

Observations on the marine nematode genus *Spirinia* Gerlach, 1963 (Desmodoridae: Spiriniinae) with descriptions of two new species

J. W. Coles

15 Rushfield Road, Liss, Hampshire GU33 7LW

Synopsis

Observations on the nematode genus *Spirinia* Gerlach, 1963 are made including notes on its systematic position. The genus is characterized by the shape of the head, form and position of the amphids, narrow slightly cuticularized buccal cavity, short oesophagus with a pronounced bulb and form of the male genital apparatus. The tail-shape separates the genus into two sub-genera—conical in the subgenus *Spirinia* and flagellate in the subgenus *Perspiria*. A list of the valid species is given together with notes of those considered as *nomina dubia* and a dichotomous key for the determination of species. Descriptions and/or notes are given of the following species: *Spirinia* (*S.*) *parasitifera* (Bastian, 1865); *S.* (*S.*) *schneideri* (Villot, 1875); *S.* (*S.*) *hopperi* sp. nov.; *S.* (*S.*) *laevis* (Bastian, 1865); *S.* (*S.*) *gerlachi* (Luc & DeConinck, 1959); *S.* (*Perspiria*) *hamata* Wieser & Hopper, 1967; *S.* (*P.*) *mokii* sp. nov.

Introduction

This report was prompted by a collection of *Spirinia parasitifera* (Bastian, 1865) from localities in North America (Canada; Massachusetts and Florida, USA) provided by Mr Bruce E. Hopper of the Canadian Department of Agriculture. Apart from one population in Nova Scotia (Bras d'Or Lake) they show variation in the form of the manubrium (cephalated proximal portion of the spicule) not apparent in *S. parasitifera* from European waters. As this is the only character in which they differ a taxonomic distinction is not justified. Specimens of *S. parasitifera*, as well as four other species, including one described as new (*S.* (*S.*) *hopperi*) from British coasts are also examined. A new species belonging to the subgenus *Perspiria* Wieser & Hopper, 1967 (*S.* (*P.*) *mokii*) from Malaysia is described. Observations are also made on specimens of *S.* (*P.*) *hamata* Wieser & Hopper, 1967 from Florida.

Typically *Spirinia* species live in sandy and muddy habitats and are often found in sand surrounding the roots of *Zostera* (eelgrass). Twenty-five nominal species have been described, 13 of which are currently included in the genus. See Gerlach & Riemann (1973) for nomenclatorial changes and synonymies up to 1972. Since 1972 another species (*Spirinia* (*S.*) *gnaigeri* Ott) has been described from an inter-tidal sand-flat, Bermuda (Ott, 1977).

A list and key to all valid species of *Spirinia* is included (see p. 80). Notes are also given of species considered as *nomina dubia*.

Material and methods

The specimens from British coasts were fixed in formalin with sea-water. All specimens studied are deposited in the collection of the British Museum (Natural History). The examination was carried out mainly with the light microscope using transmitted light interference microscopy in some instances. Specimens of *S.* (*S.*) *parasitifera*, *S.* (*S.*) *schneideri*, *S.* (*S.*) *hopperi* and *S.* (*S.*) *laevis* were also examined with a scanning electron microscope for elucidating details of the labial and cephalic sensilla and for the appearance of the cuticle. Only absolute measurements are given (see Tables I–X). The head diameter was taken at the mid-level position of the amphids. Measurements of the arc-length of the spicules are given, not the chord.

Systematic position of *Spirinia*

The genus (as *Spira*) was established by Bastian (1865) but first fully characterized by De Man (1890). As *Spirina* Filipjev, 1918 it was first included in the family Desmodoridae (established as sub-family Desmodorini) by Filipjev (1922), subsequently raised to family by Steiner (1927). Chitwood (1936) subdivided the Desmodoridae into four subfamilies and included *Spirina* in a tribe Spirinacea of the subfamily Richtersiinae and Wieser (1954) followed this classification in a revision of the genus with a key to species.

Gerlach (1963) changed the name *Spirina* Filipjev, 1918 to *Spirinia* because the name *Spirina* was found to be preoccupied by a mollusc. More recently there have been changes in the classification of the Desmodoridae and *Spirinia* is currently placed as the type-genus of the subfamily Spiriniinae. See De Coninck (1965), Gerlach & Murphy (1965), Wieser & Hopper (1967), Gerlach & Riemann (1973) and Lorenzen (1981). Wieser & Hopper (1967) erected the subgenus *Perspiria* for the species of *Spirinia* having a flagellate and coarsely-striated tail.

Spirinia is redefined as follows: Desmodoridae, Spiriniinae. Cuticle with or without transverse striations. Body setae present. Head narrow but not set-off from body, more truncate in some species than in others. Buccal cavity small and narrow, the walls only slightly cuticularized, sometimes with minute teeth. Amphids a prominent single spiral, circular in outline, situated near the anterior end. Oesophagus usually short in comparison with the total body-length (an exception being a species belonging to the subgenus *Perspiria*) and with a posterior bulb. Testis single and straight (outstretched). Spicules paired, arcuate, of equal length, with a club or hook-shaped expansion (manubrium) at the proximal end. Gubernaculum short, without a posteriorly directed apophysis. Ovaries paired and reflexed. Tail conical in the subgenus *Spirinia*, flagellate in the subgenus *Perspiria*.

The closest related genus is *Chromaspirina* Filipjev, 1918, which has a larger and more heavily-cuticularized buccal cavity, often armed with larger teeth than in *Spirinia*. Also the transverse striations are much coarser compared with those in *Spirinia*. Cuticular striations are not present in *S. schneideri* and *S. hopperi*. Lorenzen (1981) has noted the similarity of *Alaimonema* Cobb, 1920 to *Spirinia*. Although Cobb (1920) gives quite a detailed description, the important differential characters are not clear, and there is only an illustration of the anterior end of the worm.

List of valid species of *Spirinia*

Subgenus *Spirinia* sensu stricto Gerlach, 1963

- S. (S.) gerlachi* (Luc & De Coninck, 1959)
- S. (S.) gnaigeri* Ott, 1977
- S. (S.) hopperi* sp. nov.
- S. (S.) laevioides* Gerlach, 1963
- S. (S.) laevis* (Bastian, 1865)
- S. (S.) parasitifera* (Bastian, 1865)
- S. (S.) schneideri* (Villot, 1875)
- S. (S.) septentrionalis* (Cobb, 1914)
- S. (S.) tenuicauda* (Allgén, 1959)

Subgenus *Perspiria* Wieser & Hopper, 1967

- S. (P.) flagellata* Vitiello, 1971
- S. (P.) hamata* Wieser & Hopper, 1967
- S. (P.) mokii* sp. nov.
- S. (P.) striaticaudata* (Timm, 1962)

Dubious species

Spirinia (S.) sabulicola (Filipjev, 1918) was described from the Black Sea from female specimens only. Males have not been found since and there are no redescrptions, so this species is unlikely to

be recognized with any degree of certainty. It is therefore treated as a *nomen dubium*. *S. (S.) similis* (Cobb, 1898) was described without an illustration and also unlikely to be recognized. It is therefore regarded as a *nomen dubium*.

Key to subgenera and species

- | | | |
|-----|--|--------------------------------|
| 1 | Tail shape conical, of varying length but never filiform (subgenus <i>Spirinia</i>) | 2 |
| 1' | Tail shape filiform, transverse striations of the cuticle more prominent on the tail (subgenus <i>Perspiria</i>) | 10 |
| 2 | Body setae short (up to 10 µm) | 3 |
| 2' | Body setae long (greater than 10 µm) | 7 |
| 3 | Cuticular striations present | 4 |
| 3' | Cuticular striations absent | 6 |
| 4 | Striations on the cuticle resolvable into dots | <i>S. (S.) septentrionalis</i> |
| 4' | Striations on the cuticle not resolvable into dots | 5 |
| 5 | Amphids about one-third of the corresponding head diameter in width, tail typically conical | <i>S. (S.) parasitifera</i> |
| 5' | Amphids 75% of corresponding head diameter in width. Males twice the length (2.12 mm) of the females (1.35 mm), tail uniformly thinner in its posterior part | <i>S. (S.) tenuicauda</i> |
| 6 | Tail short (1–1.5 times anal body diameter in length) | <i>S. (S.) schneideri</i> |
| 6' | Tail longer (2–3 times or more than the anal body diameter in length) | <i>S. (S.) hopperi</i> |
| 7 | Body setae long in cervical region only, body length 2–3 mm. Proximal end of spicules hook-like in shape | <i>S. (S.) laevis</i> |
| 7' | Body setae long throughout the length of the body, body length less than 1.6 mm | 8 |
| 8 | Amphids greater than 50% of the corresponding head diameter | <i>S. (S.) gerlachi</i> |
| 8' | Amphids less than 50% of the corresponding head diameter | 9 |
| 9 | Sub-cephalic setae present anterior to cephalic setae, cervical setae up to 15 µm in length | <i>S. (S.) laevioides</i> |
| 9' | Sub-cephalic setae absent anterior to cephalic setae, cervical setae 20–22 µm in length | <i>S. (S.) gnaigeri</i> |
| 10 | Pre-anal supplements present in male | <i>S. (P.) flagellata</i> |
| 10' | Pre-anal supplements absent in male | 11 |
| 11 | Cervical setae fairly long, other body setae lacking, spicules with only a small club-shaped expansion at the proximal end | <i>S. (P.) striaticaudata</i> |
| 11' | Cervical setae short | 12 |
| 12 | Proximal end of spicules markedly hook-shaped, body length about 2 mm | <i>S. (P.) hamata</i> |
| 12' | Proximal end of spicules with club-shaped manubrium, not hook-like, body-length less than 2 mm | <i>S. (P.) mokii</i> |

Species studied

Spirinia (Spirinia) parasitifera (Bastian, 1865)
(Figs 1a; 2a–f; 3a; 5a–c; 8a–b)

Spira parasitifera Bastian 1865; *Spirina parasitifera*: Filipjev, 1918. For full synonymy see Gerlach & Riemann, 1973.

TYPE LOCALITY. Falmouth, Cornwall, England.

