

# Notes on the family Tubolaimoididae Lorenzen, 1981 (Nematoda: Chromadoria) with a description of *Chitwoodia tenuipharyngealis* sp. n.

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**Summary.** *Chitwoodia tenuipharyngealis* sp. n. and *Tubolaimoides tenuicaudatus* (Allgen, 1934) are described from specimens recovered from the White Sea. *Ch. tenuipharyngealis* sp. n. differs from *Ch. menora* Gerlach, 1956 by its longer body (1760  $\mu\text{m}$  vs. 1148  $\mu\text{m}$ ), finely striated cuticle and proximally widened spicules, and from *Ch. warwicki* Jayasree, 1976 by its amphidial width (12  $\mu\text{m}$  and 39% c.b.d. vs. 5-6,5  $\mu\text{m}$  and 19-26% c.b.d.), thin, and weak pharynx which is not enlarged anteriorly, and its longer, thinner body (1760  $\mu\text{m}$  and  $a=52$  vs. 1410-1460  $\mu\text{m}$  and  $a=38-39$ ). During ontogenesis in *Ch. tenuipharyngealis* the round amphid of the J4 transforms into the loop-shaped amphid of the adult. The phenomenon of amphid metamorphosis in larval development of marine nematodes is discussed and new emended diagnoses of the taxa *Tubolaimoides* Gerlach, 1963, *Chitwoodia* Gerlach, 1956, and Tubolaimoididae Lorenzen, 1981 are presented.

**Key word:** marine nematodes, morphology, *Chitwoodia tenuipharyngealis* sp. n., *Tubolaimoides*, *Chitwoodia*, Tubolaimoididae, the White Sea.

The Tubolaimoididae are a small family of relatively rare marine nematodes comprising less than ten species in two genera. The genus *Tubolaimoides* Gerlach, 1963 was originally referred to Linhomoeidae as a result of species having circular amphids, and *Chitwoodia* Gerlach, 1956 with species having loop-shaped amphids, to Axonolaimidae (Gerlach & Riemann, 1973). Lorenzen (1981) combined both genera and created a new taxon at the family rank. However the family Tubolaimoididae does not have any holapomorphies and is characterized mostly by plesiomorphic features.

Lorenzen (1981) placed Tubolaimoididae in Leptolaimina (i.e. Chromadoria) due to the presence of ventrally coiled amphids and absence of metanemes. However, the presence of three lips around the mouth and the position of the dorsal and subventral esophageal gland outlets at the region of the stoma may

be considered as enoplid characters. Therefore, the taxonomic position of Tubolaimoididae in the Nematoda is not yet unambiguously established.

Two species belonging to the genera *Tubolaimoides* and *Chitwoodia* are described here together with comments on their morphology and amphid development. Also, new emended diagnoses of the family and both genera are proposed.

## MATERIAL AND METHODS

Samples of ocean floor sediments were collected using the SCUBA-diving technique and fixed with 10% formalin and sea water solution. The supernatant of each sample was decanted through a mesh sieve 70  $\mu\text{m}$ . Nematodes recovered were processed by slow evaporation to pure glycerin and mounted on slides for examination by light-microscopy.

## DESCRIPTIONS

### *Chitwoodia tenuipharyngealis* sp. n. (Figs. 1 - 3)

**Holotype male** (moulting from fourth juvenile stage J<sub>4</sub> to adult): L = 1760 μm, a = 51.8, b = 9.3, c = 6.8, body diameter at the level of the posterior cephalic setae = 30 μm, nerve ring = 30 μm, cardia = 34 μm, midbody = 34 μm, anus = 30.5 μm.

