*Nematol. medit. (1999), 27: 27-29*

*Division of Entomology and Nematology, Indian Institute of Horticultural Research, Hessaraghatta Lake P. O., Bangalore - 560 089, India*

# CONCOMITANT INFLUENCE OF HYDROGEN PEROXIDE, WATER TEMPERATURE GRADIENT AND ROOT PROCESSING METHOD ON BURROWING NEMATODE EGRESS FROM BANANA ROOTS[1]

by

RASHID M. KHAN and P. PARVATHA REDDY

**Summary**. Splitting of banana roots and their incubation at 25 °C (±2 °C) in plain tap water yielded a significantly higher and physiologically active population of *Radopholus similis*. Conversely, split root incubation in hydrogen peroxide (20 ml/lit) at 20 °C yielded a higher population as compared to split root incubation at 20 °C in tap water. By and large root splitting had a positive influence on nematode egress from roots compared to unsplit roots.

The burrowing nematode, *Radopholus similis*, is one of the most damaging pests of banana (Gowen and Quénéhervé, 1990). Precise quantification of nematode population inhabiting a given sample/observational unit(s) of root/rhizome is of prime concern for a variety of studies pertaining to population dynamics, management strategies, quarantine inspection/detection and diagnostic surveys undertaken to assess the population in infested/uninfested regions. Furthermore, a fairly large population is required to conduct experiments under pot culture/microplot conditions.

Incubation techniques utilizing hydrogen peroxide (3%) as an incubation medium and varying temperature ranges viz., 21.3 °C (Tarjan, 1972), 1-3% hydrogen peroxide with temperature ranges of 20.7-21.8 °C (Tarjan, 1967) have been found effective in extracting a relatively higher population of *R. similis*. Likewise, the beneficial role of hydrogen peroxide and temperature in extracting a significantly higher population of the citrus nematode, *Tylenchulus semipenetrans*, has been further ascertained (Tarjan, 1972). Moreover, realization about the parasitic nature of *R. similis* has also given an understanding about the positive influence of root chopping/maceration on the higher recovery of *R. similis* from banana roots (Gowen and Edmunds, 1973). The current investigation was undertaken to monitor the concomitant influence of varying degrees of controlled temperature with root chopping and incubation media viz., hydrogen peroxide and tap water, vis-a-vis unchopped roots and room temperature on the recovery of *Radopholus similis* (Cobb) Thorne.

## Materials and methods

Three banana plants (*Musa paradisiaca* L. cv. Dwarf Cavendish) were selected from a planta-

[1] IIHR Contribution No. 28/98.

tion having a fairly wide spread and uniform infestation of the burrowing nematode. Roots were collected at 5-20 cm depth. Before further processing, the roots were thoroughly washed in running tap water. Roots having uniformly distributed brown spindle shaped lesions/relatively blackened appearance, were selected for the investigations. They were cut into pieces measuring 0.5/1 cm. One set of root pieces was used as such and termed as "unsplit roots", whereas in the other set, the roots were longitudinally split into four parts and were accordingly termed as "split roots". Five g sample of each set of such roots was used for the investigation. Three sets of constant temperature viz., 20 °C, 25 °C and 30 °C (±2 °C) and room temperature, ranging between 18.0 °C to 24.2 °C, were used. Roots (5 g split/unsplit) were incubated either at room temperature or in B.O.D. incubators operating at the various temperatures. Two incubation media viz., tap water or hydrogen peroxide ($H_2O_2$ at 20 ml/lit) were used. Twenty ml of $H_2O_2$ or plain water were poured into the Petri dish (90 mm diameter) containing a 60 mesh wire sieve (60 mm diameter) with a double layer of tissue paper spread over it and on which were placed 5 g of either split or unsplit roots. Observations on the nematode population recovery (juveniles/females/males) settled in the medium were taken at 48 hr intervals and continued up to 144 hr. Incubation media were changed at each 48 hr intervals. Nematode populations were counted using a stereoscopic bioncular microscope and data analysed statistically.

