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

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Abstract: Thripenema 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. Thripenema fuscum can be distinguished from all other previously described Thripenema 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, Thripenema 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 Aiptinothrips 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 Taeiniothrips vaccinophilus Hood. Reddy et al. (1982) reported Howardula aptini infecting Megalurothrips sp.

Siddiqi (1986) created a new genus, Thripenema, 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 Thripenema khustalevi 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 Thripenema, which we describe herein as Thripenema 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 ×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-
ing in glycerin on glass slides. Measurements are given in micrometers as means ± standard deviations, followed by ranges in parentheses.

**SYSTEMATICS**

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

**Description**

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

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

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

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

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

**Infective females (n = 16):** Length = 257 ± 14.6 (227–279); width = 12.2 ± 1.1 (10.0–13.6); a = 21.4 ± 2.2 (17.0–25.5); b = 1.5 ± 0.1 (1.3–1.7); c = 11.6 ± 1.0 (10.5–13.0); esophagus length = 167 ± 13.6 (139–189); stylect length = 11.5 ± 1.3 (9.1–13.6); V% = 81.8 ± 1.7 (78.0–84.0); tail length = 22.4 ± 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. Stylect 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, continuous with body, sometimes slightly offset. Lateral fields with two incisures forming a band occupying up to 40% of body width. Stylect about three times as long as head width (Fig. 1B), without knobs but with slight basal thickening. Stylect lumen wide. Dorso-esophageal gland orifice about one stylect length posterior to stylect base. Esophageal gland orifice about one stylect length posterior to stylect base. 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. Stylect present (Fig. 2A), very thin, nearly indistinguishable after fixation. Stylect 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
Diagnosis: Male large (averaging 302 μm), body curved dorsally with thin stylet present. Spicule averaging 12.9 μm. Parasitic females oval, averaging 152 × 73 μm. Stylet not observed. Eggs large, 54 × 27 μm. Infective female averaging 257 μm, stylet base without knobs but slightly thickened; c = 11.5.

Relationships: Thripnema fuscum n. sp. can be distinguished from all other species of Thripnema 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 × 27 μm vs. 30 × 28 μm); from T. nicklewoodi by parasitic female size (152 × 73 μm vs. 210 × 56 μm), ratio a (2.1 vs. 3.8), large eggs (55 ×
Fig. 2. *Thripemema 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 μm for A, C, and D, 30 μm for B.

27 μm vs. 35 × 18 μm); from *T. khrustalevi* by parasitic female size (152 × 73 μm vs. 250 × 120 mm) and stylet length of infective females (11.5 vs. 13–15 μm); from *T. aptini* by parasitic female size (152 × 73 μm vs. 291 × 75 μm) and male tail length (27–38 μm vs.
were observed. Although up to 175 immature thrips were present, but occasionally two or three parasitic females exited thrips via the anus. The ovaries increase in length with several flexures. Adult thrips and, rarely, second instars were parasitized. Pupae were not hosts. Generally, only one parasitic female per host thrips. 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. fuscom. 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. fuscom probably occurs in the peanut flowers.

Highest rates of parasitism of F. fusca in peanut by T. fuscom 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 fuscom has been found parasitizing tobacco thrips collected from these winter host plants.

Western flower thrips, Frankliniella occidentalis (Pergande), occasionally are infected with T. fuscom. 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.

**Biology**

Infenicestage females of Thripenema fuscom 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. fuscom. 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. fuscom probably occurs in the peanut flowers.

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**LITERATURE CITED**


