

FOUR NEMATODA ARAEOLAIMIDA FROM THE ÖRESUND, DENMARK. WITH REMARKS ON THE OESOPHAGEAL STRUCTURES IN *AEGIALOALAIMUS*.

by

Preben Jensen

Marine Biological Laboratory
University of Copenhagen, Strandpromenaden, DK-3000 Helsingør, Denmark

Résumé

Quatre espèces de Nématodes sont décrites d'une zone infralittorale de fond bourbeux située dans le Nord de l'Öresund (Danemark) ; trois sont nouvelles : *Leptolaimoides haploopis* n. sp. ; *Leptolaimus sundensis* n. sp. et *Leptolaimus danicus* n. sp. ; *Aegialoalaimus elegans* De Man, 1907, svn. *Tubuligula roscoffensis* Boucher & Helléouët, 1977 est redécrit ; *Tubuligula* Boucher & Helléouët, 1977 est considéré comme synonyme de *Aegialoalaimus* De Man, 1907. Les structures caractéristiques de l'oesophage de *Aegialoalaimus* sont discutées en opposition avec celles de la cavité buccale du type *Haliplectus*.

Introduction

This is the second in a serie of papers on the nematode fauna of a sublittoral region in the northern part of the Öresund, Denmark (see Jensen, 1976).

The four described species belong to genera tabulated within the Araeolaimida in the checklist of Gerlach & Riemann (1973/74) ; however the systematic position of *Aegialoalaimus* De Man, 1907 is open for discussion.

Material

The specimens are collected from the following stations in the Öresund, Denmark:

Station II: 56° 06, 0' N, 12° 33, 0, E; 28m depth; silty sand; *Haploops* community;

Station III: 56° 06, 2' N, 12° 30, 7' E; 27m depth; fine sand; *Amphiura filiformis* community.

The material is deposited in the Zoological Museum, University of Copenhagen, Denmark (ZMUC). All drawings are made with a camera lucida.

The specimens are fixed in 4 per cent formalin and mounted in glycerol.

Abbreviations

L = body length (mm)

a = $\frac{\text{body length}}{\text{max body diam.}}$

b = $\frac{\text{body length}}{\text{oesophagus length}}$

c = $\frac{\text{body length}}{\text{tail length}}$

Values in the formula indicate in microns (μm):

$\frac{\text{length from anterior end to measured organs}}{\text{corresponding body diameter (D) in } \mu\text{m}} = \text{body length}$

—	nerve ring	end of oesophagus	middle (M, ♂) or vulva (♀)	anus
D	D	D	D	D

Descriptions

Leptolaimoides haploopis n. sp.

(Fig. 1-3)

Material

Station II: 25 Nov. 1975; 1 male (holotype, slide no. 311b).

Measurements

L = 0.77mm

a = 43

b = 4.6

c = 6.0

—	?	166	M	639	766 μm
5	—	16	18	15	

Cuticle annulate from head to tail tip with a lateral field beginning just posterior to the amphids and visible to the end of the conical region of the tail (Fig. 1, 2). No somatic setae are in the oesophagus region, but further behind 3 μm long setae are present in four submedian rows on the cuticle; they may, however, easily be overlooked. Amphids elongate loop-shaped, 30 μm long and 2-3 μm wide (Fig. 1), the anterior border 14 μm behind the front end, i.e. about three head diameters behind the front end.

Head with six minute papillae and four 1 μm long cephalic setae. The buccal cavity is narrow, cylindrical, 15 μm deep and surrounded by a thin oesophageal muscle layer (Fig. 1). The oesophagus itself is cylindrical and not enlarged posteriorly. Cardia, nerve ring, renette cell and excretory opening not observed.

Spicules proximally cephalate, distally tapering, 19 μm around the arc, 16 μm from tip to tip; i.e. 1.1 x anal diameter (Fig. 2-3). The gubernaculum surrounds the spicules in a cuff-like manner and is provided with a single caudally directed apophysis, 6 μm long. No preanal supplements.

Tail conical from cloaca and 55 μm backwards, then tapering to a filiform posterior part, which is annulate, too (Fig. 2).

