

S. R. LEATHER, K. F. A. WALTERS AND J. S. BALE. 1993. The ecology of insect overwintering. Cambridge University Press; Cambridge, England. Hardback, x + 255 p. ISBN 0-521-41758-9. \$59.95.

As I write this review, the air temperature this December morning hovers about 5°C, a chilly reminder that even southern Florida feels the impact of winter. Lacking insulating clothes, our local insect fauna must practice some of the behavioral or metabolic adaptations that are the topics of the present book by three British investigators. This attractive volume stresses physiological mechanisms and draws from a somewhat different journal literature compared with its closest facsimile, **Seasonal adaptations of insects** by Tauber et al. (1986), which presents a more evolutionary approach to overwintering.

Following a brief Introduction, Chapter 2 of Leather et al. considers "The overwintering locale - suitability and selection", a unique overview of microhabitats and microclimates sought by insects for protection from hibernal conditions. This chapter culls a diverse literature, including many relevant citations from meteorology and even one from a speleology journal, that bear on overwintering sites. The third chapter "Stimuli controlling diapause and overwintering" documents an impressive variety of entomological responses to seasonal environmental cues. This section describes how insects use daylength, temperature, and, to a lesser extent, biotic stimuli in multifarious ways to regulate diapause initiation, maintenance, or termination.

Chapter 4 on "Insect cold-hardiness" is the longest (76 pages) and, arguably, most specialized portion of the book, focusing on mechanisms of cryoprotection. In spite of stated goals to merge ecological and physiological views of cold-hardiness, this chapter dwells so intensively on physiological and biochemical specializations that the connecting threads to insect ecology are barely visible. Nevertheless, this section provides excellent coverage of insect cryobiology, even borrowing from fish (anti-freeze proteins were first discovered from cold-water species) and plant physiology to describe cryo-protective mechanisms. "Costs and benefits of overwintering" is the title of Chapter 5 which examines an eclectic mix of themes such as familial or latitudinal specificity of overwintering stages, bet-hedging strategies, and the physical, metabolic, and reproductive costs of overwintering. The final chapter "Prediction and control" describes circumstances (aphid and moth pests receive most coverage) where counts of pre-winter abundance have been used to forecast the probability and intensity of a post-diapause outbreak. Examples of host-plant manipulations and cultural practices, such as tillage, are recommended as alternatives to direct control to forestall an outbreak. Although the authors advocate a detailed understanding of the overwintering process to facilitate control, simple life table information would suffice to predict the emergence levels of pests based upon pre-winter abundances.

An appealing feature of this book is its use of case-study methods to discuss overwintering paradigms in depth. The many European examples, drawing from publications in Scandinavian tongues as well as Russian, French and German, should provide some fresh insights to North American readers. Graphs and figures, some original and others reproduced from journals, are distributed liberally through the text to elucidate concepts or highlight data. Some graphs are, unfortunately, difficult to decipher or provided with insufficient documentation. Other irritations include missing or inaccurate citations and some ponderous sentence structures. Yet, these are minor quibbles about a valuable book that fills a vacant niche on insect cryobiology and should stimulate entomologists to consider the pure and applied ramifications of overwintering strategies.

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This article is from *Florida Entomologist Online*, Vol. 77, No. 2 (1994).

FEO is available from the Florida Center for Library Automation gopher (sally.fcla.ufl.edu) and is identical to *Florida Entomologist (An International Journal for the Americas)*.

FEO is prepared by E. O. Painter Printing Co., P.O. Box 877, DeLeon Springs, FL 32130.