

Free-living nematodes of the families Selachinematidae and Richtersiidae in the White Sea (Nematoda, Chromadoria)

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Eight species of the families Selachinematidae and Richtersiidae are found in the White Sea, North Russia. The new species, *Gammanema anthostoma* sp. n., is distinguished by the peculiar cheilostomal rugae protruding from the mouth. Its males differ from the males of all *Gammanema* species in the lack of supplementary organs. Females of *G. anthostoma* sp. n. differ from those of the two *Gammanema* species whose males are hitherto unknown: from the females of *G. mediterraneum* Vitiello, 1970 in the lacking long somatic setae, value of the b index and three times longer body; and from females of *G. cancellatum* Gerlach, 1955 in the length ratio of the outer labial and cephalic setae. Six species (*Choniolaimus panicus*, *Gammanema fennicum*, *G. rapax*, *Halichoanolaimus robustus*, *Latronema aberrans*, *Richtersia inaequalis*) are recorded from the White Sea for the first time. *G. fennicum* is resurrected as a good species and its male is described for the first time; this species is strongly sexually dimorphic. *G. rapax* is a very variable species or even a group of species, as its redescrptions differ in important details; its wide distribution needs confirmation. In males of *Latronema aberrans*, the spermatozoa are filiform unlike rounded spermatozoa of other selachinematids.

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Introduction

The nematofauna of the White Sea in Northern Russia has been step by step explored by several authors in last decades (e.g. Galtsova, 1976; Galtsova & Platonova, 1988; Tchesunov, 1993, 1996, 2000a, 2000b; Platonova & Mokievsky, 1994; Decraemer & Tchesunov, 1996). The families Selachinematidae and Richtersiidae are among those nematode taxa, which were not studied hitherto.

According to numerous observations, the selachinematide nematodes are specialised predators attacking and ingesting other nematode species. The selachinematids are often distinguished by stout cylindrical body with truncate cephalic end and wide mouth with buccal cavity complicated by rhabdions, denticles or mandibles. The elaborate buccal armature obviously acts by gripping and holding preys.

The other family, Richtersiidae, comprises nematodes of different appearance. They have very stout cylindrical or even saccate body, with soft cuticle bearing longitudinal rows of minute spikes. Buccal cavity is soft-walled and devoid of any armament. Until recently, the diet of

Richtersiidae remains to be obscure. The families Selachinematidae and Richtersiidae were considered to be closely related by Lorenzen (1981), who united both taxa under the name Selachinematidae.

The goal of this paper is to contribute to the nematofauna of the White Sea and to solve some taxonomic problems in Selachinematidae and Richtersiidae. A new species is described and brief notes are given to seven known species. Six species were not previously recorded from the White Sea.

Material and methods

All specimens were collected in the Kandalaksha Bay of the White Sea in a depth range from tidal zone to 20 m. Sediment sampling from sublittoral zone was done by scuba divers. Nematodes are mounted in permanent glycerin slides. Type specimens are deposited in the Zoological Museum of the Moscow State University.

The following abbreviations are used: a = body length to midbody diameter ratio; a.b.d. = anal body diameter; b = body length to pharynx length ratio; c = body length to tail length ratio; c.b.d. =

corresponding body diameter; L = length of body; V = position of the vulva as percentage of body length.

Family SELACHINEMATIDAE

Choniolaimus panicus Gerlach, 1956 (Fig. 1)

panicus Gerlach, 1956: 93-94, Figs 29 m-n; Platt & Warwick, 1988: 292-293, Figs 133 A-E.

Material examined. 1 ♂ and 3 ♀, **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of the Moscow State University, upper subtidal zone, depth 9 m, medium sand with broken shells, 24.VI.1999.

Discussion. *Ch. panicus* was originally described by Gerlach (1956) and then redescribed by Platt & Warwick (1988). Our specimens differ slightly from those of Gerlach in the body ratios (male *a* 66, *b* 18, *c* 38.5 *versus a* 36, *b* 11.2, *c* 29.8) and relatively smaller amphid (50-78% of c.b.d. *versus* 100%). White Sea specimens correspond to those described by Platt & Warwick almost entirely, except relative width and number of turns of the amphid (50-78% c.b.d. and 4-5.75 turns *versus* 100% c.b.d. and 4 turns).

Distribution. *Ch. panicus* was found in the Kiel Bight (Gerlach, 1956) and in estuaries of southwestern Great Britain (Platt & Warwick, 1988). This species is recorded from the White Sea for the first time.

