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Juan F. Barrera

Beyond IPM: Introduction to the Theory of Holistic Pest Management

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To my wife, Mara
To my daughter, Mara Alejandra, and my sons, Jupiter Raúl, Víctor Hugo, and Juan Gerardo
To my parents, Júpiter Barrera Flores (RIP) and Norma Gaytán Aguirre (RIP)

Foreword by Aurelio Ciancio

In the present volume, the author proposes and describes a new paradigm in pest management. This is the Holistic Pest Management (HPM) approach of which the author is a firm and enthusiastic supporter and fine scientific investigator. HPM basic concept relies on placing the farmer's well-being at the center of any pest management action. This is deployed through the identification and application of several parameters and variables for risk assessment and socioeconomic analyses. The HPM theory by itself is fascinating, not only because it affords the problem of linking pest management to environmental protection but mainly because of its focus. Attention is in fact given to the farmer and social aspects of crop production rather than to the crop productivity alone, considering income and yields as a way (and not as a goal) to receive a benefit from a more socially equal agriculture.

A number of questions, however, arise from the adoption of this perspective. In particular, can the holistic approach be applied to any socio-agrosystem? Moreover, may a new determinism in socio-ecology provide a suitable new philosophy capable to sustain, through its practical application, a crowded planet? Can we leave apart many aspects of complexity not yet considered in HPM, including the effect of chaotic and fast changes of food webs (including climate effects), and at which scales can HPM be applied?

The author is aware of these aspects and correctly starts his exposition by providing data on global agricultural ecosystems, including crop production, emerging issues in plant protection, and socioeconomic scenarios that may determine the success or failure of the management options chosen. This is followed by a historical review of conventional IPM through an epistemological and updated approach, which is useful both for students and researchers. In the following chapters, more details on HPM are progressively added, moving the reader from theory to practice, by means of a detailed methodology description, with the help of many graphic illustrations, and description of the author's own experience.

As a direct consequence of the HPM paradigmatic shift, new fields of study also emerge. The integration of factors external to the farm but directly involved in the decision-making process concerning the pest requires a perspective based on a rural anthropology and sociology. New studies will be needed on the impact of social

organizations including state structures, (micro-)credit providers, multinationals, and markets, as well as on the role of predatory or marginal agriculture. All these aspects lead us to consider again the complexity of the world agriculture and the uncertainties linked to such a fascinating approach.

The new perspectives emerging by the paradigmatic shift herein proposed need to be consolidated and tested in the future. When passing from theory to reality, more practical examples will be needed to test HPM and to get a better comprehension of its implications and value. One of the recurrent questions posed, "why a pest is a pest," will surely deserve more analyses. It calls for studies integrating the evolutionary biology of species with the effects of anthropic changes such as deforestation, intensive agriculture, and monoculture, finally considering globalization and trade.

The volume is rich in citations, and the text is well written, correlated and supported by a comprehensive description of the work of many investigators, analyzed in detail. The author has the merit of offering the reader a new way of thinking and seeing at an old problem. He has to be acknowledged for dedicating such an effort to the divulgation of this new perspective and methodological approach, which will undoubtedly raise interest in the future, by promoting further research and applications.

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Aurelio Ciancio

Foreword: Holistic Pest Management by Pablo Liedo

Humankind has suffered the effects of pests since ancient times. Since then, control methods were sought and developed to suppress pest populations and reduce their damage. From the mid-1940s of the last century, through advances in synthetic chemistry, highly effective and cheap insecticides were developed. Their impact was such that pests were considered history of the past. The negative effects on the environment and beneficial organisms, the accumulation of toxic waste, and the emergence of resistance and secondary pests were phenomena that were not given importance. The consequence of dependence on pesticides was, in the best scenario, the search for more effective chemicals with a lower impact on the environment. This represented a significant increase in costs. At the other extreme, the abuse of insecticides resulted, in some cases, in an irreparable deterioration of nature and even in the loss of human lives due to poisoning.

Then, in the 1960s, it was concluded that it was necessary to use all available methods to prevent the damage of pests, leaving the use of insecticides as a last resort. Integrated Pest Management (IPM) became not only the desirable strategy but even a school of thought, the paradigm.

The concept of IPM and its philosophy has been widely accepted to such an extent that today there are IPM associations and many universities offer specialties or postgraduate degrees in this field. Many countries have identified it as the basis of their human, animal, and plant public health policies. Organizations such as FAO and WHO have adopted it as the strategy to address pests and disease vectors. This wide acceptance is due to the fact that the concept implies the optimization of resources, minimizing externalities or unwanted side effects. Put simply, IPM means "doing the right thing." Who could oppose this philosophy?

However, the question is not whether the concept is accepted or not but rather if it is applied or is only theory and good intentions.

There is evidence demonstrating the effectiveness of IPM, suppressing pests, reducing their damage, and minimizing the application of pesticides. However, there is also ample evidence that this strategy is not applied or adoption has been slow or that IPM are short-lived. What are the reasons for this?

