Descriptions of Meloidogyne camelliae n.sp. and M. querciana n.sp. (Nematoda: Meloidogynidae), with SEM and Host-Range Observations

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Abstract: Meloidogyne camelliae n.sp. on camellia (Camellia japonica) from Japan and M. querciana n.sp. on pin oak (Quercus palustris) from Virginia, USA, are described and illustrated. M. camelliae n.sp. is distinguishable from other species of the genus especially by its striking perineal pattern having heavy ropelike striae forming a squarish to rectangular outline with shoulders or projections, appearing sometimes almost starlike. M. querciana differs from other species by its characteristic perineal pattern round to oval in outline, sometimes with a low arch, and sunken vulva surrounded by a prominent obovate area devoid of striae. M. querciana shows some relationship to M. ovalis, but differs further from the latter by longer larvae, absence of annules on head of larvae, and rarity of males. Examination of specimens of M. camelliae n.sp. and M. querciana n.sp. with the scanning electron microscope confirmed observations made by optical microscopy and revealed diagnostic and other structures in greater detail. In greenhouse host tests, M. camelliae infected camellia heavily, showed moderate infection on oxalis, only a trace infection on tomato, and no infection on five other plants tested; and M. querciana attacked pin oak, red oak, and American chestnut heavily, but did not infect nine other test plants. In another test, pin oak seedlings did not become infected when heavily inoculated with and grown in the presence of two populations of M. incognita incognita and one of M. incognita acrita. The common names “camellia root-knot nematode” and “oak root-knot nematode” are respectively proposed for M. camelliae and M. querciana. Key Words: taxonomy, morphology, SEM ultrastructure, host-range, camellia, Camellia japonica, pin oak, Quercus palustris, red oak, Q. rubra.

In 1965 two interesting root-knot nematodes were received for identification, one on camellia (Camellia japonica L.) from Japan and the other on a pin oak (Quercus palustris Muenchh.) seedling from a nursery in Virginia, USA. Examination of a limited number of females obtainable from the roots indicated that both nematodes were new species of Meloidogyne. For study of more females and other stages, the small camellia plant and pin oak seedling were potted and grown in isolated areas of the greenhouse. The specimens used in this paper and an earlier report (1) came from these cultures.

Larvae for morphological examination were generally recovered from fresh infected roots (or egg sacs) kept in petri dishes with a small amount of water. Females were later dissected from the roots after fixation overnight in 3% formaldehyde solution. Some males were obtained in the same manner, but most were recovered from the soil by sieving followed by Baermann funnel extraction. The procedures used in measuring, drawing, and preparing specimens were essentially those used by Golden and Birchfield (2) except that some fixed females were cut and mounted in lactophenol solution. Photomicrographs of perineal patterns and eggs were made with an automatic 35-mm camera using an interference contrast system attached to a compound microscope; and those of infected roots and whole females were made with a 8.3 × 10.8-cm sheet-film camera attached to a dissecting microscope. The photograph of the oak plant was taken with a 35-mm camera. In making the scanning electron microscope (SEM) micrographs, living specimens were fixed in 3% glutaraldehyde solution with phosphate buffer, dehydrated in ethanol, critical-point dried, sputter-coated with gold-palladium, and examined with a scanning electron microscope.

Host tests were conducted in the greenhouse on the plants listed below.

For the nematode from camellia: camellia, Camellia japonica L.; citrus (rough lemon), Citrus limon (L.) Burmann; corn (Golden Bantam), Zea mays L.; rose (unknown cultivar of floribunda type), Rosa sp.; soybean (Lee), Glycine max (L.) Merr.; tomato (Marglobe), Lycopersicon esculen-
tum Mill.; and wheat (Red coat), *Triticum aestivum* L.


For each test plant, for each nematode, three 15-cm pots were filled with steam-sterilized soil, inoculated with about 100 ml of heavily infested soil containing chopped infected roots, and then planted with young seedlings or seeds as appropriate. After about five months the plants were harvested and the roots examined macro- and microscopically for infection. The host test with the nematode from pin oak was repeated. Concurrently, a separate experiment with pin oak as the test plant was conducted in the same manner using as inoculum two populations of *M. incognita incognita* (Kofoid & White, 1919) Chitwood, 1949 (one from cucumber and one from azalea), and one population of *M. incognita acrita* Chitwood, 1949, from pepper. Tomato and pepper were used as controls in this test.

