

## BOOK REVIEW

### Mass Production of Beneficial Organisms Invertebrates and Entomopathogens

Edited by Juan Morales-Ramos, Guadalupe Rojas and David I. Shapiro-Ilan. Academic Press inc. for Elsevier, Copyright 2014, pp. XXI-742, figures 70. ISBN 978-0-12-391453-8

A massive volume of nearly eight hundred pages have been edited to put together a lot of news from different experts (46 in total) from all over the world. The book topic is how to make commercially viable the production of invertebrates (arthropods and annelids) and entomopathogenic microorganisms (including, traditionally, nematodes) that are useful to humans and pets.

Edgar G. King, currently director of the USDA-ARS Mid South Area, has played a major role in the creation of the National Biological Control Laboratory and has actually “inspired” this book, which the editors have dedicated to him.

The whole book reflects the willing to be able to translate this collection of data and experience in economic realities: a challenge to win any battle which depends on the availability of mass produced beneficial organisms of excellent quality, *i.e.* cultured so as to keep all their starting characteristics which have proven to be useful. This result should be achieved through inexpensive production techniques, so that it becomes economically “convenient”.

The placement of the production of our food and, a bit, of our pleasure of living in the hands of the beneficial organisms is a challenge that, as explained in the introduction, the book addresses. Beneficial organisms comprise the arthropods and entomopathogens for the biological control of arthropod pests and the invertebrates which are mass reared for their products and ecological services, including protein-rich human feed.

In this book there is not anything really unknown on the subject of mass production of beneficial organisms; yet, it contains a collection of news, commented by the expert contributors, that are fundamental to begin rebuilding new experiences.

The huge bibliography which concludes each chapter well supports the content of these.

In the version of the book in PDF, the bibliographic citations of the text in blue allow to reach directly the relevant references and, from these, the text of the same. When this is not directly possible, the references are in black and, when available, the URL is indicated.

It seems however worth to start flipping through the book. By looking at the contents, we understand immediately that the entire subject matter is divided into three sections and twenty chapters.

Besides the introduction, the first section comprises chapters dealing with solved or unsolved problems to make the production of entomophagous insects commercially advantageous, even through the development

of artificial diets. The mass rearing of the biological control agents of invasive plants is also dealt with. The stem-galling wasp *Tetramesa romana*, an enemy of *Arundo donax*, was presented as case study.

Life tables have been selected as tools to evaluate the quality of arthropod mass rearing, justifying them with the results previously obtained with their use. In the final chapter of the section, the concepts and methods for quality assurance of mass-reared entomophagous insects are emphasized.

The second section examines what has been achieved in the production of entomopathogens: nematodes (as usual considered as pathogens instead of parasitic animals), fungi, bacteria and viruses, highlighting the methods used and how many of these are commercially adoptable. The last chapter of this section deals with the mass production of entomopathogens (as components of biopesticides) in less industrialized countries.

The third section deals with the insects as partial source of protein in the diets of juvenile fish and crustaceans and as food for insectivores. An evaluation is made about the influence on insect nutritional capacity exerted by their body composition (in relation to size and development stage), their diet and environment, including their parasites, pathogens and toxins. Even in human nutrition, the insects, as food, are a sustainable resource, according to what is said in the book. In fact, there are currently examples of mass production of insects that can get into our diet if not as such, at least as suppliers of energy; among many insect species, *Musca domestica* is reported as a promising candidate for human nutrition, because it is easy to rear and its larvae and pupae are very high in useful proteins. With these, meat alternatives, protein and nutrient supplements and other new products can be produced.

The rearing of pollinators is dealt with, with regard to what has been done in the United States with solitary bees (of the genera *Megachile* and *Osmia*).

The last chapter of the book deals with the current and potential benefits of the mass production of earthworms and how this should be done to make it economically advantageous, for what can be obtained from them, *i.e.* the production of proteins, organic waste management, rehabilitation of soils, and more. This chapter closes emphasizing that our future will be directly and indirectly shaped by earthworms.

The topic “earthworms” closes the subject of mass production of beneficial organisms, which the book wanted to address in a complete way.

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