Aphelenchoides microstylus n. sp. and Seinura onondagensis n. sp. (Nemata: Aphelenchina) from New York

T. R. Kaisa

Abstract: Aphelenchoides microstylus n. sp. and Seinura onondagensis n. sp., a nematode predator, are described from dead Scots pine (Pinus sylvestris L.) in Onondaga County, New York. Females of A. microstylus are 370 to 485 µm long. The body is slender and tapers posteriorly to an amucronate, pointed terminus. The head is continuous with the body, and lips bear a stylet guide. Diagnostic characters of females are three incisures in the lateral field, a short stylet (6–7.5 µm) with small basal knobs, a single row of oocytes, and a long postuterine sac (25–50 µm). Males are characterized by small spicules (10–11 µm); two pairs of post-anal, subventral papillae; and a single row of spermatocytes. A bursa and gubernaculum are absent. Seinura onondagensis females are characterized by a body of moderate length (475–595 µm), finely annulated cuticle, and a slightly set-off head. Diagnostic characters are four incisures in the lateral field, long stylet without basal knobs (17–22 µm), single row of oocytes, and presence of a postuterine sac (14–38 µm). Males are unknown. The monospecific genus Indaphelenchus is proposed as a synonym of Seinura, and S. siddiqii n. comb. is proposed for the only species, I. siddiqii.

Key words: Aphelenchina, Aphelenchoides microstylus, bark beetle, Indaphelenchus siddiqii, nematode, new combination, new species, New York, Pinus sylvestris, predator, Scots pine, Seinura onondagensis, synonym, taxonomy.

Fewer than 10% of described Aphelenchoides or Seinura species are associated with insects. Fuchs (1931), Massey (1971, 1974), and Rühm (1957) have provided the only descriptions of these species in association with insects. These nematodes have been described in association with coniferous beetles of the families Scolytidae and Curculionidae.

In 1990, an undescribed Aphelenchoides sp. and Seinura sp. were isolated from Scots pine in Onondaga County, New York, in association with bark beetles. Recently, slides of the same undescribed Seinura sp. were discovered in the U.S. Department of Agriculture (USDA) Forest Service RMRS Collection. In 1965, Massey collected these specimens from Durham, North Carolina, in association with the beetle Hylobius pales Herbst. Massey never described this species or designated a specific epithet for it and, to date, it remains undescribed.

This paper describes the two new species herein known as Aphelenchoides microstylus n. sp. and Seinura onondagensis n. sp. Morphological measurements of Massey’s material are provided, and the designation S. onondagensis is proposed for this material.

Materials and Methods

During summer 1990 specimens of Aphelenchoides microstylus n. sp. and Seinura onondagensis n. sp. were isolated from dead Scots pine logs in Onondaga County, New York. Nematodes were recovered by soaking the wood in water overnight. After identification, nematodes were heat-killed and fixed in glycerin-formaldehyde. Permanent mounts were made in glycerin after processing the nematodes slowly to glycerin by Hooper’s method (1970). Specimens of S. onondagensis from Durham, North Carolina, were obtained from the USDA Forest Service RMRS Collection, Lincoln, Nebraska.

Drawings of A. microstylus and S. onondagensis were created with a Nikon Optiphot light microscope fitted with a drawing attachment. Measurements of specimens from New York and the USDA Forest Service were taken from permanent, glycerin mounts. All
measurements are in micrometers (µm) unless otherwise specified.

**Systematics**

*Aphelenchoides microstylus* n. sp.

(Figs. 1–5)

**Description**

*Holotype (female in glycerin):* Length 480; stylet 6; ratios—a 27.4, b 9.6, c 12.8, V 69.

*Females (n = 10):* Length 370–485 (429; SD 31.5); stylet 6–7.5 (6.6; SD 0.7); ratios—a 25.4–48.5 (33.2; SD 6.2), b 7.8–14.9 (9.7; SD 1.8), c 12.2–16.2 (14.1; SD 1.1), c’ 2.8–4.7 (3.8; SD 0.6), V 69–74 (70.5; SD 1.6).

Body slender, ventrally curved, tapering posteriorly to pointed, amucronate terminus. Cuticle with fine, transverse striae. Lateral field with three incisures. Head continuous with body, lips with stylet guide. Stylet

![Figures 1-5](image-url)

**Figs. 1–5.** *Aphelenchoides microstylus* n. sp. 1) Full view of female. 2) Full view of male. 3) Head and neck of female. 4) Female tail. 5) Male tail. Scale = 25 µm in Figs. 1,2; 6 µm in Fig. 3; 7 µm in Figs. 4,5.

