Book Reviews

Microbial Herbivores

Biochemical Aspects of Plant-Parasite Relationships. Proceedings of a symposium, Hull, England, Apr. 1975. J. FRIEND and D. R. THRELFALL, Eds. Academic Press, New York, 1976. xiv, 354 pp., illus. $23.50. Annual Proceedings of the Phytochemical Society, No. 13.

I am reading this volume in a lowland tropical rain forest, an appropriate place to contemplate plant-parasite interactions. It is almost constantly wet here and never very cold; microbial growth is not restrained by weather. Every plant bears fungal colonies or epiphyllae, and the decay from bacterial digestion begins in foliage within hours after it is cut or falls from plants. Yet the forest is healthy. None of the 500 or so plant species within walking distance is obviously debilitated by disease, and most leaf area of most plant species is apparently free of microbial activity. The burns, blazes, spots, and lesions of infection are tiny and rare on all but the oldest leaves, even on plants that retain leaves for many months. This is the ultimate enigma of host-parasite interactions. What are the mechanisms and mechanics of the equilibrium between hosts and parasites? That the balance is unstable we see in the case of plagues, pest outbreaks, and disease epidemics in agricultural plants; that it is not simple we see in the plethora of diseases suffered by every plant species. Obviously, the questions of plant pathology are ecological, epidemiological, and morphological as well as biochemical.

Fortunately, in spite of its title, the orientation of *Biochemical Aspects of Plant-Parasite Relationships* is not merely biochemical, and its content is germane to broader issues of plants and their parasites. In the lead chapter, T. F. Preece gives an ecologically insightful perspective of the sequence of events in fungal immigration onto, and colonization of, leaves. D. J. Royle's account of structural factors in disease resistance in plants is introduced with the observation that, since the advent of modern biochemical techniques, serious research on the morphology of plant-parasite interactions has waned. But the external form of plants seriously affects disease resistance, in complex ways. Spines, hairs, wax, and leaf shape, for example, influence the rate of spore washing from leaves, and these influences differ among microbial species as a function of spore wettability. In another chapter on structure, D. S. Ingram, J. A. Sargent, and I. C. Tommerup summarize the anatomical aspects of leaf infection by fungi. The enzymology of plant cell wall hydrolysis by fungi is described by D. F. Bateman and protoplast killing by R. K. S. Wood, in biochemical discussions complementary to those of the chapters on morphology. Other aspects of the physiology of pathogens growing inside plants are covered in G. A. Strobel's chapter on the poisoning of plants by invading fungi and in J. Friend's on lignification of infected tissue. A diversity of topics completes the volume: there is a chapter on the nucleic acid metabolism of plant pathogens by J. A. Callow, one on pathogenic microbes in the soil by J. R. Coley-Smith, one on the influence of host plant genetics on pathogens by R. Johnson, and chapters on phytoalexin-like substances by several authors.

Phytoalexins are, properly, antimicrobial substances synthesized by plants after infection, but many compounds that kill microbes in vitro are found in plants independently of infection. Speculation in this volume on the evolutionary causes and physiological functions of phytoalexins parallels that in the literature concerned with the role of secondary plant substances in insect-plant interactions. In both there are the skeptics, who see the antibiotic properties of plant products as fortuitous or even artifactual, or as metabolic storage or waste products. The proponents of these views are often chemists or cell physiologists, and experiments to discover the functions of these substances in natural situations are usually not suggested. In the opposite corner are the question-begging evolutionists, who enthusiastically imagine deterministic antibiotic roles for each novel compound. These are usually whole-organism biologists who do not carefully differentiate between fact and imagination and whose enthusiasm for critical tests of their notions is often not equal to their speculative creativity. In the volume at hand, B. J. Deverall takes a refreshingly scientific view of all this. He suggests that the roles in plant disease resistance of most phytoalexin-like compounds are not yet demonstrated and that a major emphasis of research should now be on the evaluation of these roles in real parasite-host interactions. In my opinion he is correct, and the possibility that such compounds have no function should be entertained in this research. This does not mean that there has never been a function for some compounds, but that some may fall into disuse in an evolutionary sense.

Herbivorous arthropods might be considered plant parasites on the order of the pathogenic microbes that are the subject of this volume. Plants are simultaneously attacked by both arthropod and fungal parasites, and it is unfortunate that researchers have not yet taken this into account. For example, some supposed phytoalexins could also render protection against insects, either directly or via microbial symbionts of insects. Surely, the damage done to plants by insects is a major mode for the introduction of microbes into plant tissues that are effectively protected by external morphology, as described in this volume. Research on plant parasites in the broad sense will mature only when microbial researchers join arthropod researchers. Only then might the vexing questions of the function and origin of novel plant products have a high probability of being answered.

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Coastal Plants

Seagrass Ecosystems. A Scientific Perspective. Papers from a workshop, Leiden, The Netherlands, Oct. 1973. C. PETER MCROY and CARLA HELFFERICH, Eds. Dekker, New York, 1977. xii, 314 pp., illus. $29.75. Marine Science, vol. 4.

Shallow coastal waters dominated by seagrasses are among the most productive areas of the world's oceans. In daily photosynthetic fixation of organic carbon seagrass ecosystems often exceed both coral reefs and areas of oceanic upwelling.

The study of seagrasses, the underlying sediment, the overlying water column, and the associated animals and