Mycoplasmalike Bodies Associated with Peach and Periwinkle Exhibiting Symptoms of Peach Yellows

A. L. Jones, G. R. Hooper,
D. A. Rosenberger, and J. Chevalier

Associate Professor, Department of Botany and Plant Pathology; Director, Electron Optics Laboratory and Associate Professor, Department of Entomology; Research Assistant, Department of Botany and Plant Pathology; and Laboratory Technician, Department of Botany and Plant Pathology, respectively, Michigan State University, East Lansing 48824.

These investigations were supported in part by federal funds, both Hatch Amended and Regional Research, under Project NE-14.

Journal Article No. 6749 of the Michigan Agricultural Experiment Station.

ABSTRACT

Mycoplasmalike bodies (MLB) were found associated with peach trees exhibiting peach yellows symptoms, and in *Vinca rosea* following dodder transmission from peach. They were present, often in large numbers, in phloem cells and were delimited by a unit membrane. Small (124-nm diam), filamentous, dark-staining bodies predominated in the phloem parenchyma. The MLB appeared to contain ribosomelike bodies and strands of DNA, and were morphologically indistinguishable from MLB associated with other yellows-type diseases.

Phytopathology 64:1154-1156

Additional key words: Prunus persica.

Peach yellows is of historical importance because it was one of the first virus-like diseases to be studied extensively and because of its past economic importance to the peach industry. Erwin F. Smith demonstrated that peach yellows was transmissible by budding and grafting but not by mechanical means (6, 7). About 40 years later, Kunkel obtained transmission of yellows with the plum leafhopper *Macropsis trimaculata* Fitch (2). However, no virus has ever been identified as the causal agent.

Recently mycoplasmalike bodies (MLB) were found associated with peach trees exhibiting symptoms of little peach (1). Peach yellows and little peach are similar in many ways and the two diseases were considered to be caused by strains of the same etiological agent (3). Both diseases have approximately the same host range and geographical distribution, the causal agents are transmitted by the same insect (2, 5), are inactivated at the same temperatures (4), and cross-protect one against the other (3). We therefore wished to determine whether trees exhibiting symptoms of peach yellows might also have MLB associated with the phloem tissues.

MATERIALS AND METHODS.—Peach yellows in naturally infected 'Cresthaven' peach (*Prunus persica* Batsch) was obtained from Dr. K. D. Hickey, Fruit Research Laboratory, Winchester, Virginia, and buds from this tree were inserted into five 'Rutgers Red Leaf' peach seedlings in December 1972. Typical peach yellows symptoms developed about 3 months later in two seedlings.

Apical cuttings of dodder (*Cuscuta subinclusa* Dru. & Hitg.), grown from seed and maintained on healthy periwinkle (*Vinca rosea* L.), were attached to the slender, willowy shoots of infected seedlings. After the dodder was