MATERIAL STUDIED. 4♂♂ 1♀ from *Laminaria* holdfasts off the west coast of Scotland, near Gallanchmore Farm, situated on the mainland side of the sound of Kerrera, two miles south of Oban, BM(NH) 1961.105–134; 1♂ from sand-flats, Whitstable, Kent BM(NH) 1964.255; 4♂♂, 6♀♀ and 1 juvenile from sand around the roots of *Zostera*, Hannafore, Looe, Cornwall BM(NH) 1985.1.26–29; 9♂♂, 6♀♀ and 4 juveniles from Bras d'Or Lake, Nova Scotia, Canada (12 m coarse bottom) BM(NH) 1985.2.52–54; 1♂ from sediment on the south side of Pigeon Key, Florida, USA BM(NH) 1986. 12–5; 16♂♂, 10♀♀ from *Thalassia* bed, Biscayne Bay, Florida, BM(NH) 1985.2.33,

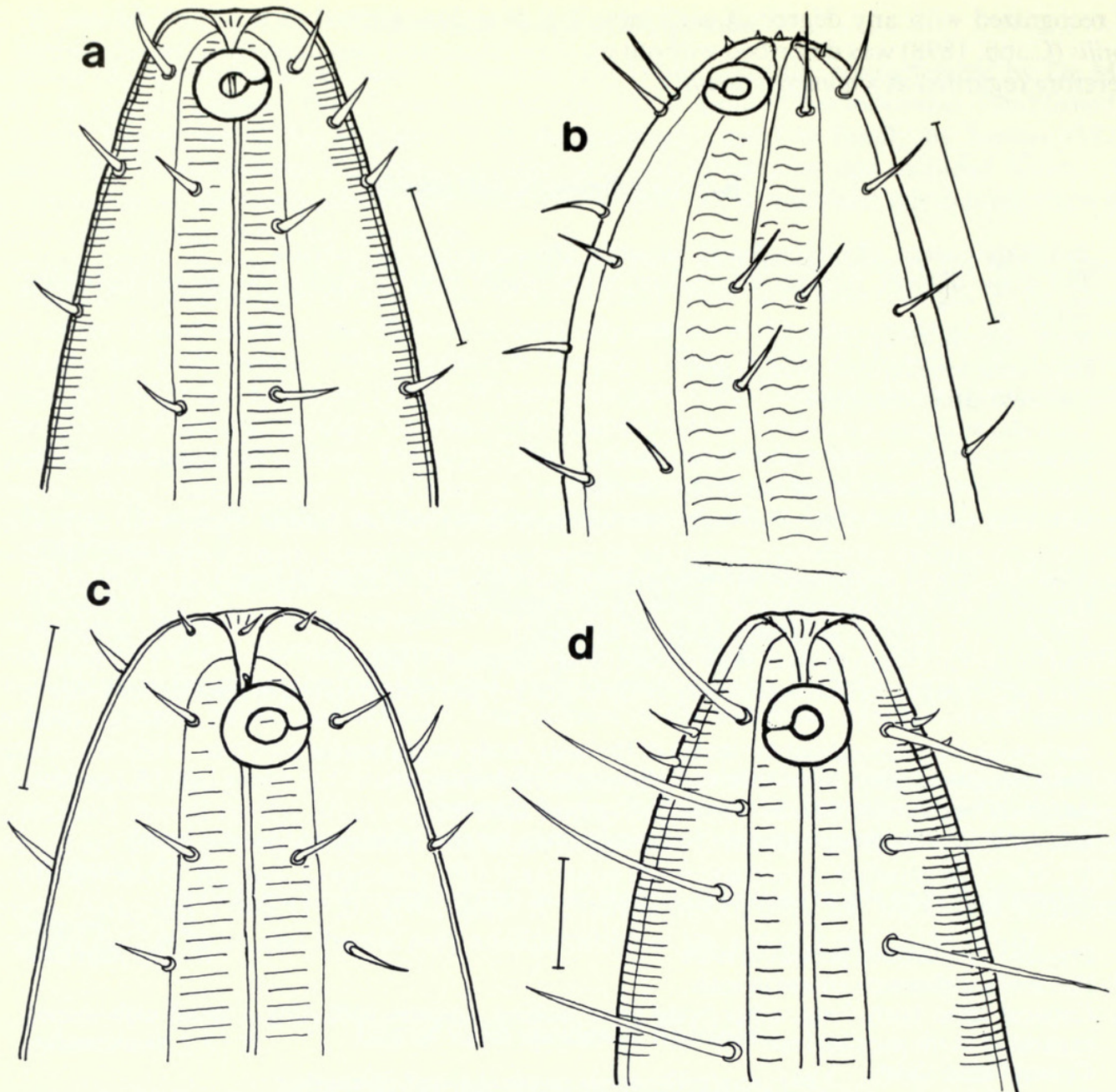


Fig. 1 Lateral views of head of (a) *Spirinia* (*S.*) *parasitifera*; (b) *S.* (*S.*) *schneideri*; (c) *S.* (*S.*) *hopperi*; (d) *S.* (*S.*) *laevis*. Bar scales: (a) = 12 μm ; (b) = 20 μm ; (c) = 10 μm ; (d) = 10 μm .

38–40, 43–46; 1♀ from *Diplanthera* bed, Biscayne Bay off Virginia Key, Florida BM(NH) 1985.2.34; 4♂♂, 1♀ from the same locality but from a public beach area BM(NH) 1985.2.35–37, 39; 7♂♂, 3♀♀ from south shore of Pigeon Key, Florida BM(NH) 1985.2.41–42; 3♂♂, 2♀♀ from Quissett Harbour, near Woods Hole, Massachusetts, USA BM(NH) 1985.2.47; 1♂ from Penzance Marsh, Woods Hole, Massachusetts BM(NH) 1985.2.48; 4♂♂, 3♀♀ from Port Monmouth, New Jersey, USA BM(NH) 1985.2.49; 10♂♂, 2 juveniles from West Laurencetown, Nova Scotia, Canada BM(NH) 1985.2.50–51.

MEASUREMENTS. Tables I–IV.

SYSTEMATIC NOTES. The specimens examined in the present report agree well with the previous descriptions of this species in most respects. See Stekhoven (1935), Bresslau & Stekhoven (1940) and Warwick (1968). Six labial papillae and a ring of six cephalic papillae, further posteriorly, not always seen or reported before, have been seen with the aid of the scanning electron microscope (see Fig. 8a–b). The four cephalic setae are about 5–6 μm long, situated sublaterally in the region of the anterior end of the amphipods.

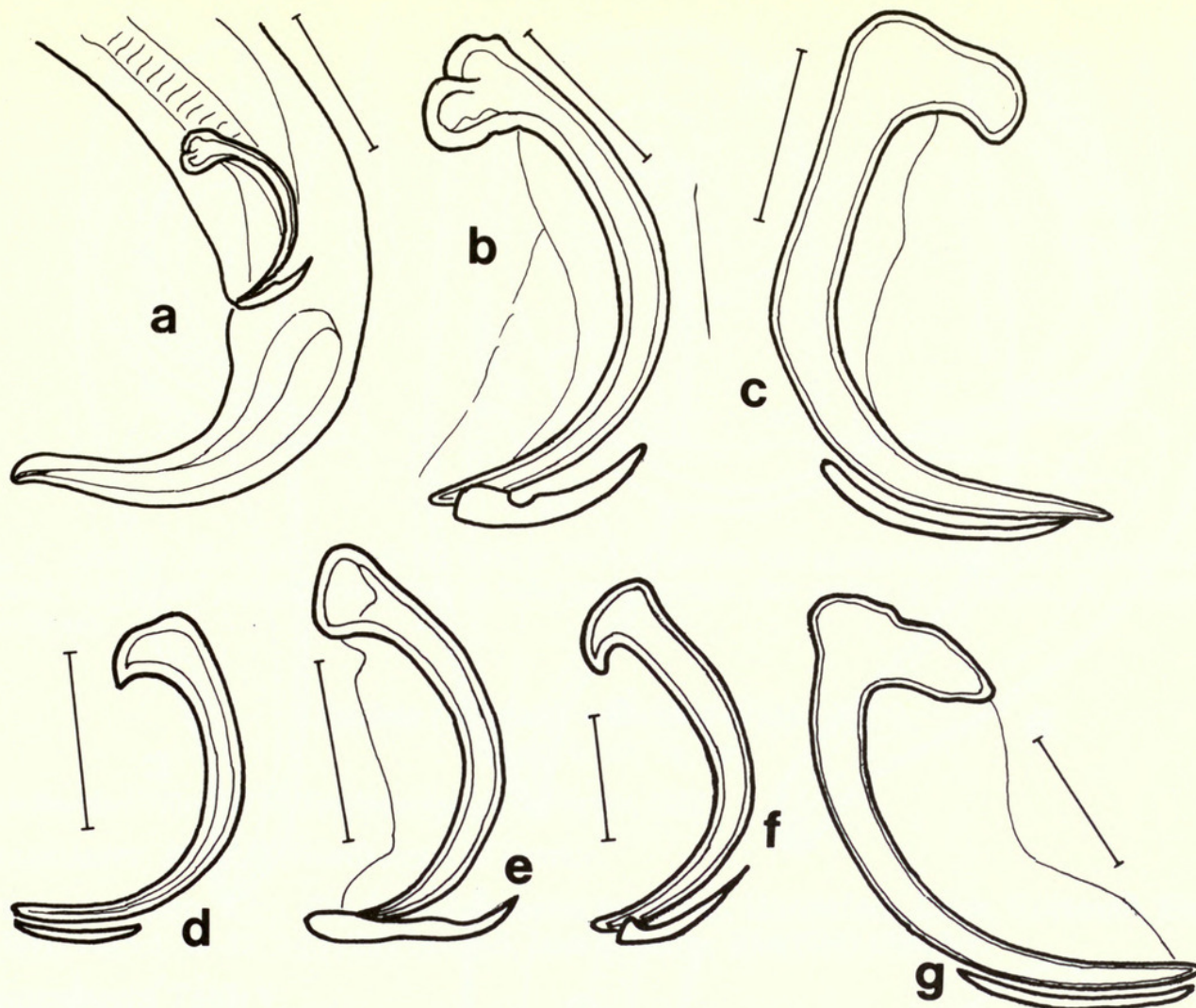


Fig. 2 *Spirinia* (*S.*) *parasitifera*: (a) Tail region of male; (b) Lateral view of spicule; (c–f) Variations of spicules in specimens from North America. *S.* (*Perspiria*) *hamata* (g) Lateral view of spicule. Bar scales: (a) = 50 μ m; (b) = 25 μ m; (c) = 15 μ m; (d) = 15 μ m; (e) = 26 μ m; (f) = 15 μ m; (g) = 15 μ m.