Body cylindrical, long, thread-like. Cephalic end truncated. Cuticle finely cross-striated. Mouth relatively wide, surrounded by three lips. Labial papillae (1st circle of cephalic sensillae) not observed. Two separated circles of cephalic setae (6 + 4). Cephalic setae in both circles almost equal in length (6-7 μm). Somatic sensillae not observed. Amphids posterior to the third circle of cephalic sensillae. Amphid of J<sub>4</sub> small, circular, with a distinct cuticular edge, slightly broken postero-dorsally. Amphid of J<sub>4</sub> 7 μm wide (20% of corresponding body diameter), situated 32-37 μm posterior to the anterior end. Adult amphid nearer anterior end, large, loop-shaped, ventrally coiled; both branches not contiguous; dorsal longer than ventral branch, with nerve attached. Adult amphid 12 μm wide (36% of corresponding body diameter), dorsal branch 17 μm long, ventral branch 13 μm long, distance from the anterior end to the amphid 17-18 μm.

Stoma funnel-shaped, weakly developed, with dorsal cuticular wall being more thickened and sclerotized. Dorsal external wall of the anterior esophagus slanting. Esophagus hardly visible, thin and cylindrical along its length, radial muscular striation difficult to discern.

Renette ampulla posterior to the nerve ring, inflated. Renette body behind cardia. Anterior end to renette ampulla, 133 μm.

Anterior and posterior testes apparently straight; *vas deferens* only slightly compartmentalized. Spicules short, weak, arched, gradually widening from the distal acute end proximad. Spicula length 32.5 μm along chord; 43 μm along arch. Gubernaculum with a short caudal apophysis 13.5 μm long. Supplements not observed.

Tail conical, attenuated, ventrally coiled, 12 cloacal diameters long. Caudal glands not visible; short and wide terminal spinneret.

**Type locality.** White Sea, Kandalaksha Bay, Karela Shore, mouth of the Tchupa Bay, Tcheremshicha Shoal, 20 m depth, coarse sand, July 1991.

**Type material.** Holotype male (moulting from fourth juvenile stage J<sub>4</sub> to adult) is deposited on slide number Ic-376 in the Zoological Museum of the Moscow State University, Moscow.

**Differential diagnosis.** Four species of *Chitwoodia* have been described (Gerlach, 1956; Jayasree, 1976) and all were from European seas. The new species is most similar to *Ch. menora* Gerlach, 1956 and *Ch. warwicki* Jayasree, 1976. *Ch. tenuipharyngealis* sp. n. differs from *Ch. menora* by its longer body length (1760 μm vs. 1148 μm. The fully adult male may be even longer), finely striated cuticle and proximally widened spicules. *Ch. tenuipharyngealis* sp. n. can be distinguished from *Ch. warwicki* by its elongated amphids (amphid width 12 μm and 39% c.b.d. vs. 5-6.5 μm and 19-26% c.b.d.), thin and weakly developed pharynx which is not enlarged anteriorly, and longer and thinner body (1760 μm and a = 51.8 vs. 1410-1460 μm and a = 38.1-38.6).

### *Tubolaimoides tenuicaudatus* (Allgen, 1934) (Figs. 4 & 5)

Allgen, 1934: 108, figs. 11 a-b (*Tubolaimella tenuicaudata*), 108-109, figs. 12 a-b (*Tubolaimella zostericola*); Schuurmans Stekhoven, 1935: 35, figs. 16 a-b (*Sphaerocephalum longicaudatum*); Allgen, 1947: 24-25, figs. 5 a-b (*Tubolaimella zostericola*); Gerlach, 1963: 648-649, figs. 21 a-d; Blome, 1982: 61-62 (329-330).

**Females** (n=2): L = 955-1210 μm, a = 30-31.5, b = 6-7.5, c = 5.5, V = 47.7-48.5%, body diameter at the level of posterior cephalic setae = 28.5 μm, nerve ring =

