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A BACTERIAL SPORE PARASITE OF NEMATODES

R. P. Esser

HISTORY AND CLASSIFICATION: In 1906, Cobb illustrated an endosporous parasite in the body of Discolaimus bulbiferus (Cobb, 1906) Heyns, 1963. In 1940, Thorne described a similar parasite from Pratylenchus brachyurus (Godfrey, 1929) Filipjev and Schuurmans Stekhoven, 1941, and placed it in the class Sporozoa of the phylum Protozoa and named it Duboscqia penetrans. In 1975, Mankau placed it in the Eubacteriales (true bacteria) and named it Bacillus penetrans. Sayre and Wergin, 1977, concluded that B. penetrans was not the correct placement. They suggested that it resembled Pasteuria ramosa Metchikoff (a budding-type bacterium) or an Actinomycete (a bacterium that has a filamentous growth habit). Because of the taxonomic uncertainty, Sayre and Wergin refer to this parasite as BSPN ("bacterial spore parasite of nematodes") and consider BSPN as the same parasitic organism which has appeared under a variety of names in the literature.

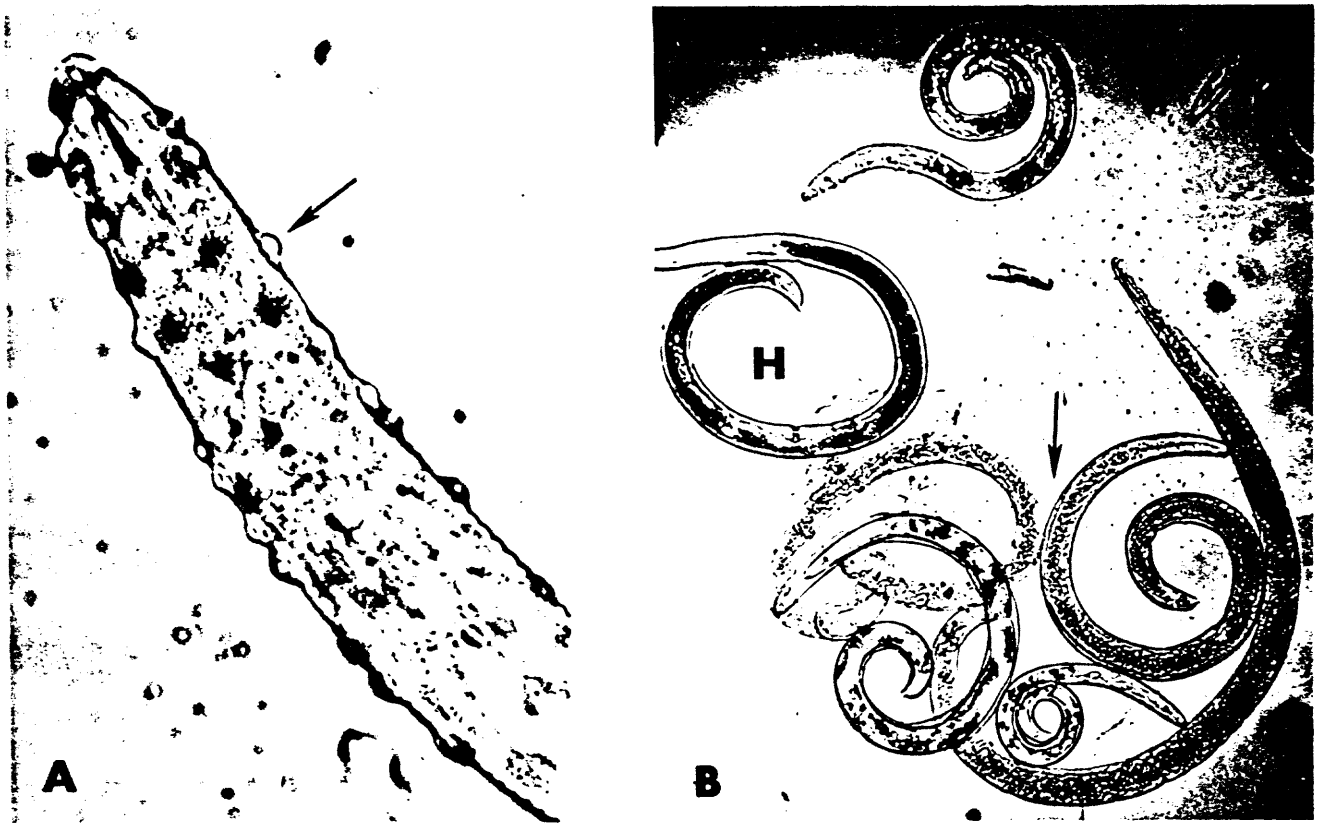

Figure 1. Spiral nematodes infested with BSPN

A. Closeup of female infected with endospores (arrow)
B. Infected females (arrow) near healthy females (H)

Contribution No. 212, Bureau of Nematology, P. O. Box 1269, Gainesville, FL 32602

GEOGRAPHIC DISTRIBUTION: The parasite appears to be distributed worldwide. In Florida, it is not uncommon to find the parasite on nematodes originating from turf, vegetable, and ornamentals in both field and greenhouse plantings. A large population of Helicolytenchus microlobus Perry, 1959, was found severely infected with the parasite (Fig. 1-B) in a commercial turf planting of Zoysia japonica Steud. in South Florida. In North Florida, large numbers of root-knot nematodes have been found infected with BSPN in field plantings of ligustrum and some other ornamental shrubs.