Gammanema anthostoma sp. n. (Figs 2, 3)

Holotype. ♂, **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of the Moscow State University, upper subtidal zone, depth 14 m, medium to silty sand, 20.VII.1998.

Paratypes. 4 ♂, 4 ♀, 1 juvenile, same locality, depth 10-16 m, 20.VII and 12.VIII.1998.

Description. Medium-sized nematodes with stout cylindrical body. Males: L 1002-1950 µm; *a* 22.8-28.5; *b* 5-7.3; *c* 12.3-16.8. Females: L 1487-1782 µm; *a* 17.7- 23.7; *b* 4.8-5.9; *c* 10-14; V 58.3-64%. Body diameter in males at the level of: cephalic setae 33-55 µm, nerve ring 35-60 µm, cardia 43-59 µm, midbody 45-63 µm, tail base 37-51 µm. These measurements in females are, respectively, 40-56 µm, 56-72 µm, 59-70.5 µm, 64-80 µm, 54-60 µm. Cuticle finely annulated and internally punctate. Dots rather large and arranged regularly in staggered rows in adjacent annules.

Head truncate. Inner labial sensilla represented by short setae 5-6.5 µm long in both sexes and looking leaf-shaped, especially in females. Outer labial sensilla and cephalic sensilla joined in one

circle. Outer labial sensilla short conical; cephalic sensilla represented by much longer setae. In males, outer labial setae 5.5-7.5 µm and cephalic setae 11-18 µm long. In females, these setae 5-7.5 µm and 15-19 µm long, respectively. Amphid spirally coiled, in 2.5 turns in males and 1.5 turns in females, from round to transversely oval in outer contour. Amphid width 14-26 µm or 32-44.5% c.b.d. in males, and 9.5-10.5 µm or 14.5-18% c.b.d. in females. There are four latero-medial cervical setae, 6-7.5 µm long in males and 5-8 µm in females, in an imperfect circle just behind the amphid.

Walls of cheilostoma armoured with twelve rugae protruding outside the mouth. Each ruga anteriorly turns into a subtle free peduncle with a triangular tip cap. Buccal cavity consists of two chambers. Anterior chamber resembling a shallow cup, 8-20.5 µm deep and 17-34 µm wide in males, 20-26 µm deep and 27-40 µm wide in females. When mouth is opened, the strong movable rhabdions may be positioned almost perpendicular to the body axis. Each rhabdion of anterior chamber terminates posteriorly in a tooth-like projection and bears also two smaller subterminal teeth. Posterior chamber more or less cylindrical, narrow, 13-18 µm deep and 9-17 µm wide in males, 20-31 µm deep and 17-27 µm wide in females. Its walls equipped with rhabdions. Pharynx with twisting internal lumen, muscular, stout, swollen anteriorly and posteriorly, 201-295 µm long and 25-36 µm wide at the nerve ring in males and 264-338 µm long and 23-45 µm wide in females. Midgut composed of very large cells. As clearly visible in females, anus lacking and rectum vestigial.

Female gonads paired and antidromously reflected. In three females, they are situated ventrally and to the right of the intestine; in one female, the position of gonads is difficult to determine. Male gonads paired and opposed. Anterior testis straight; posterior testis reflexed. In two males (including holotype), both testes situated ventrally and to the left of the intestine; in one male, they are situated ventrally; in other two males, the position of gonads is difficult to determine. Spicules arcuate, 62-87 µm along the arch, with narrow proximal knobs and acute distal ends. Gubernaculum also arcuate, 36-41 µm long. No preanal supplementary organs discernible.

Tail short, conical, 66-141 µm or 2.3-2.8 a.b.d. long in males and 115-154 µm or 2.1-2.6 a.b.d. long in females.