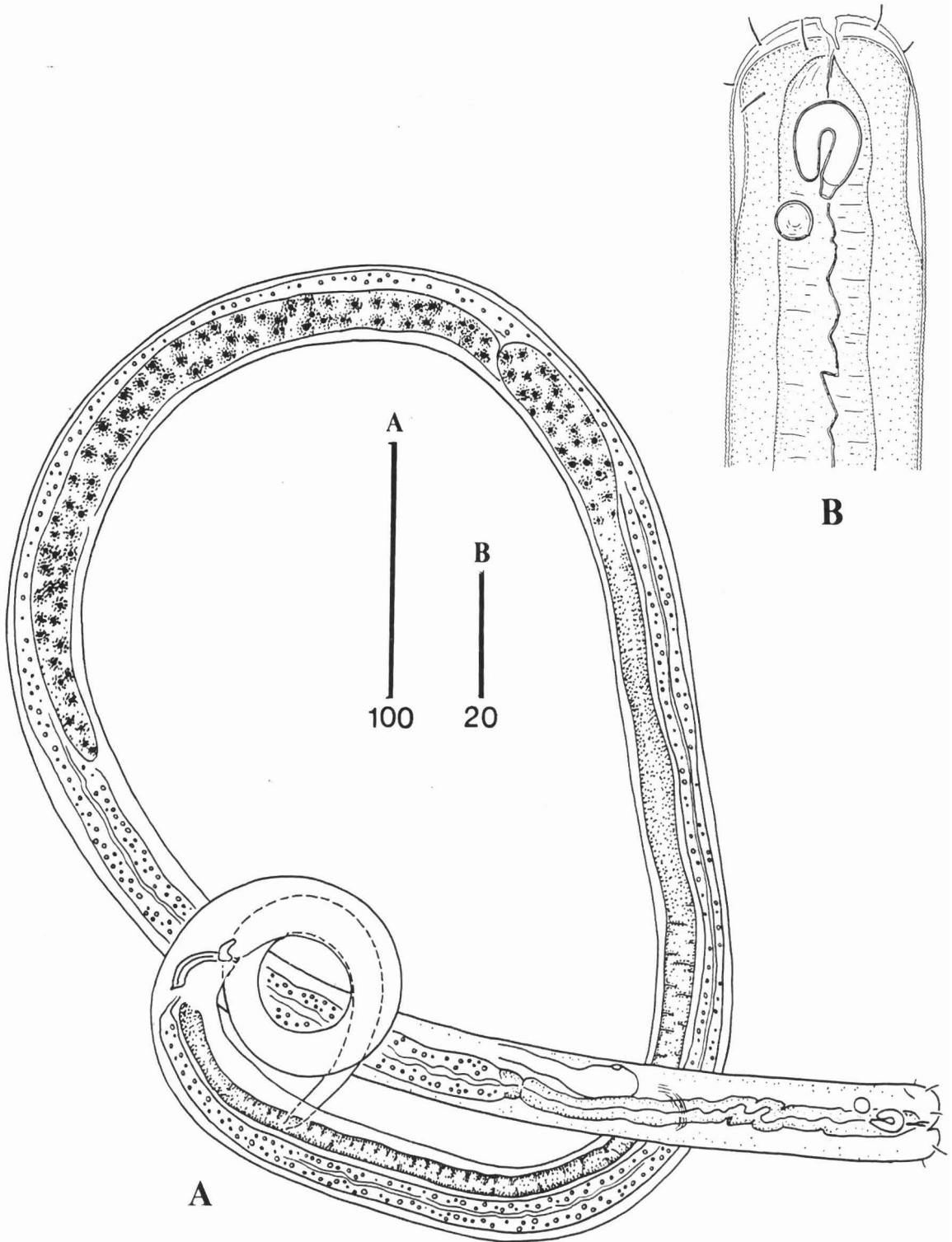


Fig. 1. *Chitwoodia tenuipharyngealis* sp. n. Male moulting to adult stage. A: Total view; B: Cephalic end. Bars in  $\mu\text{m}$