It is from this reflection and field experience, when developing the technology for the integrated management of the coffee berry borer, that the idea of Holistic Pest Management (HPM) was brewing in Juan Barrera. The need for a paradigm shift puts human being at the center of a participatory decision-making system for pest management. As the name implies, its main characteristic is the holistic approach.

This book represents the culmination of an intellectual effort of 15 years, accompanied by a constant and close experience, experimentation, and discussion with rural producers, students, and fellow researchers. It starts with a review of the IPM concept, its background, and limitations. It raises and justifies the need for the holistic approach and its theoretical support in the science of complexity. In this volume, Barrera describes the methods for application and implementation of HPM, which have been tested and evaluated. Finally, he analyzes the perspectives and challenges of the new approach. I trust it will be a work of transcendence, not only in the field of pest management but also in the fields of agroecology, science, and education.

For me, it is an honor to foreword this book by my colleague and friend Juan Barrera, who has been trained at the IPM school under one of its founders in Mexico, Dr. Dieter Enkerlin. Over three decades, I have had the privilege of interacting with him in different projects and facets. I have always admired his high level of commitment and dedication, which has led him to fulfill his goals and objectives. This book is a clear example of that.

Tapachula, Chiapas, Mexico Pablo Liedo
December 2019

Preface

About 15 years ago, we asked ourselves why many Mexican coffee growers, particularly smallholders, did not use—or did so to a minimum—the integrated management of coffee berry borer (*Hypothenemus hampei*), the most important coffee crop pest worldwide. At that time, we deduced that this was due in large part to the fact that the control programs and campaigns were aimed at reducing the level of infestation but paid very little attention to reducing producer vulnerability and increasing their response capacity toward this pest.

When deepening the analysis of this situation, we found that the problem did not seem to be limited to Mexico, not even to coffee crop, that is, it was a much more widespread problem than previously thought. Therefore, we concluded that Integrated Pest Management (IPM) followed a typically reductionist strategy by focusing on the pest and detaching itself from the problems associated with other components of the crop production system, including the producers themselves.

When reviewing the literature on the subject, we found more criticism in other parts of the world, which made us suspect that something was lacking in IPM. The concordance of our ideas with those of other researchers reinforced our efforts to find a holistic approach to pest management decisions. As a starting point, we took two central ideas: first, the actions should always put the farmer at the center of the system, and, second, management should consider both pests and other system components. We have called this approach "Holistic Pest Management" (HPM). In order to publicize these concepts and the development of their advances, in this book, I present an introduction to the theory of HPM, a new paradigm that goes beyond IPM. It is not a matter of renaming or redefining the IPM but of replacing it.

After the introductory chapter (Chap. 1), where the foundations that justify proposing an approach to "go beyond IPM" are laid, the nature of IPM is first reflected upon (Chap. 2). As we enter IPM analysis, it will be seen that this is a decision-making system that promotes actions that lead to pest management under a reductionist approach. Hence, IPM reductionism appears as the main cause of its anomalies.

Subsequently, we will see that for a realistic management of pests, a holistic approach to them is essential (Chap. 3). At this point, we will venture into the philosophy of holism and the concepts related to complex systems management; we will exhaust the issue by analyzing some of the main alternatives to IPM that have emerged in the last 30 years.

In the succeeding chapters, the HPM is addressed. First, it begins with the concept, principles, and theory that underpin it (Chap. 4); next, the description of methods continues, emphasizing the procedures for calculating and interpreting the Holistic Risk Index (HRI)—the cornerstone of HPM—and how it relates to resilience (Chap. 5). Then, step-by-step and with some examples, the methodology to implement HPM is described (Chap. 6).

A final section (Chap. 7) compares IPM and HPM vis-à-vis to clear up their differences, including cases of HRI application in fields other than pest management, and finally the challenges of HPM.

I have no doubt that this book will be useful for both theorists and pest management practitioners. The book will even be of interest to those who study and manage complex systems from other disciplines.

Tapachula, Chiapas, Mexico Juan F. Barrera
December 2019

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Over the years, many ideas expressed herein about HPM were nurtured with the opinions and suggestions of Ramón Jarquín, Jürgen Pohlan, William Gamboa (RIP), Manuel Parra, Balente Herrera, Javier Valle, Jaime Gómez, Christiane Junghans, and Julio S. Bernal.

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With Edwin Castellanos, Ana Lucía Solano, Helda Morales, Hallie Eakin, Catharine Tucker, and Rafael Díaz, members of the "Cambios Globales y Café" project, I found the ideal interdisciplinary niche to implement some methods with a holistic approach.

In the company of Pablo Liedo and several generations of students of El Colegio de la Frontera Sur (ECOSUR) Doctoral Seminar on Pest Management, from 1998 to date, we review, comment, and discuss books and articles on various topics of Integrated Pest Management (IPM); thanks to this, the need to propose a paradigm shift germinated in me.

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