Journal of Nematology 21(3):431–433. 1989.

Parasitism of the Citrus Nematode, *Tylenchulus semipenetrans*, by *Pasteuria penetrans* in Iraq

F. A. Fattah, H. M. Saleh, and H. M. Aboud[1]

Key words: biocontrol, citrus, *Pasteuria penetrans*, *Tylenchulus semipenetrans*.

Pasteuria penetrans Sayre & Starr parasitizes several nematode species and is considered a promising biocontrol agent of the root-knot nematode, *Meloidogyne* spp. (1,7). Numerous plant-parasitic nematodes, including *Tylenchulus semipenetrans*, however, are seldom if ever infected by this biocontrol agent (3).

Tylenchulus semipenetrans Cobb is the most economically important and widespread nematode pest of citrus worldwide. In Iraq, it occurs in more than 90% of the citrus orchards and nurseries (4).

Specimens of *T. semipenetrans* infected by *P. penetrans* were detected during routine collection of soil and root samples from *T. semipenetrans*-infected citrus trees at Al-Dorah, Baghdad. *T. semipenetrans* motile stages were extracted from soil and roots by a modification of Cobb's sieving and decanting method (6) and from sedentary adult females by maceration or dislodging. Nematode stages infected with *P. penetrans* were examined in a water suspension through a compound microscope.

Only second-stage juveniles (J2) and adult males had *P. penetrans* spores affixed to their cuticles (Fig. 1A–C). Juveniles with attached spores tended to aggregate in groups of 2–5 nematodes and stick to each other. Similar observations of *Meloidogyne javanica* were made (3).

Endospores, sporangia, and other *P. penetrans* life stages were found inside the J2 bodies (Figs. 2A, 3) but not inside males or females, indicating that *T. semipenetrans* is a host of *P. penetrans*. *P. penetrans* appeared to prevent the normal development of infected J2. Specimens with advanced infections were sluggish or immobile and their internal organs were invaded or replaced by *P. penetrans* life stages (Fig. 2).

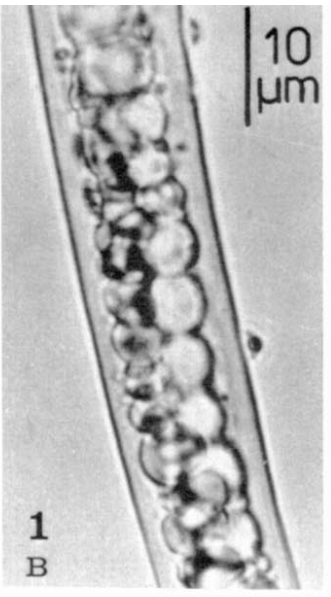
The spherical endospores and the crescent-shaped sporangia from this population of *T. semipenetrans* were smaller (2.6 μm) than those reported from *Meloidogyne* species (3.4 μm) (5) but were similar in size to those reported from *Pratylenchus* species (9). The mode of infection of *T. semipenetrans* by *P. penetrans* differed from that reported for *Meloidogyne* spp. Infection of *T. semipenetrans* and *Meloidogyne* spp. differed in that mature spores were observed in motile, soil-borne J2 of *T. semipenetrans* as opposed to sedentary, adult females of *Meloidogyne* spp. Thus, *P. penetrans* may limit *T. semipenetrans* root invasion by infecting and killing nematodes in the soil before penetration occurs. In contrast, it suppresses *Meloidogyne* spp. root attack by limiting egg production after the nematode has parasitized the roots. High densities of *P. penetrans* spores may also suppress root invasion by *Meloidogyne* spp., because heavily encumbered J2 are less motile although they are not infected while in the soil (2).

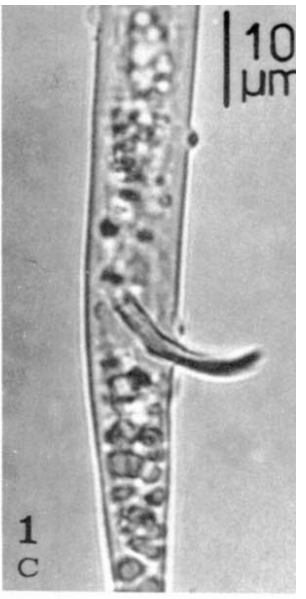
An association between *P. penetrans* and *T. semipenetrans* was reported twice before. Mankau and Prasad (3) observed one *T. semipenetrans* with one spore on its cuticle but did not observe infection. They concluded that *T. semipenetrans* was not a host.

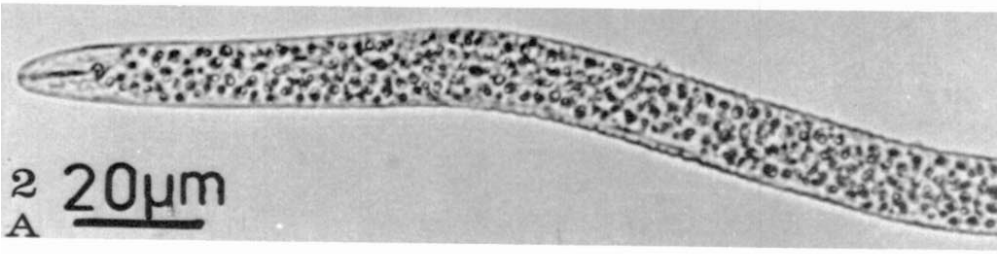
Received for publication 19 May 1988.

