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# This Week's Citation Classic®

**Tauber M J & Tauber C A.** Insect seasonality: diapause maintenance, termination, and postdiapause development. *Annu. Rev. Entomol.* 21:81-107, 1976.
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This review took an ecophysiological approach to consolidate and analyze critically the widely scattered literature on a significant aspect of insect life histories. We emphasized mechanisms that regulate dormancy and how a combination of laboratory and field studies can discern their function in nature. [The *SCI*® indicates that this paper has been cited in over 175 publications.]

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In examining the subject of insect phenology during the mid-1970s, we saw major gaps in the knowledge of the annual seasonal cycles of insects. At that time we had studied various aspects of insect phenology, including diapause, for about 10 years, and we were stimulated by the comprehensive approaches of Jan deWilde, Stanley Beck, and Anthony Lees. Although a series of reviews and monographs had emphasized diapause induction, a major aspect of seasonality—one that often comprises the greatest part of the annual life cycle—was relatively neglected and misunderstood. This was the period of dormancy after its induction; we focused our review on this topic.

Our review aimed at providing a framework for understanding the diverse mechanisms that allow insects to pass through dormancy and make the transition to development and reproduction. We focused on three general concepts that were either contrary to generally held views or neglected:

(1) *Diapause is a dynamic, not a static, state.* Experiments showed that dormant insects respond covertly to a variety of environmental factors. As the season progresses and environmental conditions change, the physiological state of the diapausing animal also changes. This concept is particularly significant for understanding how insects "track" their environments and for predicting life-history events in insect life cycles.

(2) *Few species require chilling or other specific stimuli to break diapause.* Based on laboratory studies, the importance of low temperature had dominated the thinking of insect ecologists and physiologists in their approach to diapause termination. Our interpretation of the accumulated evidence was that for many insects chilling is not required to terminate diapause and that, even in the specific cases in which chilling hastens diapause termination in the laboratory, it was not demonstrated to do so in the field. Our questioning of this prevalent belief provided us with the basis for interpreting laboratory-derived experimental data within an ecologically and evolutionarily meaningful context.

(3) *Intraspecific variation characterizes all aspects of insect dormancy.* Variation in the mechanisms of diapause induction was well known, particularly through work in the USSR. However, little emphasis had been placed on the variation expressed after diapause induction. This area continues to be a fruitful field for basic and applied ecological and evolutionary investigations.

Our review has been cited frequently probably because it summarized widely scattered literature and it offered a framework for an experimental approach to the regulation of dormancy in nature. Furthermore, the topic is at the interface between insect ecology, physiology, and genetics, and it has broad implications for evolutionary and applied aspects of all three fields.

In the decade since the publication of our review, research on insect seasonality has been very active, as evidenced by a variety of national and international symposia dealing with the role of seasonality in the evolution of life histories.[1-3] Our work on this review helped stimulate us to write a book (with Sinzo Masaki, a colleague from Japan) dealing with all phases of insect seasonal cycles;[4] it covers mechanisms as well as ecological and evolutionary implications.

1. **Dingle H.** *Evolution of insect migration and diapause.* New York: Springer-Verlag, 1978. 284 p. (Cited 80 times.)
2. **Brown V K & Hodek I.** *Diapause and life cycle strategies in insects.* The Hague, The Netherlands: Junk, 1983. 283 p. (Cited 20 times.)
3. **Taylor F & Karban R.** *The evolution of insect life cycles.* New York: Springer-Verlag, 1986. 287 p. (Cited 5 times.)
4. **Tauber M J, Tauber C A & Masaki S.** *Seasonal adaptations of insects.* New York: Oxford University Press, 1986. 411 p. (Cited 35 times.)




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