

PREFACE

Pierre Jolivet's book, "Insects and Plants," is on one of the most attractive subjects a biologist can offer to an educated public. The erudition found in this book is softened by the simplicity and clarity of his text, which makes the book readable by all. In the world of living things, cooperative correlations between two or more species are frequently observed. More than half the species of insects are the oppressors of the plants on which they feed. Less commonly, the reverse is true. Even more, certain plants are dependent on insects for survival. Information on the latter surpasses the former in interest and complexity. The herbivorous insect does not eat just any plant that it comes across. Even the migratory locust, despite its well known insatiable appetite, has its preferred host plants, and avoids other species even to the point of starvation.

Generally insects will feed on numerous species of plants; sometimes they are restricted to a single family, a single genus, or even a unique species. These insects are monophytophagous. It is now known that plants emit odors which attract certain species of insects. The classical example of this is the attraction of the cabbage butterfly to mustard oil of the cruciferous plants. Another example is the terpenes present in conifers. These substances attract scolytid beetle pests of pines, firs, spruce, and other trees.

It is not to discover the diet that best suits the species, but to find the factors which have modified the genetic code of the species for this specialized way of life that is difficult to determine.

Odor from food plants is a significant stimulant for insects. Molecules of substances emitted from the plant, as photons emitted from a light source, go out in all directions. The few molecules which reach an insect's antenna are sufficient to orient and direct the insect to its favorite plant host. There it may feed, or, if a female, it may lay eggs.

The study of these phenomena is a study of evolution. All of the facts have not yet been found. For example, how and when did transformations from a general to a specialized diet take place? In the example above, a minute quantity of molecules

(emitted from the specific plant and difficult to detect) initiates the movement of the insect toward the stimulus source.

Carnivorous plants are amazing because of their specialized method of getting food. They have acquired in the past the ability to feed like animals. Pierre Jolivet describes with precision their specialized feeding mechanisms. These plants, even though they have this strange ability, retain their autotrophic characteristics, including the chlorophyll needed for photosynthesis, and they probably could survive for a time without any animal food as their only nitrogen source. The movement of leaves and other plant organs, anatomical peculiarities adapting them for predation, the digestive enzymes, and the permeability of cell membranes to digested organic products, equips the approximately 500 species of carnivorous plants known today for this strange way of life. Their movements are coordinated to the point of operating efficiently as passive predators. The evolution of these plants, belonging to a few isolated families, has come about through preexisting genes, although the necessity of this revolutionary change for the survival of the species does not seem particularly evident. These details may be found in this book.

The most complex evolutionary problem discussed in the book concerns the coevolved interrelationships between plant and insect. Many plants must be fertilized during the visits of pollen collectors or nectar feeders. When a flower is pollinated only by the intervention of an insectivorous insect, one or the other, or both, must be greatly modified for this purpose. The book describes with precision the anatomical features and the chemical attractants utilized by the plants in this relationship with insects (see chapter 12).

It is difficult to explain these unique lines of development; it is much more difficult to follow and interpret the coevolution taking place in two distinct, widely separated species. One is modified to compliment the other. Unsuspected properties are put to work to achieve this harmony.

Two views on coevolution are expressed by biologists. For some, the plant and the insect evolved separately. It is just a coincidence that this happened and has nothing to do with a special evolutionary process. It happened to be more or less useful to the plant. In fact, they say, anthropomorphism is the inventor of this so-called evolution. On the other side, the view is that the

insect and plant evolved together, each receiving aleatory mutations, but keeping only those which gave the plant or the animal an advantage. This is the application of simple Darwinian selection. Darwin was, during his life, perplexed by reports of this kind of insect-plant relationship. In fact, he devoted an entire book to one aspect of this, a book on carnivorous plants.

But of what value was Darwin's and his followers' explanation? The postulation of so many required reciprocal genes and mutations, and that in two opposing lines of development, makes the probability of such events extremely remote almost to the point of being nonexistent. Other conditions needed to permit this double plant-insect evolution further weakens the aleatory thesis.

Even though more and more data is being added each day, for the most part, the present situation requires a biologist to have the courage to say "I don't know." Acknowledging this fact does not lower his esteem, but rather, honors him. Pierre Jolivet's totally objective book opens several rich and vast fields to exploration. It stimulates reflection. The biologist must not limit his studies to a few cultivated or cultured species. He cannot have a true idea of the complexity of biological phenomena without considering animals and plants together in their natural habitats and observing their mutual interactions. The living world is brightened by its diversity. The questions suggested to the observer and thinker are of a quasi-infinite number. Only a very small part of them have held the attention of scientists.

Reckless and arrogant is the one who pretends, in the precarious and limited state of our knowledge, to explain the fundamental mechanisms of life and the avatars of its forms.

Pierre Jolivet's book, even with its richness of facts, clearly shows our ignorance. It is a book of truth. What better can be said of a scientific book?

-Pierre-P. Grassé

*Member of the French Academy of Sciences,
Professor of Zoology*