In the specimens examined from British coasts, as well as those from Bras d'Or Lake, Nova Scotia, Canada, the proximal end of the spicules (manubrium) is typically club-shaped (see Fig. 2a–b). The manubrium in the specimens from the other localities in North America, however, is more angular in shape, with variations (see Figs 2c–g, 3a). As this character appears to be the only way in which they differ from the typical form, the North American specimens cannot be considered as representing a different species. It is noted that most of the specimens from Florida are shorter in body-length, but this feature is often known to be the case with the same species found in warmer waters.

Suctorina attached to *S. parasitifera* have been seen in the specimens from Bras d'Or Lake, Nova Scotia, in the same way as Allgén (1934, 1951) found them on *S. parasitifera* from European waters.

GEOGRAPHICAL DISTRIBUTION. Cosmopolitan (see Gerlach & Riemann, 1973 for references prior to that date). It has since been reported from: Strangford Lough, Northern Ireland (Platt, 1977); Ems Estuary, W. Germany (Bouwman, 1981); Island of Sylt, North Sea (Blome, 1982); Loch Etive, Argyllshire, Scotland (Warwick & Gage, 1975); Gallanachmore, Argyllshire (present report); Isles of Scilly (Warwick & Coles, 1977); Exe Estuary, S. Devon, England (Warwick, 1968); Looe, Cornwall; Whitstable, Kent, England (present report); Long Island, Atlantic coast of North America (Tietjen, 1977); Bras d'Or Lake, and West Laurencetown, Nova Scotia, Canada (present report); Florida Keys, Florida; Woods Hole, Massachusetts and Port Monmouth, New Jersey, USA (present report). The record of Cobb (1928), stated as 'locality unknown' in Gerlach & Riemann (1973), was from Woods Hole, Massachusetts, USA.

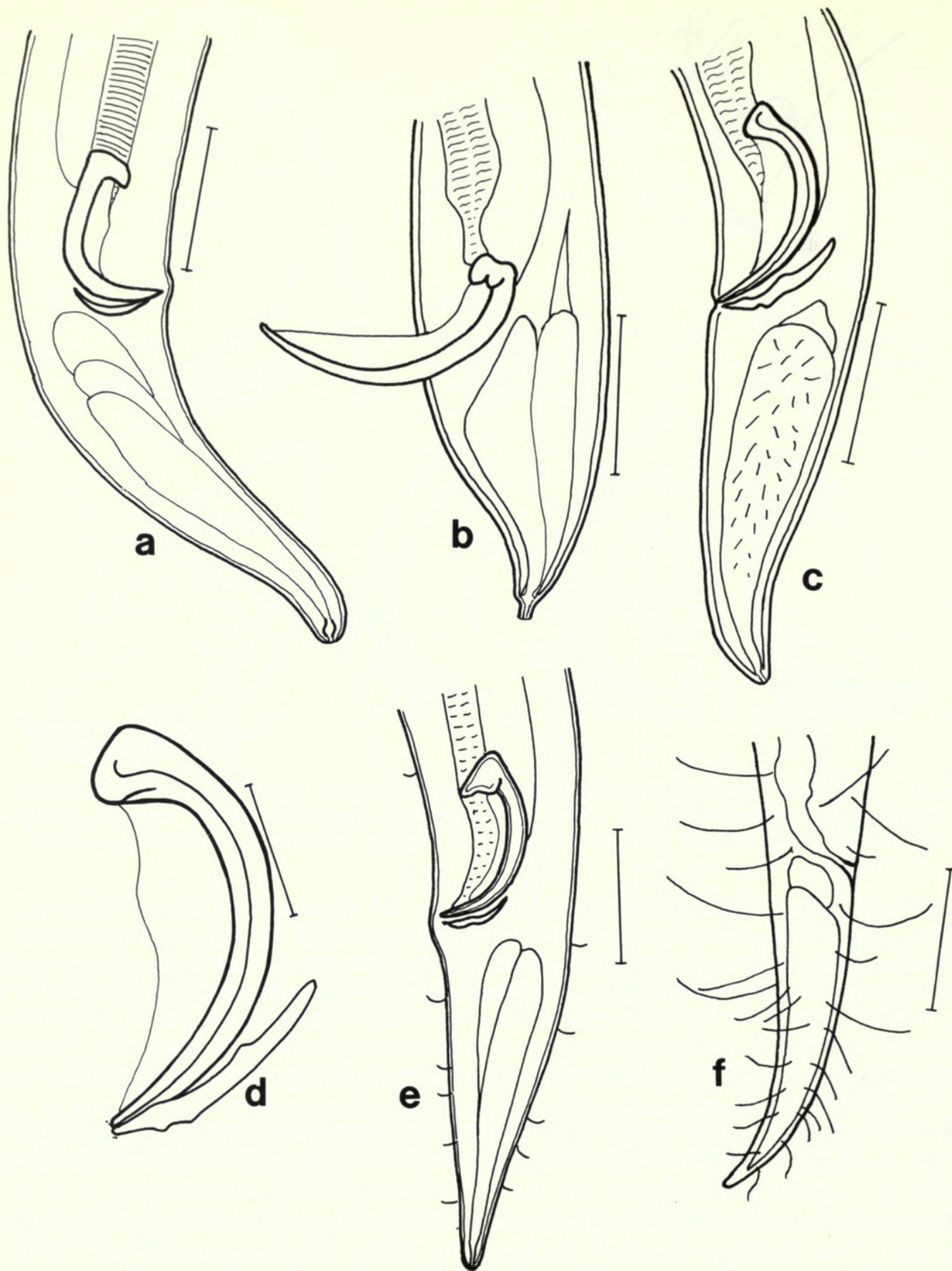


Fig. 3 *Spirinia* (*S.*) *parasitifera*: (a) Tail region of male in specimen from Florida. *S.* (*S.*) *schneideri* (b) Tail region of male with spicule extended from body, gubernaculum not shown. *S.* (*S.*) *hopperi*; (c) Tail region of male; (d) Lateral view of spicule and gubernaculum. *S.* (*S.*) *laevis*; (e) Tail region of male. *S.* (*S.*) *gerlachi* (f) Tail region of female. Bar scales: (a) = 45 μ m; (b) = 75 μ m; (c) = 60 μ m; (d) = 25 μ m; (e) = 50 μ m; (f) = 45 μ m.

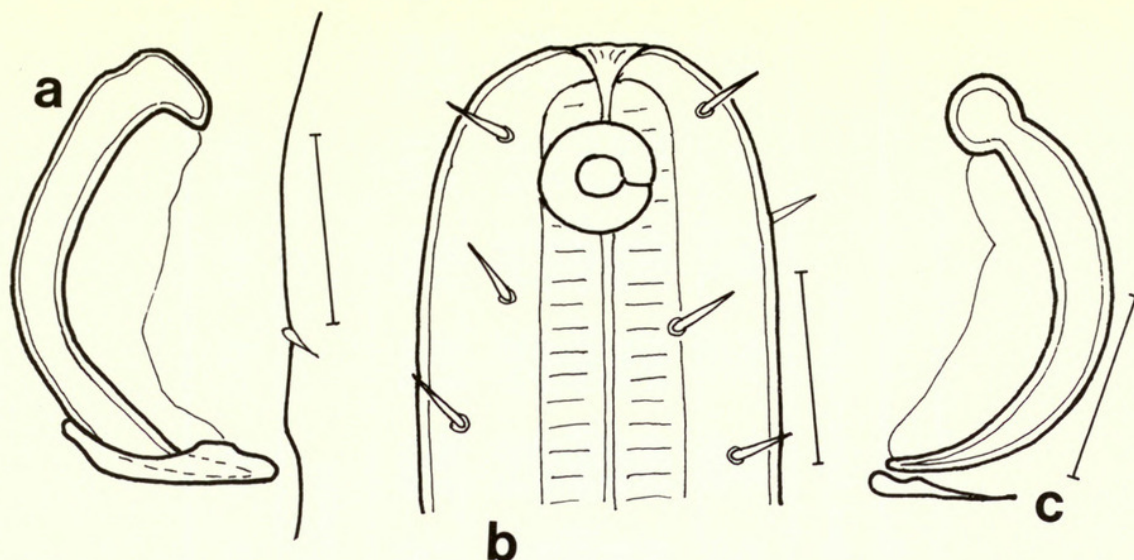


Fig. 4 *Spirinia (Perspiria) mokii*: (a) Lateral view of spicule and gubernaculum; (b) Lateral view of head; (c) Spicule and gubernaculum in holotype specimen. Bar scales: (a) = 20 μm ; (b) = 8 μm ; (c) = 20 μm .

***Spirinia (Spirinia) schneideri* (Villot, 1875)**
(Figs 1b, 3b, 7a, 9a)

Spira schneideri Villot, 1875. *Spirina schneideri*: Filipjev, 1918.

TYPE LOCALITY. Roscoff, North coast of France.

MATERIAL STUDIED. 4♂♂, 4♀♀ from *Laminaria* holdfasts, Hannafore, Looe, Cornwall, England, BM(NH) 1985.1.30–32; 2♂♂, 2♀♀ in sand, Isles of Scilly, BM(NH) 1980.3.1.

MEASUREMENTS. Table V.

SYSTEMATIC NOTES. This is a large species without cuticular striations. The cephalic sense organs are typical in arrangement (Fig. 9a). The specimens in the present report agree well with the description by Luc & De Coninck (1959). An important distinguishing characteristic is that the tail in both sexes is short, particularly so in the male (see Figs 3b & 7a).

GEOGRAPHICAL DISTRIBUTION. Roscoff, North Coast of Brittany (Villot, 1875); Luc & De Coninck (1959); Atlantic coast of Ireland (Southern, 1914); Looe, Cornwall, England (present report); Isles of Scilly (Warwick & Coles, 1977 and present report).