Discussion

eptolaimoides haploopis n. sp. is related to *T. thermastrix* (Lorenzen, 1966) by the similar copulatory apparatus and the lack of preanal supplements. *L. haploopis* n. sp. differs, however, in the structure of the lateral field, in the presence of cephalic setae and in the actual measurements. *D. tubulosus* Vitiello, 1971, the other species of the genus, differs from both species by the presence of tubular preanal supplements.

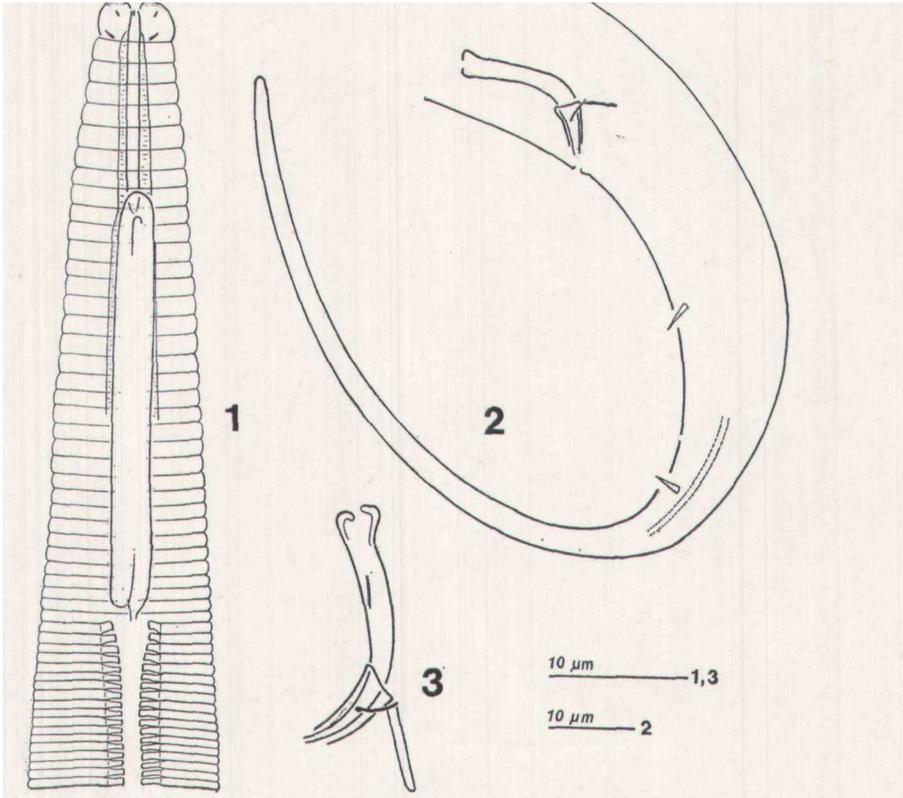


FIG. 1-3

Leptolaimoides haploopis n. sp., male (holotype); left lateral views.
 1: anterior region of the body; 2: posterior region of the body; 3: copulatory apparatus.

Leptolaimus danicus n. sp.

Material (Fig. 4-7)

Station III: 5 March 1975; 1 male (holotype, slide no. 72).

Measurements

L = 0.52mm

a = 29	b = 4.5	c = 6.2
— 73 116 M 435	4 13 17 18 17	519 μm

Cuticle annulate with about $2\ \mu\text{m}$ wide rings (Fig. 4-5). Lateral field $2\ \mu\text{m}$ wide, arises $46\ \mu\text{m}$ behind the front end and is visible to the anteriormost part of the tail (Fig. 4). Somatic setae small. Amphids with a circular opening, $4\ \mu\text{m}$ in diameter, i.e. 50 per cent of the body diameter. Anterior border of amphids $10\ \mu\text{m}$ behind the front end.