## Results and discussion

It is evident from the data presented in Table I that temperature has a decisive influence on the movement of nematodes from root tissues and their consequent recovery from the incubation medium. Also, root splitting exerted a positive effect on extraction efficacy. Incubation of split roots in tap water at 25 °C was optimum

TABLE I - *Influence of incubation medium, temperature, root processing technique and time interval on extraction of* Radopholus similis *from banana roots.*

| Type of roots | Treatment | | Nematodes extracted after | | | Total population |
|---|---|---|---|---|---|---|
| | Incubation medium | Incubation temperature | 48 hr | 94 hr | 144 hr | |
| Unsplit roots | Tap water | 30 °C | 10 | 7 | 4 | 21 |
| Split roots | Tap water | 30 °C | 96 | 73 | 29 | 198 |
| Split roots | $H_2O_2$ | 30 °C | 29 | 39 | 18 | 86 |
| Unsplit roots | Tap water | 25 °C | 64 | 27 | 21 | 112 |
| Split roots | Tap water | 25 °C | 459 | 103 | 102 | 664 |
| Split roots | $H_2O_2$ | 25 °C | 224 | 36 | 46 | 306 |
| Unsplit roots | Tap water | 20 °C | 27 | 5 | 14 | 46 |
| Split roots | Tap water | 20 °C | 67 | 14 | 13 | 94 |
| Split roots | $H_2O_2$ | 20 °C | 198 | 70 | 87 | 355 |
| Unsplit roots | Tap water | Room temp. | 53 | 35 | 22 | 110 |
| Split roots | Tap water | Room temp. | 173 | 61 | 34 | 268 |
| Split roots | $H_2O_2$ | Room temp. | 55 | 22 | 10 | 87 |
| C.D. at 5% | | | 233.18 | 65.80 | 51.28 | 271.13 |

for obtaining the significantly highest number of active nematodes followed by incubation of split roots in $H_2O_2$ at 20 °C. The third highest nematode recovery occurred when split roots were incubated in $H_2O_2$ at 25 °C. Incubation of the split roots in water at room temperature also yielded a substantial nematode population. By and large nematode recovery was substantially low from unsplit roots incubated at different temperatures. It was, however, relatively higher in two temperature regimes viz., 25 °C and room temperature as compared to 30 °C and 20 °C. It was also notable that highly active nematodes were recovered from split roots incubated in tap water at 25 °C, whereas the nematodes recovered from split roots in $H_2O_2$ at 25 °C and 30 °C were either inactive or dead. This immobility or high degree of mortality was pronounced after 96 and 144 hr of incubation. Even the second highest number of nematodes recovered from the split roots in $H_2O_2$ at 20 °C treatment were found to exhibit some immobility.

High recovery of *R. similis* in split roots in water at 25 °C as compared to split roots in $H_2O_2$ at 25 °C and its reversal in these treatments could be ascribed to the higher rate of oxidation processes at 25 °C as compared to 20 °C, which might be relatively more toxic to the nematodes at 25 °C. Furthermore, the likelihood of release of more phenolic compounds at higher temperatures also cannot be ruled out. Relative immobility/mortality of nematodes under $H_2O_2$ at higher temperature also corroborates our contention.

**Acknowledgements**. The authors are grateful to the Director, Indian Institute of Horticultural Research, Bangalore, for the encouragement and the facilities provided during the course of these investigations.

## Literature cited

GOWEN S. R. and EDMUNDS J. E., 1973. An evaluation of some simple extraction techniques and the use of hydrogen peroxide for estimating nematode populations in banana roots. *Plant Dis. Reptr.*, *57*: 678-681.

GOWEN S. and QUÉNÉHERVÉ P., 1990. Nematode parasites of bananas, plantains and abaca. Pp. 431-460. In "*Plant Parasitic Nematodes in Subtropical and Tropical Agriculture*" (M. Luc, R. A. Sikora and J. Bridge, eds). CAB International, Wallingford, U.K..

TARJAN A. C., 1967. Influence of temperature and hydrogen peroxide on the extraction of burrowing nematode from citrus roots. *Plant Dis. Reptr.*, *51*: 1024-1028.

TARJAN A. C., 1972. Observations on extracting citrus nematodes, *Tylenchulus semipenetrans*, from citrus roots. *Plant Dis. Reptr.*, *56*: 186-188.

Accepted for publication on 8 October 1998.