*Meloidogyne camelliae* n.sp.

**FEMALES (30):** Length 700–1081 μm (mean 905 μm, standard deviation (SD) 95 μm); width 357–674 μm (545 μm, SD 75); a = 1.4–2.2 (1.7, SD 0.2); b = 4.1–6.2 (5.2, SD 0.6); stylet 17.2–18.1 μm (17.5 μm, SD 0.3); width of stylet knobs 4.0–5.6 μm (4.9 μm, SD 0.4); dorsal esophageal gland orifice (DGO) 3.4–5.6 μm (4.4 μm, SD 0.4) from base of stylet; center of median bulb 72–110 μm (88 μm, SD 9.5) from anterior end; vulva slit length 26–36 μm (30 μm, SD 3); distance from vulva slit to anus 17–27 μm (20 μm, SD 2.9).

**HOLOTYPE (female):** Length 989 μm; width 530 μm; a = 1.8; b = 5.2; stylet 18 μm; DGO 4.3 μm from base of stylet; width of stylet knobs 4.3 μm; vulva slit length 33 μm; distance from vulva slit to anus 22.4 μm.

**Description:** Body globular to pear-shaped (Fig. 36), without posterior protuberance, and with prominent neck situated anteriorly on a median plane with terminal vulva. Females pearly white, often become cream-colored in older specimens. Esophageal and anterior region commonly appearing as illustrated (Fig. 6). Head offset from neck, bearing a labial cap and two cephalic annules. Cephalic framework distinct but weak; stylet fairly strong, with backward-sloping knobs (Fig. 6). Excretory pore clearly visible, variable in exact position, but averaging 31 μm from anterior end. Massive egg sac extruded posteriorly, often two or more times the size of the female (Figs. 32, 35, 37). Perineal pattern (Figs. 7–15, 19–23) highly distinctive, with heavy ropelike stria forming a squarish to rectangular outline having shoulders or projections sometimes appearing almost star like (Fig. 7); vulva and anus sunken in a squarish area devoid of striae.

**MALES (55):** Length 1587–2180 μm (1945 μm, SD 151); a = 36–54 (44, SD 3.8); b = 5.6–9.8 (7.6, SD 0.8); c = 127–321 (182, SD 28); stylet 20.7–23.7 μm (22.4 μm, SD 0.7); DGO 4–7 μm (5.3 μm, SD 0.8) from base of stylet; center of median bulb 86–112 μm (102 μm, SD 6.6) from anterior end; spicules 33–39 μm (35 μm, SD 1.2); gubernaculum 8–12 μm (9.6 μm, SD 0.6); tail 6–13 μm (11 μm, SD 1.4).

**ALLOTYPE (male):** Length 2034 μm; a = 43; b = 8.7; c = 170; stylet 22.9 μm; DGO 5.2 μm from base of stylet; spicules 35 μm; gubernaculum 8.6 μm; tail 12 μm.

**Description:** Body long, slender, vermiform, tapering slightly at both extremities. Midbody width 34–59 μm (44 μm, SD 3.5). Cuticular annules prominent, measuring about 3.5 μm at midbody. Head only slightly offset, with large labial annule (head cap), and without postlabial annules (Figs. 3, 28–31). Lateral field (Fig. 2) about 1/4 body width at midbody, commonly with four lines; two outer bands occasionally areolated but not completely so; center band slightly smaller, sometimes showing a fifth line, especially in older specimens. Stylet, knobs, cephalids, hemizonid, excretory pore, and anterior portion commonly appear as illustrated (Fig. 3). Testis one. Spicules arcuate, tips rounded. Distinct phasmids at level of or posterior to cloaca. Tail short, rounded (Fig. 1).
FIG. 1–6. Drawings of *Meloidogyne camelliae* n.sp. 1–3) Male. 4–5) Larva. 6) Anterior region of female.
FIG. 7-15. Photomicrographs of representative perineal patterns of nine different females of *Meloidogyne camelliae* n.sp.
Males are very common on the type host.