Comparison. Males of *G. anthostoma* sp. n. differ from males of all other *Gammanema* species in the lack of supplementary organs. Females of *G. anthostoma* sp. n. are distinguished from those of the two *Gammanema* species whose

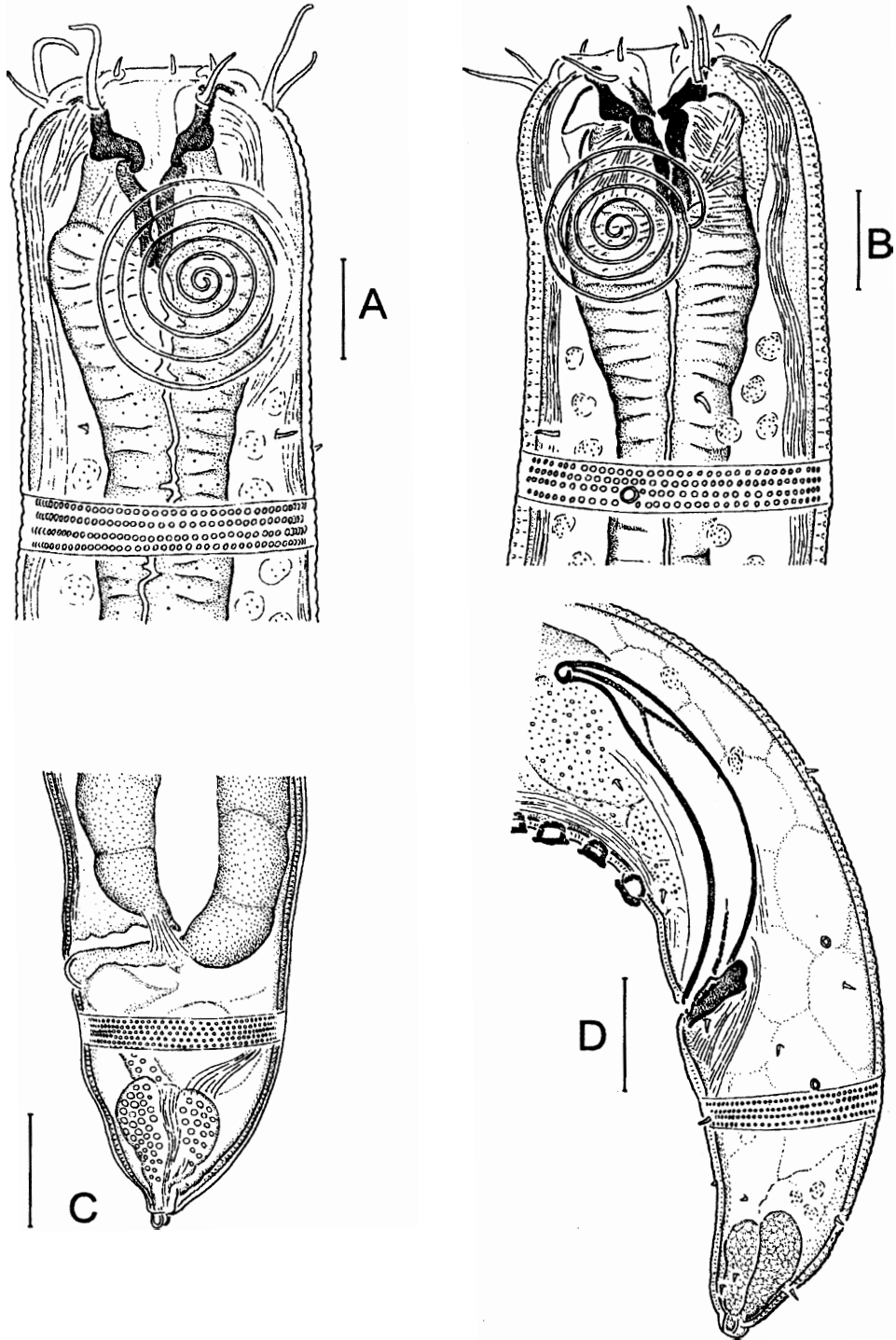


Fig. 1. *Choniolaimus panicus* Gerlach, 1956. A, male, cephalic end; B, female, cephalic end; C, female, tail; D, male, posterior body end. Scale bars: A, B – 10 μ m; C, D – 20 μ m.