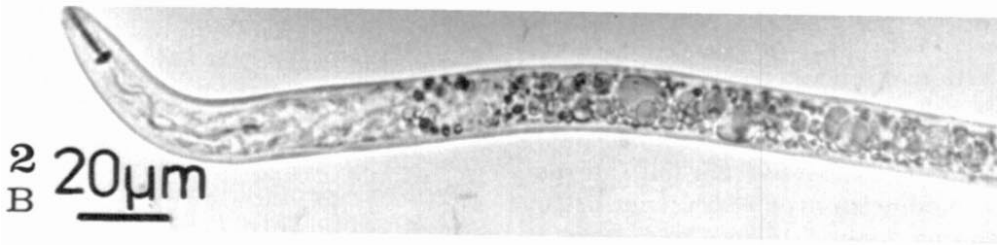
[1] Scientific Researcher and Assistant Scientific Researchers, Department of Plant Protection, Faculty of Agriculture and Biology, P.O. Box 765, Baghdad, Iraq.

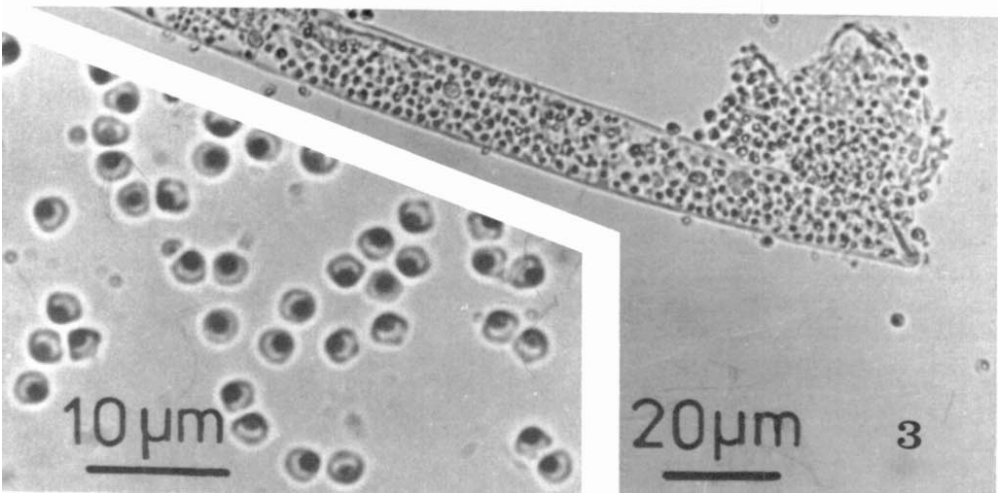

10 µm
1 A


10 µm
1 B


10 µm
1 C


2 A
20µm


2 B
20µm


10 µm
20µm
3

Sturhan (8) reported that *P. penetrans* was observed inside *T. semipenetrans* on Samoa Island but provided no details.

This study adds to the host range of *P. penetrans* and provides evidence of variable host preference in this biological agent.

Literature Cited

1. Browns, S. M., J. L. Kepner, and G. C. Smart. 1985. Increased crop yields following application of *Bacillus penetrans* to field plots infested with *Meloidogyne incognita*. Soil Biology and Biochemistry 17:483–486.

2. Davies, K. G., B. R. Kerry, and C. A. Flynn. 1988. Observations on the pathogenicity of *Pasteuria penetrans*, a parasite of root-knot nematodes. Annals of Applied Biology 112:491–501.

3. Mankau, R., and N. Prasad. 1977. Infectivity of *Bacillus penetrans* in plant-parasitic nematodes. Journal of Nematology 9:40–45.

4. Natour, R. M., J. M. Allow, and Z. A. Katcho. 1975. The effects of DBCP on citrus-root nematode and citrus growth and yield in Iraq. Journal of Nematology 7:270–274.

5. Sayre, R. M., and M. P. Starr. 1985. *Pasteuria penetrans* (ex. Thorne, 1940) nom. rev., comb. n., sp. n., a mycelial and endospore-forming bacterium parasitic in plant-parasitic nematodes. Proceedings of the Helminthological Society of Washington 52:149–165.

6. s'Jacob, J. J., and J. V. Bezooijen. 1971. A manual for practical work in nematology. Wageningen, The Netherlands.

7. Stirling, G. R. 1984. Biological control of *Meloidogyne javanica* with *Bacillus penetrans*. Phytopathology 74:55–60.

8. Sturhan, D. 1985. Studies on distribution and hosts of the nematode parasite *Bacillus penetrans*. Biologischen Bund fur Land-und Forstwirtschaft Berlin-Dalhem 226:75–93.

9. Thorne, G. 1940. *Duboscqia penetrans*, n. sp. (Sporozoa, Microsporidia, Nosematidae), a parasite of the nematode *Pratylenchus pratensis* (de Man) Filipjev. Proceedings of the Helminthological Society of Washington 7:51–53.

←

FIGS. 1–3. 1) *Tylenchulus semipenetrans* infected with *Pasteuria penetrans*. A, B) *P. penetrans* spores attached to the cuticle of a second-stage juvenile. C) Posterior body of an adult male with *P. penetrans* spores attached to the cuticle. 2) *Tylenchulus semipenetrans* second-stage juveniles. A) *P. penetrans* sporulation inside the body. Note complete obliteration of digestive system. B) Noninfected specimen. 3) Ruptured *Tylenchulus semipenetrans* second-stage juvenile infected with *Pasteuria penetrans*. Inset is an enlargement of the spores.