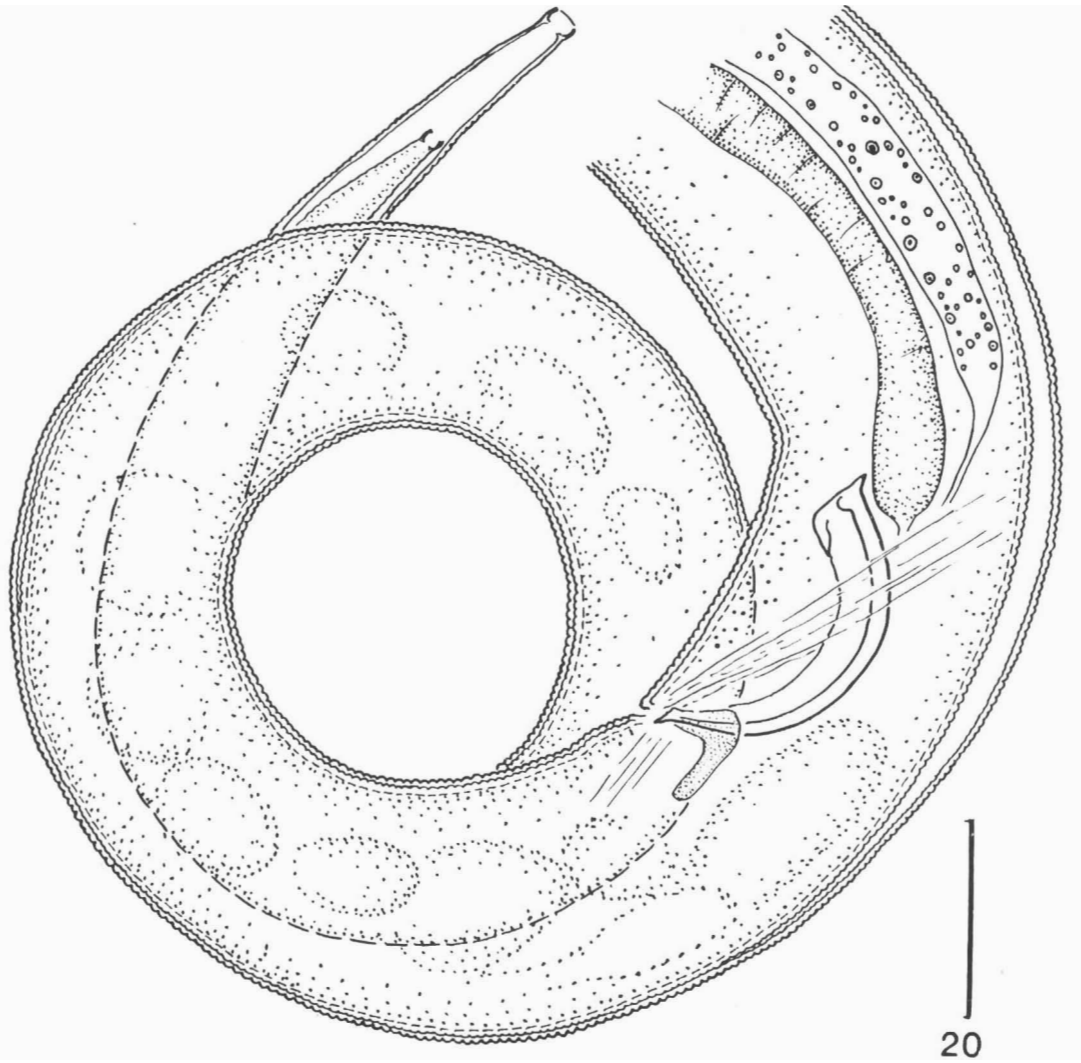


Fig. 2. *Chitwoodia tenuipharyngealis* sp. n. Male moulting to adult stage, posterior body. Bar in  $\mu\text{m}$ .

28-34.5  $\mu\text{m}$ , cardia = 36  $\mu\text{m}$ , midbody = 32-38.5  $\mu\text{m}$ , anus = 22.5-26  $\mu\text{m}$ .

Body cylindrical, anteriorly truncated, posteriorly gradually attenuated from the anus to the tail tip. Cuticle thin, with indistinct cross-striation, without lateral differentiation.