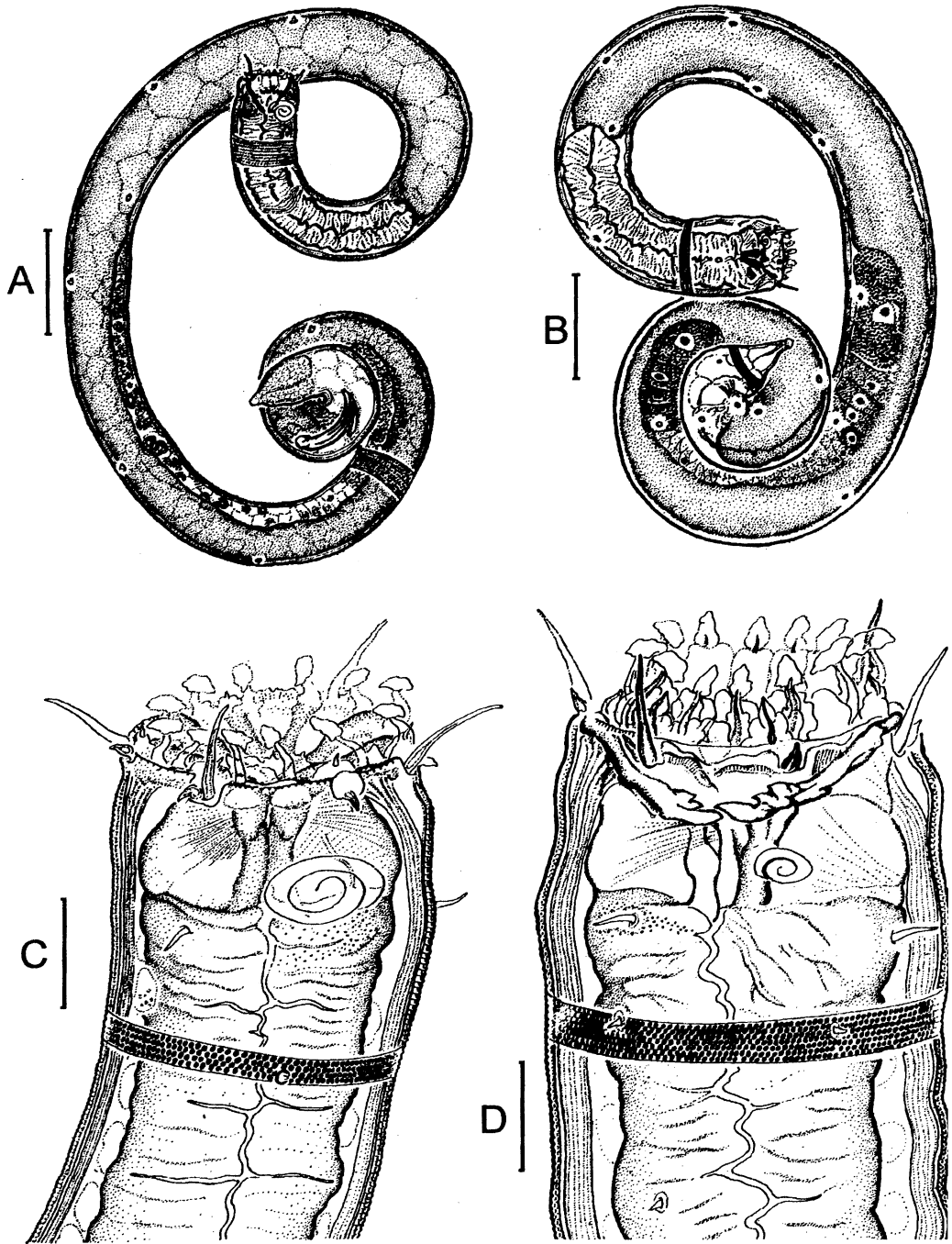


Fig. 2. *Gammanema anthostoma* sp. n. A, male, habitus; B, female, habitus; C, male, cephalic end; D, female, cephalic end. Scale bars: A, B – 100 µm; C, D – 20 µm.