SECOND-STAGE LARVAE (70): Length 443-576 μm (501 μm, SD 21); a = 21-30 (26, SD 1.8); b = 2.3-3.8 (3.1, SD 0.4); c = 9.5-12 (10.7, SD 0.6); stylet 11.2-12 μm (11.6 μm, SD 0.2); DGO 3-4.5 μm (3.7 μm, SD 0.4) from base of stylet; median bulb center 58-73 μm (65 μm, SD 2.7) from anterior end; head width 5.2-6.9 μm (6.2 μm, SD 0.2); head height 2.6-3.4 μm (3.0 μm, SD 0.1); hw/hh ratio 1.5-2.3 (2.1 SD 0.1); tail length 40-56 μm (47 μm, SD 3.1); hyaline tail terminal 4-8.9 μm (6.3 μm, SD 1.4); caudal ratio A 1-2.7 (1.6, SD 0.3); caudal ratio B 1-2.9 (1.8, SD 0.5); phasmids 32-38 μm (35 μm, SD 2.3) from tail tip.

Description: Body vermiform, tapering at both extremities but much more so posteriorly. Head continuous with body, with weak cephalic framework, but without postlabial annules (Figs. 4, 24-27). Body annules distinct, becoming coarser in posterior portion. Lateral field with 4 lines, not areolated, and 1/4 body width, the latter being 17-24 μm (19.5 μm, SD 1.2) at its widest part. Stylet, knobs, excretory pore, hemizonid, and anterior portion appearing about as illustrated (Fig. 4). Cephalids indistinct and not shown. Phasmids small but distinct, located about one anal body width posterior to anus. Rectum not dilated. Tail with rather coarse annules extending almost to end, with fine rounded terminus (Fig. 5).

EGGS (25): Length 100-120 μm (110 μm, SD 5); width 46-53 μm (48.6 μm, SD 2.3); L/W ratio 2-2.6 (2.3, SD 0.2). Egg shell hyaline, without visible markings, as seen with optical microscopy (Fig. 38).

HOLOTYPE (female): Originally received from Japan 26 March, 1965, and subsequently grown on camellia in an isolated greenhouse area. Slide T-293t, USDA Nematode Collection (USDANC), Beltsville, Maryland, USA.

ALLOTYPE (male): Slide T-294t. Same data as holotype. USDANC, Beltsville, Maryland, USA.

PARATYPES: Males, females, larvae, and eggs: USDANC, Beltsville, Maryland; University of California Nematode Survey Collection (UCNSC), Davis, California, USA; Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England; Canadian National Collection of Nematodes, Ottawa, Canada; and Laboratoire des Vers, Muséum National d’Histoire Naturelle, Paris, France.

TYPE HOST AND LOCALITY: Roots of Camellia japonica from an unknown area of Japan.

DIAGNOSIS: The perineal pattern, described and illustrated herein, with coarse, ropelike striae readily distinguishes Meloidogyne camelliae from all other species of the genus.

SEM examination of specimens confirmed observations made with optical microscopy and showed much more detail. On the female (Figs. 16-23), two head annules were evident (see especially Fig. 18) and the perineal pattern showed a sunken vulva and anus and heavy ropelike striae often interspersed with fine striae. Anterior views of larvae (Figs. 24-27) and males (Figs. 28-31) clearly revealed, particularly, the absence of postlabial head annules, and showed the amphidial openings, and nature of the labial cap.

In the host-range test, no infection of citrus, corn, rose, soybean, and wheat by M. camelliae was detected. Tomato had a few scattered tiny galls in which a single small adult female was occasionally found and a small number of eggs were seen rarely. Some of the galls contained only an immature female. On camellia, however, during the test period large numbers of females developed on the roots. Also, a volunteer oxalis plant (Oxalis sp.) found growing with one of the camellia replicates had a moderate infection.

On the roots of its type host and on oxalis, M. camelliae does not appear as a usual root-knot species. There is little or no swelling of the root at the infection site, and half or more of the female's body protrudes from the root (Figs. 32-35), as is common with cyst nematodes. The massive egg sac, attached posteriorly to the female, adds further to the unusual appearance of this species.

The common name “camellia root-knot nematode” is proposed for this new species.

Meloidogyne querciana n.sp.

FEMALES (30): Length 533-1170 μm (891 μm, SD 163); width 387-877 μm (639 μm, SD 106); a = 1.1-1.9 (1.4, SD 0.2); b = 3.7-7.1 (5, SD 1.2); stylet 17-18.7 μm (17.5
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FIG. 24-31. Scanning electron micrographs of larvae and males of *Meloidogyne camelliae* n.sp. 24–27) Anterior regions and heads of larvae. 28–31) Anterior region and heads of males.
μm, SD 0.5); width of stylet knobs 3.9–4.7 μm (4.3 μm, SD 0.2); DGO 4.3–6.0 μm (4.5 μm, SD 0.5) from base of stylet; vulva slit length 20–33 μm (29 μm, SD 3.3); distance from vulva slit to anus 17–23 μm (20 μm, SD 2.3); center of median bulb to anterior end 75–95 μm (84 μm, SD 7.1); excretory pore 26–51 μm (36 μm, SD 6.4) from anterior end.