***Spirinia (Spirinia) hopperi* sp. nov.**
(Figs 1c, 3c–d, 6d–e, 7b, 9b)

TYPE LOCALITY. Wembury Bay, South Devon, England.

MATERIAL STUDIED. 6♂♂, 6♀♀ from a fairly deep rock-pool, approximately MLWS, Wembury Bay, South Devon. Holotype ♂ BM(NH) 1985.1.14; paratypes BM(NH) 1985.1.15–25.

MEASUREMENTS. Table VI.

DESCRIPTION. Cuticle without striations. Lateral fields are prominent, just a little wider than a third of the corresponding body diameter. Six labial papillae have only been seen with the aid of the scanning electron microscope (see Fig. 9b). The intermediate circle of six cephalic sense organs are setose (3–4 μm). The four cephalic setae are about 7–8 μm long situated sublaterally in the region of the centre part of the amphids. The amphids are approximately a third of the corresponding head diameter in width and typical of the genus in shape. Cervical setae are present 8 μm in length. They tend to be arranged in eight longitudinal rows, although rather sporadic, and become sparse towards the region of the posterior end of the oesophagus. Very short setae occur in the anal and tail regions. A small dorsal tooth is present in the narrow mouth cavity. The oesophagus and

Table I. Measurements (in mm) of *Spirinia (S.) parasitifera* (Bastian)

	Specimens from West coast of Scotland								Specimens from Hannafore, Looe, Cornwall							
	♂ ₁	♂ ₂	♂ ₃	♂ ₄	♀ ₁	♂ ₅	♂ ₆	♂ ₇	♂ ₈	♀ ₂	♀ ₃	♀ ₄	♀ ₅	♀ ₆	♀ ₇	J ₁
Body-length	2.56	2.60	2.65	2.75	3.20	2.50	2.75	2.80	3.30	2.47	2.70	2.70	2.82	3.00	3.18	1.95
Max. body-breadth	0.05	0.06	0.06	0.07	0.08	0.06	0.07	0.07	0.07	0.08	0.08	0.10	0.08	0.08	0.10	0.04
Head-diameter	0.015	0.015	0.015	0.016	0.020	0.015	—	0.015	0.017	0.012	0.017	0.013	0.013	0.015	0.016	0.01
Length of oesophagus	0.14	0.15	0.16	0.16	0.19	0.16	0.16	0.15	0.16	0.14	0.16	0.15	0.16	0.15	0.16	0.14
Tail-length	0.15	0.12	0.14	0.14	0.14	0.14	0.14	0.13	0.16	0.14	0.14	0.17	0.18	0.15	0.16	0.13
Distance of nerve-ring from ant. end.	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.08	0.10	—	0.11	0.10	0.10	0.09	0.10	0.09
Anal-diameter	0.04	0.04	0.04	0.04	0.06	0.04	0.04	0.06	0.06	0.04	0.05	0.05	0.06	0.05	0.05	0.04
Length of spicules	0.08	0.10	0.09	0.08	—	0.09	0.08	0.09	0.10	—	—	—	—	—	—	—
Length of gubernaculum	0.02	0.03	0.03	0.03	—	0.03	0.03	0.03	0.04	—	—	—	—	—	—	—
Distance of vulva from ant. end.	—	—	—	—	—	—	—	—	—	1.15	1.25	1.30	1.32	1.30	1.50	—

Table II. Measurements (in mm) of *Spirinia* (*S.*) *parasitifera* (Bastian)

Specimens from Bras d'Or Lake, Nova Scotia, Canada												
	♂ ₉	♂ ₁₀	♂ ₁₁	♂ ₁₂	♂ ₁₃	♂ ₁₄	♂ ₁₅	♀ ₈	♀ ₉	♀ ₁₀	♀ ₁₁	J ₂
Body-length	2.00	2.25	2.40	2.50	2.52	2.55	2.65	2.02	2.50	2.55	2.75	2.05
Max. body-breadth	0.04	0.04	0.05	0.05	0.06	0.04	0.06	0.05	0.06	0.08	0.07	0.05
Head-diameter	0.017	0.017	0.018	0.018	0.017	0.017	0.018	0.017	0.017	0.018	0.018	0.013
Length of oesophagus	0.13	0.15	0.14	0.13	0.15	0.15	0.15	0.14	0.15	0.15	0.15	0.14
Tail-length	0.14	0.13	0.14	0.16	0.15	0.13	0.16	0.10	0.16	0.15	0.17	0.15
Distance of nerve-ring from ant. end.	0.08	0.10	0.09	0.08	0.09	0.09	0.09	0.09	0.10	0.09	0.08	0.09
Anal-diameter	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03
Length of spicules	0.06	0.06	0.06	0.06	0.07	0.07	0.07	—	—	—	—	—
Length of gubernaculum	0.02	0.02	0.02	0.02	0.03	0.02	0.03	—	—	—	—	—
Distance of vulva from ant. end.	—	—	—	—	—	—	—	1.02	1.26	1.25	1.32	—

Table. III. Measurements (in mm) of *Spirinia* (S.) *parasitifera* (Bastian)

	Specimens from near Woods Hole, Massachusetts, USA				Specimens from West Laurencetown, Nova Scotia, Canada								
	♂ ₁₆	♂ ₁₇	♂ ₁₈	♀ ₁₂	♂ ₁₉	♂ ₂₀	♂ ₂₁	♂ ₂₂	♀ ₁₃	♀ ₁₄	♀ ₁₅	♀ ₁₆	♀ ₁₇
Body-length	2.52	2.55	2.95	2.47	2.40	2.60	2.70	2.80	2.05	2.10	2.50	2.50	2.60
Max. body-breadth	0.05	0.07	0.07	0.08	0.05	0.05	0.06	0.05	0.07	0.07	0.08	0.06	0.07
Head diameter	0.015	0.012	0.013	0.015	0.017	0.015	0.017	0.015	0.018	0.015	0.016	0.018	0.015
Length of oesophagus	0.15	0.14	0.15	0.15	0.15	0.14	0.16	0.16	0.16	0.15	0.16	0.16	0.15
Tail-length	0.14	0.16	0.15	0.14	0.13	0.14	0.14	0.13	0.14	0.12	0.14	0.12	0.13
Distance of nerve-ring from ant. end.	0.09	0.09	0.08	0.09	0.09	0.08	0.10	0.09	0.09	0.09	0.08	0.09	0.09
Anal-diameter	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04
Length of spicules	0.07	0.06	0.09	—	0.06	0.07	0.05	0.07	—	—	—	—	—
Length of gubernaculum	0.03	0.02	0.03	—	0.015	0.02	0.015	0.02	—	—	—	—	—
Distance of vulva from ant. end.	—	—	—	1.15	—	—	—	—	0.65	1.10	1.30	1.20	1.20

Table IV. Measurements (in mm) of *Spirinia* (*S.*) *parasiifera* (Bastian) from localities in Florida, USA

	♂ ₂₃	♂ ₂₄	♂ ₂₅	♂ ₂₆	♂ ₂₇	♂ ₂₈	♂ ₂₉	♂ ₃₀	♀ ₁₈	♀ ₁₉	♀ ₂₀	♀ ₂₁	♀ ₂₂	♀ ₂₃
Body-length	1.65	1.80	1.85	1.90	1.90	1.95	1.95	2.15	1.65	1.70	1.69	1.80	1.90	1.91
Max. body-breadth	0.06	0.06	0.06	0.05	0.05	0.05	0.06	0.05	0.06	0.07	0.06	0.06	0.06	0.06
Head-diameter	0.017	0.017	0.016	0.016	0.016	0.017	0.017	0.017	0.016	0.017	0.017	0.016	0.016	0.016
Length of oesophagus	0.13	0.13	0.13	0.12	0.12	0.13	0.12	0.15	0.11	0.13	0.12	0.11	0.14	0.13
Tail-length	0.10	0.10	0.13	0.12	0.12	0.11	0.10	0.12	0.12	0.10	0.10	0.08	0.11	0.10
Distance of nerve-ring from ant. end.	0.08	0.09	0.06	0.06	0.07	0.08	0.08	0.09	0.06	0.08	0.08	0.07	0.06	0.08
Anal-diameter	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.04	0.03
Length of spicules	0.07	0.06	0.06	0.05	0.07	0.06	0.06	0.07	—	—	—	—	—	—
Length of gubernaculum	0.03	0.02	0.02	0.02	0.03	0.02	0.03	0.03	—	—	—	—	—	—
Distance of vulva from ant. end	—	—	—	—	—	—	—	—	0.77	0.90	0.82	0.85	0.95	0.94