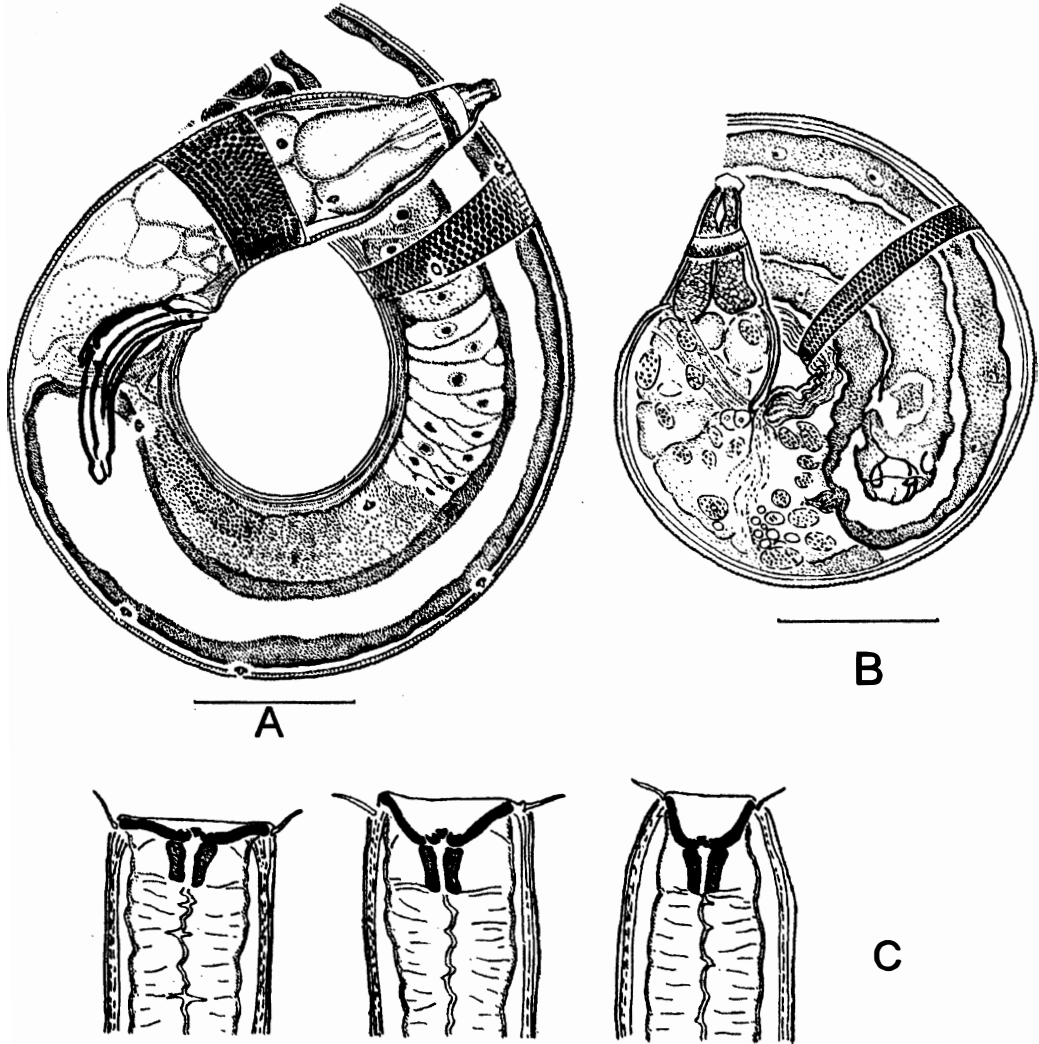


Fig. 3. *Gammanema anthostoma* sp. n. A, male, tail; B, female, tail; C, states of the flexible stoma. Scale bars: A, B – 50 μ m.

males are hitherto unknown: from those of *G. mediterraneum* Vitiello, 1970 in the lacking long somatic setae, value of the b-index (5.2-7.3 versus 3.4) and three times longer body; and from those of *G. cancellatum* Gerlach, 1955 in the length ratio of the outer labial and cephalic setae (outer labial setae in *G. anthostoma* are shorter and in *G. cancellatum* longer than cephalic ones).

Etymology. The name derived from two Greek words reflects the superficial resemblance of the opened mouth of the nematode to a flower with numerous stamens (rugae).

Gammanema fennicum (Gerlach, 1953), sp. dist. (Figs 4, 5)

fennicus Gerlach, 1953: 22-23, Figs 6 a-c (*Halichanolaimus*); Gerlach, 1964: 37.

Material examined. 4 σ , 5 f , 1 juvenile, **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of the Moscow State University, upper subtidal zone, depth 8-16 m, medium sand with broken shells, 1.VII.1994, 10.VIII.1998, 7.VII.1999.

Description. Body medium-sized, slender, cy-

lindrical in males; much stouter, cylindrical to spindle-shaped in females. Males: L 2165-2600 μm ; *a* 28.4-48.7; *b* 6.3-8.1; *c* 17.6-24.2. Females: L 1672-2782 μm ; *a* 13-24.6; *b* 5.5-5.9; *c* 16-23.5; V 63.6-72%. Body diameter in males at the level of: cephalic setae 44-46 μm , nerve ring 43-59 μm , cardia 43-59 μm , midbody 56-66 μm , anus base 47-62 μm . These measurements in females, respectively, 61-70 μm , 76-101 μm , 77-103 μm , 90-125 μm , 78-94 μm . Cuticle annulated and punctate. Dots minute and arranged irregularly.