Mouth opening surrounded by three sloping lips mound-like which are joined by a thin cuticular fold. Small conical tubercles present on the internal sides of these mound-like areas. Two separate, adjacent, circles of cephalic setae (6+4); setae thin, cylindrical, and of approximately equal length (6,5-8,5  $\mu\text{m}$ ). Amphid small, circular, situated behind (20-21  $\mu\text{m}$ ) the cephalic setae. One specimen with the amphidial cuticular edging interrupted posteriorly, amphid of second specimen with an entire cuticular edging. Amphid 5-7  $\mu\text{m}$  wide (17-24% of corresponding body diameter). An obscure spiral structure just behind the amphid.

Stoma weakly developed with dorsal wall being more sclerotized than ventral wall. Oesophagus muscular, cylindrical, with the anterior end slightly bulbous with with a slanting dorsal wall. Oesophageal glands not observed. Cardia large, rounded, more than half being embedded in intestine.

Renette containing a ventral pore posterior to the nerve ring. Terminal end of the renette duct inflated, resembling a long ampulla. Anterior end to the nerve ring 75  $\mu\text{m}$  (44-50% of the total esophagus length) and the ventral pore 92  $\mu\text{m}$  (55-76% of the total pharynx length) from the inflated end.

Female gonads didelphic, amphidelphic, situated to the right of the intestine; ovaries antidromous.

Tail conical attenuated, 7.5-8.4 anal diameters long. Caudal gland bodies indistinct except for the elongated terminal ampullas.

**Locality.** White Sea, Kandalaksha Bay, Karela Shore, Velikaya Salma Strait, 20 m depth, coarse sand. 11 August 1987.

**Remarks.** The specimens generally agree well with the available descriptions of this species. However, they differ from specimens originally named as

*T. zostericola* (Allgen, 1934) which were subsequently considered to be conspecific with *T. tenuicaudatus* (Gerlach & Riemann, 1973) in the distance of the amphideal aperture from the anterior end (20-21  $\mu\text{m}$  vs. 7  $\mu\text{m}$ ).

The species is distributed in the North Sea (Belgian Coast, Sylt Island), Kattegat, Oeresund, Kiel Bay and White Sea. Usually recovered from medium to coarse sand, with low density, from the tidal or upper subtidal zones.

## DISCUSSION

In *Chitwoodia tenuipharyngealis* a characteristic of the amphidial metamorphosis in postembryonal development is similar to that observed in larval ontogenesis of some Axonolaimidae (*Axonolaimus helgolandicus* and *Synodontium monhystera*): the definitive loop-shaped amphid in J<sub>2</sub> - adult is preceded by a smaller circular amphid with the nerve attached posterio-laterally (Lorenzen, 1971, 1973). A similar development in amphidial ontogenesis from circular to spirally coiled shape has been reported also for several desmodorid and draconematid nematodes (Clasing, 1980; Coomans et al., 1985).

A common pattern of amphid's ontogenesis may therefore be traced in larval development of phylogenetically unrelated families with the round form preceding the loop-shaped or spiral form. This suggests that a simple, round, amphid with posterio-dorsal interruption is a plesiomorphic condition and the loop-shaped one is apomorphic. *Chitwoodia* may be considered as a more developed taxon descending from a *Tubolaimoides*-like ancestor. This conclusion is supported by the observation that the oesophagus of *Chitwoodia* is thin, with weak muscular striations. This is evidently an apomorphic condition derived from the normal muscular *Tubolaimoides* oesophagus corresponding to the general nematode type (Tchesunov, 1990).

In the examples cited above the amphidial metamorphosis occurs during the first moult (J<sub>1</sub>/J<sub>2</sub>). However in *Chitwoodia tenuipharyngealis* the amphid transforms after this moult which suggests that the loop-shaped amphid of *Chitwoodia* is a relatively later

