

Behavior of Insect Natural Enemies

Ecology and Applications in Biological Control

Edited by Prof. Omkar and Prof. Yaghoub Fathipour



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Prey–predator interactions: a vital aspect of an effective biological control system

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Learning objectives

1. To be able to understand various aspects of predatory behavior in insects.
2. To appreciate how predatory adaptations allow predators to survive in hostile environments.
3. Evaluate various types of predatory parameters and the survival strategy of prey for predator–prey interactions.
4. Explore a population simulation with two interacting populations.

6.1 Introduction

Predation is recognized as one of the unique phenomena linked to the relationships between species on Earth. On Earth, there are different kinds of predators. They vary in size from tiny animals, like ostracods, to large mammals, like tigers and lions. Predators are animals that attack, subdue, kill, and eat their prey as a whole or in parts, and they need a lot of food to grow to adulthood. According to this classification, parasitoids, like some tiny wasps and flies, which only need and consume one type of prey item for their whole life span, are distinguished from predators. Adult parasitoids are free-living organisms that deposit their eggs inside or on the surface of hosts. After emerging from the eggs, larvae feed parasitically on or inside the host until it dies.

Foraging is the act of searching for food and feeding once a food source has been identified and accepted as a suitable host component, piece of prey, or parasitoid host. For humans, the process seems straightforward enough, but the modifications that help tiny insects overcome challenges, like complicated environments and specialized diets, become more convoluted. A parasitoid's journey of behavioral decisions, from locating a suitable habitat to accepting and depositing on a host to deceiving the host, illustrates this idea. The interpretation of the decision-making system that leads to the search field's narrowing can be attributed to the series of behaviors that most insects go through to locate food. This holds regardless of whether an organism is obtaining food for its offspring or for itself.

There are two distinct stages in the host-finding behavior of parasitoids:

1. the host's habitat location; and
2. the host's location within its habitat.

Two different types of stimuli are involved at each level of this sequence: attractant stimuli, which cause an orientation toward areas that either contain hosts or are likely to contain hosts, and arrestant stimuli, which cause a decrease in the amount of area or distance that parasitoids moving within these areas cover in a given amount of time. Once caught in a host region, parasitoids are prone to further arresting and attracting stimuli, which tend to confine their movements to even smaller host distribution units (Waage, 1978). Similar responses to a hierarchy of stimuli are shown by predators. An important percentage of the adult life of a parasitoid is spent in seeking potential hosts. They can find possible host patches through auditory, visual, or olfactory cues. There are a few examples of the work of auditory and visual cues (Alphen and 1986). This suggests that either less time and effort has been spent studying these cues, or that they are less significant