Head with four cephalic setae $3\ \mu\text{m}$ long, other cephalic sense organs not observed. Buccal cavity in two portions (Fig. 5); the

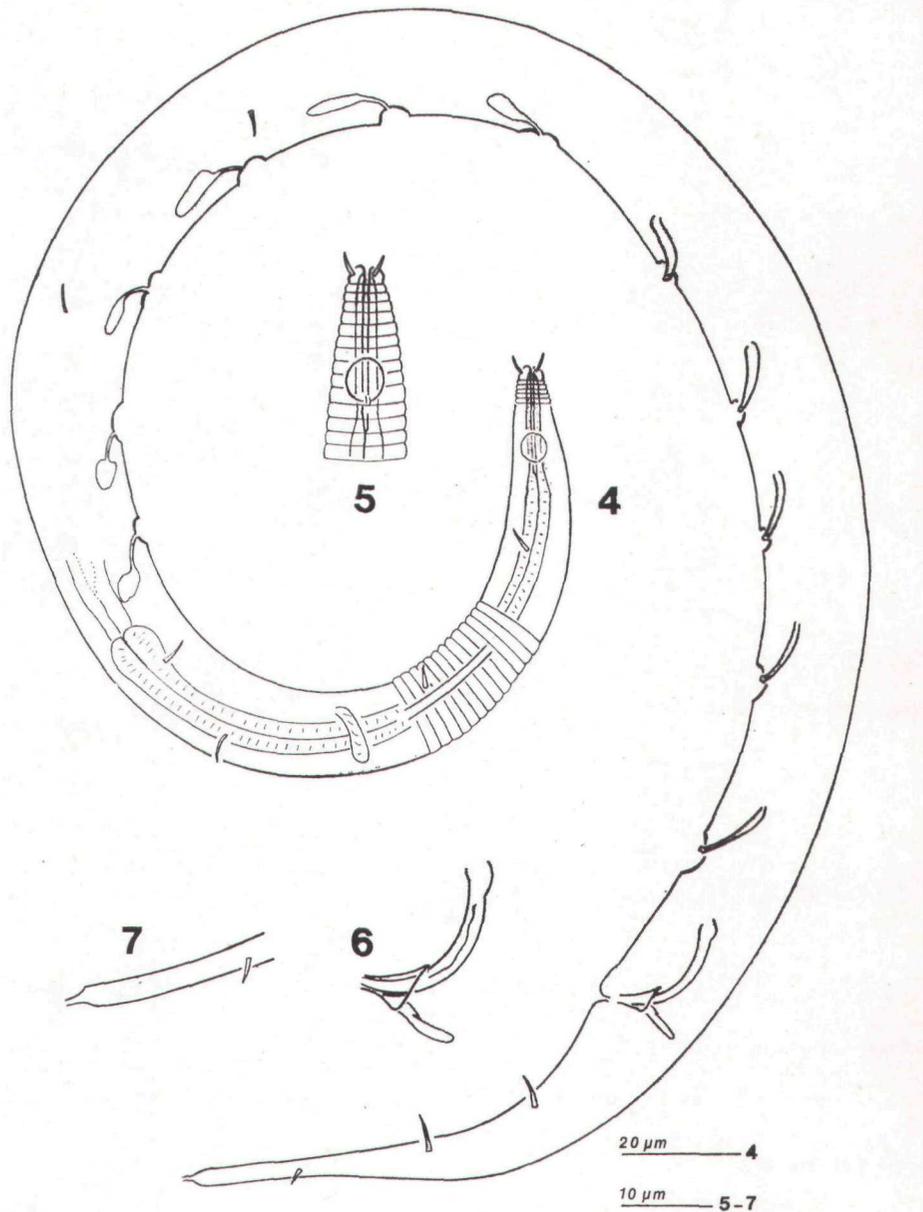


FIG. 4-7

Leptolaimus danicus n. sp., male (holotype); left lateral views.
4: total view; 5: head end; 6: copulatory apparatus; 7: tail tip.

anteriormost part has a shallow, 2 μm wide opening with sclerotized walls, the posterior part, a 15 μm long, narrow tube. The oesophagus surrounds the tubular portion; behind this, the musculature is dilated; the posterior end is a pear-shaped terminal bulb (Fig. 4). Nerve ring at 63 per cent of oesophageal length. Renette cell and excretory pore opening not observed.