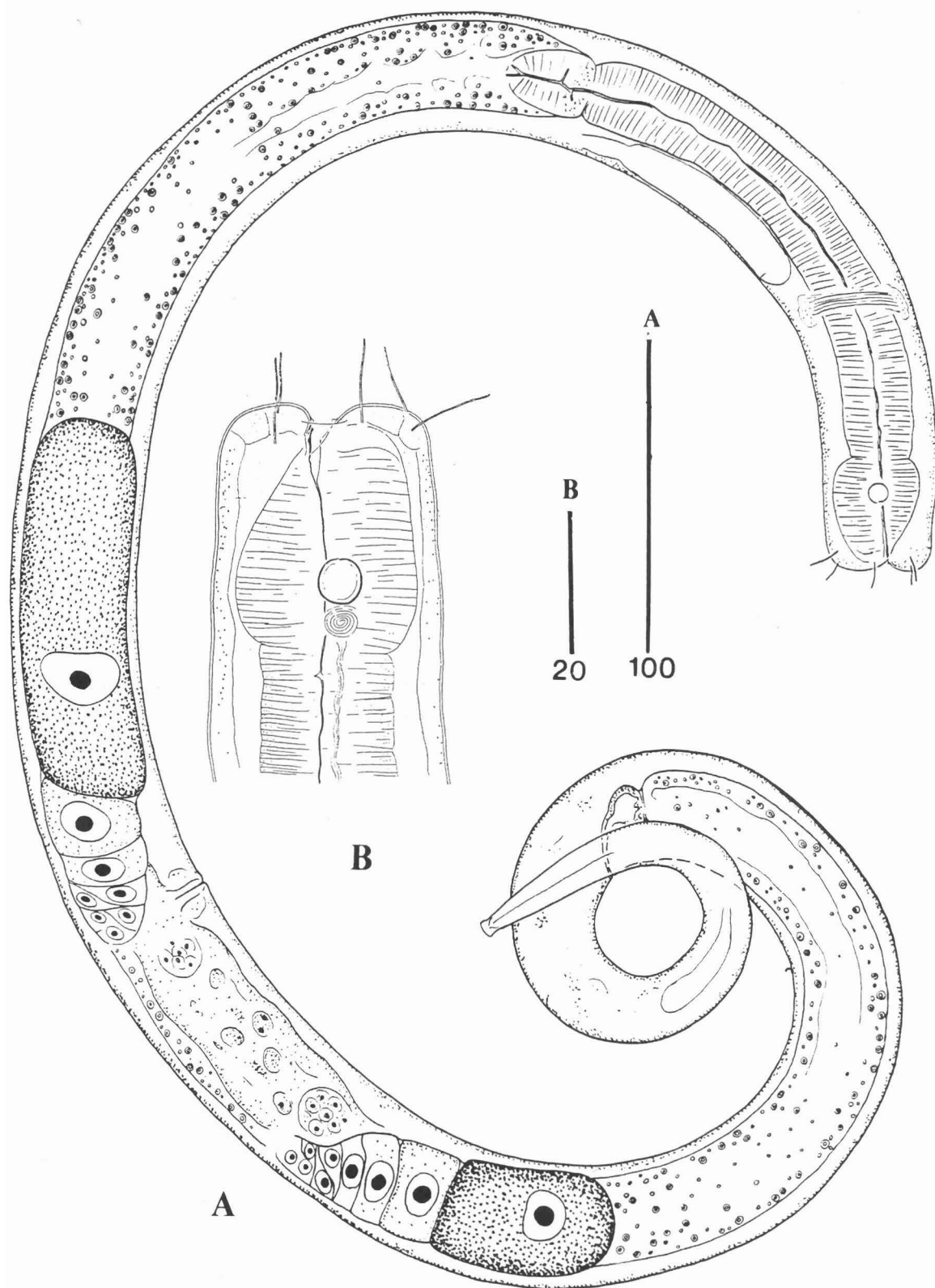


Fig. 3. *Tubolaimoides tenuicaudatus* (Allgen, 1934). Female. A: Total view; B: Cephalic end. Bars in  $\mu\text{m}$ .

acquisition in evolutionary terms in comparison with the analogous amphid of Axonolaimidae.

