*Nematol. medit.* (1977), 5: 17-24.

*Department of Zoology University of Nigeria - Nsukka, Nigeria*

# STUDIES ON THE PATHOGENICITY OF *HOPLOLAIMUS INDICUS* SHER TO TOMATO AND CITRUS PLANTS

by

J. C. GUPTA

A previous study (Gupta and Atwal, 1971) showed that tomato and some species of citrus were favourable hosts for the reproduction of *Hoplolaimus indicus* Sher, 1963. In the Indian Punjab large numbers of this nematode were found in the rhizosphere of plants in tomato fields and citrus orchards where yields were declining. The experiments discussed here investigated the effect of different population levels of *H. indicus* on these plants.

## *Materials and methods*

Tomato (*Lycopersicon esculentum* Mill.) and six species of citrus, namely, rough lemon (*Citrus jambhiri* Lush.), karna khatta (*C. karna* Raf.), mandarin (*C. reticulata* Blanco), sweet orange [*C. sinensis* (L.) Osbeck], lemon [*C. limon* (L.) Burm.] and trifoliate orange [*Poncirus trifoliata* (L.) Raf.] were grown from surface sterilized seeds in steam sterilised soil in seed boxes. At 15 days post-germination the plants were planted singly in 22.5 cm clay-pots containing a mixture of sterilised sandy loam and farmyard manure and the pots transferred to a glass house at 25-30° C. Suspensions of nematodes were poured on to the surface of the soil close to the base of the plant stem to provide populations ranging from 100 to 8,000 females per 500 g of soil and males in the ratio 4:1 (females: males). There were five replicates for each treatment which were arranged

randomly on the benches. The plants were sprayed twice weekly with nicotine sulphate to protect them from insect attack.

The tomato and citrus plants were grown for 3 and 6 months respectively after transplanting. The plants were observed for variation in leaf colour,curling and drooping of leaves, dieback of twigs etc., at weekly intervals throughout the duration of the experiment. At the end of the experiment shoots (minus leaves) and roots were weighed and the length of the shoots and roots were measured. Discolouration, lesions and development of feeder roots were noted.

## *Results*

### TOMATO

Plants exposed to populations of 100 nematodes/500 g soil did not differ from untreated controls. Plants exposed to 1.000 nematodes showed yellowing of leaves and reduction in growth at 1½ months and at higher nematode populations at one month after the start of the experiment. At 2½ months, plants died in the pots with an initial population level of 4,000 nematodes and those with 2,000 nematodes showed reduced growth, weak stems and drooping of leaves. Shoot and root weights decreased in relation to nematode numbers (Table I).

Table I - *Mean fresh weights (g) of tomato shoots and roots per five plants at different initial population densities of* H. indicus.

| Initial population density per 500g of soil | Shoot weight | Root weight |
|---|---|---|
| 0 | 70 | 16 |
| 100 | 70 | 16 |
| 1000 | 62 | 14 |
| 2000 | 40 | 8 |
| 4000 | 11 | 1 |
| LSD at 5% | 2.42 | 1.36 |
| LSD at 1% | 3.36 | 1.88 |

I) *Citrus jambhiri*:

Symptoms of attack were apparent three months after exposure to the initial population levels of 4,000 and 8,000 nematodes; the leaves were generally yellow with the margins rolled and dry; two months later the leaves began to fall and at the end of the experiment only a few leaves were left on the plants with 8,000 nematodes. Marked differences were observed in the growth of the shoots and roots at different levels of nematode population (Diagr. I, II, III and IV).

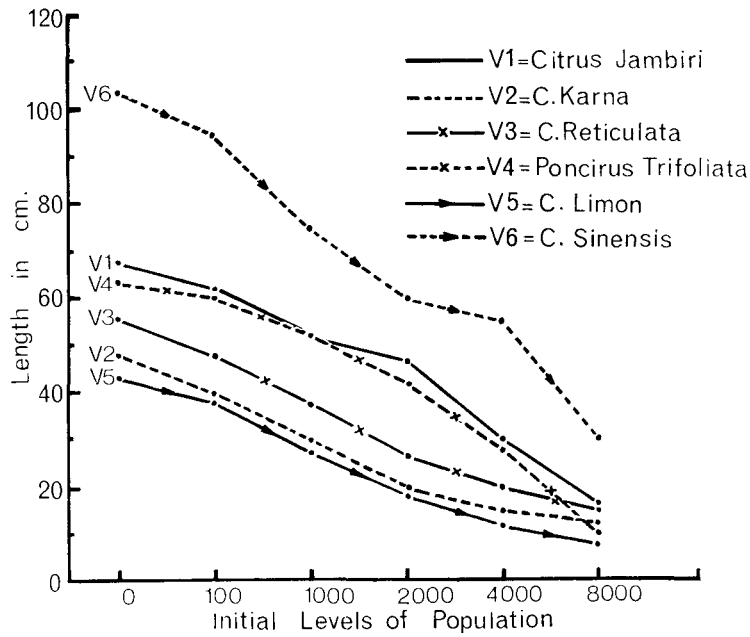


Diagram I - Effect of population levels of *H. indicus* on the shoot length of different citrus species.