Head truncate and not set off from body. All anterior sensilla seta-like, with sexual dimorphism in size. Inner labial setae inserted at edge of circular membrane surrounding mouth opening. Outer labial setae and cephalic setae in one joint circle. In males, inner labial setae 17-24 μm , outer labial setae 8-11 μm , cephalic setae 34-50 μm long. These measurements in females are, respectively, 9-13 μm , 10-13 μm , 20-37 μm . Amphids oligospiral, showing remarkable sexual dimorphism. In males, amphid coiled in 1.5-1.75 turns, with broad corpus gelatum, large, its width is 28-31 μm or 60-70% c.b.d. In females, amphid much smaller, in 1.5-2 turns, 9.5-11 μm or 11.8-13% wide. There are six (males) or four cervical setae at hind edge of amphid. Their length is 10-13 μm in males and 6-14 μm in females. Other somatic sensilla represented by pores 2 μm wide and shorter setae 2-4.5 μm long. In males, setae on tail up to 5.5 μm long.

Rugae of cheilostoma weakly developed. Buccal cavity voluminous, composed of two compartments. Anterior compartment is a truncated cone in shape; its walls are strengthened by thick solid rhabdions, toothless in males and forked posteriorly in two tooth-like projections in females. In males, posterior compartment cylindrical, with non-sclerotised walls. In females, posterior compartment is a truncated cone with sclerotised walls. In males, anterior stoma compartment 14-20 μm long and 16-27 μm wide; posterior compartment 12-15 μm long and 14-19 μm wide. These measurements in the females are 29-40 μm and 44-52 μm ; 16-27 μm and 31-44 μm . Pharynx in females thicker and stronger than in males: 234-321 μm long and 26-31 μm wide in the middle in males and 282-460 μm long and 46-50 μm wide in females. Midgut consists of relatively small cells, poorly pigmented. Rectum normally developed.

Female reproductive system didelphic and amphidelphic, with antidromously reflexed ovaries. Both ovaries lie ventrally and slightly to the right (four females) or slightly to the left (one female) of the intestine.

Anterior testis outstretched; posterior testis opposed. In one male, both testes lie ventrally and slightly to the right of the intestine; in other males, position of testes is obscure. Spicules arcuate, 62-64 μm in length (along the arch). Gubernaculum slightly arched, 36-42 μm long. There is a midventral series of 13-21 sucker-like supplementary organs anterior to the anus. Their height is 2-3 μm , transverse diameter 7-9 μm .

In males, tail short, cylindroid, with finger-like tip, 95-127 μm or 1.9-2.2 a.b.d. long. In females, tail short, conical, 70-115 μm or 1.22-1.86 a.b.d. long.

Discussion. The original diagnosis under the name *Halichoanolaimus fennicus* was based on one female and one juvenile specimen found in the east Baltic Sea (Gerlach, 1953). Later, Gerlach (1964) considered this species as belonging to the genus *Gammanema* and conspecific with *G. rapax* (Ssaweljev, 1912). However, we found two distinct species in the same samples. One of them corresponds well to the original diagnosis of *H. fennicus*, while another one to descriptions of *G. rapax*. Therefore, *Gammanema fennicum* is treated here as a separate species. Our females of *G. fennicum* differ from the type female very slightly, in the greater body diameter at the level of cephalic setae (61-70 μm versus 48 μm) and lower c-index (16-23.5 versus 25.8). Females of *G. fennicum* differ from females of *G. rapax* in having a circular membrane between the inner labial sensilla as well as in the tiny irregular punctation in the cuticle and a-index 13-24.6 versus > 30.

Males of *G. fennicum* are described here for the first time. The conspecificity of the males and females of *G. fennicum* here described may seem to be questionable because of their strong sexual dimorphism in the body shape, amphid, size of the inner labial sensilla and sclerotisation of the stoma walls. Our opinion is based on two considerations. First, both males and females were repeatedly found in the same samples of sediment, together with two other distinct *Gammanema* species also presented by males and females. No other unidentified *Gammanema* females or males were found in the same samples. Second, some other *Gammanema* species, for example *G. conicauda* Gerlach, 1953, are also sexually dimorphic, though not so distinctly as *G. fennicum*. The males of *G. fennicum* differ from all other known males of the genus in the non-sclerotised and non-toothed buccal cavity and very long inner labial setae. To some extent, the males *G. fennicum* resemble those of *G. kosswigi* Gerlach, 1964, but differ from the latter in the sucker-like supplementary organs (versus setose supplements in *G. kosswigi*).