Spicules equal, proximally cephalate and distally tapering, 22 μm around the arc, 19 μm from tip to tip; i.e., 1.1 x anal diameter. Gubernaculum triangular, surrounding the spicules, provided with a single dorsal apophysis, 6 μm long (Fig. 6). Preanal supplements are situated ventrally from the posterior oesophageal region to 26 μm in front of the cloaca; they are equally spaced every 20-25 μm (Fig. 4). The anteriormost six supplements exist as sclerotized depressions in the cuticle, each opening connected through a duct with an ampulla. The posteriormost five openings have, in addition to the sclerotized depressions, a 11 μm long sclerotized tubulus, which distally is dentate. Tail slender, 5 x anal diameter; spinneret protuded (Fig. 7).

Discussion

The checklist of Gerlach & Riemann (1973) tabulates 29 *Leptolaimus* species to which one has to add *L. pocillus* de Bovée, 1974; *L. scotlandicus* Jayasree & Warwick, 1977; *L. septempapillatus* Platt, 1973; *L. tritubulatus* Boucher & Helléouët, 1977; *L. vinnulus* Vitiello, 1974 and the present *L. danicus* n. sp. *Leptolaimus* species are mainly differentiated by the number and shape of the preanal supplements; by the combination of sclerotized tubuli and depressed supplements reaching from the oesophageal region to the cloaca region (group II, in the key by de Bovée, 1974). *L. danicus* n. sp. is closely related to *L. cupulatus* Lorenzen, 1972; *L. leptalens* Lorenzen, 1971; *L. mixtus* Lorenzen, 1972 and *L. papilliger* De Man, 1876. None of these species has a combination of tubuli and supplements as in *L. danicus* n. sp.

Diplopeltula sundensis n. sp.

(Fig. 8-11)

Material

Station III: 25 February 1975; 1 male (holotype, slide no. 37).

Measurements

L = 1.12mm a = 56 b = 14.3 c = 12.4

—	56	78	M	1025	
	11	17	19	20	20
					1115 μm

Cuticle annulate with 2 μm wide rings from the neck region to the tail end (Fig. 8, 10). No somatic setae observed besides some irregularly distributed setae on the tail, 3 μm long. Amphids loop-

shaped, about $17\ \mu\text{m}$ long, $4\text{--}8\ \mu\text{m}$ wide and the anterior border situated $1.5\ \mu\text{m}$ behind the cephalic setae (Fig. 8).

Head rounded with a narrow neck region, $10\ \mu\text{m}$ wide. Four slender cephalic setae $5\ \mu\text{m}$ long insert close to the front end; no other cephalic sense organs observed. Buccal cavity reduced to a narrow $2\text{--}3\ \mu\text{m}$ deep opening (Fig. 8). Oesophagus dilated in the

