruses has been shown to be an alternative means of production of these proteins for functional and/or structural studies. Also the novel strategies include site directed mutagenesis, domain swapping among different Cry toxins where novel hybrid proteins were constructed containing domains or loop regions from different Cry proteins that resulted in improved toxicity against selected insect pests.

In selected chapters, many interesting aspects are highlighted, such as reports of biotechnological studies linked to genetically modified plants containing new *Bacillus thuringiensis* proteins, and the beneficial interactions between Bt-bioinsecticides and parasitoids and predators in agricultural ecosystems. Also interesting is the work presented on a range of microorganisms with biopesticidal action, other than the two main protagonists of this book, which the authors propose as new alternatives as active agents in the field aimed at targets such as *Acromyrmex* spp., *Nasutitermes ehrhardt* and *Rhizoctonia solani*. This also includes the potential of using synergistic interactions of *Bacillus thuringiensis* and *Bacillus subtilis* with *Purpureocillium lilacinus*, or even the Nuclear Polyhedrosis virus, among others.

Concerns over mosquito resistance to the entomopathogenic bacteria *Bacillus thuringiensis* and *Lysinibacillus sphaericus* are revisited with information on the current state of the art. Finally, aspects related to the role of the Brazilian governmental company “Empresa Brasileira de Pesquisa Agropecuária”, which is focused on agriculture and which develops products for application at the field level, as well as studies to combat new pests, are addressed.

At the end of this preface, I am sure that the plethora of authors are convinced that they have done their best to make this book a reality, and that they have contributed greatly to the work, which will hopefully fulfill the curiosity of an increasing number of readers and students interested in this area.

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