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BOOK REVIEW

BELLOWS T.S., FISHER T.W., CALTAGIRONE L.E., DAHLSTEN D.L., GORDH G. & HUFFAKER C.B. (eds): *Handbook of Biological Control: Principles and Applications of Biological Control*. Academic Press, San Diego, San Francisco, New York, Boston, London, Sydney, Tokyo, 1999, 1046 pp. ISBN 0-12-257305-6. Price USD 139.95

Fifty-eight scientists have written a new handbook, dedicated to the theory and practice of biological pest control.

The Principles of Biological Control written by H. L. Sweetman (1958) and first of all the *Biological Control of Insect Pests and Weeds*, edited by DeBach (1964), which represents the "California School" of classical biological pest control, could be considered as basic handbooks. But during the past forty years there have been remarkable developments in all trends related to biological and integrated pest management. New methods in basic as well as in applied research were developed. There have been distinct changes in the practice of pest management in various agroecosystems. Great numbers of

papers and some principal books have been published. These circumstances have required elaboration of a new collective handbook, which processed and critically evaluated new information. So, the new *Handbook of Biological Control* is not only a revision of the basic handbooks mentioned above, but a modern work, covering, as much as possible, the great breadth of biological control science. The book was compiled by a group of leading specialists in their particular areas of research; two of them, C. Huffaker and K. Hagen, are now deceased.

Including the Introduction the matter is divided into forty-one chapters, which are aggregated in five key topical groups: I. Introduction (Preface plus Chapter 1), II. Principles and processes (Chapter 2 – Chapter 14), III. Agents, biology, and methods (Chapter 15 – Chapter 25), IV. Applications (Chapter 26 – Chapter 39), and V. Research and the Future (Chapters 40 and 41). Chapter 2: The authors T. S. Bellows and M. P. Hassell deal with theories and mechanisms of natural population regulation, starting with single-species populations and leading on to interspecific competition: host – parasitoid systems, host –

pathogen systems, and multispecies systems. Chapter 3: G. Gordh and J. W. Beardsley point to the confusion and misleading inferences about an organism if it is not properly classified. Chapter 4: T. R. Unruh and J. B. Woolley consider molecular methods for biological control, with particular reference to their utility in biosystematics and the study of field populations of insect biotypes. This chapter reviews isozyme electrophoresis; restriction fragment analysis; and sequencing of ribosomal RNA, mitochondrial DNA, and genomic DNA. DNA – DNA hybridization and immunological distances are also discussed. Chapter 5: E. F. Legner and T. S. Bellows describe criteria that will help delineate search areas of choice before exploration for entomophagous organisms begins. Ascertaining region of origin of the target pest or its plant hosts, if possible, will prioritize areas to be searched. Key considerations are taxonomy, distribution, hosts of record, and biology of closely related species. Chapter 6: This chapter by T. W. Fisher and L. A. Andrés on quarantine or isolation work contains concepts, including principles, facilities needed, and procedures to be used. Chapter 7: This chapter by L. K. Etzel and E. F. Legner is primarily, but not exclusively, on insect parasites and predators and relates to three major purposes: permanent establishment, periodic colonization and augmentation, and inundative releases. Chapter 8: The authors T. S. Bellows and R. G. Van Driesche discuss the construction and analysis of field life tables in the evaluation of biological control agents. They describe the types of life tables and use them to evaluate natural enemy actions to answer two basic questions; the first deals with their impact on their hosts (prey), and the second considers their ecological roles, particularly in stabilizing populations. Chapter 9: R. F. Luck, B. M. Shepard, and P. E. Kenmore update and suggest methods to achieve greater precision in the evaluation of natural-enemy effectiveness. Chapter 10: A. P. Gutierrez, L. E. Caltagirone, and W. Meikle present an economic evaluation of biological control efforts. Chapter 11: G. W. Elzen and E. G. King consider the use of natural enemies in a “rational insect management program that considers all available methods, such as selective use of pesticides, use of semiochemicals and/or supplements of natural enemies.” Chapter 12: M. J. Whitten and M. J. Hoy deal with breeding and selection for genetic improvement of natural enemies – mites are stressed because more work has been done on mite predators of mites than on other groups. Authors cite reviews on genetic improvements of pathogens and nematodes but do not deal with them. Chapter 13: M. W. Johnson and B. E. Tabashnik discuss how pesticides can disrupt biological control through direct and indirect effects. Chapter 14: D. K. Letourneau and M. A. Altieri discuss various aspects of environmental management to enhance biological control. Chapter 15: G. Gordh, E. F. Legner, and L. E. Caltagirone deal specifically with the biology and mechanisms of parasitoids and parasitism. Chapter 16: K. S. Hagen, N. J. Mills, G. Gordh, and J. A. McMurtry discuss the biology of predators and mechanisms of predation. Chapter 17: This chapter deals with biological control of weeds. T. S. Bellows and D. H. Headrick discuss the attributes of insects used to control alien weeds. Chapter 18 and 21: B. A. Federici considers the use of insect pathogens in biological control. Emphasis is not on biological control per se, but on its use in IPM. Chapter 19: J. A. Dodds provides a review of two vital plant processes that limit the disease process. Systemic acquired resistance occurs when a plant is inoculated with a virulent pathogen against which it is able to mount a resistance reaction. Later, should the plant be inoculated by a pathogen to which it is normally susceptible, infection is greatly limited by the resistance in the plant induced by the first pathogen. Chapter 20: A variety of mechanisms are currently being investigated to genetically engineer plants to be

