

Thripinema fuscum n. sp. (Tylenchida: Allantonematidae), a Parasite of the Tobacco Thrips, *Frankliniella* *fusca* (Thysanoptera)¹

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Abstract: *Thripinema fuscum* n. sp., a parasite of the tobacco thrips, *Frankliniella fusca*, is described and illustrated from material collected from peanut (*Arachis hypogaea*) in Marianna, Florida. *Thripinema fuscum* can be distinguished from all other previously described *Thripinema* spp. by the dorsal curvature of the male and the presence of a stylet in the male. Highest parasitism rates of *F. fusca* by *T. fuscum* in peanuts were 51% in 1995 and 68% in 1996.

Key words: biocontrol, description, *Frankliniella fusca*, insect parasitic nematode, key, nematode, new species, parasite, peanut, taxonomy, *Thripinema fuscum*, Thysanoptera, tobacco thrips.

Nematodes infesting Thysanoptera were first recorded from Europe in *Thrips physophus* L. (Uzel, 1895). Russell (1912) found a nematode inhabiting the bean thrips, *Heliothrips fasciatus* (L.), in California but did not describe the nematode. Sharga (1932) described a nematode from *Aptinothrips rufus* (Gmelin) in England as *Tylenchus aptini*. Lysaght (1936) proposed the taxon *Anguillulina aptini* for this species, and a year later published an ecological study of the nematode including seasonal abundance and life cycle (Lysaght, 1937). Wachek (1955) transferred *A. aptini* to the genus *Howardula*. Nickle and Wood (1964) reported *Howardula aptini* infecting two species of blueberry thrips, *Frankliniella vaccinii* Morgan and *Taeniothrips vacciniophilus* Hood. Reddy et al. (1982) reported *Howardula aptini* infecting *Megaluriothrips* sp.

Siddiqi (1986) created a new genus, *Thripinema*, based on host range and the oval shape of the parasitic female. His revision of the genus included renaming the nematodes described by Sharga (1932), Nickle and Wood (1964), and Reddy et al. (1982) as *T. aptini*, *T. nickelwoodi*, and *T. reniraoi*, respectively. Chizov et al. (1995) described

Thripinema khrustalevi from two hosts, *Thrips trehernei* Prisner and *T. physophus* L.

During the summers of 1995 and 1996 we conducted a survey of the natural enemies of tobacco thrips, *Frankliniella fusca* (Hinds), found on 'Florunner' peanut (*Arachis hypogaea* L.) at the North Florida Research and Education Center field station, Marianna, Florida. Several nematodes were discovered within the abdominal cavity of an adult female *F. fusca*. After collection of additional specimens, we concluded that the nematode represented a new species in the genus *Thripinema*, which we describe herein as *Thripinema fuscum*. The new species is named after the host, *F. fusca*.

MATERIALS AND METHODS

Collection of nematodes: Collections of peanut flowers began September 1995 until October peanut harvest and again in 1996 from July to October peanut harvest. Percent infection was estimated by weekly collections of 35 randomly selected flowers. Flowers were gently opened with larval forceps while submerged in a 5% formalin solution. All stages of thrips present were dissected. Parasitic and unmated reproductive stage females, eggs, adult males, and all juvenile stages were found. Infective stage females also were obtained by dissecting peanut flowers in a small dish of distilled water under a stereomicroscope at $\times 35$.

Light microscopy preparation: Nematode life stages dissected from thrips and collected from peanut flowers were transferred to warm lactophenol for 3 days before mount-

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ing in glycerin on glass slides. Measurements are given in micrometers as means \pm standard deviations, followed by ranges in parentheses.

SYSTEMATICS

Thripinema fuscum Tipping and Nguyen,
n. sp.
(Figs. 1,2)

Description

Holotype (male): Length = 296 μ m; width = 13.6 μ m; a = 21.6; c = 9.3; stylet length = 10.6 μ m; spicule length = 12.3 μ m; gubernaculum length = 5.5 μ m; tail length = 31.8 μ m.

