Meloidogyne incognita: A Metabolic Sink[1]

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Chlorosis, stunting, and aggravation of nutrient deficiencies are symptoms frequently associated with infection by the root-knot nematodes *Meloidogyne* spp.. Wallace (4) treated tomato plants with $^{14}CO_2$, after they were infected by *M. javanica,* and concluded that the formation of syncytia and galls did not result in the creation of metabolic sinks and that increased metabolic activity in the roots did not result in an increased mobilization of nutrients from tops to roots.

Bird and Loveys (1) found that galls and egg masses on infected plants exposed to $^{14}CO_2$ contained about 6 times as much ^{14}C as did adjacent root tissues and that maximum incorporation of labelled photosynthate corresponded to maximum growth and activity of the syncytia. They concluded that organic nutrients required by the nematode originate as products of photosynthesis and that the nematode acts as a metabolic sink. Our results confirm and extend the conclusions of Bird and Loveys (1).

Tomato plants (*Lycopersicon esculentum,* Mill; 'Bonnie Best') were inoculated

Received for publication August 1976.

[1] Journal Paper No. 2659 of the Arizona Agricultural Experiment Station. Conducted as an exercise in Plant Pathology 275b "Methods in Plant Pathology" by the following students: M. de Mendonça, S. Dong, J. Khalil, A. Llanes, M. Miller, C. Roll and T. Sprenger.

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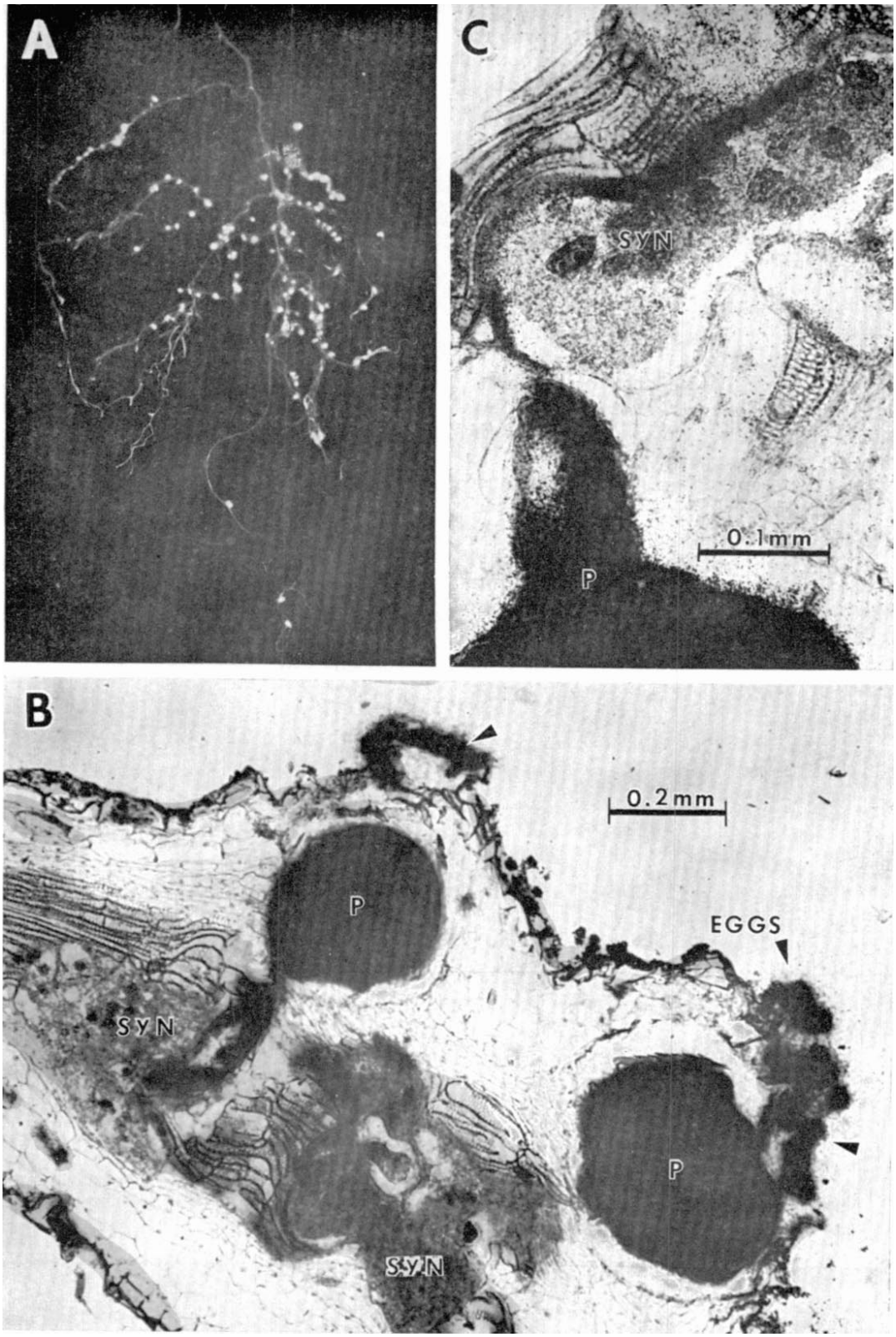

FIG. 1-(A-C). Autoradiographs of tomato roots infected with *M. incognita*. *A)* Intact portion of freeze-dried root system (actual size). *B)* Longitudinal; section through gall. *C)* Longitudinal section of lightly labelled syncytium. P = parasite (adult female); syn = syncytium.

with 5,000 larvae of *M. incognita* 5 weeks after being sown and exposed 4 weeks later to 500 μCi $^{14}CO_2$ from barium carbonate according to the method of Bird and Loveys (1). Labelled plants were harvested 5 days after exposure to $^{14}CO_2$ and the roots either freeze-dried or fixed in FAA, imbedded in paraffin, and sectioned for autoradiography (3). Freeze-dried roots were autoradiographed by placing them in contact with Kodak medical X-ray film for 4-7 days. Replications consisted of 3 plants treated with $^{14}CO_2$, and 1 plant, treated with a comparable volume of air, served as a control.

Noninfected portions of roots contained detectable amounts of radioactivity 5 days after exposure to $^{14}CO_2$, but most of the activity was located at the infection site (Fig. 1-A). Autoradiographs of sectioned galls showed that little activity was associated with hyperplastic cortical cells (Fig. 1-B) and that syncytia were only lightly labelled. In contrast, mature female nematodes and their eggs (Fig. 1-B, C) were so intensely labelled that the exposed photographic emulsion was opaquely black and visible to the unaided eye in prepared sections. Thus, if syncytia are considered to be multinucleate forms of transfer cells (2) and mobilization of photosynthates to these cells occurs, the nematode is capable of nearly exhausting those products in 5 days or less. Labelling patterns of roots and nematodes support the concept that syncytia are forms of transfer cells and that root-knot nematodes act as metabolic sinks.

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