Allotype (male in glycerin): Length 510; stylet 6; spicules 11; ratios—a 34, b 9.3, c 18.5, c’ 2.2.

Males (n = 10): Length 350–480 (402; SD 44.4); stylet 6–7.5 (6.6; SD 0.7); spicules 10–11 (10.2; SD 0.4); ratios—a 29.3–38.4 (34; SD 3.4), b 8–10.5 (9.3; SD 0.9), c 14.5–21.1 (18.1; SD 2), c’ 2–3 (2.4; SD 0.3).

Body J-shaped, at times ventrally curved. Cuticle, head, excretory pore, median bulb, and stylet same as female. Tail conoid to pointed, amucronate terminus. Testis 165 to 275 long, spermatocytes in single row. Spicules arcuate, 10 to 11 long; apex and rostrum prominent. Two pairs of post-anal, subventral papillae present: first pair just anterior to tail tip, second pair one body width posterior to cloaca. Bursa and gubernaculum absent.

Type host and locality

From the xylem of dead Scots pine (Pinus sylvestris L.), Syracuse University Campus, Onondaga County, New York.

Bionomics

Bark beetle associate.

Type specimens

Holotype (female): Collected 23 June 1990 by T. R. Kaisa in Onondaga County, New York. Slide no. T-535t, deposited in the U.S. Department of Agriculture Nematode Collection (USDANC), Beltsville, Maryland. Allotype (male): Same data as holotype. Slide no. T-536t deposited in USDANC, Beltsville, Maryland. Paratypes (females and males): Same data as holotype. Two females on slide no. T-4787p and three males on slide no. T-4788p deposited in USDANC, Beltsville, Maryland; three females and one male in Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England; and two females and one male in State University of New York College of Environmental Science and Forestry, Program in Environmental and Forest Biology, Department of Entomology, Syracuse, New York.

Diagnosis

The female of Aphelenchoides microstylus n. sp. is 370 to 485 µm long. The body is slender and ventrally curved posteriorly to a pointed, amucronate tail. The cuticle is finely annulated and bears three incisures in the lateral field. The stylet is short (6–7.5 µm), with small basal knobs. The intestine terminates in a rectum and anus. Oocytes are arranged in a single row, and a long postuterine sac is present (25–50 µm). The vulva is protuberant, and a flap is absent. The male is 350 to 510 µm long. The body is slender and tapers posteriorly to an amucronate tail, which bears two pairs of post-anal, subventral papillae. Spicules are 10 to 11 µm long with a prominent apex and rostrum. A bursa and gubernaculum are absent.

Relationships

Aphelenchoides microstylus n. sp. has a simple, amucronate tail and belongs to the Group 1 category of Aphelenchoides species as described by Shahina (1996). All species in this group except A. helicus Heyns, 1964 are differentiated from A. microstylus by a set-off head. Aphelenchoides helicus differs in having a longer female body (480–500 µm vs. 370–485 µm), stouter female body (24–31 vs. 25.4–48.5), and a longer stylet (10 µm vs. 6–7.5 µm).

Other characters that differentiate the rest of the Group 1 species from A. microstylus are listed in Table 1.

Remarks

Three Group 1 species were not compared to A. microstylus because of uncertainty regarding their placement in this group or taxonomic status. Aphelenchoides orientalis Eroshenko, 1968 and A. parasubitenuis Shavrov, 1967 were described as mucronate and may belong to the Group 2 (mucro-
nate) category of *Aphelenchoidea* species. The status of *A. zeravschanicus* Tulaganov, 1949 is unresolved; Sanwal (1961), Baranovskaya (1981), and Ebsary (1991) regard it as species inquirenda whereas Hunt (1993) considers it a valid species.

Seinura onondagensis n. sp.  
(Figs. 6–8)

**Description**

**Holotype (female in glycerin):** Length 540; stylet 22; ratios—a 27, b 6.8, c 6.2, c′ 8.8, V 69.

**Females (n = 16):** Length 475–595 (535; SD 34); stylet 17–22 (18; SD 0.7); ratios—a 24–30 (28; SD 1.9), b 6–8 (7.6; SD 0.5), c 7–10 (7.3; SD 0.8), c′ 6–9 (7.3; SD 1.3), V 68–73 (71; SD 1.8).