Males (n = 11): Length = 302 \pm 27 (254–333); greatest width = 14.9 \pm 1.8 (12.1–16.7); a = 20.4 \pm 2.0 (17.5–23.5); c = 9.3 \pm 0.7 (8.4–10.2); stylet length = 11.4 \pm 2.0 (9.0–15.2); spicule length = 12.9 \pm 1.5 (10.3–15.2); gubernaculum length = 6.0 \pm 1 (3.6–7.0); tail length = 32.5 \pm 3.5 (27.3–37.8).

Parasitic females (n = 11): Length = 152 \pm 26.8 (121.0–186.0); width = 72.8 \pm 9.7 (59.0–94.0); a = 2.1 \pm 0.3 (1.6–2.5).

Eggs (n = 13): Length = 53.6 \pm 9.6 (42.4–71.2); width = 26.8 \pm 5.8 (16.7–37.9).

Allotype (infective female): Length = 274 μ m; width = 12.1 μ m; a = 22.6; b = 1.5; c = 11.9; esophagus length = 178 μ m; stylet length = 12.7 μ m; V% = 84; tail length = 23 μ m.

Infective females (n = 16): Length = 257 \pm 14.6 (227–279); width = 12.2 \pm 1.1 (10.0–13.6); a = 21.4 \pm 2.2 (17.0–25.5); b = 1.5 \pm 0.1 (1.3–1.7); c = 11.6 \pm 1.0 (10.5–13.0); esophagus length = 167 \pm 13.6 (139–189); stylet length = 11.5 \pm 1.3 (9.1–13.6); V% = 81.8 \pm 1.7 (78.0–84.0); tail length = 22.4 \pm 2.2 (19.7–24.2).

Parasitic females: Different stages of parasitic females found in thrips, ranging from slightly swollen young females (Fig. 1C) to fully swollen older mature females (Fig. 1D,F). Body of mature female oval or elliptical. Stylet and esophagus indistinct or not observed in mature females but distinct in younger females. Vulva subterminal. Occasionally, part of uterus protruding from vulva. Ovary long, convoluted, with two or three flexures. Uterus large, usually containing a single egg (Fig. 1D,F).

Infective females: Body nearly straight or slightly curved ventrally when relaxed (Fig. 1A). Lip region moderately sclerotized, con-

tinuous with body, sometimes slightly offset. Lateral fields with two incisures forming a band occupying up to 40% of body width. Stylet about three times as long as head width (Fig. 1B), without knobs but with slight basal thickening. Stylet lumen wide. Dorso-esophageal gland orifice about one stylet length posterior to stylet base. Esophagus long, posterior end reaching beyond mid-body (Fig. 1A). Anterior part of esophagus thin, less than 40 μ m long, then reduced posteriorly. Esophageal glands well developed, long, extending to posterior third of body, nuclei usually distinct. Nerve ring located near base of anterior part of esophagus. Secretory-excretory pore not observed. Ovary single, prodelphic. Uterus well developed, containing sperm in mature females (Fig. 1E). Vulva usually one or more tail lengths anterior to anus. Tail tapering posteriorly to a rounded or conical tip, sometimes with short hyaline portion.

Free-living males: Body curved dorsally when relaxed (Fig. 2B). Lateral fields with two incisures forming a smooth band (Fig. 2D) occupying one-fifth to one-fourth of body width. Lip region usually slightly swollen, occasionally distinctly offset, moderately sclerotized. Stylet present (Fig. 2A), very thin, nearly indistinguishable after fixation. Stylet base slightly thickened. Esophagus degenerate, indistinct. Testis well developed, usually occupying up to one-half of body cavity diameter at mid-body and containing numerous sperm throughout its entire length. Spicules paired, thin. Gubernaculum straight or slightly curved with posterior tip rounded, somewhat curved dorsally, well cuticularized. Caudal alae large, rounded, with crenate margins (Fig. 2C).

Type host and locality

Tobacco thrips, *Frankliniella fusca*, collected from peanut, Jackson County, Marianna, Florida, USA.