II) *Citrus karna*:

Symptoms associated with nematodes were similar to those in *C. jambhiri* but there was interveinal yellowing of leaves which was

different from that occurring in other species. Differences in growth were again observed in relation to nematode populations (Diagr. I, II, III and IV).

III) *Citrus reticulata*:

In addition to symptoms of yellowing and rolling of the leaves, die-back of the twigs was observed in plants exposed to populations of 8,000 nematodes. There were significant decreases in the length and weight of shoots and roots related to the populations of *H. indicus* (Diagr. I, II, III and IV).

IV) *Citrus sinensis*:

This was the most susceptible citrus species to *H. indicus*. Lengths and weights of shoots and roots were affected at all nematode population levels (Diagr. I, II, III and IV). Plants with 8,000

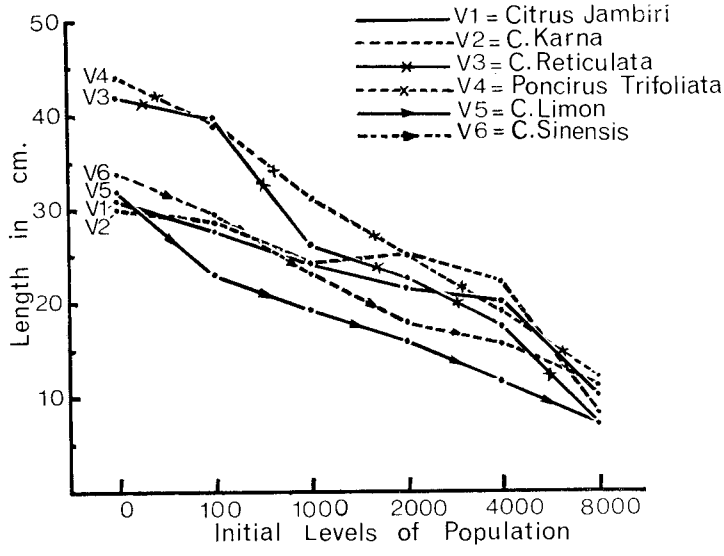


Diagram II - Effect of population levels of *H. indicus* on the root length of different citrus species.

nematodes began to show symptoms of decline as early as two months after inoculation. Most of the plants showed stunted growth and some died before the end of the experiment.

V) *Citrus limon*:

Distinct yellowing of the leaves occurred in plants exposed to 8,000 nematodes. Three months after inoculations, weakening of leaf base was observed in pots with 4,000 and 8,000 *H. indicus* and this

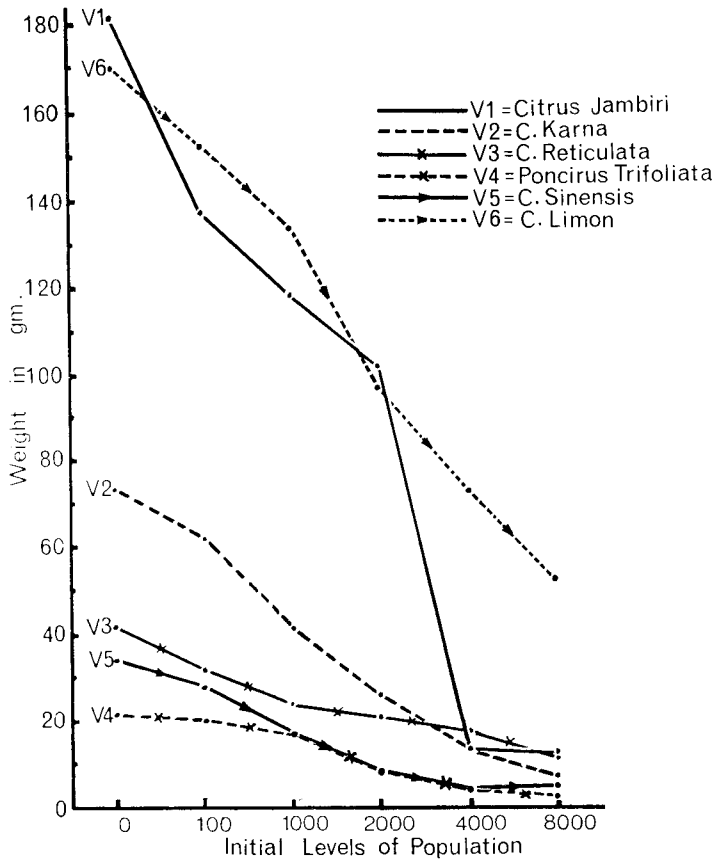


Diagram III - Effect of population levels of *H. indicus* on the fresh weight of shoots of different citrus species.

led to the shedding of leaves subsequently. Reduction in growth was observed in all the treatments in comparison with the control (Diagr. I, II, III and IV).