**HOLOTYPE** (female): Length 955 μm; width 731 μm; a = 1.3; b = 4.8; stylet 17.2 μm; width of stylet knobs 4.7 μm; DGO 4.7 μm from base of stylet; vulva slit length 33 μm; distance from vulva slit to anus 21 μm; center of median bulb 89 μm and excretory pore 43 μm from anterior end.

**Description:** Body pearly white, globular to pear-shaped, without posterior protuberance, and with well defined but small neck situated anteriorly on a median plane with the terminal vulva (Fig. 77). Esophageal and anterior region commonly appearing as illustrated (Fig. 47). Head more or less continuous with neck, bearing a prominent labial cap (Fig. 71) and two annules (Figs. 47, 72). Cephalic framework weak. Stylet strong with rather prominent knobs sloping posteriorly. Excretory pore distinct, and about two stylet lengths from anterior end.

**Males (4):** Length 1392–1862 μm (1635 μm, SD 248); a = 49–58 (53, SD 4.5); b = 6–9 (8, SD 1.3); c = 137–182 (148, SD 25); stylet 19–19.6 μm (19.3 μm, SD 0.4); width of stylet knobs 3.9–4.5 μm (4.1 μm, SD 0.3); DGO 2.2–2.8 μm (2.6 μm, SD 0.3) from base of stylet; spicules 32–32.5 μm (32.3 μm, SD 0.4); gubernaculum 7.3–10.1 μm (8.4 μm, SD 1.2); center of median bulb 80–87 μm (83 μm, SD 3.3) from anterior end; tail 10–12 μm (11 μm, SD 1.0).

**ALLOTYPE** (male): Length 1836 μm; a = 49; b = 9; c = 182; stylet 19 μm; DGO 2.8 μm from base of stylet; spicules 32 μm; gubernaculum 10 μm; tail 10 μm.

**Description:** Body quite slender, vermiform, tapering slightly at both extremities. Head slightly offset, with massive labial annule (head cap), and without postlabial annules. Stylet, knobs, cephalids, hemizonid, excretory pore, and anterior portion commonly appearing as illustrated (Fig. 46). Lateral field (Fig. 45) with 4 lines, generally not areolated, and about 1/5 body width at midbody, the latter being 25–38 μm (31 μm, SD 5.1). Testes two. Spicules arcuate, with rounded tips. Phasmids prominent, at level of cloaca. Tail short, rounded (Fig. 45).

Males are extremely rare, with only four having been found on the type host (pin oak) and two in poor condition on red oak.

**SECOND-STAGE LARVAE (70):** Length 411–541 μm (467 μm, SD 25.5); a = 23–39 (30, SD 3); b = 2.2–3.4 (2.6, SD 0.2); c = 7–13 (10, SD 0.6); stylet 10.2–11.6 μm (11.1 μm, SD 0.3); DGO 2.6–4.3 μm (3.5 μm, SD 0.4) from base of stylet; head height 4.3–5.6 μm (5.2 μm, SD 0.2); hw/hh ratio 1.7–2.6 (2.1, SD 0.2); center of median bulb 51–63 μm (56 μm, SD 2.5) from anterior end; tail length 39–52 μm (46 μm, SD 3); hyaline tail terminal 8–14 μm (11 μm, SD 1.4); caudal ratio A 1.4–2.8 (2.1, SD 0.3); caudal ratio B 2.4–5.6 (3.3, SD 0.8).

**Description:** Body vermiform, 11–20 μm (15 μm, SD 1.3) wide at midbody, tapering at both extremities but much more so posteriorly. Head not offset, with weak cephalic framework, and without annules (Figs. 39, 62–64). Perineal pattern (Figs. 48–58, 65–70) often oval, but more elongate in dorso-ventral plane, sometimes squarish with indication of a low arch just above anal area; striae generally well spaced, fairly coarse and often continuous, and commonly surrounding the vulva area, which is located almost in the center of the pattern.

