

# RESEARCH NOTES

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## Histopathology of Root Gall Induced in Tomato by *Globodera pallida*

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*Key words:* cell hypertrophy, *Globodera pallida*, cyst nematode, histopathology, *Lycopersicon esculentum*, tomato, root gall, syncytium.

Several species of plant-parasitic nematodes induce root galls. Root tip galls are common symptoms of infection by *Subanguina radiculicola* (Greeff) Param., *Hemicy-*

*cliophora arenaria* Raski, *Longidorus* spp., *Paratrichodorus* spp., *Trichodorus* spp., or *Xiphinema* spp. (6,7,9). Galls on root tips and root axes are specific symptoms of *Meloidogyne* spp. and *Nacobbus* spp. infections (4). Galls on root axes have also been reported on only some hosts of *Rotylenchulus macrodoratus* Dasgupta, Raski, and Sher (8). Among species of Heteroderidae, root galls have been reported only in tomato (*Lycopersicon esculentum* Mill.) infected by *Globodera rostochiensis* (Woll.) Mulvey and Stone (1,2,5). We report an unusual swelling of tomato roots infected by a Chilean population of *G. pallida* (Stone) Mulvey and Stone. The pathology of this root reaction

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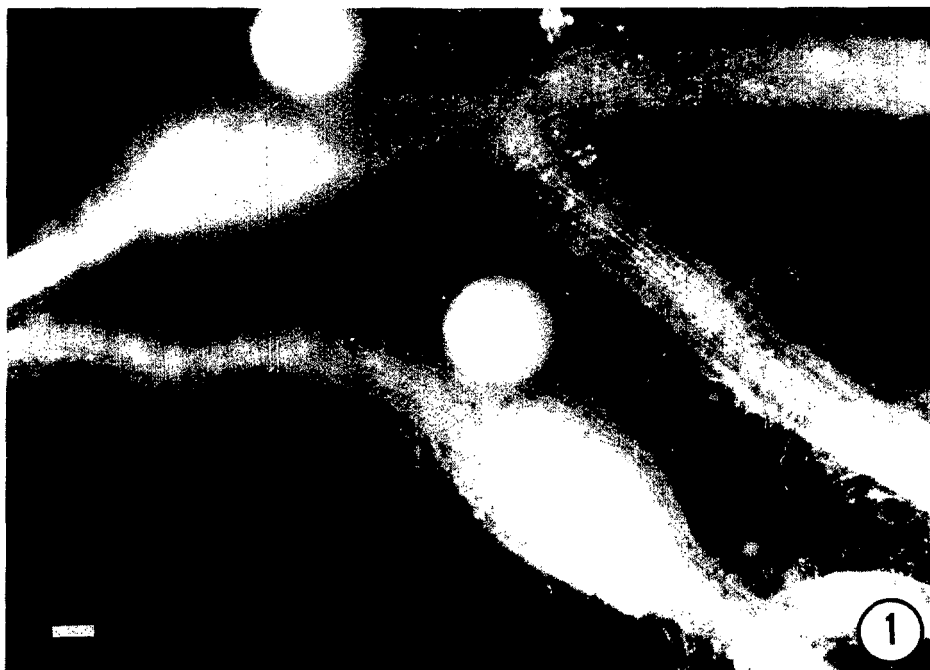


FIG. 1. Tomato root galls infected with white females of *Globodera pallida*. Scale bar = 175  $\mu$ m.