resistant to pathogenic viruses. B. Cooper shares insights into several of these mechanisms, including coat-protein mediated protection, RNA mediated protection, and several mechanisms that relate to the pathogen genome or to changes in plant enzymes relied on by the pathogen for reproduction. Chapter 22: S. N. Thompson and K. S. Hagen deal with the principles of nutrition of entomophagous insects. Chapter 23: R. F. Luck, L. Nunney, and R. Stouthamer deal more specifically with the evolutionary ecology of parasitoids. They discuss the impact of culturing on sex ratios and quality of insectary product, the natural enemy, both from a theoretical and practical perspective. Chapter 24: B. E. Tabashnik and M. W. Johnson conclude that pesticide resistance is more likely to be documented in pests than in natural enemies. Chapter 25: D. W. Fulbright outlines the history and findings of the research that has followed the fate of chestnut blight, a devastating disease of chestnuts in both North America and Europe. Chapters 26 and 32: As T. S. Bellows points out, controlling plant pathogens through biological control or manipulation of microbial populations is essentially ecological management at the microbial level. Chapter 27: C. E. Kennett, J. A. Beardsley, and J. W. McMurtry discuss tropical and subtropical crops and provide, by far, the most important examples of solid classical biological control. Chapter 28: M. T. AliNiazee and B. A. Croft review biological control work on pests of deciduous tree fruits and the use of some key natural enemies and IPM for these crops. Chapter 29: D. L. Dahlsten and N. J. Mills discuss the great differences between forest management and agricultural crop management. Chapter 30: M. Kogan, D. Gerling and J. V. Maddox review the methods of enhancing biological control on several transient crops. Chapter 31: M. P. Parrella, L. S. Hansen and J. van Lenteren deal with biological control in greenhouse ecosystems mostly on vegetables and flowers. Abiotic and cultural conditions are quite suitable for the development of IPM systems. Chapter 33: D. L. Flaherty and L. T. Wilson review the problem of culture and pest management in cultivated grapes worldwide. They found that very little work on biological pest control in grapes has been done. Chapter 34: R. D. Goeden and L. A. Andrés cover the biological control of weeds, both terrestrial and aquatic. They detail the history and the methodology in choosing and carrying out a project. Chapter 35: E. N. Rosskopf, R. Charudattan, and J. B. Kadir discuss the opportunities for biological control of weeds using pathogens. Chapter 36: D. L. Dahlsten and R. W. Hall note that the urban environment is very diverse and offer special opportunities for IPM and biological control. Chapter 37: R. Garcia and E. F. Legner deal with biological control of medical and veterinary pests. Chapter 38: M. S. Hoddle provides a review of biological control of vertebrates in both natural and agricultural ecosystems. Chapter 39: M. A. Altieri and C. I. Nicholls utilize programs of classical biological control in Latin America as a model for dealing with these types of problems in countries where assessment technology is limited. Chapter 40: J. H. Perkins and R. Garcia discuss the general social, political, economic, and philosophical factors that affect research and implementation of biological control. Chapter 41: T. S. Bellows provides a view toward the future of biological control and the roles of experts and institutions.

The book is a well-arranged work, providing basic information in a versatile spectrum of all related subject fields, which could be recommended to all those interested in biological pest control. It is also much needed for students of this specialization. Some unfortunate misprints in the Latin names of insects do not diminish the value of the work. The authors must be congratulated for this excellent book.

J. Havelka