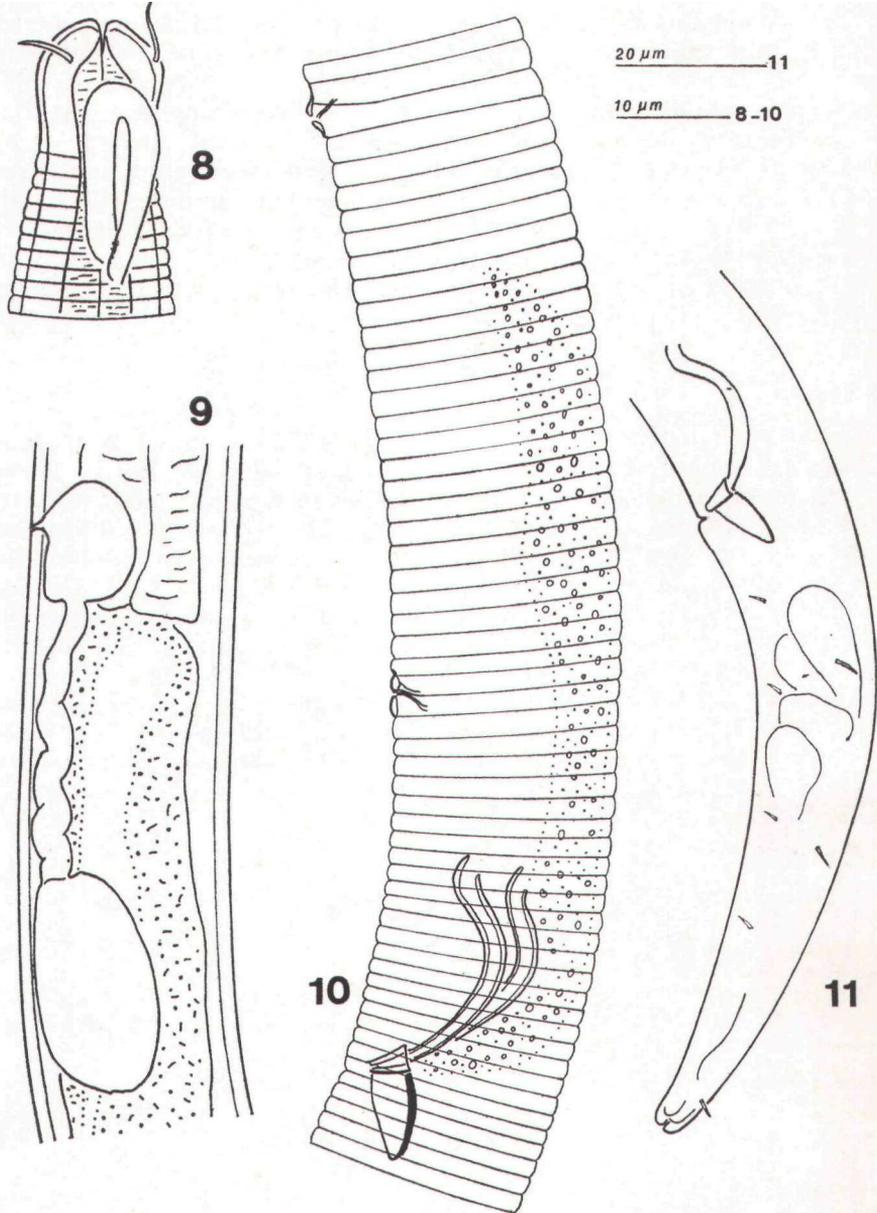


FIG. 8-11

Diplopetula sundensis n. sp., male (holotype); left lateral views. 8: head end; 9: excretory system; 10: cloaca region; 11: posterior region of the body.

head region, narrow at the neck and posteriorly gradually enlarged, without forming a bulb. Cardia not observed. Nerve ring at 69 per cent of the oesophageal length. Renette cell oval shaped, 25 μm behind the oesophagus end; excretory pore 5 μm anterior to the end of the oesophagus (Fig. 9).

Two equal spicules, 25 μm long measured around the arc, 20 μm from tip to tip; i.e., 1 x anal diameter (Fig. 10-11). Their shape reminds a sickle. Gubernaculum small with a prominent triangular caudal apophysis, the dorsal margin most heavily sclerotized. A slender granulated gland is situated 70 μm in front of the cloaca and dorsal to the gubernaculum (Fig. 10). Two ventral supplements 34 μm and 85 μm in front of the cloaca. The cuticle is in the supplement region more prominent sclerotized than elsewhere and slightly dilated at each supplement. Each supplement has a fine duct.

Tail conical, with a rounded tip. Caudal glands in tandem within the tail (Fig. 11).

Discussion

The checklist of Gerlach & Riemann (1973) tabulates 14 *Diplopeltula* species; one has to add *D. asetosa* Juario, 1974; *D. lucanica* Boucher & Helléouët, 1977 and the present *D. sundensis* n. sp. *D. sundensis* n. sp. differs from all other species of the genus by the triangular apophysis which is prominently sclerotized at the dorsal margin; further, by the supplements which never have been observed before in *Diplopeltula* species. Sickle-shaped spicules are known from *D. nuda* Gerlach, 1956 and *D. bulbosa* Vitiello, 1972; however, these species further differ in amphids and cephalic setae. The structures of the renette cell and the excretory pore have *D. sundensis* n. sp. in common with *D. asetosa* as well as the narrow neck region.

D. sundensis n. sp. reminds in the general shape of the body and the narrow neck region to *Pterygonema* (Cesamonematoidea, Desmodorida), and the characteristic apophysis of the gubernaculum is similar to the structure found in *P. cambriensis* Ward, 1973. However, *Diplopeltula* and *Pterygonema* differ in the sclerotization of the head and in the ornamentation of the cuticle. But, as the systematic position of the Ceramonematoidae among the Desmodorida is not very satisfactory, one might in further studies remember the aboved mentioned similarities (see also Gerlach, 1950, p. 138).