**Females (n = 3):** Durham, North Carolina population (Slide no. 56-P in USDA Forest Service RMRS Collection). Length 530–650 (573; SD 55); stylet 18–20 (19; SD 0.8); ratios—a 27–31 (28.7; SD 1.7), b 7–8 (7.6; SD 0.4), c 6–7 (6.4; SD 0.2), c′ 7–9 (8; SD 0.6), V 68–70 (69; SD 0.6).


**Male:** Unknown.

**Type host and locality**

From the xylem of dead Scots pine (*Pinus sylvestris* L.), Syracuse University Campus, Onondaga County, New York.

<table>
<thead>
<tr>
<th>TABLE 1. Characters differentiating Group 1 <em>Aphelenchoidea</em> spp. with set-off heads from <em>Aphelenchoidea microstylus</em> n. sp.</th>
</tr>
</thead>
</table>
| **A. africana**  Dassonville & Heyns, 1984  
Longer, knobless female stylet (11–13 µm); longer female tail (c 10–12); larger spicules (12–16 µm). |
| **A. capsuloplanus**  (Haque, 1967) Andrássy, 1976  
Shorter female tail (c 17–19); larger spicules (15–17 µm). |
| **A. confusus**  Thorne & Malek, 1968  
Longer, knobless female stylet (12 µm); longer female body (600 µm); shorter female tail (c 18). |
| **A. helicosoma**  Maslen, 1979  
Curved female and male tails, longer female body (520–610 µm), longer female stylet (13–16 µm); larger spicules (22–27 µm). |
| **A. involutus**  Minagawa, 1992  
Longer, curved female tail (c 6–8); longer female stylet (14–16 µm); smaller V (61–63). |
| **A. jacobi**  Husain & Khan, 1967  
Longer, knobless female stylet (12–14 µm); smaller female b (3–5); larger spicules (13–15 µm). |
| **A. kuehnii**  Fischer, 1894 in Thorne, 1961  
Longer female body (610–800 µm), longer female stylet (14 µm), larger spicules (18 µm). |
| **A. limberi**  Steiner, 1936 in Filipjev and Schuurmans Stekhoven, 1941  
Longer female body (550–640 µm), longer female stylet (11 µm), blunt female tail. |
| **A. longius**  Das, 1960  
Longer, knobless female stylet (14 µm); longer female tail (c 10). |
| **A. marinus**  Timm & Franklin, 1969  
Longer female body (570–860 µm), longer female tail (c 7–12), smaller V (61–68), larger spicules (24–25 µm). |
| **A. obtusicaudatus**  Eroshenko, 1967  
Longer female body (570–580 µm), shorter female tail (c 17–20). |
| **A. obtusus**  Thorne & Malek, 1968  
Stouter female body (a 26), smaller female b (6), blunt female tail. |
| **A. pityokteini**  Massey, 1974.  
Longer female body (540–740 µm), longer female tail (c 23–25), longer female stylet (12 µm), larger spicules (18.5 µm). |
| **A. polygraphi**  Massey, 1974  
Longer female body (1,180–1,300 µm), more slender female body (a 41–48), shorter female tail (c 18–22), longer female stylet (15–16 µm). |
| **A. spinosus**  Paesler, 1957  
Longer female body (1,180–1,300 µm), more slender female body (a 41–48), shorter female tail (c 18–22), longer female stylet (15–16 µm). |
| **A. taraii**  Edward & Misra, 1969  
Longer female body (570–700 µm), shorter female tail (c 23–25), longer female stylet (12 µm), larger spicules (18.5 µm). |

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**Seinura onondagensis** n. sp.
Bionomics

Nematode predator, bark beetle associate. This species was observed feeding on an *Aphelenchoides* sp. and a *Rhabditis* sp.

Type specimens

*Holotype (female):* Collected 14 July 1990 by T. R. Kaisa in Onondaga County, New York. Slide no. T-534t, deposited in the U.S. Department of Agriculture Nematode Collection (USDANC), Beltsville, Maryland. *Paratypes (females):* Same data as holotype. Six females on slide no. T-4774p deposited in USDANC, Beltsville, Maryland; seven females in Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., England; and six females in State University of New York College of Environmental Science and Forestry, Program in Environmental and Forest Biology, Department of Entomology, Syracuse, New York.