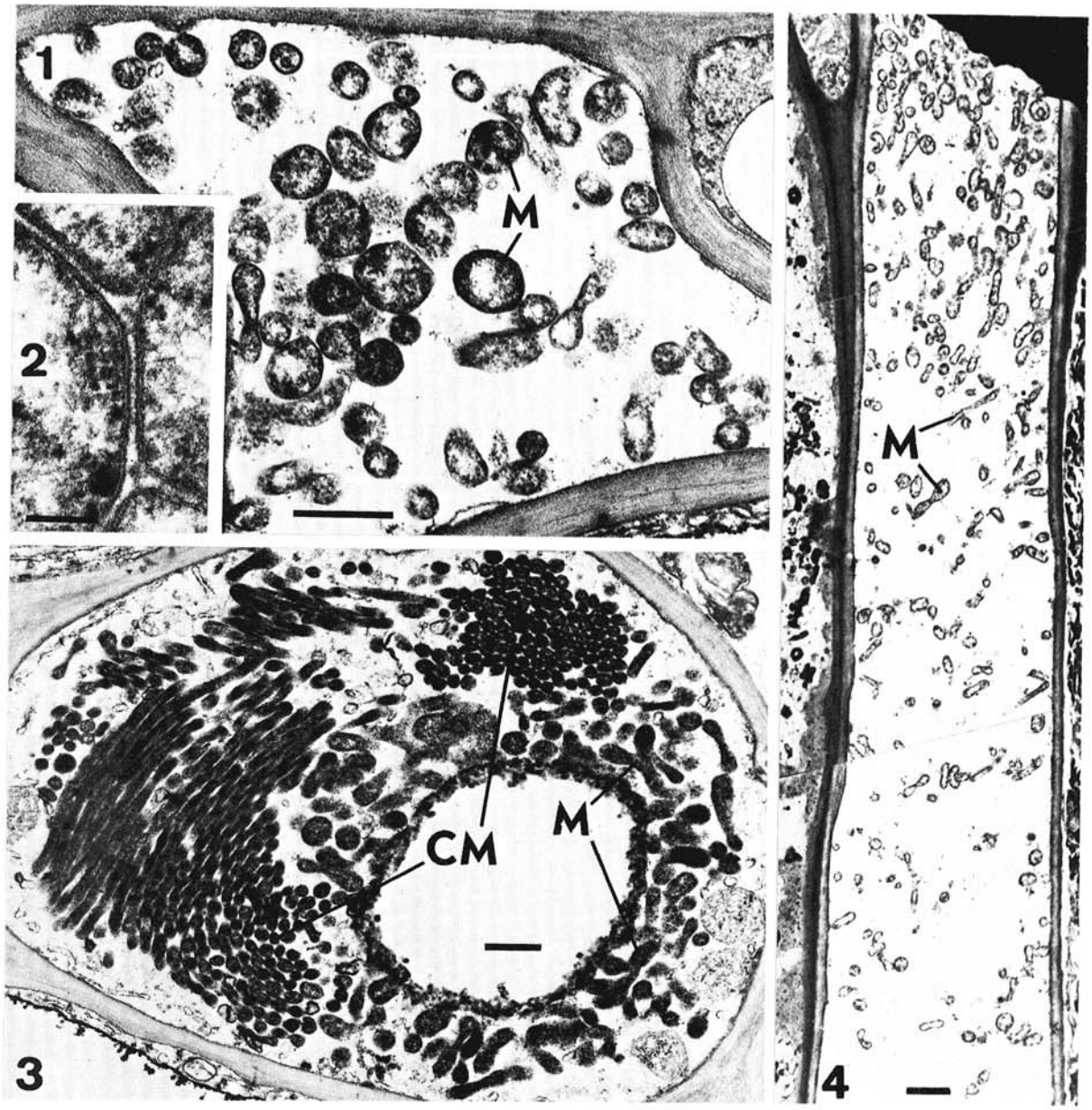

Fig. 1-4. Typical mycoplasmalike bodies (M) in phloem elements of peach and periwinkle exhibiting symptoms of peach yellows. **1)** Cross section of lateral leaf vein of peach. **2)** Trilaminar unit membrane of mycoplasmalike bodies in diseased periwinkle. **3)** Phloem parenchyma of peach with clusters (CM) of small densely stained mycoplasmalike bodies cut in cross- and oblique section and of larger, more typical bodies. **4)** Longitudinal section of lateral leaf vein of periwinkle. Bars equal 500 nm in Fig. 1 and 3; 100 nm in Fig. 2; and 1.0 μm in Fig. 4.

established on peach, strands were trained onto healthy periwinkle and were maintained for about 45 days, when the connections were broken. Dodder from healthy source plants was established on periwinkle as a control.

Segments of lateral veins of healthy and diseased peach and periwinkle foliage were cut from fully expanded leaves and immediately immersed in 5% phosphate-buffered glutaraldehyde for 2 h. The tissues were then washed in buffer, postfixed in 2.0% phosphate-buffered osmium tetroxide solution, dehydrated through an ethanol series, and embedded in Spurr's epoxy resin (8). Thin-sections of embedded tissues were cut with a diamond knife and stained in alcoholic uranyl acetate followed by aqueous lead citrate. Sections were examined with a Philips Model 300 transmission electron microscope.

RESULTS AND CONCLUSIONS.—Periwinkle parasitized by *C. subinclusa* from diseased peach trees developed a severe chlorosis and cupping of mature leaves within 2 mo after the dodder was removed. During early

stages of infection flower size was slightly reduced and severely infected plants produced only an occasional stunted flower. Control plants remained healthy. The disease was transmitted to other periwinkle by cleft-grafting scions taken from diseased periwinkle.

Mycoplasmalike bodies (MLB) were observed in elements of mature sieve tubes from leaves of peach exhibiting yellows symptoms (Fig. 1) and from leaves of periwinkle (Fig. 4) exhibiting symptoms of peach yellows, but not in leaves from healthy plants. Ellipsoidal and ovate bodies were observed in varying concns from a few per cell to high concns that occupied most of the lumen. The typical unit membrane characteristic of MLB was present (Fig. 2) along with ribosomelike bodies and threadlike material presumed to be DNA. In longitudinal sections, the MLB appeared more filamentous than in cross sections.

Clusters of small, densely stained MLB averaging 124 nm in diam were found in the phloem parenchyma, companion cells, and immature sieve tubes of peach (Fig. 3) and periwinkle. These bodies were filamentous and were not found in mature sieve tubes. Thin MLB were observed near the pores of some sieve plates, but they were not densely stained. Small and large MLB were sometimes found in the same cell.

Sections of plant tissues that had shown symptoms for several weeks contained necrotic phloem cells and densely stained, irregularly shaped, and partially collapsed MLB. Unit membranes were visible around some of these bodies, but their internal structures could not be discerned. In some sections, clusters of small MLB, typical ellipsoidal and ovate bodies, and collapsed bodies were observed in adjacent cells.

LITERATURE CITED

1. JONES, A. L., G. R. HOOPER, and D. A. ROSENBERGER. 1974. Association of mycoplasmalike bodies with little peach and X-disease. Phytopathology 64: 755-756.
2. KUNKEL, L. O. 1933. Insect transmission of peach yellows. Contrib. Boyce Thompson Inst. 5:19-28.
3. KUNKEL, L. O. 1936. Immunological studies on three peach diseases: yellows, rosette and little peach. Phytopathology 26:201-219.
4. KUNKEL, L. O. 1936. Heat treatment for the cure of yellows and other virus diseases of peach. Phytopathology 26:809-830.
5. MANNS, T. F., and M. M. MANNS. 1935. The dissemination of peach yellows and little peach. Pages 40-44 *in* Del. Agric. Exp. Stn. Bull. 192.
6. SMITH, E. F. 1888. Peach yellows: a preliminary report. Pages 1-254 *in* U.S. Dep. Agric., Botan. Div. Bull. 9.
7. SMITH, E. F. 1891. Additional evidence on the communicability of peach yellows and peach rosette. U.S. Dep. Agric. Div. Veg. Pathol. Bull. 1.
8. SPURR, A. R. 1969. A low-viscosity epoxy resin embedding medium for electron microscopy. J. Ultrastruct. Res. 26:31-43.