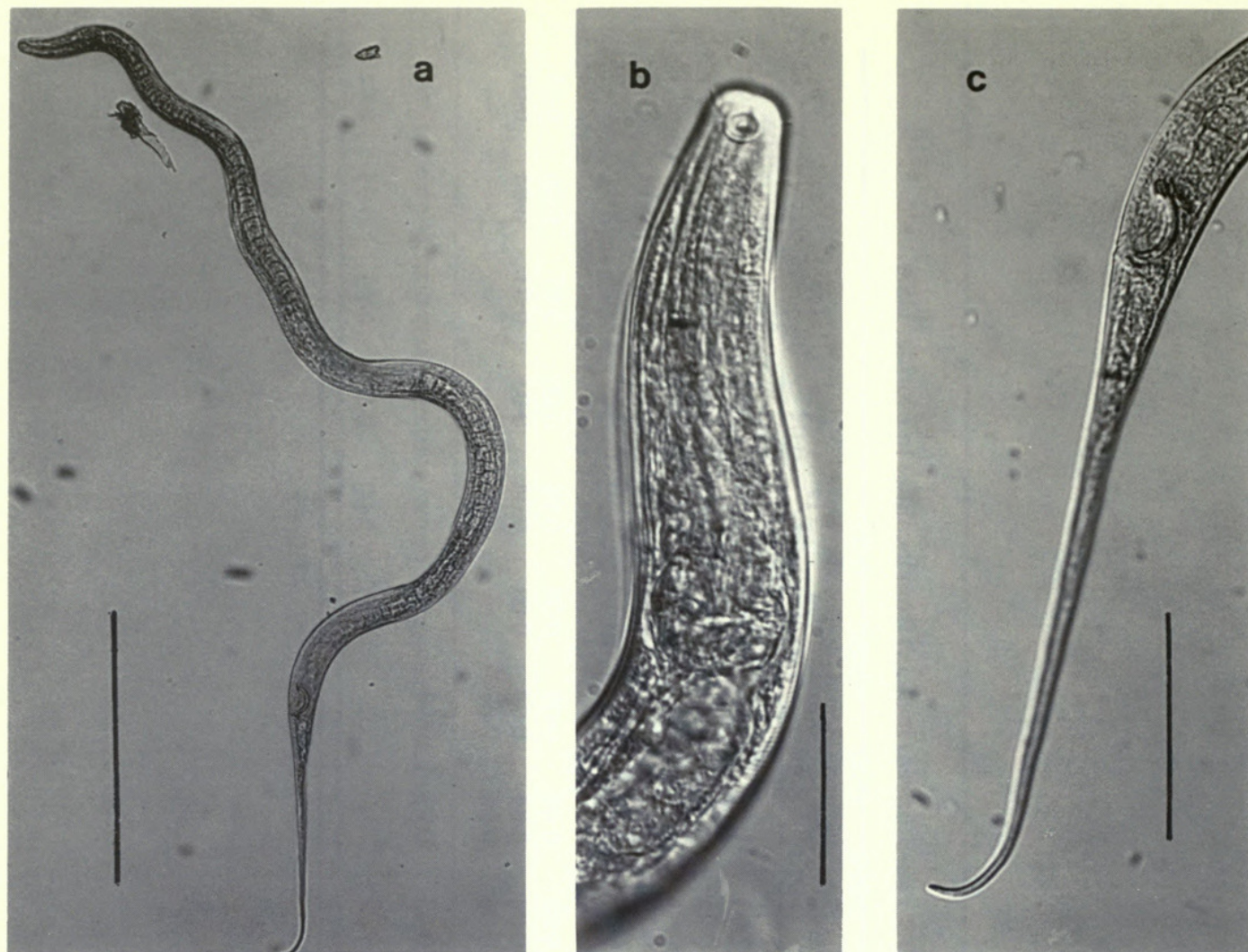


Fig. 5 *Spirinia* (*S.*) *parasitifera*: (a) male specimen; (b) oesophageal region; (c) Tail region of male. Bar scales: (a) = 500 μ m; (b) = 75 μ m; (c) = 50 μ m.

Table V. Measurements (in mm) of *Spirinia* (*S.*) *schneideri* (Villot)

	Specimens from Hannafore, Looe, Cornwall						Specimens from Isles of Scilly			
	♂ ₁	♂ ₂	♀ ₁	♀ ₂	♀ ₃	♀ ₄	♂ ₃	♂ ₄	♀ ₅	♀ ₆
Body-length	4.40	5.20	4.50	4.55	4.70	4.80	4.75	6.00	4.75	5.70
Max. body-breadth	0.11	0.14	0.13	0.12	0.13	0.13	0.12	0.13	0.15	0.16
Head-diameter	0.015	0.02	0.017	0.017	0.02	0.02	0.02	0.02	0.02	0.02
Length of oesophagus	0.21	0.25	0.21	0.23	0.24	0.24	0.22	0.25	0.25	0.25
Tail-length	0.14	0.16	0.14	0.13	0.14	0.13	0.14	0.14	Tail bent	0.14
Distance of nerve-ring from ant. end	0.13	0.15	0.13	0.12	0.15	0.16	0.14	0.18	0.15	0.16
Anal-diameter	0.10	0.12	0.10	0.09	0.09	0.09	0.09	0.12	—	0.10
Length of spicules	0.13	0.16	—	—	—	—	0.17	0.18	—	—
Length of gubernaculum	0.03	0.05	—	—	—	—	0.17	0.18	—	—
Distance of vulva from ant. end	—	—	2.05	1.95	Not seen	2.10	—	—	2.32	2.40

Table VI. Measurements (in mm) of *Spirinia* (*S.*) *hopperi* sp. nov.

	♂ ₁	♂ ₂	♂ ₃	♂ ₄	♂ ₅	♂ ₆	♀ ₁	♀ ₂	♀ ₃	♀ ₄	♀ ₅	♀ ₆
Body-length	4.10	4.50	4.90	4.80	5.10	5.40	4.70	4.80	4.90	4.92	5.10	5.30
Max. body-breadth	0.08	0.08	0.08	0.10	0.10	0.08	0.10	0.10	0.10	0.10	0.10	0.11
Head-diameter	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Length of oesophagus	0.20	0.22	0.22	0.23	0.24	0.26	0.22	0.24	0.20	0.21	0.24	0.24
Tail-length	0.18	0.16	0.18	0.20	0.21	0.18	0.17	0.21	0.18	0.20	0.18	0.20
Distance of nerve-ring from ant. end.	0.12	0.12	0.13	0.14	0.15	0.14	0.12	0.13	0.11	0.12	0.14	0.14
Anal-diameter	0.07	0.07	0.08	0.07	0.07	0.08	0.06	0.06	0.06	0.06	0.06	0.06
Length of spicules	0.11	0.12	0.12	0.11	0.12	0.13	—	—	—	—	—	—
Length of gubernaculum	0.04	0.06	0.04	0.05	0.05	0.05	—	—	—	—	—	—
Distance of vulva from ant. end.	—	—	—	—	—	—	1.90	2.10	1.95	1.92	2.20	2.20

intestine are typical of the genus. The oesophageal bulb is 35 µm in width (about 60% of the corresponding body diameter in width) and about 40 µm in length. The tail is conical and fairly long in both sexes (see Figs 3c, 7b).

MALE. The testis is single, anterior and outstretched, commencing near the anterior end of the intestine and running ventro-laterally to the right of it throughout its length. The vas deferens is long and muscular in appearance and terminates with a narrow duct to the cloaca. The spicules are fairly long and quite prominent, with a slight expansion (manubrium) at the proximal end. The gubernaculum consists of two pieces, a little less than half as long as the spicules. A ventral ala (or velum) is present on each spicule (see Fig. 3c–d).

FEMALE. The ovaries are paired and antidromously reflexed, situated laterally to the left of the intestine. Up to eight eggs have been seen at a time, 3 in the anterior uterus and 5 in the posterior uterus. They measure 140 × 70 µm–150 × 80 µm in size. The vulva, as a small transverse slit, is situated ventrally half-way along the length of the body.

DIFFERENTIAL DIAGNOSIS. This species, in common with *S. schneideri*, differs from all other species of *Spirinia* in the absence of cuticular transverse striations. It is about the same length as *S. schneideri* (up to just over 5 mm) but differs from that species in having a fairly long conical tail. The shape of the spicules and gubernaculum are also characteristic.

ETYMOLOGY. I name this species after Mr Bruce E. Hopper, who first suggested that I investigate the species belonging to the genus *Spirinia*.

GEOGRAPHICAL DISTRIBUTION. Wembury Bay, South Devon, England (present report).

***Spirinia* (*Spirinia*) *laevis* (Bastian, 1865)**

(Figs 1d, 3e, 6a, 8c)

Spira laevis Bastian, 1865; *Spirina laevis*: Filipjev, 1918; *Spirina pilosa* Allgén, 1935.

TYPE LOCALITY. Falmouth, Cornwall, England.

MATERIAL STUDIED. 3♂♂, 1♀ Exe Estuary, S. Devon (in sand) BM(NH) 1985.1.1–3; 6♂♂, 5♀♀ from Hanafore, Looe, Cornwall (in *Laminaria* holdfasts) BM(NH) 1985.1.4–13.

MEASUREMENTS. Table VII.

SYSTEMATIC NOTES. The specimens examined in the present report conform well with the previous descriptions. The transverse cuticular striations are a little coarser compared with those in *S.*

