

The Biotic Environment

1. Introduction

This chapter will deal with the biotic environment of insects, which is composed of all other organisms that affect insects' ability to survive and multiply. In other words, the interactions of insects with other organisms (of the same and other species) will be discussed. Food is the most obvious and important biotic factor, and insects are involved in a wide spectrum of trophic relationships with other organisms, both living and dead. As the majority of insects feed on plant material in one form or another, they are key components in the flow of energy through the ecosystem. However, other interactions are known that, though not as easily recognized as feeding, are nonetheless important regulators of insect distribution and abundance.

2. Food and Trophic Relationships

Insects have evolved diverse feeding habits that allow them to exploit virtually every naturally occurring organic substance. Among their adaptations are specialized ingestive and digestive systems, the ability to detoxify or physically avoid toxins produced by the host, mutualistic relationships between the insect and microorganisms, and life-history strategies that result in temporal avoidance of resource-poor situations (including those resulting from interspecific competition) or times when the host's toxins are abundant. Thus, insects participate in an array of trophic interactions as herbivores, predators, parasites, parasitoids, detritivores, and prey in both terrestrial and freshwater ecosystems (Figures 23.1 and 23.2). Food may be an important limiter of insect population growth; it may also affect the distribution and the dispersal of species over time (Price, 1997).

2.1. Quantitative Aspects

Though the amount of food available might be considered as an important regulator of insect abundance, it has been found in natural communities that populations do not normally use more than a small fraction of the total available food. This is primarily because other

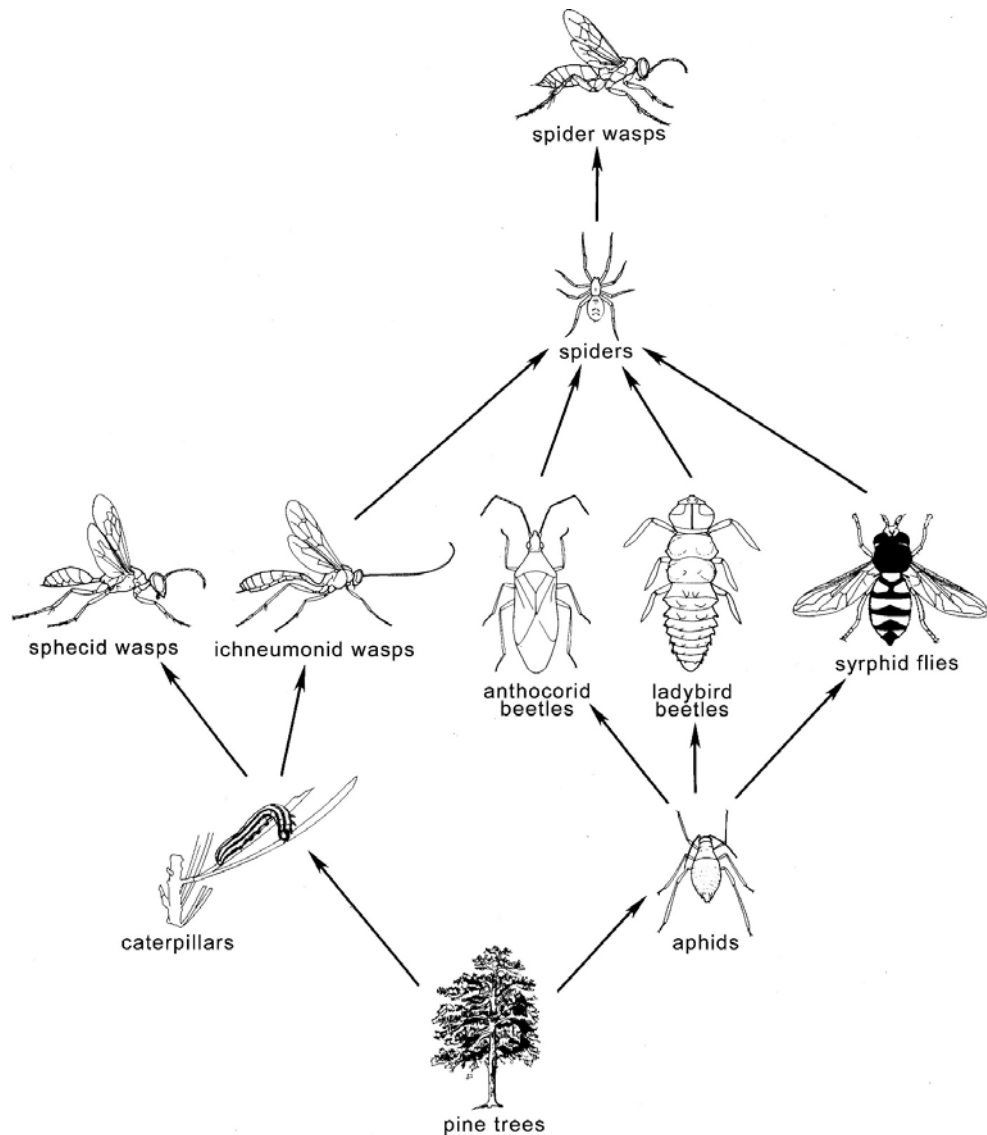


FIGURE 23.1. An example of a food web in a terrestrial ecosystem, showing the importance of insects. [From P. W. Price, The concept of the ecosystem, in: *Ecological Entomology* (C. B. Huffaker and R. L. Rabb, eds.). Copyright © 1984 by John Wiley and Sons, Inc. Reprinted by permission of John Wiley and Sons, Inc.]

components of the environment especially weather but including, for example, predators, parasites, and pathogens, usually have a significant adverse effect on growth and reproduction. Other features of insects may, however, be important in this regard. Many species, especially plant feeders, are polyphagous. Thus, when the preferred food plant is in limited quantity, alternate choices can be used. Among endopterygotes, larvae and adults of a species may eat quite different kinds of food, and in some species such as mosquitoes the food of the adult female differs from that of the adult male.

Two situations may occur in which the quantity of food limits insect distribution and abundance. In the first, there is no absolute shortage of food, but only a proportion of the total is available to a species. Thus, there is said to be a “relative shortage” of food. Various reasons may account for the food not being available. (1) The food may be concentrated