

Association of a Mycoplasma with Haywire Disorder of Potatoes

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ABSTRACT

Mycoplasmalike bodies were observed in electron micrographs of the graft-transmitted haywire disease of potatoes. Healthy growth resulted after administration of chlorotetracycline. *Phytopathology* 61:1316-1317.

Additional key words: yellows virus.

Haywire disease of potatoes has been variously described as a viral disorder (4) caused by the curly top virus (3) or tomato big-bud virus (8). The disease is prevalent in the western USA and especially Nebraska seed stock. Development of the disease is characterized initially by purpling of the meristem leaf margins, followed by stunting, stem swelling, production of aerial tubers, and reduced tuber set. This communication presents evidence from transmission properties, electron microscopy of thin sections, and chemotherapy for the association of a mycoplasma with haywire of potato.

The source of infected material for much of these studies was the cultivar, Bliss Triumph, seed potato stock grown in western Nebraska. Transmission of the causal agent of haywire disease by graft trans-

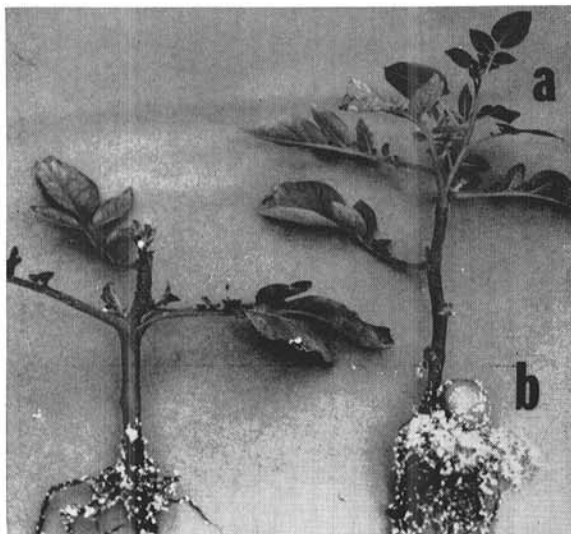


Fig. 1. Haywire-infected potato sprouts from a common seed piece after 30 days in control hydroponic culture (left) or supplemented with 200 ppm chlorotetracycline (right), indicating new healthy growth (a) and tuber formation (b).