VI) *Poncirus trifoliata*:

Nematodes at all population levels apparently caused a decrease in growth compared with the control but no other symptoms associated with nematode attack were observed in this species (Diagr. I, II, III and IV).

*Root examination*: All infected plants had discoloured feeder roots but it was particularly severe in *C. jambhiri, C. karna* and *C. sinensis*. Staining of the roots showed the presence of *H. indicus* in the root tissues of these three species.

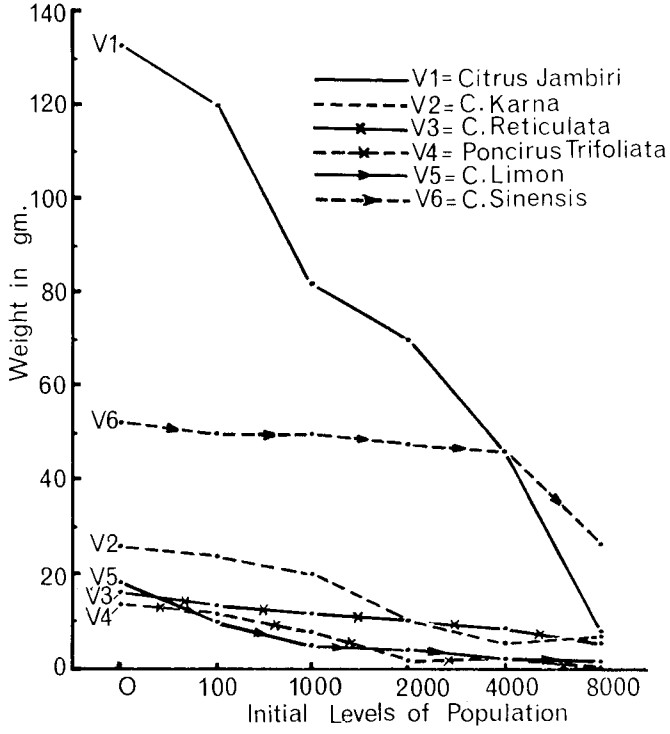


Diagram IV - Effect of population levels of *H. indicus* on the fresh weight of roots of different citrus species.

## *Discussion*

Although inocula of 100 and 1,000 *H. indicus* caused some reduction of plant growth, a remarkable reduction was observed at and above an initial population level of 2,000. Tomato plants did not survive an initial nematode population level beyond 4,000 even for a few weeks.

None of the citrus root-stocks used in the experiment were completely resistant to *H. indicus* attack. It is therefore recommended that soil sterilization should be undertaken on any site chosen for citrus plantation where there are more than 2,000 *H. indicus* per 500 g of soil.


## *Acknowledgement*

The author sincerely acknowledges the help rendered by Dr. A. S. Atwal of the Punjab Agricultural University Ludhiana (India) in the completion of this study.



## SUMMARY

At initial density of 2,000 females and 500 males/500g of soil of *Hoplolaimus indicus* Sher produced visible symptoms of attack both in tomato and citrus species. Out of the six citrus species, *Citrus jambhiri* Lush., *C. karna* Raf., *C. reticulata* Blanco, *C. sinensis* (L.) Osbeck, *C. limon* (L.) Burm. and *Poncirus trifoliata* (L.) Raf., none was completely resistant to the attack of the nematode.



## RIASSUNTO

*Studi sulla patogenicità di* Hoplolaimus indicus *Sher verso Pomodoro ed Agrumi.*

Densità iniziali di popolazioni di 2.000 femmine e 500 maschi di *Hoplolaimus indicus* Sher hanno prodotto sintomi visibili degli attacchi del nematode su piante di Pomodoro e di Agrumi. Delle sei specie di Agrumi saggiate, *Citrus jambhiri* Lush., *C. karna* Raf., *C. reticulata* Blanco, *C. sinensis* (L.) Osbeck, *C. limon* (L.) Burm. e *Poncirus trifoliata* (L.) Raf., nessuna è risultata completamente resistente agli attacchi del nematode.

## LITERATURE CITED

GUPTA, J. C. and ATWAL, A. S., 1971. Biology and ecology of *Hoplolaimus indicus* (Hoplolaiminae: Nematoda). II. The influence of various environmental factors and host plants on the reproductive potential. *Nematologica, 17*: 277-284.

Accepted for publication on 2 December 1976.