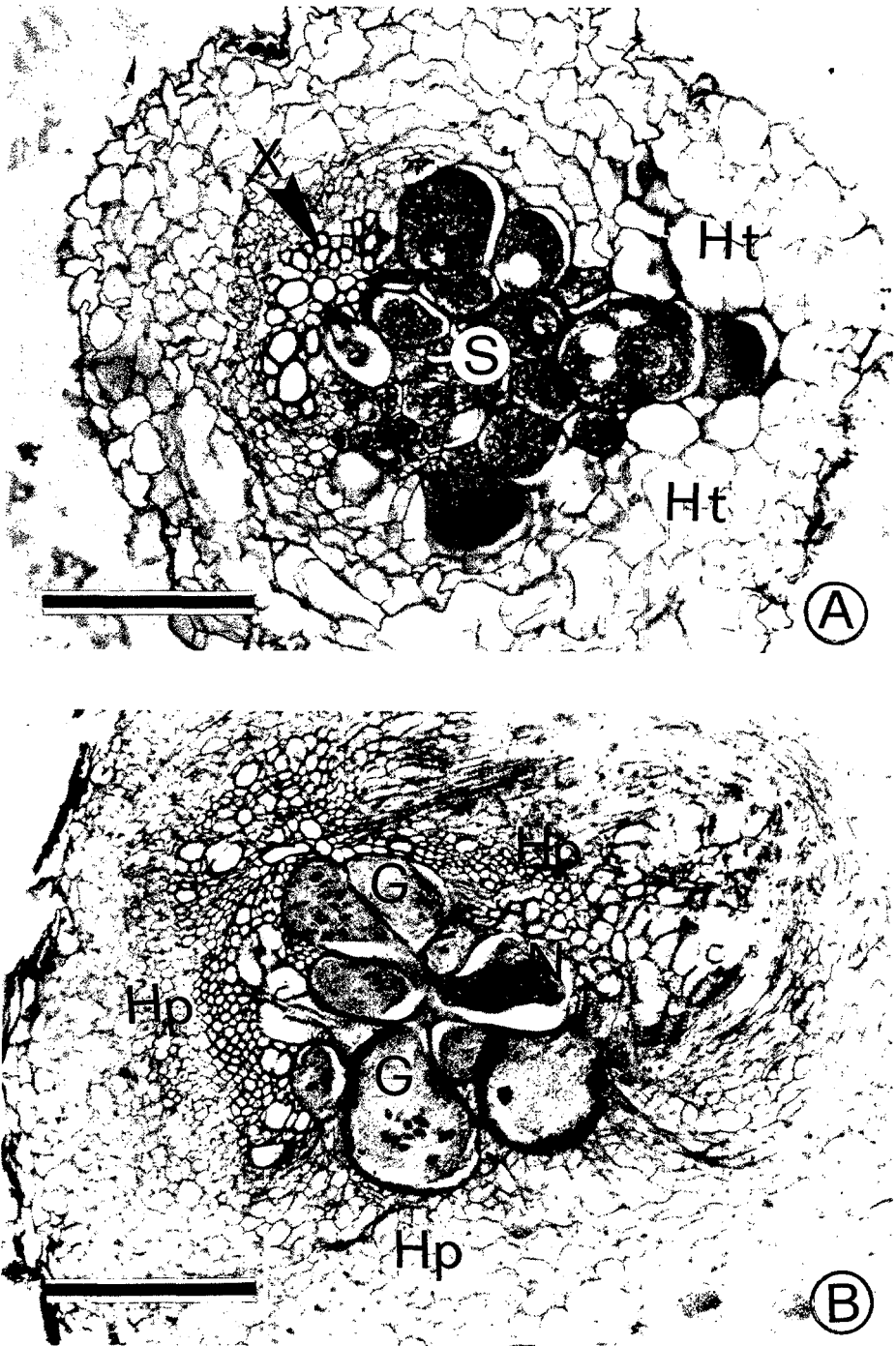


FIG. 2. Histological changes induced by *Globodera pallida* and *Meloidogyne incognita* in tomato root. Scale bars = 175  $\mu$ m. A) Root gall cross section showing an enlarged syncytium (S) induced by *G. pallida* and surrounded by enlarged cortical cells (Ht). Note normal cortical cell size in the portion of the root section not invaded by syncytium (X = xylem). B) Root gall cross section showing an *M. incognita* female (N) near the feeding site among giant cells (G). Hyperplasia (Hp) is evident in the vascular and cortical parenchyma. Note asymmetry of the root structures and fragmentation of the stele by the giant cells.

is described and compared to root galls induced by *M. incognita* (Kofoid and White) Chitwood in tomato.

Tomato (cv. Roma) root galls induced by females of either *G. pallida* or *M. incognita* were fixed in formalin-acetic acid-ethyl alcohol dehydrated in tertiary butyl alcohol series, embedded in paraffin, sectioned at 10  $\mu$ m, stained with safranin and fast-green, mounted in Dammar xylene, and examined microscopically (3).

*Globodera pallida* galls occurring along the root axis were 1.5–2 times normal root diameter. However, they were smaller than galls induced by *M. incognita* (0.5–0.8 mm wide  $\times$  1.0–1.5 mm long vs. 2.5–3.0 mm wide  $\times$  4.0–5.0 mm long). Usually a *G. pallida* female was attached to the apical or basal end of a gall (Fig. 1). Histological sections showed little hyperplasia but much hypertrophy of cortical parenchyma cells adjacent to the syncytium induced by the nematode. These cortical cells were 1.5–2 times larger than cortical cells in the portion of the root section not invaded by the syncytium (Fig. 2A). The expansion of the syncytium caused asymmetry of the root structure (Fig. 2A).

By comparison, sections through galls induced by *M. incognita* showed an extensive hyperplasia of vascular and cortical paren-

chyma adjacent and away from giant cells induced by the nematode (Fig. 2B). Asymmetry of root structure and stele fragmentation by giant cells also were observed (Fig. 2B).

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