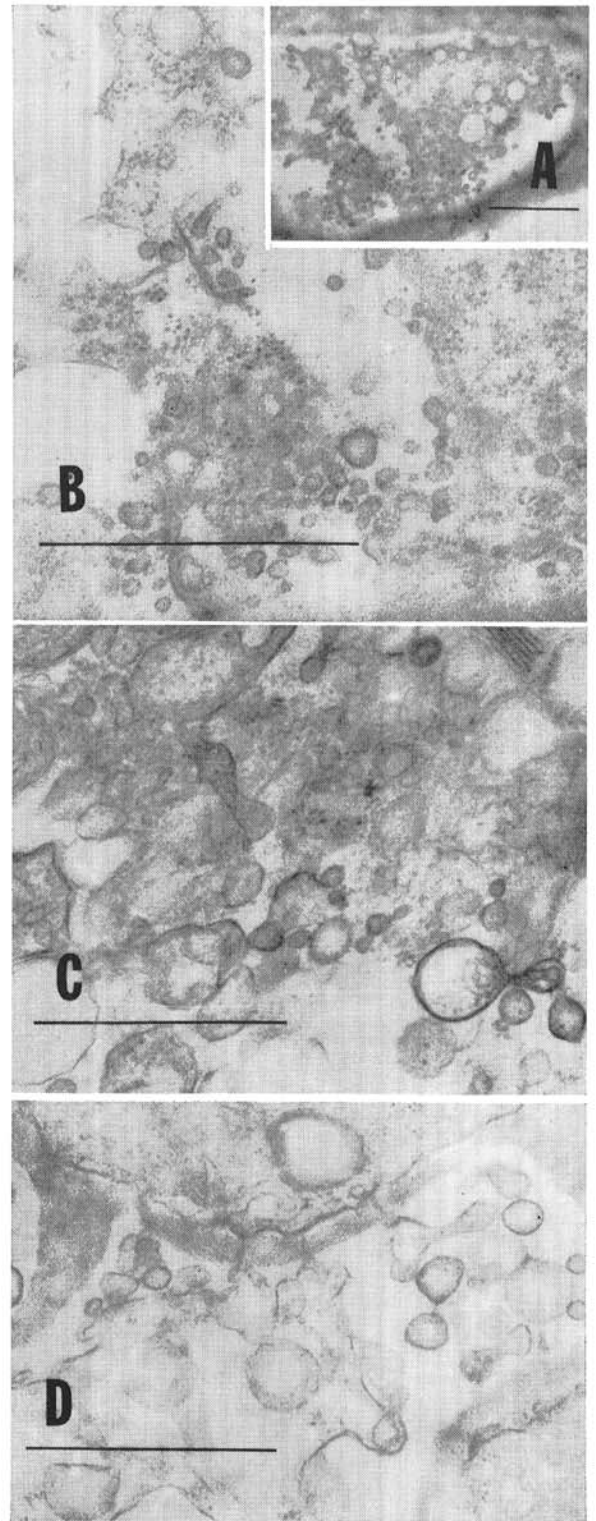


Fig. 2. Electron micrographs (at different magnification) of A, B) vascular tissue, and C, D) degenerate mesophyll, from haywire-infected potato, indicating presence of pleomorphic bodies. Scale line indicates 1 μ .

mission to potato has been confirmed (4). However, foliar rubbing or razor slashing the stems with crude sap, concentrated extract, or with phenol extract from infected tissues were unsuccessful. Rutgers tomato grafted with haywire-infected potato displayed yellows in the meristem region accompanied by filiform leaves with purple margins within 30 to 60 days. No evidence of "big-bud" symptoms (8) were observed.

Tetracycline antibiotics were administered in hydroponics solution (American Hydroponics Farms, 12-12-20) to plants grown in perlite medium. Disappearance of haywire symptoms in new growth was obtained when diseased specimens of Nebraska-grown potatoes, collected in Alabama or western Nebraska, were grown in 200 ppm chlorotetracycline. In most cases, some tuber formation was initiated within 1 month after administration of the antibiotic. Figure 1 shows the effect on (a) healthy new growth and (b) tuber formation elicited by the presence of the chlorotetracycline. These newly initiated tubers (0.5-3 cm in diam) could be immediately sprouted without pretreatment to break dormancy, and resulted in healthy growth. However, when removed from the tetracycline and transplanted to soil, haywire symptoms recurred in 50% of the plants within 30 days.

Leaf tissues from naturally infected potato were minced in cold 4% glutaraldehyde in 0.1 M phosphate buffer, pH 7.0, further fixed in 2% OsO₄, and embedded in Spurr low-viscosity embedding epoxy (7). Thin sections were cut with glass knives in a Porter-Blum MT-1 ultramicrotome and stained with 5% aqueous uranyl acetate and lead acetate. Pleomorphic bodies (50-300 m μ in diam) could be visualized in phloem and mesophyll contiguous to vascular tissue (Fig. 2-A, B). Degenerate cells with structures in apparent stages of budding were observed only in haywire-infected tissues (Fig. 2-C, D). Similar structures were not found in healthy potato.

The structures observed in infected tissues and the

disappearance of symptoms by tetracycline antibiotics suggest that the causal agent of the haywire disease is a mycoplasma and not a virus. The relationships among the big-bud of tomato (2), bunch-top disease (5), purple-top wilt (1), or aster-yellows (9) and haywire remains obscure. Nevertheless, similarities of the disease expression and properties are suggestive that a common organism or closely related organisms may be implicated as the causal agent(s) for this disease complex. This possibility is further supported by the presence of mycoplasmal bodies associated with aster yellows and purple-top wilt (6), big-bud of tomato, and now haywire.

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