**EGGS (30):** Length 94–110 μm (101 μm, SD 3.5); width 47–62 μm (51 μm, SD 2.6); L/W ratio 1.7–2.2 (2, SD 0.1). Egg
FIG. 32-38. Photomicrographs of females and eggs of Meloidogyne camelliae n.sp. 32-35) Females typically protruding from roots of camellia and causing little or no gall formation. (Note the small young egg sac on female in Fig. 34 and the massive one on female in Fig. 35). 36) Isolated females showing gross shape. 37) Isolated females with characteristically large egg sacs intact. 38) Eggs with larvae within.

FIG. 48–60. Photomicrographs of females of *Meloidogyne querciana* n.sp. 48–58) Representative perineal patterns of 11 different specimens. 59) Focus on sunken vulva slit of specimen in Fig. 57. 60) Focus on sunken vulva slit of specimen in Fig. 58.
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shell hyaline, without visible markings as seen by optical microscopy (Fig. 78).

Following are morphometric data on females and larvae grown on another host, red oak:

**FEMALES (25):** Length 774-1324 μm (1056 μm, SD 175); width 490-860 μm (683 μm, SD 100); a = 1.1-2.1 (1.6, SD 0.2); b = 4.7-8.0 (6.2, SD 1.3); stylet 17-18.7 μm (17.7 μm, SD 0.6); width of stylet knobs 3.4-4.7 μm (4.2 μm, SD 0.3); DGO 3.5-6.0 μm (4.7 μm, SD 0.8) from base of stylet; vulva slit length 21-34 μm (28 μm, SD 3.9); distance from vulva slit to anus 15-23 μm (19 μm, SD 2.1); median bulb center 70-98 μm (84 μm, SD 8) from anterior end; excretory pore 26-72 μm (41 μm, SD 11) from anterior end.

**LARVAE (30):** Length 419-493 μm (452 μm, SD 21); a = 21-28 (25, SD 1.8); b = 2.7-3.9 (3.1, SD 0.4); c = 7.6-10.9 (9.7, SD 0.7); stylet 10.2-11.9 μm (11.1 μm, SD 0.3); DGO 2.6-3.4 μm (3.5 μm, SD 0.3) from base of stylet; head height 5.1 μm; hw/hh ratio 2; center of median bulb 49-69 μm (56 μm, SD 3.5) from anterior end; tail length 41-49 μm (45 μm, SD 2.4); hyaline tail terminal 6.8-12.8 μm (10.1 μm, SD 1.5); caudal ratio A 1.3-2.5 (2.0, SD 0.3); caudal ratio B 2.6-4.9 (3.3, SD 0.8).

**HOLOTYPE (female):** Originally received from an unknown nursery in Augusta County, Virginia, on 17 February 1965 (and subsequently grown in an isolated greenhouse area). Slide T-295t, USDA Nematode Collection (USDANC), Beltsville, Maryland, USA.

**ALLOTYPE (male):** Slide T-296t. Same data as holotype. USDANC, Beltsville, Maryland USA.

**PARATYPES:** Males, females, larvae, and eggs in USDANC, Beltsville, Maryland. Females, larvae, and eggs: University of California Nematode Survey Collection (UCNSC), Davis, California, USA; Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England; Canadian National Collection of Nematodes, Ottawa, Canada; and Laboratoire des Vers, Muséum National d’Histoire Naturelle, Paris, France.

**TYPE HOST AND LOCALITY:** Roots of Quercus palustris Muenchh. (pin oak) at an unknown nursery in Augusta County, Virginia, USA.

**DIAGNOSIS:** Meloidogyne querciana differs from other species of the genus especially by its characteristic perineal pattern and sunken vulva with surrounding area devoid of striae as described and illustrated above. Although this new species shows some relationship to M. ovalis Riffle, 1963, it differs further from the latter species by longer larvae (467 μm vs 342 μm), absence of annules on larval head (2 in ovalis), and rarity of males.

SEM examination of M. querciana confirmed observations made with optical microscopy. On the female head (Figs. 71, 72), two annules, labial cap, and slitlike amphidial openings can be seen. The general nature and some variations in perineal pattern and vulva region are depicted in Figs. 65-70. A partial view of a larva tail (Fig. 61) shows typical absence of striae in about the posterior 1/3 tail portion. The dumbbell shape of the labial cap and the complete lack of postlabial annules in larvae are evident in Figs. 62-64.