Aegialoalaimus elegans De Man, 1907

Material (Fig. 12-16)

Station III: 5 March 1975; 1 female, slide no. 71.

Measurements

L = 0.80mm

a = 36

b = 5.1

c = 9.8

—	60	156	430	714	
9	16	19	22	18	795 μm

Body cylindrical with a conical head and a rounded tail tip. Neck region slightly constricted. Cuticle thin. A fine striation is visible in the oesophageal region; it cannot be established elsewhere on the body because a finely granulated layer covers most of the body just below the cuticle. These granules may also give the

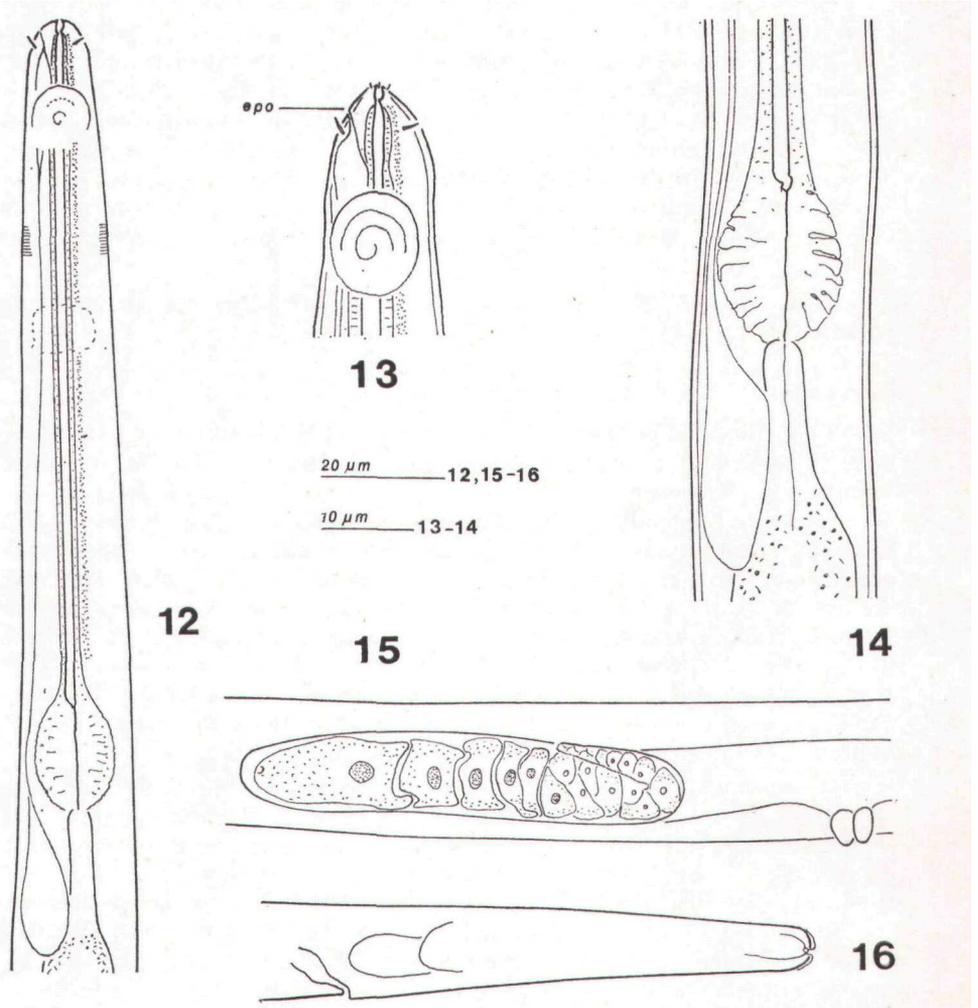


FIG. 12-16

Aegialoalaimus elegans De Man, 1907, female; left lateral views.