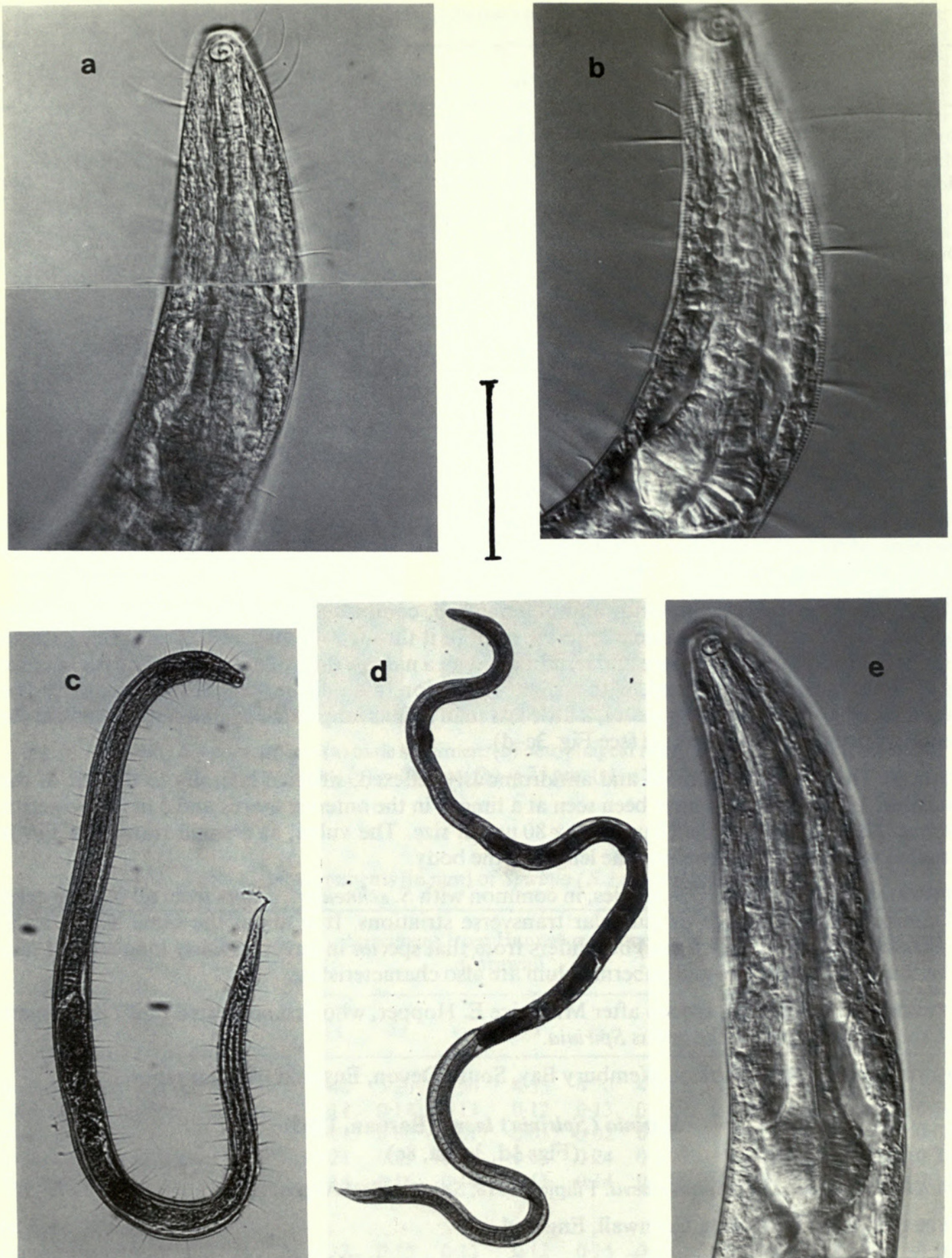


Fig. 6 *Spirinia* (*S.*) *laevis* (a) oesophageal region, *Spirinia* (*S.*) *gerlachi* (b) oesophageal region; (c) female specimen. *S.* (*S.*) *hopperi* (d) female specimen; (e) oesophageal region. Bar scales: (a) = 55 μm ; (b) = 40 μm ; (c) = 300 μm ; (d) = 535 μm ; (e) = 60 μm .

Table. VII. Measurements (in mm) of *Spirinia* (S.) *laevis* (Bastian)

	Specimens from Exe Estuary, Devon					Specimens from Hannafore, Looe, Cornwall								
	♂ ₁	♂ ₂	♂ ₃	♀ ₁	♂ ₄	♂ ₅	♂ ₆	♂ ₇	♂ ₈	♂ ₉	♀ ₂	♀ ₃	♀ ₄	
Body-length	3.80	4.12	4.40	3.70	3.62	3.63	3.65	3.65	3.70	3.85	3.02	3.80	4.65	
Max. body-breadth	0.06	0.06	0.06	0.06	0.07	0.09	0.08	0.10	0.08	0.07	0.07	0.07	0.08	
Head diameter	0.015	0.016	0.020	0.015	0.015	0.017	0.020	0.015	0.020	0.017	0.012	0.012	0.015	
Length of oesophagus	0.17	0.16	0.17	0.15	0.17	0.16	0.17	0.17	0.16	0.17	0.15	0.15	0.19	
Tail-length	0.15	0.14	0.12	0.10	0.10	0.14	0.13	0.14	0.13	0.13	0.11	0.12	0.15	
Distance of nerve-ring from ant. end.	0.10	0.09	0.10	0.09	0.10	0.10	0.11	—	0.11	0.11	0.09	0.10	0.12	
Anal-diameter	0.05	0.06	0.06	0.04	0.05	0.08	0.06	0.08	0.06	0.05	0.05	0.05	0.06	
Length of spicules	0.07	0.09	0.10	—	0.09	0.08	0.10	0.09	0.08	0.08	—	—	—	
Length of gubernaculum	0.02	0.03	0.04	—	0.03	0.02	0.03	0.03	0.03	0.02	—	—	—	
Distance of vulva from ant. end.	—	—	—	2.60	—	—	—	—	—	—	1.30	2.28	1.90	

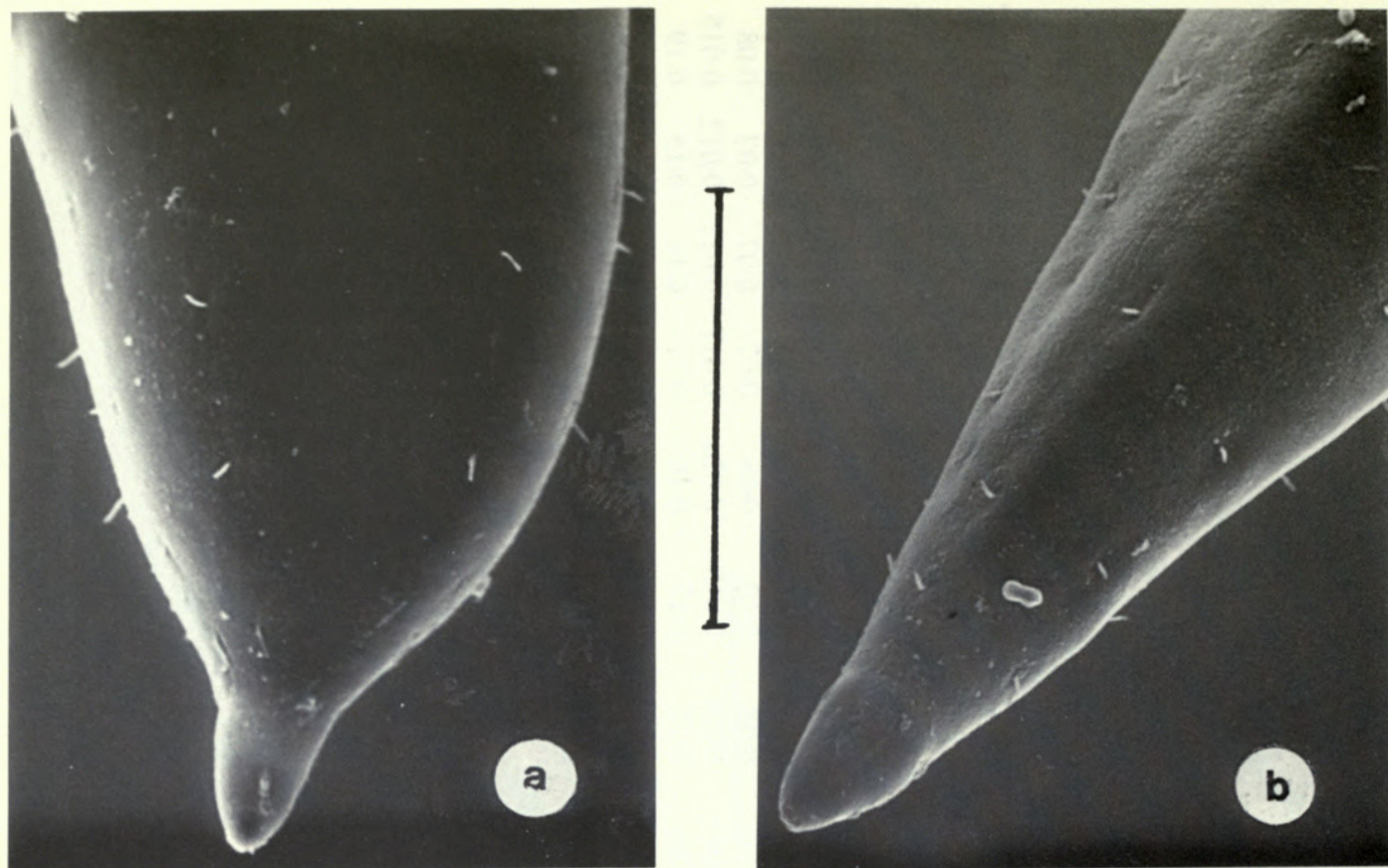


Fig. 7 *Spirinia* (*S.*) *schneideri* (a) Tail. *S.* (*S.*) *hopperi* (b) Tail. (scanning electron micrographs). Bar scale = 40 μ m approx.

parasitifera. An inner crown of six labial papillae, as well as an intermediate ring of six cephalic papillae have been revealed with the aid of the scanning electron microscope. The four cephalic setae measure 20 μ m in length. Long cervical setae up to 25 μ m in length, as well as shorter subcephalic setae (about 5 μ m long) are also present.

S. laevis is known principally from European waters (North Sea and English Channel). It has also been reported from the Atlantic coast of Ireland (Southern, 1914) and the Pacific coast of North America (Wieser, 1959). The description of *S. laevis* from Puget Sound by Wieser (1959) differs from the typical form with regard to the shape of the spicules—the ventral edge being more or less transparent and forming a triangular projection in the middle of the spicule. It seems advisable to wait until more specimens are found off the Pacific coast before regarding this character to be important as distinctive of a different taxon. Wieser (1959) does not state the number of males examined. The ventral edge of the spicule may be a more prominent, or perhaps distorted, ventral ala or velum. The same author also notes differences in the length of the tail, comparing specimens described by Gerlach (1950) as 1.5 anal body diameter long, while Bresslau & Stekhoven (1940) give the tail length as 4 anal body diameters in length. In the Puget Sound specimens the tail measures 3 anal body diameters in length. In the present specimens from the south-west coasts of England, the tail varies from 2 to 3 anal body diameters in length.

GEOGRAPHICAL DISTRIBUTION. See Gerlach & Riemann (1973). It has since been reported from the Island of Sylt, North Sea (Blome, 1982); Exe Estuary, S. Devon and Looe, Cornwall, England (present report).

Spirinia (*Spirinia*) *gerlachi* (Luc & De Coninck, 1959)
(Figs 3f, 6b–c)

Spirina gerlachi Luc & De Coninck, 1959

TYPE LOCALITY. Roscoff, Brittany, NW coast of France.