Type specimens

Holotype (male) and allotype (infective female): Deposited in the U. S. Department of Agriculture Nematode Collection (USDANC), Beltsville, Maryland, USA.

Paratypes: Deposited in the USDANC, and the Florida Department of Agriculture and

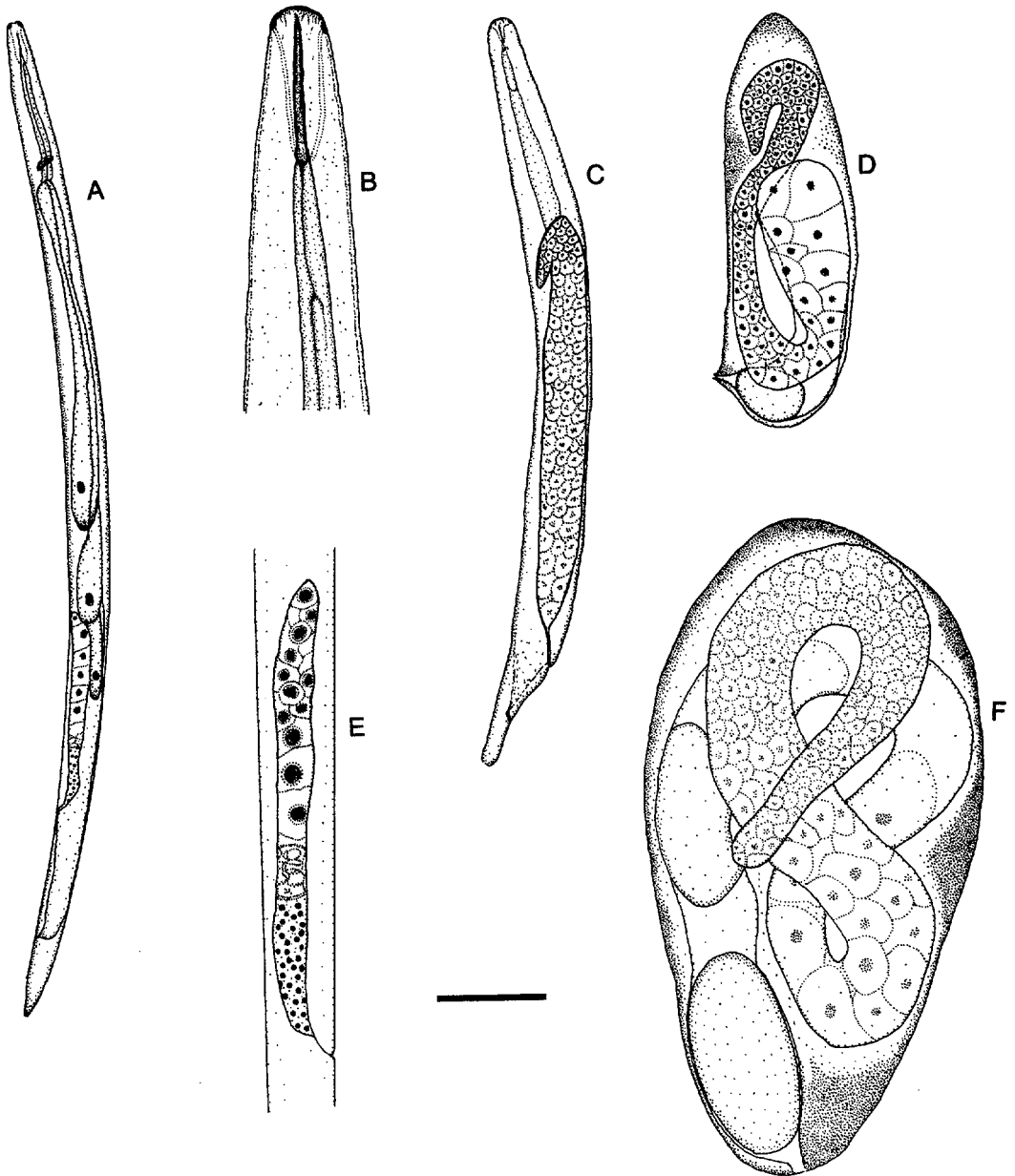


FIG. 1. *Thripenema fuscum* n. sp., female. A) Infective female. B) Anterior region of infective female. C,D,F) Progressive enlargement of parasitic females. E) Gonad of infective female. Scale bar 26 μm for A, C, D, and F, 12 μm for B and E.