In the host-range test, barley, corn, Kentucky bluegrass, oats, pansy, peanut, rye, strawberry, and wheat were not hosts. Chestnut, pin oak, and red oak were hosts. On pin oak the numerous galls on young roots were rather small and discrete (Figs. 73, 74, 76) but on older roots the galls coalesced and formed massive knots. Females of M. querciana were generally embedded in the galls though on young roots egg masses could sometimes be seen protruding from the gall surface. Host plants infected by M. querciana were smaller than uninfected controls, as indicated by red oak (Fig. 75). In the separate test in which pin oak was grown in the presence of two populations of M. incognita incognita and one population of M. incognita acrita, there was no evidence of infection on this plant. The tomato and pepper control plants, however, were heavily infected.

Microscopic examination and the morphometric data for specimens from red oak

**FIG. 61-72.** Scanning electron micrographs of larvae and females of Meloidogyne querciana n.sp. (61) Posterior portion of larva tail showing absence of annules. (62-64) Head region and heads of larvae. (65-70) Perineal patterns and vulval areas. (71-72) Head end and head region of females.
FIG. 73–78. Specimens of Meloidogyne querciana n.sp. on or isolated from roots of two oaks. 73, 74, 76) Photomicrographs of small infected roots of pin oak showing galls and some eggs sacs on surface. 75) Photograph of red oak, infected on left, healthy on right. Note stunted size and galled roots (actual size of infected plant about 35 cm). 77) Photomicrographs of females isolated from pin oak showing gross shape. 78) Photomicrograph of eggs.
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LITERATURE CITED


Anhydrobiotic Coiling of Nematodes in Soil
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Abstract. Nematodes of three genera (Acrobeloides sp., Aphelenchus avenae, and Scutellonema brachyurum) were induced to coil and enter anhydrobiosis in drying soil of two types: sandy loam and loamy sand. Coiling was studied in relationship to soil moisture characteristics. Coiling and the physiological state of anhydrobiosis occurred before the water in sandy soils reached a water potential of -15 bars. Coiling was maximum at 3-6 bars, depending on the soil type and nematode species. It appeared that induction of coiling and anhydrobiosis were determined by the physical forces exerted by the water film surrounding the nematode, which, for these three species, was 6-9 monomolecular layers of water, rather than the % moisture and relative humidity of the soil per se. Key Words: anhydrobiosis, Aphelenchus avenae, Acrobeloides, Scutellonema brachyurum, soil moisture, survival, monomolecular layers of water.

Physiological and ultrastructural changes associated with anhydrobiosis and coiling in nematodes were demonstrated in 1974 with Anguina tritici larvae by Bird and Buttrose (1) and with Aphelenchus avenae larvae and adults by Crowe and Madin (5). Coiled nematodes in dry desert soils have been collected and observed by Demeure (7), Freckman, Kaplan and Van Gundy (9), and Freckman (10). Towson (16) observed coiled root-knot nematode larvae in desiccated soil under laboratory conditions. Although no coiled nematodes have been observed directly in dry soil, it has been postulated that they can survive long hot dry periods in the anhydrobiotic state (10).

Coiling, a morphological condition associated with anhydrobiosis, can be induced in A. avenae in the laboratory by slowly drying a minimum of 0.1 g wet weight mass of nematodes in chambers designed to maintain a relative humidity of 97% (6). The relative humidity of the soil pore spaces in field soil remains above 99% at the permanent wilting point (15 bars) (2). Our sampling of desert soils indicated that coiled nematodes were found in soils of less than 15 bars suction and suggested that moisture factors other than relative humidity were involved in initiating anhydrobiosis of single nematodes in soil. This research was done to induce coiling in drying soil, to study coiling in relation to the soil moisture characteristics of drying soil, and to observe anhydrobiotic nematodes directly in soil.

MATERIALS AND METHODS

Nematodes. Three nematode species were selected for study to represent the various nematode trophic groups commonly found in soil. The fungal feeder Aphelenchus avenae Bastian, 1865, was cultured in the laboratory on Rhizoctonia solani Kuhn, 1858 (8, 4). The bacterial feeder Acrobeloides sp. was collected from a Mojave desert soil near Rock Valley, Nevada, and cultured in a mixed bacterial culture on oatmeal and agar. The plant parasite (presented above) did not differ from those for the specimens grown on pin oak. Also, specimens from pin oak collected in 1965 did not differ from specimens collected from the same host in 1978.

The common name “oak root-knot nematode” is proposed for this new species.