THE EFFECT OF DELAYED EMERGENCE ON INFECTIVITY OF JUVENILES OF THE POTATO CYST NEMATODE GLOBODERA ROSTOCHIENSIS

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The potential infectivity of second stage juveniles of Globodera rostochiensis was influenced by the amount of their lipid reserves at the time of hatching. Scanning microdensitometry showed that stimulation of hatch by potato root diffusate increased lipid utilization by the unhatched juvenile and late hatching individuals had a significantly reduced lipid content at eclosion. Late hatching juveniles had impaired infectivity and delayed development compared with juveniles emerging from the same cysts soon after stimulation. This effect was not caused by initial differences in lipid content. The results are discussed in the context of the significance of delayed hatching in G. rostochiensis.

Keywords: Hatching, lipid reserves, invasion, development, host-parasite relations, plant nematodes.

The hatching of the potato cyst-nematode Globodera rostochiensis is highly dependent on host root diffusates, although a 30-50% annual decrease in numbers may occur in the field in the absence of a host crop (Oostenbrink, 1950). The rate of hatch of G. rostochiensis varies considerably in the field depending on soil moisture, soil aeration and temperature (Jones, 1975). Conditions can be standardised in laboratory based hatching tests (Fenwick & Widdowson, 1958) and the timescale of the response of G. rostochiensis to root diffusate can be studied. Hatching may continue for 3 or 4 months but the majority of second stage juveniles emerge from cysts during the first 1 or 2 weeks after stimulation by potato root diffusate (Fenwick, 1949). After hatching, the juveniles of Globodera spp. remain infective for a limited period and this has been correlated with the extent of their initial neutral lipid reserves (Storey, 1984). A decline in lipid reserves during storage has also been associated with a reduction in mobility of a number of plant and animal parasitic nematodes (Van Gundy, Bird & Wallace, 1967; Croll & Matthews, 1973; Ogunfowora, 1979). However, the infectivity of juveniles emerging from cysts at various times after exposure to host root diffusate has not been studied. This work therefore investigates the effect of delayed emergence on the neutral lipid content and subsequent ability of juveniles to invade host roots.
Cysts of _Globodera rostochiensis_ Ro1 were produced on pot-grown plants cv. Arran Banner, extracted by standard methods (Shepherd, 1970) and stored after air-drying at room temperature (20°C) for 15 months until the start of experiments in November, 1982. Hatching tests were carried out at 20°C with batches of 25 cysts in four-fold replication. The cysts were soaked in distilled water for 7 days before juveniles were stimulated to hatch by replacing the water with potato root diffusate (PRD). The PRD was obtained from potato plants cv. Arran Banner as described by Shepherd (1970) and diluted with distilled water (1 in 4) to give an optimum dilution for hatching. Numbers of juveniles emerging were recorded at regular intervals and the PRD was replaced after each count with fresh stock kept at 5°C. After 23 days, the cysts were broken open and the number of viable unhatched juveniles counted in order to estimate the percentage hatch between each sampling period. Four replicates of 25 cysts were used for the hatching test at 20°C and further batches were used for the infectivity tests.

Three classes of nematodes were compared in the analyses of lipid reserves. In the first two groups, the relative lipid reserves of at least 40 naturally hatched and artificially hatched juveniles were compared at 2, 5, 8, 12 and 16 days after exposure to PRD. The controls, which were sampled at the same times, were a group of artificially hatched nematodes which did not receive PRD after soaking but were kept in distilled water. Neutral lipids were stained with Oil Red O (G. T. Gurr) according to the methods of Storey (1984) and the lipid content of whole juveniles was quantified with a Vickers M86 scanning microdensitometer (Croll, 1972; Storey, 1981). The unhatched samples were obtained for analysis of lipid reserves by removing eggs from 40 cysts and releasing the juveniles by gently squeezing at least 100 eggs between 2 cover slips.

The relative infectivity of a range of early to late hatching juveniles was compared using the small pot tests of Storey (1981) which were modified by the inclusion of a sintered glass disc (porosity 4, Gallenkamp Ltd.) to provide better control of sand moisture content. Seeds of tomato cv. Moneymaker were germinated in EFF compost at 20°C and after 1 week groups of 3 seedlings were washed and transplanted to 3.5 cm diameter pots containing 40 g of acid washed sand (Fisons) with 150-400 μm particle size. The pots were maintained at pH 1.65 which is the optimum moisture content for nematode mobility and invasion in this sand (Wallace, 1958) and the seedlings were grown in the greenhouse at 16-20°C, 70-80% r.h. and 18 h light each day. After 14 days in the pots, the seedlings were inoculated with 4 replicates of 200 hatched juveniles per pot, whose average emergence time after stimulation by PRD was 1.5, 5, 7, 9.5, 12, 15, 18.5 or 19 days respectively. Tomato seeds were germinated at various times so that all were the same age at the time of inocula-