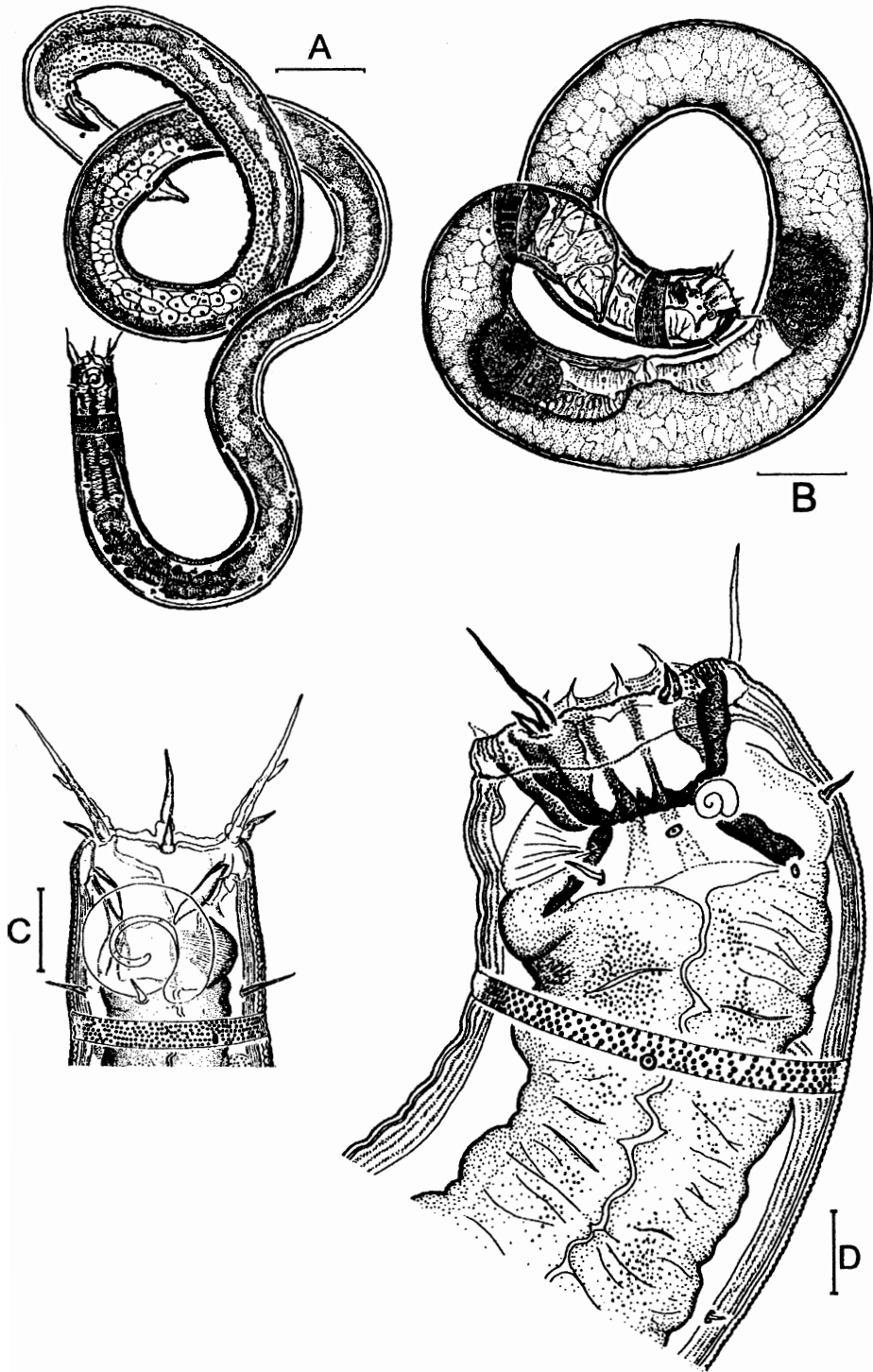


Fig. 4. *Gammanema fennicum* Gerlach, 1953. A, male, habitus; B, female, habitus; C, male, cephalic end; D, female, cephalic end. Scale bars: A, B – 100 μ m; C, D – 20 μ m.

