MYCOPLASMA: SUSPECTED ETIOLOGIC AGENT OF CORN STUNT

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Corn stunt, a disease affecting corn (Zea mays L.) and teosinte (Euchlaena mexicana L.), which causes an economically important disease in Latin American countries and occurs in several southern states of the United States, was reported for the first time in 1945. It has been generally accepted that the disease is caused by a virus. This assumption was based on circumstantial evidence. Plant symptoms, such as interrupted streaks, chlorosis, stunting, and the production of adventitious shoots, were considered “typical” symptoms of plant virus infection. Several species of leafhoppers are known to transmit corn stunt. This transmission and particularly a protracted incubation period of the etiologic agent in leafhoppers, as well as in plants, further supported viral etiology.

Finally, mechanical transmission of the corn stunt agent to leafhoppers by needle inoculation and interference of strains of corn stunt in plants and in insect vectors were considered characteristic for leafhopper-borne viruses. They paralleled interactions found to occur between well-characterized viruses of rice dwarf and wound tumor and their insect vectors. However, repeated efforts to characterize the suspected corn stunt virus morphologically remained unsuccessful. We have made an electron-microscopy study and found that Mycoplasma-like bodies are associated with diseased corn plants and with corn stunt-transmitting leafhopper vectors but are absent from healthy corn plants and from stock insects used as controls.

Materials and Methods.—Stock Dalbulus dimatus (Ball) insects were reared on corn plants, and infective vectors were obtained by confining leafhoppers to stunted corn for 30 days. Afterwards, the vectors were individually tested for 1 week on healthy corn seedlings to ascertain their infectivity. Brains, ventral ganglia, and intestinal tracts were excised and processed for electron microscopy examination. Chlorotic, adventitious shoots were excised from diseased corn plants and prepared for thin sectioning as described previously. Control specimens from healthy plants were prepared and examined in the same manner as the diseased material.

Results.—In 4 out of 11 corn stunt-transmitting leafhoppers, Mycoplasma-like bodies, 80–800 μ in diameter, were observed in the ventral ganglia cells (Fig. 1A) and the filter chamber region of the intestine (Fig. 1B). These pleomorphic bodies possessed a variety of internal structures surrounded by a unit membrane. One type had central regions of netlike strands assumed to be nuclear areas. This type contained ribosomelike granules, about 10–15 μ in size, in a ground substance of intermediate density. A second type contained ribosomelike granules in a dark substance but no central areas of netlike strands. Some bodies contained other combinations of the internal structures described. No similar bodies were observed in ten healthy stock leafhoppers that had no access to stunted corn. In thin sections of diseased plant tissue, Mycoplasma-like bodies similar to those found in infective insect vectors were observed in the...
FIG. 1.—(A) A section through the cytoplasm of a nerve cell of the leafhopper Dalbulus eliminatus infected with corn stunt. Mycoplasma-like bodies bounded by a unit membrane (arrows) contain ribosomelike particles.

(B) Mycoplasma-like bodies in an intestinal cell of the leafhopper D. eliminatus infected with corn stunt. These bodies clearly show a central nucleuslike area (N) and a peripheral cytoplasmic area with ribosomelike particles.
cells of phloem tissue (Fig. 2). The bodies detected in plant cells did not possess clearly defined unit membranes. *Mycoplasma*-like bodies were not observed in healthy plants.

The *Mycoplasma*-like bodies found in infected insects and plants are morphologically similar to the *Mycoplasma* that infect animals, including birds and man. Corn stunt is the first plant disease in which *Mycoplasma*-like bodies have been detected in ultrathin sections of both the diseased plants and the

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**Fig. 2.**—A section through a phloem tissue cell of a corn plant infected with corn stunt. Most *Mycoplasma*-like bodies show a central nucleuslike area (N) and a peripheral cytoplasmic area with ribosomelike particles.
infective leafhopper vectors. Since similar bodies have not been found to be associated with healthy corn plants or with nontransmitting insects, the Mycoplasma-like bodies are suspected as possible etiologic agents of the disease. This assumption is further strengthened by the preliminary results of antibiotic treatment of infected corn plants. In these tests, the development of corn stunt disease symptoms was delayed three to four weeks or completely blocked in corn seedlings grown in hydroponic culture with 50 ppm tetracycline hydrochloride. The corn seedlings were treated with the tetracycline antibiotic for two or four days after exposure to infectious vectors.

Discussion.—The establishment of Mycoplasma etiology must await the successful isolation, cultivation, identification, and plant inoculation of these agents. Efforts to culture the Mycoplasma-like bodies are under way, but no cultures have been obtained as yet on media that support growth of certain species of human Mycoplasma.

Recently there have been descriptions of Mycoplasma-like bodies from plants with four different diseases in Japan9 and from American aster yellows,10 but not from aster leafhoppers or other leafhoppers carrying the respective disease agents to plants. Treatment of mulberry dwarf-infected plants in Japan11 and plants with American aster yellows12 with tetracycline antibiotics suppressed or blocked symptom development, and in the latter, injection of vectors with tetracycline antibiotics suppressed transmission of the disease agent.12

It is somewhat surprising that until recently Mycoplasma, known to cause diseases in higher animals, have not even been suspected as possible disease agents in plants and invertebrate animals. The present findings might lead to renewed efforts to characterize agents of several plant and insect diseases of uncertain etiology.

Summary.—Mycoplasma-like bodies were detected in electron micrographs of corn stunt-diseased corn plants as well as in leafhopper vectors carrying the disease agent. The association of these bodies with infective insects and diseased plants, combined with their absence from healthy plants and stock insects, strongly suggests that they may be the etiologic agents of the corn stunt disease. This is the first reported instance of Mycoplasma-like bodies in both diseased plants and infective vectors.

1 Altstatt, G. E., Plant Disease Repr., 29, 533 (1945).
3 Kunkel, L. O., these PROCEEDINGS, 32, 246 (1946).
10 Maramorosch, K., E. Shikata, and R. R. Granados, Phytopathology, in press.