Consumer Services, Division of Plant Industry Nematode Collection, Gainesville, FL, USA.

Diagnosis: Male large (averaging 302 μm), body curved dorsally with thin stylet present. Spicule averaging 12.9 μm . Parasitic females oval, averaging 152 \times 73 μm . Stylet not observed. Eggs large, 54 \times 27 μm . Infective female averaging 257 μm , stylet base without knobs but slightly thickened; $c = 11.5$.

Relationships: *Thripenema fuscum* n. sp. can be distinguished from all other species of *Thripenema* by the male possessing a stylet and a dorsally curved body. Further, *T. fuscum* n. sp. differs from *T. reniraoi* by the c -ratio (11.6 vs. 9.9) and larger eggs (55 \times 27 μm vs. 30 \times 28 μm); from *T. nicklewoodi* by parasitic female size (152 \times 73 μm vs. 210 \times 56 μm), ratio a (2.1 vs. 3.8), large eggs (55 \times

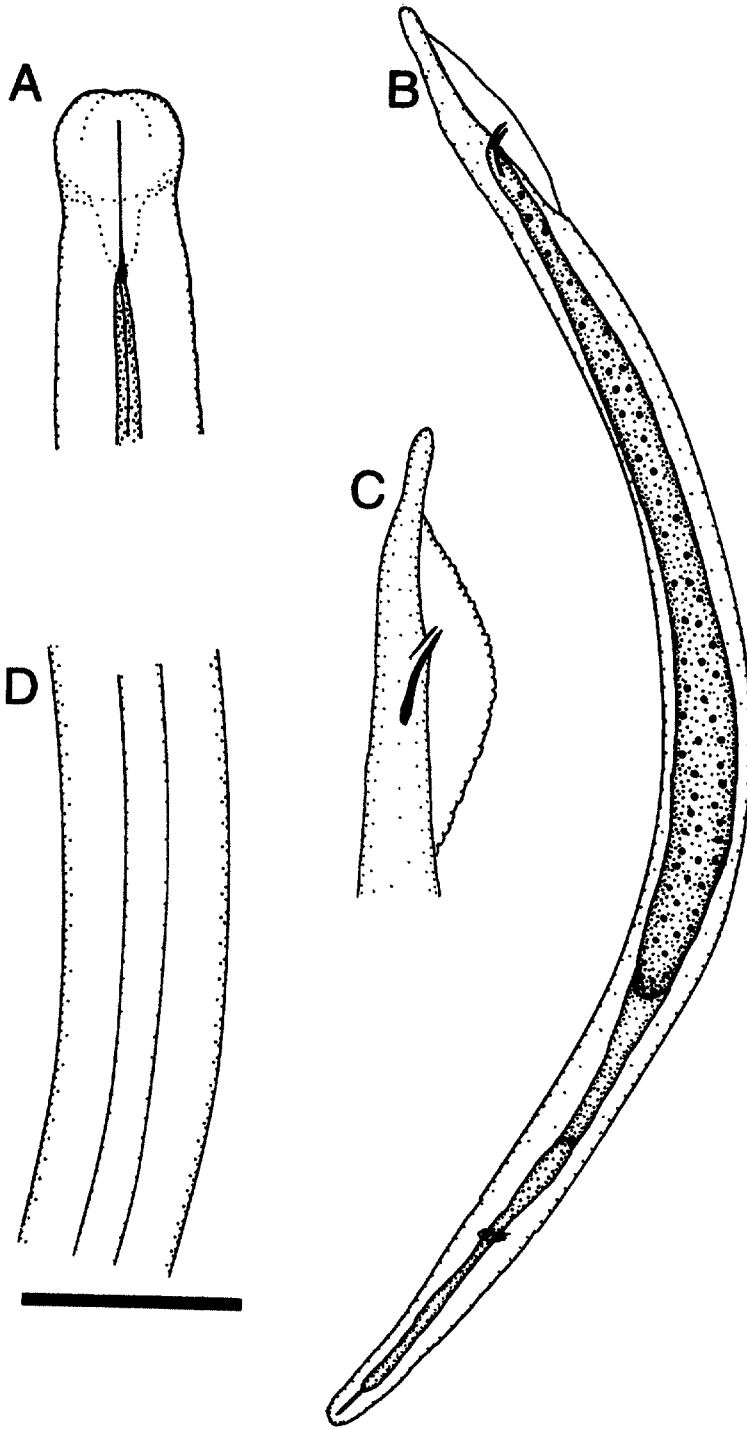


FIG. 2. *Thripenema fuscum* n. sp., male. A) Anterior region of male. B) Young male exhibiting slight dorsal curve. C) Bursa. D) Lateral field of male. Scale bar 14 μ m for A, C, and D, 30 μ m for B.

27 μ m vs. 35 \times 18 μ m); from *T. khrustalevi* by parasitic female size (152 \times 73 μ m vs. 250 \times 120 μ m) and stylet length of infective fe-

males (11.5 vs. 13–15 μ m); from *T. aptini* by parasitic female size (152 \times 73 μ m vs. 291 \times 75 μ m) and male tail length (27–38 μ m vs.

21–27 μm). The following key will assist in identification of known *Thripenema* spp.

Key to species of *Thripenema*

1. Caudal alae reaching tail tip (peloderan) ----- 2
Caudal alae not reaching tail tip (leptoderan)----- 3
2. Parasitic female spindle-shaped or bean-shaped with tail ending in a sharp point; V% about 84 -----
----- *T. nicklewoodi*
Parasitic female oval or spherical, vulva terminal -----
----- *T. khrustalevi*
3. Stylet present in male, male body curved dorsally ----- *T. fuscum* n. sp.
Stylet absent in male, male body of curved dorsally ----- 4