12: oesophagus region; 13: head end (epo = excretory pore opening); 14: bulb region; 15: anterior branch of the reproductive system; 16: posterior end of the body.

impression that the cuticle is ornamentated with points, especially prominent on the tail. Somatic setae not observed. Amphids weakly sclerotized with a nearly circular outline, 10 μm in diameter; i.e. 83 per cent of the corresponding body diameter (Fig. 12-13). Within the amphid aperture, 3-4 concentric lines are distinct,

especially in the anterior half; however, a spiral shaped amphid cannot be established. The anterior borders of the amphids are situated 11 μm behind the front end.

Around the opening of the buccal cavity, six minute setae insert. Four thin cephalic setae 2 μm long are situated 5 μm behind the front end. The buccal cavity consists of a small 2 μm deep part which is provided dorsally with a small sclerotized tip; further backwards continues a 6 μm long sclerotized cylindrical part, 1.5 μm in diameter (Fig. 13). The posterior part is surrounded by oesophageal musculature. The oesophagus itself is cylindrical 2.5 μm in diameter, posteriorly developed into a conspicuous bulb, 13 μm wide and about 20 μm long (Fig. 12, 14). The oesophageal lumen has sclerotized walls, which form a cylindrical tube, internal diameter 1.5 μm . The tube can be followed to an irregularity in the anterior-most part of the terminal bulb. Further backwards in the bulb, the sclerotized lumen cannot be established. Cardia slender, 4 μm wide and about 17 μm long, without granules or interruptions (Fig. 12). Throughout the oesophageal region, a granulate gland is present at the dorsal margin (Fig. 12-13). Renette cell at cardia level; the cell empties apparently through an ampulla in a fine duct and opens in front of the cephalic setae, 3 μm behind the front end (Fig. 12-13).

Reproductive system didelphic-amphidelphic with apparently double reflexed ovaries (Fig. 15). Vulva situated at 54 per cent of the body length. Vagina prominently sclerotized.

Tail cylindrical to conical, 5.2 anal diameter long (Fig. 16). Spinneret present. Caudal glands within the tail.

Discussion

I have no hesitation to identify this single specimen as *Aegialoalaimus elegans* De Man, 1907, referring to the original description (general shape, buccal cavity, peculiar structure of the oesophagus and amphids). Stekhoven, 1931 and Bresslau & Stekhoven, 1935 described specimens of *A. elegans*, although they could establish an annulated cuticle ornamentated with points and spiral-shaped amphids. I suspect, however, that they misinterpreted the granulated layer just below the cuticle as cuticular points. The amphids described and depicted as spiral may be in fact the weak concentric lines seen within the circular aperture by De Man and in the present specimen.

Tubuligula Boucher & Helléouët, 1977 has all the characteristics of *Aegialoalaimus* De Man, 1907 (see above); after a reexamination of some of the type material of *Tubuligula* (1) (type species: *T. roscoffensis* Boucher & Helléouët, 1977), I consider the two genera congeneric. Further, *A. roscoffensis* is very similar to *A. elegans*; the only difference I could find is that the material from Boucher

& Helléouët have slightly longer cephalic setae than the Öresund female and that of De Man (Holland). This difference may be caused by the fact that Boucher & Helléouët specimens are slightly longer than material reported from elsewhere; I therefore conclude that the two species are synonymous, which is agreed by G. Boucher (letter communication from G. Boucher of 20th September 1977). It may be noted, however, that males have 7-8 minute preanal supplements; in male R 12976, I found 7 preanal supplements, the anteriormost one situated 65 μm in front of the cloaca; at their positions, the cuticle is slightly darker and enlarged. In the Öresund female, I presumed the excretory pore opening to be in front of the cephalic setae, as an ampulla and a fine duct penetrating the cuticle there (see p. 000, Fig. 12-13), because it is distinct and I could not find any other outlet in the oesophageal region. Boucher also could find a similar structure in female R 5163 (letter communication from G. Boucher). In males, however (at least in male R 10873, letter communication from G. Boucher), Boucher found a distinct ampulla accompanied by a fine duct at the nerve ring level and nothing in front of the cephalic setae. Since this latter position is the most normal situation in a marine nematode, it should be termed as so in the male of *A. elegans*, whereas an excretory pore-like structure is situated at the front end in the female. An excretory pore opening at the head region is, however, not unique, since it is found both males and females, at least, in some Araeolaimida representatives (see e.g. Wieser, 1954, fig. 185-189).

