

PLANT VIRUS DISEASES

Plant Viruses and Virus Diseases

By F. C. Bawden. (A New Series of Plant Science Books, Vol. 5.) Pp. xii+272. (Leiden: Chronica Botanica Co.; London: Wm. Dawson and Sons, Ltd., 1939.) 7 guilders.

THE earlier investigations of virus diseases of plants were attempted by the standard methods of the plant pathologists, and failed to reveal the cause of the disease, or to elucidate the nature of the infective agents. These methods have been supplemented by a technique of the widest biological basis, including that used by biochemists and physicists to investigate proteins and other compounds of high molecular weight. The author, with his colleagues, has played a prominent part in the isolation, purification and chemical recognition of nucleoproteins obtained only from infected plants. His hypothesis, freely accepted to-day, considers the nucleoproteins to be the viruses; this forms the theme of his book, which might with advantage have been entitled "Recent Research on the Nature of Plant Viruses". Thus it differs, particularly in outlook but also in treatment, from other recent text-books of virus diseases which are primarily concerned with the economic host plants; this one especially considers the infective agents.

In the introductory pages the author criticizes with acumen suggested schemes of classification or nomenclature based largely on records of host plants infected; in later chapters a classification based on the actions and properties of the viruses is put forward. Such a desirable change can only take place when sufficient knowledge of the viruses is gained; whereas little benefit and considerable confusion may arise from reshuffling an artificial system of nomenclature, the earlier classifications were based on the limited available facts chiefly concerned with the host plants.

Botanical readers, some perhaps less familiar with serological technique, will find these methods described as they are now utilized in virus research. Evidence shows that the viruses are themselves the antigens; for the purer the virus preparation the more active it has proved, and further, a common antigen may be obtained, for example, from plants of tobacco and phlox, infected with the virus causing tobacco mosaic. Crystalline nucleoproteins have given results of the same order, and are now regarded as the antigens specific to virus-infected plants. This is part of the experimental foundation of the author's

hypothesis. Serological technique has also proved of value in identification of the viruses and can be used to distinguish strains of the same virus.

Since Stanley (1935) claimed to have isolated the tobacco mosaic virus, much progress has been made in the methods of purification, and the text shows those employed to obtain samples of tobacco mosaic, potato 'X', tomato bushy stunt, and tobacco necrosis viruses. One yield of 80 per cent of the total protein content of the sap expressed from frozen leaves has been claimed to be virus; but in other cases cited, 2 gm. per litre of cell sap are considered to be virus. From healthy plants no such compounds are obtained by similar procedure.

Later chapters deal with the composition of viruses as revealed by chemical analysis—where the phosphorus and carbohydrate derived from the nucleic acid are of vital importance as without such fractions activity is greatly reduced—and with their optical and other physical properties, including crystalline structure studied by X-rays. Estimates of the size of the particles and their molecular weight are included. A brief account is given of the limited work that has been carried out on the physiology of virus-infected plants. The author reviews possible control measures and considers the breeding of resistant varieties to be a slow but promising line of work. Protection afforded by chance or deliberate infection with mild strains, valuable as it is with certain crops, is not considered likely to be of general use; it appears impracticable to 'vaccinate' plants against more than one virus because of the interactions and complications that may ensue.

In the concluding pages attention is focused upon the question so frequently asked by the earlier investigators: Are viruses living organisms? A straightforward definite answer cannot be given. Further knowledge regarding the activities of viruses in living tissues is needed. In the meantime it is necessary to re-examine carefully the criteria applicable to this judgment in the light of the information already known about viruses.

The book forms a readable account of recent brilliant research, the facts are authentically presented, and the literature adequately surveyed. Here and there a few trivial errors in the type have escaped the proof reader's attention; there are several short reiterations in the introductory paragraphs to the chapters. Biologists are deeply indebted to Mr. Bawden for his critical survey of the progress so recently made in this field of research.