ROOT AND CELL RESPONSE TO FEEDING BY *XIPHINEMA INDEX*

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Feeding was observed and examined on seedlings of *Ficus carica* and *Lycopersicon esculentum* under gnotobiotic conditions in agar culture.

Growing roots of fig seedlings were usually first attacked in the zone of elongation. The tips of such roots progressively swelled and developed into proliferating galls when feeding was continued for several days. Galled root-tips remained strongly attractive to feeding nematodes. About 1.0 µm thin sections through such galls revealed multinucleate and hypertrophied cells beneath and between necrotic cells at feeding sites. These modified cells, induced under aseptic conditions, were orientated to feeding sites. They were filled with cytoplasm and contained agglomerations of hypertrophied, lobed, nuclei with enlarged nucleoli. In serial sections up to 25 nuclei were counted in one single hypertrophied cell. This multinucleate condition appeared to arise from repeated mitoses without cytokinesis. In older cells signs of cell wall dissolution were quite common. Empty multinucleate cells adjacent to undamaged cells indicated that they were probably directly parasitized by feeding nematodes.

The possible function of the modified cells is discussed. Their induction appears to be a precondition for a successful host-parasite relationship. Single females produced many eggs when feeding on galled root-tips of fig seedlings. Egg production was, however, not induced when feeding was confined to root-tips of tomato seedlings which responded only with a slight swelling. Sections through parasitized tomato root-tips showed only necrotic cell reactions at feeding sites.

The plant parasitic nematode *Xiphinema index* Thorne & Allen is a serious parasite of vines throughout the world. It causes direct damage by feeding on the roots of grapevine and indirect damage by transmitting grapevine fanleaf virus which causes serious crop losses. The tips of grapevine roots, fed upon by *X. index*, stop growing and swell to form galls. The galls are composed of enlarged, multinucleate cells with dense cytoplasm beneath a layer of necrotic epidermal and outer cortical cells (Weischer & Wyss, 1976). The induction and possible function of these cells in the host-parasite-relationship is uncertain, but it is most probable that the modified cells are induced by the injection of salivary fluids during feeding.

Present knowledge about the process of salivation in Longidoridae is still fragmentary (Wyss, 1978). It was recently shown, from analysis of a research film 1), that *X. index* might release salivary fluids into the perforated cell during the short phase of prolonged oesophageal bulb elongation which occurs just after odontostyle penetration and probably also during the brief ingestion pauses

1) Film E 2375 der Encyclopaedia Cinematographica, Göttingen (in press).
(Wyss, 1977a). For these studies X. index was maintained on roots of fig seedlings on which it reproduced in agar culture (Wyss, 1977b). The main purpose of the present study was to obtain a deeper insight into the host-parasite-relationship between X. index and fig seedlings under aseptic conditions. Special emphasis was placed on the nature and possible function of nematode-induced 'giant cells'.

**MATERIALS AND METHODS**

The response of roots and root cells to feeding by X. index was examined under aseptic conditions. Seeds of Ficus carica (fig) and Lycopersicon esculentum (tomato cv Haubners Vollendung) were soaked overnight in distilled water and then surface sterilized for 20 min. in a filtered 4% Ca(OCl)_2·4H_2O solution. The seeds were afterwards washed for 1 hour in sterile distilled water and then transferred onto 1% _aqua dest._ agar for germination in daylight (fig) and darkness (tomato) at 25-28°C. A few days after emergence of the radicle (fig, 3-4 weeks; tomato, 2 days) the seedlings were transferred onto 0.6% _aqua dest._ agar in Petri dishes, and a few drops of Hoagland’s solution No. 1 were added. Fine sand particles were scattered beforehand over the still liquid agar.

The nematodes, maintained on fig plants in the glasshouse, were surface sterilized by exposing them for 90 min. in batches of about 50 to a 0.03% NaN_3 solution in staining blocks. All nematodes were soon immobilized after transfer into the sterilant. After the treatment the NaN_3 solution was sucked off and twice replaced in quick successions with sterile water. The nematodes were transferred with a sterile microneedle to 0.6% agar containing growing fig or tomato seedlings. About 60% of the treated nematodes survived and dispersed into the agar. Usually some contamination occurred on the surface of the agar at the point where the nematodes were added. However, when clean nematodes were removed from the agar and transferred to other plates, the cultures remained free from contamination for many weeks. The plates were sealed with parafilm and were kept at 25 ± 1°C at a low light intensity of 700 lux (16 h exposure/day). The response of the roots to feeding was studied with inoculations of single individuals (female, L4) or with inoculations of up to 40 nematodes (females and late larval stages) per Petri dish.

To study the response of the root to feeding by X. index, parasitized root-tips and older parts of the roots (tomato) were fixed, dehydrated and embedded in plastic as described by Wyss (1975a). 0.5-1.0 μm thick sections were cut with a dry glass knife and then stained in 0.1% toluidine blue.

**RESULTS**

**Root response**

When the seedlings were infested with single females or single L4-stages the tap root was usually selected for primary attacks. In 34 out of 40 observations