A. elegans has a very characteristic oesophageal region with a narrow buccal cavity which continues in a prominently sclerotized, cylindrical oesophageal lumen ending in an irregularity in the anterior part of the terminal bulb; the oesophageal musculature covers thinly the oesophageal lumen and is terminally enlarged to a conspicuous bulb; the cardia is apparently non-sclerotized and slender (Fig. 12). Could it be that the terminal bulb of *A. elegans* is homologous to the median bulb of the *Haliplectus*-type nematodes? (1). From this would follow, that the non-sclerotized slender cardia of *A. elegans*, in fact, is a reduced posterior part of the oesophagus of the *Haliplectus*-type. At present, however, one cannot exclude that the oesophagus of *Aegialoaimus* is an adaptive feature which has no phylogenetical relationship with structures found in the Haliplectidae.

Acknowledgments

I would like to express my thanks to professor S.A. Gerlach for access to his private library, for valuable advice and critical reading the manuscript. Dr G. Boucher kindly send me slides from Muséum National d'Histoire Naturelle, Paris. This work is part of the project "Danish Marine Nematodes", supported by a grant from the Danish Natural Science Research Council.

(1) See review of the *Haliplectus*-type buccal cavity by Gerlach (1963), e.g. p. 97.

Summary

Four nematodes are described from a sublittoral soft bottom region in the northern part of the Öresund, Denmark; three species are new: *Leptolaimoides haploopsis* n. sp., *Leptolaimus danicus* n. sp. and *Diplopeltula sundensis* n. sp.; *Aegialoalaimus elegans* De Man, 1907 syn., *Tubuligula roscoffensis* Boucher & Helléouët, 1977 is redescribed; *Tubuligula* Boucher & Helléouët, 1977 is considered congeneric with *Aegialoalaimus* De Man, 1907. The characteristic oesophageal structures of *Aegialoalaimus* are discussed against the *Haliplectus* —type buccal cavity.

REFERENCES

- References regarding nematode species up to 1972: see GERLACH S.A. & F. RIEMANN 1973-74: *The Bremerhaven checklist of aquatic nematodes*. A catalogue of Nematoda Adenophorea excluding the Dorylaimida. *Veröff. Inst. Meeresforsch. Bremerh.*, Suppl. 4, pp. 1-736.
- BOUCHER, G. et HELLÉOUËT, M.-N., 1977. — Nématodes des sables fins infralittoraux de la Pierre Noire (Manche occidentale). III. Araeolaimida et Monhysterida. *Bull. Mus. nat. Hist. nat., Paris*, 3^e sér., 427, Zool. 297, pp. 85-122."
- DE BOVÉE, F., 1974. — *Leptolaimus pocillus* n. sp., espèce nouvelle de Leptolaimidae (Nematoda). *Vie Milieu*, 24, pp. 73-81.
- JAYASHEE, K. and WARWICK, R.M. 1977. — Free-living marine nematodes of a polluted sandy beach in the Firth of Clyde, Scotland. Description of seven new species, *J. nat. Hist.*, 11, pp. 289-302.
- JENSEN, P., 1976. — Redescription of the marine nematode *Pandolaimus latilaimus* (Allgén, 1929), its synonyms and relationships to the Oncholaimidae. *Zool. Scripta*, 5, pp. 257-263.
- JUARIO, J.V., 1974. — Neue freilebende Nematoden aus dem Sublittoral der Deutschen Bucht. *Veröff. Inst. Meeresforsch. Bremerh.*, 14, pp. 275-309.
- PLATT, H.M., 1973. — Freelifving marine nematodes from Strangfjord Lough, Northern Ireland. *Cah. Biol. Mar.*, 14, pp. 295-321.
- VITIELLO, P., 1974. — Considérations sur la systématique des Nématodes Araeolaimida et description d'espèces nouvelles ou peu connues. *Arch. Zool. exp. gin.*, 115, pp. 651-669.