THE EFFECT OF NITROGEN DEFICIENCY ON THE GROWTH OF MELOIDOGYNE JAVANICA AT DIFFERENT POPULATION LEVELS

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The rates of growth of *M. javanica* at different population levels have been measured in tomatoes grown on either full nutrient or in the absence of nitrogen.

At low inoculation levels (40 larvae/plant) there is an acceleration of growth in nitrogen deficient plants. At higher inoculation levels (400 larvae/plant) this rate of growth declines and is significantly less than in plants grown on full nutrient.

At higher inoculation levels (4000 larvae/plant) the rates of growth of the nematodes in both treatments is considerably reduced.

Males were found in the treatments in which the ratios of number of nematodes in inoculum per gram of fresh weight of plant were highest. At the highest inoculation levels the nematodes significantly influenced the rates of growth of tomato plants grown either on full nutrient or in the absence of nitrogen, although this was more pronounced in the absence of nitrogen.

The hypothesis is advanced that the rate of growth of *M. javanica* is related to the degree of stress to which it is subjected. A little stress leads to an acceleration in the rate of growth and further stress leads to the production of males and a slowing down of the overall rate of growth of the particular population under consideration.

In two recent publications (Davide & Triantaphyllou, 1967b; Sembdner, 1968) attention has been directed to an apparent anomaly that exists in the findings of some workers investigating growth of nematodes belonging to the family Heteroderidae. It has been reported (Bird, 1960) that, at low levels of infection, nematode growth is more rapid in nitrogen deficient plants than in plants grown on full nutrient. However, the experiments of various other workers (Oteifa, 1951, 1953; Marks & Sayre, 1964; Davide & Triantaphyllou, 1967b) are thought (Sembdner, 1968) to contradict these findings.

It is incorrect to state that there is any contradiction in these results because not only are the species and host plants different in most instances but the medium in which the plants were grown, the type of element deficiency being examined and the number of larvae in the inoculum are also different. Thus, no two of these experiments are alike. Rates of growth can be effectively compared only if changes in size are plotted as growth curves.

In view of the conflicting results described above, rates of growth must be measured under standardized conditions that are readily reproducible in order that reliable comparisons be made.

In this paper I describe rates of growth of *M. javanica* at different population levels in tomatoes grown on either full nutrient or in the absence of nitrogen using methods and conditions which can be readily reproduced.
MATERIALS AND METHODS

Tomato seedlings (var. Tatura dwarf) were grown singly in sand of particle diameter 150 μ-250 μ supported on a disc of phosphor bronze mesh in plastic propagating tubes 4 cm in diameter by 7.5 cm in length. These seedlings were watered once after germination with a full strength Hoagland's solution made up as previously described (Bird, 1960) with the exception that ferric E.D.T.A. was not specially prepared but was made up directly from a commercially available salt. The seedlings were subsequently watered with distilled water. When the seedlings had grown to the two-leafed stage they were divided into three groups of forty-eight. Each group was set in a tray containing about 5 cm of "Perlite". Each seedling was inoculated with 2 ml of a nematode suspension containing either 40, 400 or 4,000 freshly hatched larvae, depending on which group they were in.

The plants were exposed to infection for three days, after which time it was estimated that under these conditions, which are known to be particularly favourable for infestation (Wallace, 1969), the majority of larvae would have entered the roots. Each plant was then removed very gently from the sand in its cylinder by immersing the entire cylinder in distilled water so that the sand was washed away and its roots floated free. The seedlings were set up in groups of four for water culture experiments as follows:

They were supported over 2 l plastic buckets by half inch thick polystyrene foam lids. Each plant was held in place by means of a plastic stopper which had had a hole drilled through it and had been split lengthways so that the seedling could be placed through it without any damage to the roots. These stoppers fitted into holes drilled through the lids (four per lid). The lids themselves were an improvement on the more solid types used previously because they could easily be broken away from the root thus minimizing damage to the plant when it was harvested. Air was bubbled through the nutrient solutions in the plastic buckets by means of glass tubes which passed through the centres of the lids.

Half of the plants were grown on full nutrient solution and the other half on a nitrogen deficient solution made up as described previously (Bird, 1960). The plants were grown in an air-conditioned glasshouse at temperatures which fluctuated evenly between a minimum of 18°C and a maximum of 33°C. Plants were harvested five times at 7, 12, 15, 19, 22 and, in some cases, 25 days after they had been placed in the water cultures. At each harvest six containers (i.e. one from each of the nutrient-population treatments) each containing 4 plants were disconnected from the air supply and each whole plant and its root were weighed. The roots were fixed and stained by placing them in 1% osmium tetroxide in distilled water for 1 hour at 40°. After this they were washed several times in distilled water and nematodes were dissected from all of them. The nematodes dissected from each group of four plants were pooled and an aliquot was selected at random using a wide mouthed pipette. These nematodes were placed in distilled water on slides. Several pieces of broken coverslip acted as