HOST LIST: [1/] Many species of nematodes are infected by the parasite. Phytoparasitic nematodes found infested with endospores include: *Belonolaimus longicaudatus, Dolichodorus obtusus, Helicotylenchus dihystera, H. microlobus, *Heterodera leuceilyma, Hirshmaniella gracilis, *Hoplolaimus tylenchiformis, *Meloidodera floridensis, Meloidogyne arenaria, M. incognita, M. acrita, M. javanica, Merlinius macrurus, Paralongidorus sali, Pratylenchus bachyurus, P. penetrans, P. zeae, Rotylenchus robustus, Tylenchorhynchus dubius, T. nannus, Xiphinema elongatum.

BIOLOGICAL CONTROL POTENTIAL: The parasite appears to have a high potential for reducing nematode populations. The parasite reduced root galling by Meloidogyne incognita and M. javanica on tomato and reduced the population of Pratylenchus scribneri by 53% in soil and 63% in roots after 55 days exposure (Mankau, 1972). In Florida, galled roots have been received in which no root-knot nematodes were found alive, and females in the roots were packed with endospores of the parasite. Populations of root-knot larvae are commonly seen in which 75-90% of the larvae are infected.

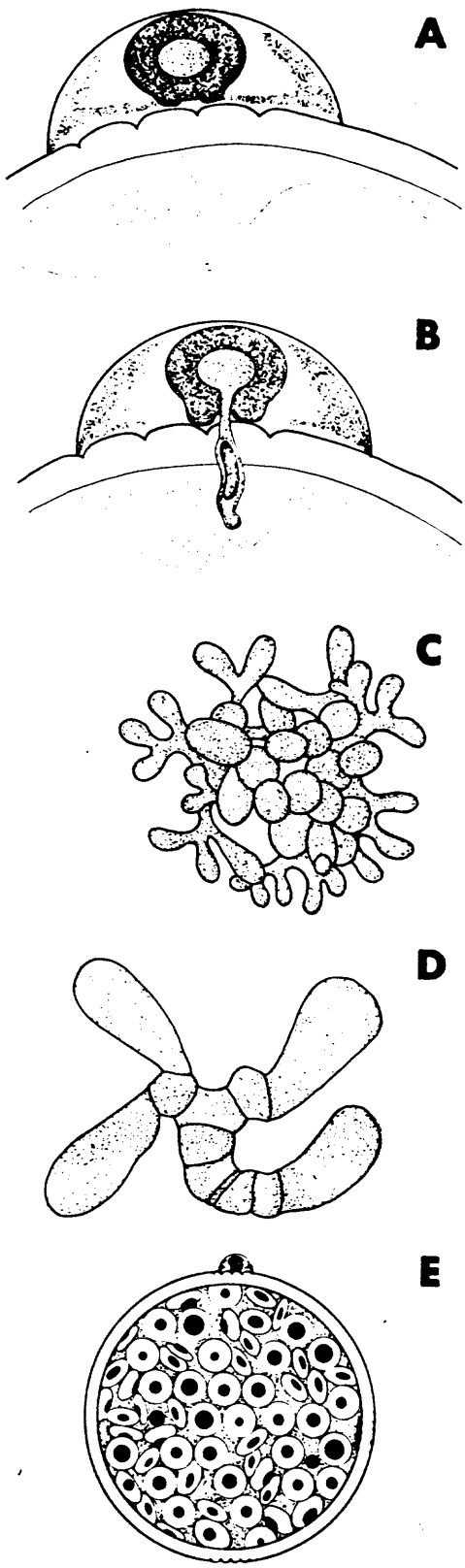

Figure 2. Life cycle of the parasite

A. Infection; B. Spore germination;
C. Vegetative growth; D. Sporulation;
E. Endospore production shown in cross section

(Figs. 2-A,B,D redrawn from Sayre & Wergin, 1977)

1/Complete development of the parasite has not been observed on some nematodes to which endospores have become attached. Names preceded by an asterisk (*) are new host records.

LIFE CYCLE: Nematodes become infected when one to hundreds of endospores in the soil adhere to their integument (Fig. 2-A). Endospores germinate when infested nematodes enter roots and begin feeding. The germ tube of the endospore penetrates the nematode integument and enters the hypodermal tissue (Fig. 2-B). Mycelial colonies (Fig. 2-C) appear as a granular mass filling the nematode body. Sporulation is initiated when terminal hyphal cells enlarge forming ovate structures (Fig. 2-D). These structures separate from parent hyphae and become sporangia. Development is complete when the sporangia develop to mature endospores in the nematode body (Fig. 2-E).

SURVEY AND DETECTION: Suspect BSPN when incubated galled roots fail to yield root-knot larvae. Affected nematodes have a chlorotic cast and diseased appearance (Fig. 1-B). Endospores adhering to the integument of infested nematodes are easy to detect (Fig. 1-A) using low powers of the compound microscope.

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