Diagnosis

The female of *Seinura onondagensis* n. sp. averages 535 µm in length with a body that tapers posteriorly to a filiform, amucronate terminus. The cuticle is finely annulated, and there are four incisures in the lateral field. The stylet is 17 to 22 µm long, and without knobs. The intestine terminates in a rectum and anus. Oocytes are arranged in a single row, sperm are present in the spermatheca, and a postuterine sac is present.

Relationships

The lack of stylet knobs, presence of a postuterine sac, and presence of a single row of oocytes differentiate *S. onondagensis* n. sp. from 82% of *Seinura* species that are not described solely from males. Table 2 lists these species and characters that differentiate them from the new taxon.

The shorter female body (475–595 µm vs. 620–820 µm) and shorter female tail (c 7–10 vs. c 4–7) differentiate *S. onondagensis* from *S. elmiraensis* (van der Linde, 1938) J. B. Goodey, 1960; *S. filicaudata* (Christie, 1939) J. B. Goodey, 1960; *S. longicaudata* (Cobb, 1893) J. B. Goodey, 1960; and *S. mali* Fuchs, 1931.

The shorter female body (390–400 µm), smaller V (60–62 vs. 68–73), shorter stylet (12–13 µm vs. 17–22 µm), and distinctly set-off head differentiate *S. nodosa* Andrássy, 1966 from the new species. The same characters also differentiate *S. hechlerae* Chatur-
Seinura hechlerae is 320 to 470 µm long, with a more anteriorly situated vulva (V 60–66) and a stylet that is 14 to 15 µm long.

Seinura oswegoensis (van der Linde, 1938) J. B. Goodey, 1960 resembles the new species in the female body length of 480–546 µm. It differs in having a more posteriorly situated vulva (V 75–76 vs. 68–73); a shorter, stouter tail (c’ 3.7 vs. c’ 6–9); and a distinctly set-off head.

Seinura onondagensis and S. paynei Grewal, Siddiqi & Atkey, 1991 are similar in stylet length, but S. paynei differs in the set-off head, longer female body (640–840 µm), longer postuterine sac (45–85 µm vs. 14–38 µm), and shorter female tail (39–50 µm vs. 55–90 µm).

Remarks

Specimens of Seinura sp. from Durham, North Carolina (Massey’s collection), are morphologically and morphometrically similar to type specimens from New York. For these reasons, the specimens are designated as S. onondagensis.

Seinura siddiqii (Bajaj, Bishnoi & Dabur, 1994) n. comb. syn. Indaphelenchus siddiqii Bajaj, Bishnoi & Dabur, 1994

Diagnosis

The female of S. siddiqii is characterized by a short body (346–410 µm), set-off head, three incisures in the lateral field, and a filiform tail. The stylet is 12–13 µm long and without basal knobs. The esophageal gland

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**Table 2.** Seinura spp. that differ from Seinura onondagensis n. sp. in the absence of a postuterine sac, presence of stylet knobs, or presence of multiple rows of oocytes.