### Diagnosis of the family Tubolaimoididae Lorenzen, 1981

Systematic position in free-living nematodes uncertain. Body cylindrical, slight tapering to the truncated anterior end. Cuticle thin, finely cross-striated. Mouth opening triangular, with three lips. The lips may be surrounded by a ring of folded cuticula. Labial sensillae very short, paired at the base of each lip. Cephalic setae arranged in two separate circles (6+4), cylindrical, about equally long and supplied with apical pores\*. Amphid rounded or loop-shaped, posterior to the 2nd circle of cephalic setae. Somatic cuticle not thickened around the mouth. Stoma not differentiated; usually the dorsal rhabdion somewhat more strongly sclerotized. Tip of the lips can be acute, like nippers. Esophageal cuff dorsally slanting. Esophagus cylindrical, either muscular or thin, lacking an obvious muscular striation. Dorsal and subventral esophageal glands open in the lumen of the anterior stomatal part of the esophagus (Lorenzen, 1981). Females with two amphidelphic antidromous genital tubes in varying position to the intestine. Males with two testes. Spicules weakly sclerotized (may be less dense than rectum). Gubernaculum with a short caudal apophysis. Supplements usually absent and seldom present as preanal ventromedian papillae. Tail usually relatively long, elongated-conical and ventrally coiled. Spinneret with three incaudal glands. Marine.

Type genus: *Tubolaimoides* Gerlach, 1963.

Only other genus *Chitwoodia* Gerlach, 1956.

### Diagnosis of the genus *Tubolaimoides* Gerlach, 1963

Tubolaimoididae. Amphid rounded, sometimes with a postero-dorsal interruption of the cuticular edging. Esophagus cylindrical, relatively thick, with well-pronounced muscular radial striation.

Type species: *T. tenuicaudatus* (Allgen, 1934).

Only type species valid.

The single other described species *T. bullatus* (Timm, 1967) (originally identified as *Tubolaimella bullata* Timm, 1961) apparently belongs to the family Linhomoeidae (Gerlach, 1963; Gerlach & Riemann, 1973).

### Diagnosis of the genus *Chitwoodia* Gerlach, 1956

Tubolaimoididae. Amphid loop-shaped, ventrally coiled, round in juveniles. Esophagus mostly thin, weak, lacking a pronounced muscular radial striation.

Type species: *Ch. falcata* Gerlach, 1956.

Other valid species: *Ch. menora* Gerlach, 1956, *Ch. tenuipharyngealis* sp. n. *Ch. tripapillata* Jayasree, 1976, *Ch. warwicki* Jayasree, 1976.

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\* Own observations made with scanning electron microscopy on *Chitwoodia* sp. from the North Sea.

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Чесунов А.В. Замечания к семейству Tubolaimoididae Lorenzen, 1981 (Nematoda: Chromadoria) и описание *Chitwoodia tenuipharyngealis* sp. n.

Резюме. Описываются *Chitwoodia tenuipharyngealis* sp. n. и *Tubolaimoides tenuicaudatus* (Allgen, 1934) из пробы чистого среднезернистого песка, взятой на глубине 20 м в Кандалакшском заливе Белого моря. *Ch. tenuipharyngealis* sp. n. отличается от *Ch. menora* Gerlach, 1956 более длинным телом (1760 мкм против 1148 мкм), тонко-кольчатой кутикулой, проксимально расширенными спикулами; от *Ch. warwicki* Jayasree, 1976 более крупными амфидами (ширина 12 мкм, или 39% соответствующего диаметра тела, против 5-6,5 мкм, или 19-26%), тонким и слабым пищеводом, более длинным и тонким телом (1760 мкм и  $a=51,8$  против 1410-1460 мкм и  $a=38,1-38,6$ ). Амфид *Ch. tenuipharyngealis* sp. n. меняется в онтогенезе от круглого у личинки 4-ой стадии к петлевидному у взрослого самца. Обсуждаются случаи смены типа амфид в постэмбриональном развитии у свободноживущих нематод. Приводятся исправленные и дополненные диагнозы семейства Tubolaimoididae Lorenzen, 1981 и родов *Tubolaimoides* Gerlach, 1963 и *Chitwoodia* Gerlach, 1956.

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