News of Science

Insect Hosts of Plant Viruses

Most plant viruses are transmitted from plant to plant by insect vectors. Evidence has been accumulating for some years that in certain cases the insect may be more than a mechanical carrier of the virus; that is, the insect may serve as an alternative host for the virus. Certain plant viruses can be transmitted from one generation of insects to the next by transovarial passage without the need for an intermediate plant host. Others, such as the aster-yellows virus, are acquired naturally by the insect through feeding on a diseased plant. After feeding, the insect vector becomes infective for other plants only after an incubation period of about 10 days, but it then remains infective for the remainder of its life.

The aster-yellows virus can be transmitted in the laboratory from one leafhopper to another by mechanically injecting into normal insects the juice of ground-up virus-infected insects, as was demonstrated originally by L. M. Black in 1940. Later the virus was transmitted from insect to insect in indefinite series by injection while the insects were maintained on plants that did not support growth of the virus [Maramorosch, *Phytopathology* **42**, 59 (1952); for a review of the literature on multiplication of plant viruses in insect vectors see Maramorosch, *Advances in Virus Research* **3**, 221 (1955)]. The presence of virus in the insects is demonstrated by placing them on healthy aster plants and observing the plants for the symptoms of the yellows disease.

Cross-protection tests have long been used to determine whether or not two plant viruses are closely related. For instance, plants that are infected with California aster-yellows are resistant to eastern aster-yellows virus, and vice versa. Since both virus strains may be transmitted by the same species of leafhopper, it was possible to do a cross-protection test in the insect vector as well [Kunkel, *Advances in Virus Research* **3**, 251 (1955)]. Leafhoppers were infected with one of the two viruses by letting them feed on infected plants, and then two weeks later they were exposed to the second virus by the same technique. After a further incubation period, they were tested to see which virus they would transmit to susceptible plants. Invariably the insects were able to transmit only the virus to which they were first exposed. Thus, there is interference between these two virus strains in the insect host as well as in the plant host.

Although the aster-yellows virus multiplies in its insect vector, it causes no obvious disease symptoms, and the infected leafhoppers live as long and breed as freely as noninfected individuals. However, a careful cytological study of the tissues of infected and virus-free leafhoppers [Littau and Maramorosch, *Virology* **2**, 128 (1956)] revealed changes in the cells of the fat-body. In uninfected insects the nuclei of these cells were round, and the cytoplasm was homogeneous and heavily stained with azure B. In infected insects the nuclei of the fat-body cells were mostly star-shaped, and the cytoplasm was reticulate and less intensely stained with azure B. The authors suggest that these cytological changes are evidence of disease and that the aster-yellows virus may multiply in the cells of the fat-body.

Recent developments in tissue-culture techniques have suggested further experiments on the growth of aster-yellows virus in insects. Leafhoppers in the nymph stage were fed for 2 days on plants diseased with aster-yellows virus. If the insects were ground up at this time and the juices were injected into adult insects, no virus could be recovered and demonstrated by the infectivity of the injected insects for aster plants. If the nymphs were permitted to live for 10 days, the incubation period for infectivity of the virus, and then ground up, the virus was readily recovered by injection of the juice into adult insects. Some of the leafhopper nymphs after feeding for 2 days on diseased plants were anesthetized and cut up, and the pieces were incubated in tissue-culture fluid for 10 days. At this time it was possible to recover virus by injecting the juice of the ground-up tissue-culture fragments into adult leafhoppers [Maramorosch, *Virology* **2**, 369 (1956)]. This experiment indicates that the aster-yellows virus can develop infectivity in cultures of insect tissues, as well as in the living insect, and suggests that the culture of individual organs may demonstrate the actual site of virus infection in the leafhopper.—M. H. A.

New Technique for Machining Tungsten

At the North American Philips Laboratories, R. Levi, has developed a technique [*Philips Tech. Rev.* **17**, 97 (1955)] to machine tungsten, which otherwise as a solid is so brittle that any machining is practically impossible.

For this purpose tungsten powder is compressed at about 2000 kg/cm^2, is presintered at 1150°C, and then sintered some more at 2400°C in a water-free reducing atmosphere. The density of the ingots reaches the value of 83 to 84 percent of solid tungsten. This porous material is next infiltrated with a filler that does not alloy with the tungsten itself. Gold, copper, and alloys of the two in all proportions seem to be suitable for these requirements.

The ingot is placed on top of a weighted amount of copper, slightly in excess of the amount that would be necessary to fill all the pores, and is impregnated at a temperature of about 1350°C. Capillary action then fills all the pores, and this is facilitated by a hydrogen atmosphere and its fluxing action. The filler not only fills all the pores but acts as a lubricant during the machining operation.

When the machining is completed, the volatilization of the copper is effected by heating the machine parts in a vacuum furnace to 1800° to 1900°C for a sufficient time. Spectroscopic examination shows only extremely faint traces of copper. Intricate parts of different sizes, including very small ones, can, in this way, be made to close the dimensional tolerances.—K. L. H.

Timber Outlook

The U.S. Department of Agriculture has issued a nontechnical publication entitled *People and Timber,* which is based on the *Timber Resource Review,* a 3-year study made by the USDA's Forest Service with the collaboration of state foresters, state agencies, forest industries, and other private and public organizations.

The annual timber cut is 48.8 billion board feet. By the year 2000, timber needs are expected to rise to 80 to 100 billion board feet a year because of an expanding economy and an increased population. According to the study, these