<table>
<thead>
<tr>
<th>Seinura species</th>
<th>Postuterine sac absent</th>
<th>Multiple rows of oocytes present</th>
<th>Stylet knobs present</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. arguta Kazachenko, 1980</td>
<td>x</td>
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<tr>
<td>S. arizonensis Massey, 1974</td>
<td>x</td>
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<tr>
<td>S. aurangabadensis Surywanshi, 1971</td>
<td>x</td>
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<tr>
<td>S. celeris Hechler &amp; Taylor, 1965</td>
<td>x</td>
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<tr>
<td>S. chertiensis Dmitrenko, 1966</td>
<td>x</td>
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<tr>
<td>S. citri (Andrassy, 1957) J. B. Goodey, 1960</td>
<td>x</td>
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<tr>
<td>S. clavata Bajaj &amp; Bhatti, 1982</td>
<td>x</td>
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<tr>
<td>S. demani (T. Goodey, 1927) J. B. Goodey, 1960</td>
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<td>x</td>
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<tr>
<td>S. diversa (Paesler, 1957) J. B. Goodey, 1960</td>
<td>x</td>
<td>x</td>
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<tr>
<td>S. fuchsi Edward &amp; Misra, 1969</td>
<td>x</td>
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<tr>
<td>S. indica Surywanshi, 1971</td>
<td>x</td>
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<td>S. kherai Singh, 1977</td>
<td>x</td>
<td>x</td>
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<tr>
<td>S. linfordi (Christie, 1939) J. B. Goodey, 1960</td>
<td>x</td>
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<tr>
<td>S. nagini Husain &amp; Khan, 1965</td>
<td>x</td>
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<td>S. oahuensis (Christie, 1939) J. B. Goodey, 1960</td>
<td>x</td>
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<tr>
<td>S. obscura Grewal, Siddiqi &amp; Atkey, 1991</td>
<td>x</td>
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<tr>
<td>S. oliveri (Chirstie, 1939) J. B. Goodey, 1960</td>
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<tr>
<td>S. oostenbrink Hans &amp; Khan, 1967</td>
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<td>S. occana (Paesler, 1957) J. B. Goodey, 1960</td>
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<td>S. pararumyura Maidyanov, 1976 in Baranovskaya, 1981</td>
<td>x</td>
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<td>S. paratenacaudata Geraert, 1962</td>
<td>x</td>
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<tr>
<td>S. propora Siddiqi, Husain &amp; Khan, 1967</td>
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<td>S. prospera Kazachenko, 1980</td>
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<td>S. stermi Hechler &amp; Taylor, 1965</td>
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<td>S. sutura Massey, 1971</td>
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<td>S. tandoni Singh, 1977</td>
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<tr>
<td>S. tenacacaudata (de Man, 1895) J. B. Goodey, 1960 in Hechler, 1963</td>
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<tr>
<td>S. triscia Bajaj &amp; Bhatti, 1982</td>
<td>x</td>
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<tr>
<td>S. variobulbosa Haque, 1966</td>
<td>x</td>
<td>x</td>
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<tr>
<td>S. winchesi (T. Goodey, 1927) J. B. Goodey, 1960</td>
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</table>
lobes are short, about two body widths long (as measured from the drawing). Both rectum and anus are distinct. Oocytes are arranged in two to three rows in the growth zone, and a long postuterine sac (34–56 µm) is present.

The male of *S. siddiqii* is 333–363 µm long. The body tapers posteriorly to a spikate tail, which bears two pairs of post-anal papillae. Spicules are 13 to 15 µm long with a prominent apex and rostrum. Spermatocytes are arranged in two rows. A bursa and gubernaculum are absent.

**Relationships**

The short male and female bodies (333–363 µm and 346–410 µm, respectively) differentiate *S. siddiqii* from all other species except *S. nagini* Husain & Khan, 1965; *S. nodosa* Andrássy, 1966; and *S. hechlerae* Chaturvedi, Singh & Khera, 1979. *Seinura nagini* is similar to *S. siddiqii* in female body length (320–400 µm), stylet length (12–15 µm), c (6–8), and V (60–64). *Seinura nagini* females differ from *S. siddiqii* females in having stylet knobs, a stylet guide, fewer rows of oocytes (two vs. two to three), smaller b ratio (3–4 vs. 6–9), and number of incisures (four vs. three). *Seinura nagini* males differ in the smaller b ratio (4 vs. 6–10), number of caudal papillae (three pairs vs. two), and longer spicules (18 µm vs. 13–15 µm). Spermatocytes are arranged in a single row in *S. nagini* vs. two rows in *S. siddiqii*.

*Seinura nodosa* is similar to *S. siddiqii* in female body length (390–400 µm), stylet length (12–13 µm), and in the ratios a (23–24) and b (7). *Seinura nodosa* females differ in having a clavate tail terminus, a more anteriorly placed vulva (V 60–62 vs. 62–68), and a shorter postuterine sac (one vs. two to four body widths long).

*Seinura hechlerae* females are similar to *S. siddiqii* females in body length (320–470 µm), V (60–66), knobless stylet, and a long postuterine sac (three body widths long). *Seinura hechlerae* females differ in having a single row of oocytes vs. two to three in *S. siddiqii*, and having a conical tail vs. filiform in *S. siddiqii*.

**Remarks**

*Indaphelenchus siddiqii* Bajaj, Bishnoi & Da- bur, 1994 was described as the only species in this new genus. The genus is remarkably similar to *Seinura* as indicated by the diagnosis: female tail filiform, female and male bodies short (≈410 µm), postuterine sac long, embryonated eggs absent in uterus, esophageal gland lobes short, male tail spikate, and spicules with a prominent apex and rostrum. Consequently, *Indaphelenchus* (Bajaj et al., 1994) is synonymized with *Seinura*, and *S. siddiqii* n. comb. is proposed for *I. siddiqii*.

**Literature Cited**


