5 Components of environment: predators and pathogens; aggressors

5.0 Introduction

The conditions caused by pathogens (microorganisms and viruses) are called diseases; so are some of the conditions caused by metazoan parasites which are also smaller than their hosts; but an animal that is eaten by another animal that is larger (or not much smaller) than itself is said to be the prey of the larger animal which is called a predator. Predators usually kill and eat the whole prey; parasites and pathogens may eat without killing; they may merely eat or they may also produce toxins that weaken or kill the host. For the purpose of ecological analysis the activities of all three groups are best placed in one category which needs a name. ‘Predation’ seems to be the most general one that emerges from common speech about predators, parasites and pathogens; so I shall call them all predators unless I want to make a narrower distinction.

In contrast to the broad usage for ‘predator’ a very narrow meaning has been reserved for aggressor. I do not, in this chapter discuss the aggression that goes with the defence of a territory. I regard territorial behaviour as an adaptation that has evolved in animals in relation to their utilization of resources; so I discuss it in chapter 3. Similarly the aggressive social behaviour found, for example, in a male cottontail ‘defending’ a group of females is an adaptation properly discussed in chapter 4. In this chapter I am interested only in the special sort of aggression that develops in crowded populations especially of small mammals and is said either to alter the animal’s physiological condition so it becomes less viable or less fecund, or else it is said to act directly on the animal, reducing its chance to survive and reproduce, without necessarily altering its physiological condition.

Because the activities of predators, parasites, pathogens and aggressors are broadly parallel, and can be represented by a generalized curve like

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the one in Fig. 5.01 I have recognized only one component of environment to embrace them all.

![Diagram](image)

Fig. 5.01. An animal’s chance of survival is reduced when predators, pathogens or aggressors are numerous. $E$ stands for the activity of the environment (predators, etc.); $P$ stands for the animal’s chance to survive and reproduce.

### 5.1 PREDATORS

The activity of a predator (using the term in its broad sense) depends on its supply of food and all the other components of its environment. If the predator is restricted to one species of prey (as many insects and other invertebrates are) it is called an *obligate* predator. If it readily eats more than one species of prey it is called a *facultative* predator.

#### 5.11 The ‘biological control’ of insect pests

About 170 years ago the scale insect *Icerya purchasi* was accidentally introduced into southern California from Australia. By 1880 it had spread and multiplied so much that it threatened to destroy the citrus industry. In 1888 a colony of 129 ladybirds *Rodolia cardinalis*, from Australia, were established inside a cage that had been built over an orange tree; the tree was carrying a dense population of *Icerya*. By April 1889 the ladybirds had increased greatly and had destroyed nearly all the scale insects. The cage was removed, and within three months *Rodolia* had spread through the orchard destroying nearly all the *Icerya* that were in it. This success was repeated elsewhere in southern California and ever since there have been few *Icerya* in this area. Smith (1939) explained this result in terms of the high powers of dispersal of the predator relative to its prey and also the high rate at which *Rodolia*