4. Parasitic female small, 150–225 μm long ----- *T. reniraoi*
Parasitic female large, 266–316 μm long ----- *T. aptini*

Biology

Infective stage females of *Thripenema fuscum* n. sp. can be collected by gently swirling peanut flowers in a dish of distilled water. After entering the host thrips by penetration through the intersegmental membrane of the coxal cavities, females change into the characteristic swollen shape for the genus. The ovary increases in length with several flexures. Adult thrips and, rarely, second instars were parasitized. Pupae were not hosts for *T. fuscum*. The ovaries of the parasitized thrips were reduced and eggs were absent. Generally, only one parasitic female per host was present, but occasionally two or three were observed. Although up to 175 immature nematodes were dissected from one insect, usually only 40 to 50 were present. After development within the host, free-living males and females exited thrips via the anus as reported by Lysaght (1937) for *T. aptini* and Nickle and Wood (1964) for *T. nicklewoodi*. Mating of *T. fuscum* probably occurs in the peanut flowers.

Highest rates of parasitism of *F. fusca* in peanut by *T. fuscum* was 51% in 1995 and 68% in 1996. In Florida, *F. fusca* is found

developing in wheat (*Triticum aestivum* L.) and flowers of wild radish (*Raphanus raphanistrum* L.) during January through March. *Thripenema fuscum* has been found parasitizing tobacco thrips collected from these winter host plants.

Western flower thrips, *Frankliniella occidentalis* (Pergande), occasionally are infected with *T. fuscum*. *Thripenema nicklewoodi* has been shown to readily parasitize *F. occidentalis* (Greene and Parrella, 1995; Wilson and Cooley, 1972). Nickle and Wood (1964) reported that pupae of *Frankliniella vaccinii* and *Taeniothrips vaccinophilus* also were parasitized by *T. nicklewoodi*.

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