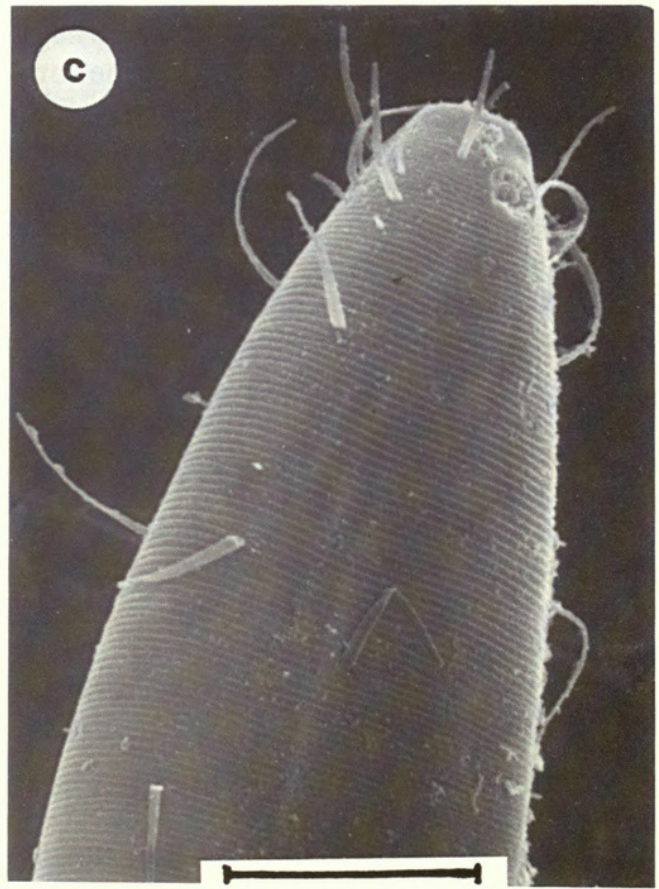
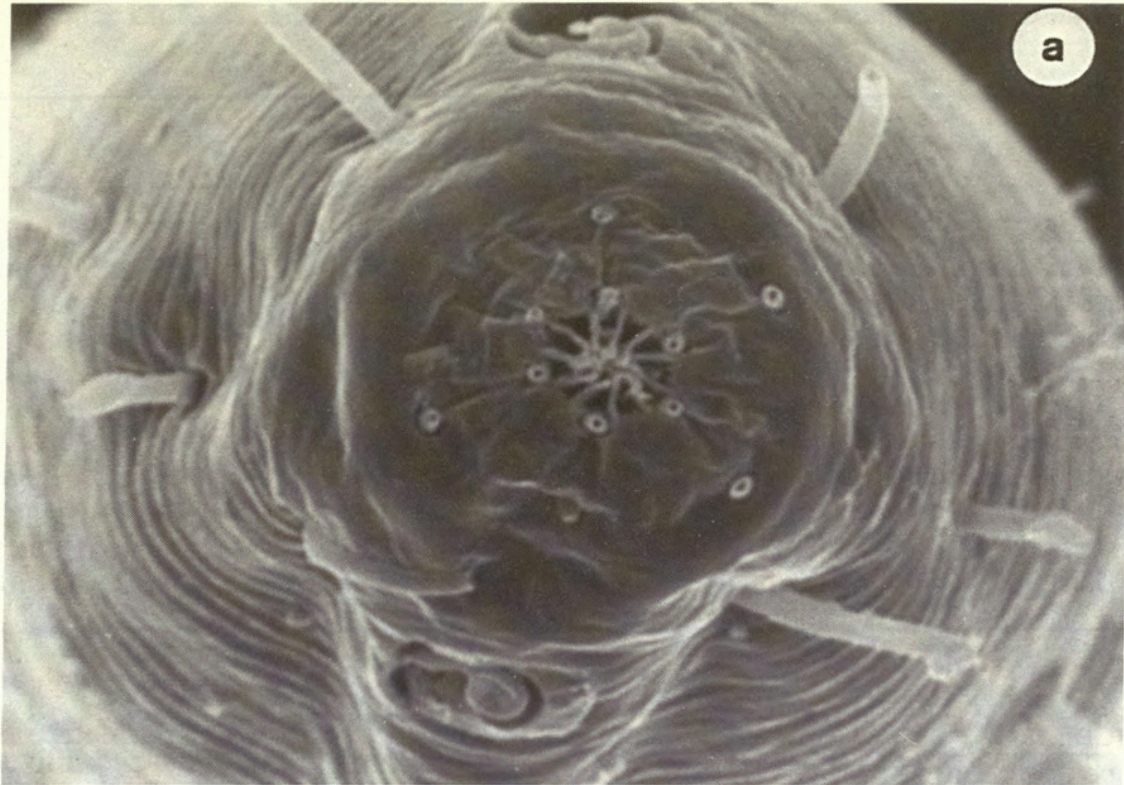


Fig. 8 *Spirinia* (*S.*) *parasitifera* (a) apical view of head; (b) anterior end of body. *S.* (*S.*) *laevis*: (c) anterior end of body (scanning electron micrographs). Bar scales: (a) = 7 μm ; (b) = 15 μm ; (c) = 24 μm .

Table VIII. Measurements (in mm) of *Spirinia* (*S.*) *gerlachi* (Luc & De Coninck) from Isles of Scilly

	2♂♂	6♀♀	J
Body-length	1.38–1.60	1.40–1.60	1.27
Max. body-length	0.06	0.03–0.06	0.04
Head-diameter	0.02	0.02	0.02
Length of oesophagus	0.12–0.13	0.12–0.13	0.11
Length of tail	0.13	0.11–0.14	0.12
Distance of nerve-ring from ant. end	0.07	0.07–0.08	0.06
Anal-diameter	0.03–0.04	0.03	0.03
Length of spicules	0.03–0.04	—	—
Length of gubernaculum	0.01	—	—
Distance of vulva from ant. end	—	0.68–0.77	—

MATERIAL STUDIED. 2♂♂, 9♀♀, 3 juvenile specimens in sand, Isles of Scilly (Appletree Bay, flats between Tresco and Sampson) BM(NH) 1980.3.2.

MEASUREMENTS. Table VIII.

SYSTEMATIC NOTES. The two male specimens conform to the description given by Luc & De Coninck (1959), except that the somatic setae are longer, measuring up to 50 µm. The testis is situated to the right of the intestine. The females, not described previously, are similar to the males in general body form. Somatic setae in the mid-body region up to 40 µm in length, commencing 30 µm from the anterior end, behind the four cephalic setae which are 10 µm long. They occur in eight longitudinal rows 20–25 µm apart. Short setae present between the rows of long setae and scattered. Amphids 10 µm in diameter. Labial papillae and setae not seen. The ovaries are paired and reflexed, situated laterally to the right of the intestine. Eggs occur in three of the specimens present. In one there is one egg in each uterus and in the other two specimens one egg in the anterior uterus only. They measure 85 µm × 45 µm. Tail in the females similar to that in the males, long and conical with setae nearly to the tip (Fig. 3f).

GEOGRAPHICAL DISTRIBUTION. Roscoff, Brittany, NW coast of France (Luc & De Coninck, 1959); Appletree Bay, Isles of Scilly (Warwick & Coles, 1977 and present report).

***Spirinia* (*Perspiria*) *hamata* Wieser & Hopper, 1967**
(Fig. 2g)

TYPE LOCALITY. Florida (Key Biscayne), east coast of North America.

MATERIAL STUDIED. 5♂♂, 2♀♀, 1 juvenile from Avonsport, Nova Scotia, Canada (in Marsh grass) BM(NH) 1985.2.55–56.

MEASUREMENTS. Table IX.

SYSTEMATIC NOTES. The specimens from Nova Scotia examined in the present report conform with the original description by Wieser & Hopper (1967) from Florida, with regard to the males. The proximal end of the spicules (manubrium) is markedly hook-shaped and the spicules are a little longer in the specimens from Nova Scotia. Females, not found previously, agree quite well with the males in general body form, including the long flagellate tail. The ovaries are paired and reflexed. Eggs are present in both of the specimens examined. In one there is one egg in the anterior uterus and one in the posterior uterus. They measure 80 µm × 50 µm and 105 µm × 60 µm respectively. In the other specimen there are two eggs in each uterus. They measure 105 µm × 50 µm–130 µm × 45 µm.

Table IX. Measurements (in mm) of *Spirinia* (*Perspiria*) *hamata* Wieser & Hopper from Avonsport, Nova Scotia, Canada

	♂ ₁	♂ ₂	♂ ₃	♂ ₄	♂ ₅	♀ ₁	♀ ₂	J
Body-length	2.05	2.40	2.40	2.40	2.45	2.15	2.40	2.00
Max. body-breadth	0.05	0.05	0.06	0.05	0.05	0.07	0.06	0.05
Head-diameter	0.01	0.015	0.016	0.015	0.015	0.015	0.018	0.011
Length of oesophagus	0.14	0.15	0.13	0.15	0.15	0.13	0.13	0.12
Tail-length	0.36	0.30	0.30	0.30	0.30	0.28	0.32	0.30
Distance of nerve-ring from ant. end	—	—	0.08	0.08	0.08	—	0.09	—
Anal-diameter	0.04	0.04	0.04	0.04	0.35	0.03	0.03	0.03
Length of spicules	0.05	0.07	0.05	0.07	0.06	—	—	—
Length of gubernaculum	0.02	0.03	0.02	0.03	0.02	—	—	—
Distance of vulva from ant. end	—	—	—	—	—	0.92	1.10	—

This species belonging to the subgenus *Perspiria* (type-species) is characterized particularly by the shape of the spicules and gubernaculum—the proximal end of each spicule is markedly hook-shaped.

GEOGRAPHICAL DISTRIBUTION. Florida, east coast of North America (Wieser & Hopper, 1967); Georgia, USA—as *nomen nudum* (Teal & Wieser, 1966); Nova Scotia, Canada (present report).

***Spirinia* (*Perspiria*) *mokii* sp. nov.**
(Figs 4a–c, 10a–c)

TYPE LOCALITY. Avicennia Forest, Kuala Selangor, Selangor, Malaysia.

MATERIAL STUDIED. 4♂♂, 2 juveniles from Avicennia and Bruguiera (mangrove) forests, Kuala Selangor, Malaysia. Holotype ♂ BM(NH) 1985.2.57. Paratypes BM(NH) 1985.2.58–62.

MEASUREMENTS. Table X.

DESCRIPTION. The cuticle appears to be smooth throughout most of the body length, but becomes markedly transversely striated on the long and flagellate tail (see Fig 10a–c). The head is truncate and the amphids are situated about 5–7 µm from the anterior end. They are 5 µm in diameter or 40% of the corresponding head diameter in size. Labial papillae have not been seen. The four cephalic setae, which are about 4–5 µm long are situated sublaterally near the anterior margin of the amphids or sometimes a little further back. Cervical setae are also present, of about the same length as the cephalic setae or a little shorter, but scattered. Rugae appear to be present around the stoma but very faint and difficult to see. The buccal cavity is only very slightly cuticularized. No teeth can be made out. The oesophagus is quite short in comparison with the total length of the worm. The oesophageal bulb is quite large in comparison with the corresponding body width (28 µm in width or about 90% of the corresponding body diameter). The tail is very long and filliform with coarse transverse cuticular striations in both sexes.

MALE. The testis is single and straight, situated to the right of the intestine. The spicules are arcuate with a rounded or club-shaped expansion (manubrium) at the proximal end. There is some variation in this respect (see Fig. 4a–c). A velum is present on each spicule. The gubernaculum is short. A single seta is situated mid-ventrally at about half-way between the proximal end of the spicules and the anus.

FEMALE. Not found.

DIFFERENTIAL DIAGNOSIS. This species differs from others belonging to the subgenus *Perspiria* by the shape of the spicules and gubernaculum, the more truncate head and in its small size.

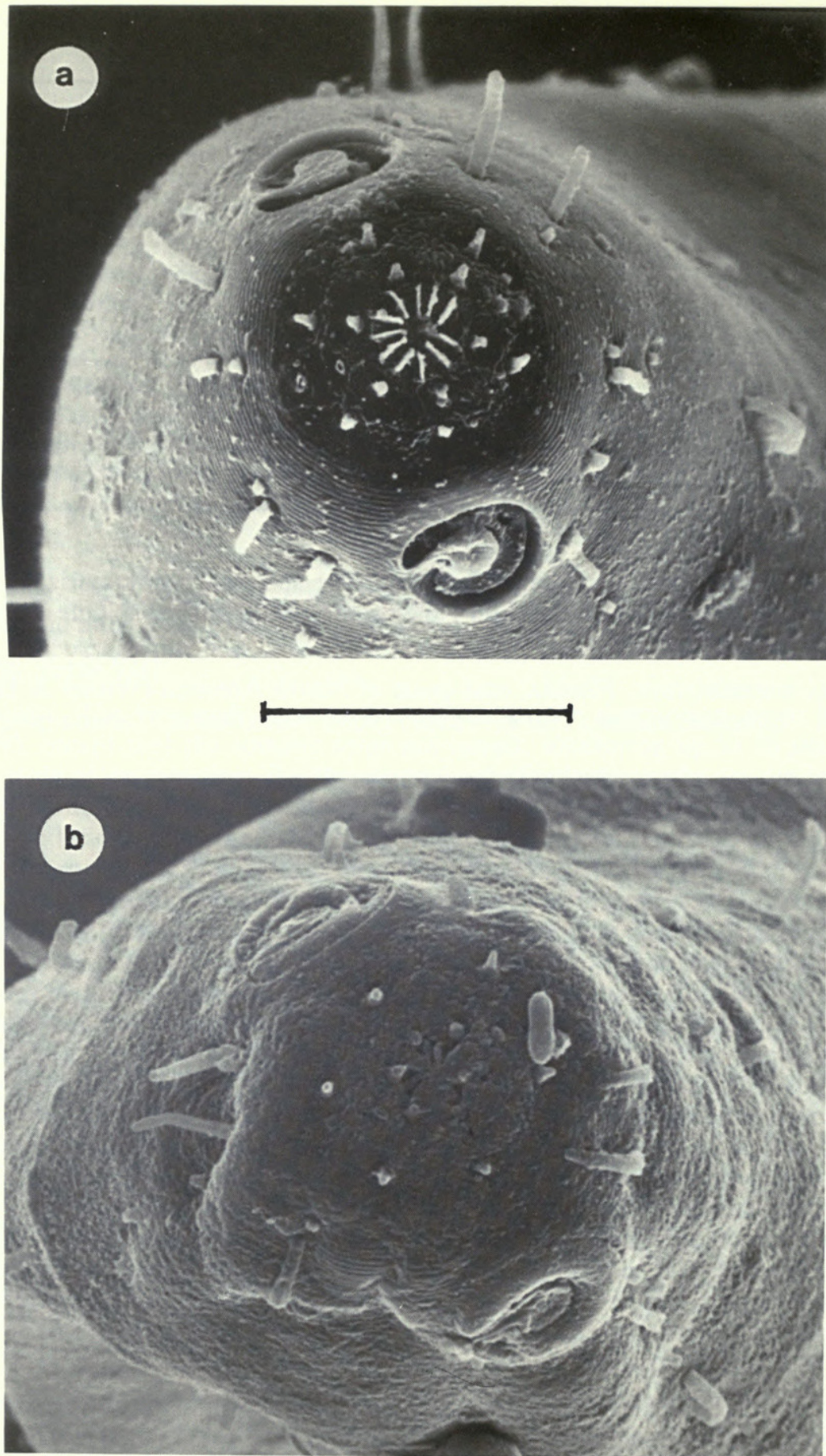


Fig. 9. *Spirinia* (*S.*) *schneideri*: (a) apical view of head. *S. (S.) hopperi* (b) apical view of head (scanning electron micrographs). Bar scale = 15 μm.

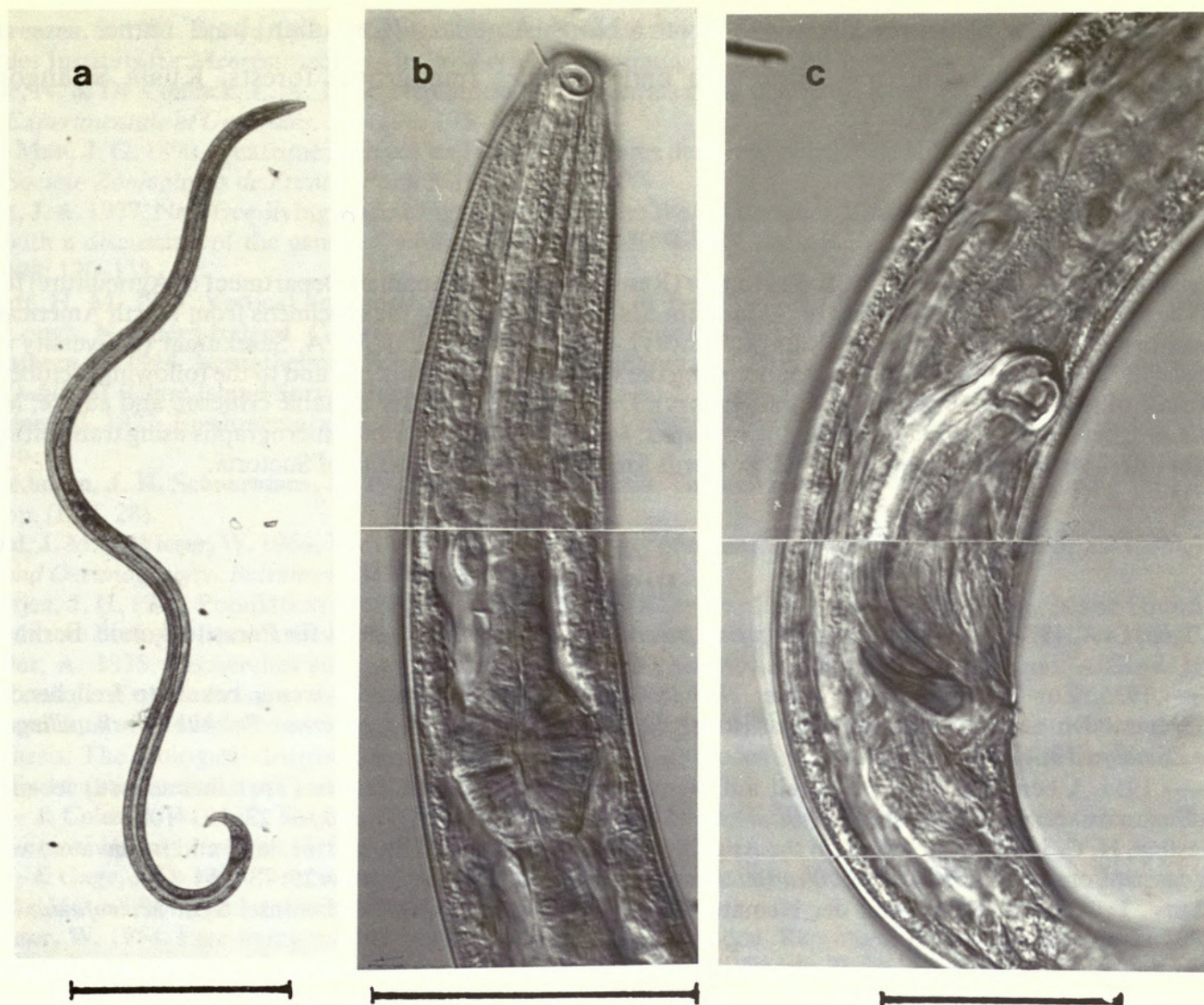


Fig. 10 *Spirinia (Perspiria) mokii*: (a) male specimen; (b) oesophageal region; (c) tail region of male. Bar scales: (a) = 300 μ m; (b) = 32 μ m; (c) = 100 μ m.

Table X. Measurements (in mm) of *Spirinia (Perspiria) mokii* sp. nov. from mangrove forests, Kuala Selangor, Malaysia

	♂ ₁	♂ ₂	♂ ₃	♂ ₄	J ₁	J ₂
Body-length	1.60	1.67	1.67	1.69	1.55	1.56
Max. body-breadth	0.05	0.05	0.05	0.04	0.05	0.06
Head-diameter	0.013	0.012	0.013	0.013	0.012	0.013
Length of oesophagus	0.10	0.12	0.12	0.11	0.11	0.11
Tail-length	0.30	0.27	0.31	0.30	0.30	0.27
Distance of nerve-ring from ant. end	0.06	0.07	0.05	0.05	0.07	0.07
Anal-diameter	0.03	0.03	0.03	0.03	0.03	0.03
Length of spicules	0.05	0.04	0.05	0.05	—	—
Length of gubernaculum	0.012	0.01	0.01	0.02	—	—

ETYMOLOGY. The name *mokii* is derived from a North American (Canadian) boys' name.

GEOGRAPHICAL DISTRIBUTION. Avicennia and Bruguiera (mangrove) forests, Kuala Selangor, Malaysia (present report).

Acknowledgements

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