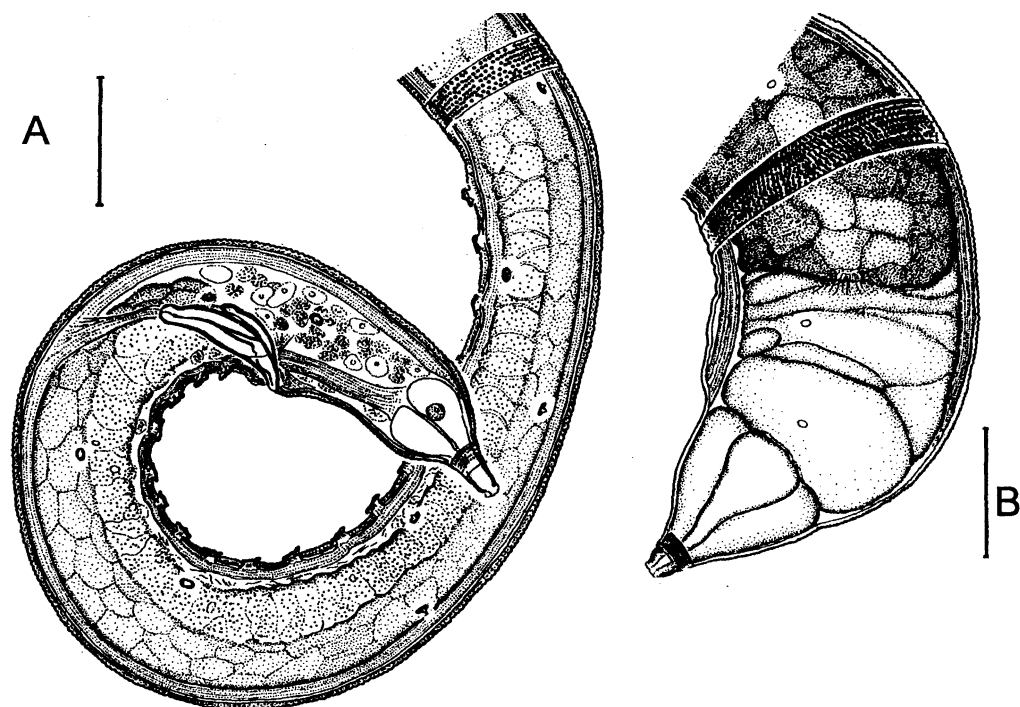


Fig. 5. *Gammanema fennicum* Gerlach, 1953, posterior body. A, male; B, female. Scale bars: 50 μ m.

***Gammanema rapax* (Ssaweljev, 1912)**
(Fig. 6)

rapax Ssaweljev, 1912: 122 (*Halichoanolaimus*); Gerlach, 1964: 37-38, Figs. 10 a, b; Platt & Warwick, 1988: 296-297, Figs 135 A-C. – *menzelii* Ditlevsen, 1918: 172-173, Pl. 6, Fig. 2, Pl. 7, Figs 1, 8 (*Halichoanolaimus*; syn. Gerlach, 1964).

Material examined. 5 σ , 9 ρ , **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of the Moscow State University, upper subtidal zone, depth 10-16 m, medium sand, 5.VII and 12.VIII.1999.

Discussion. The synonymy of *G. rapax* is rather confused, because various redescriptions do not correspond to each other in important details. The original diagnosis by Ssaweljev (1912) is too brief and devoid of figures. According to Ssaweljev (1912), this species is characterised by body length 5.8 mm and 6.1 mm in male and female, *a* 40-45, *b* 12, *c* 35 (male) and *a* 40 (female), 20-22 supplementary organs. Our specimens do not reach such a body size but coincide with the original diagnosis in all other features. Then, a single male of *G. rapax* was found by Ditlevsen (1918) in the Danish Belt Sea. Our males are inferior to that specimen in length (2.67-3.63 mm *versus*

5.9 mm), *a* (32.9-48 *versus* 74), *b* (9.3-12.3 *versus* 15), and slightly in number of supplements (21-30 *versus* 35). The male registered by Gerlach (1964) from the North Sea is, on the contrary, smaller than those of our series (L 1567 μ m) and differs in some other parameters, such as *b* (4) and amphid in 3.5 turns (number of supplements is not indicated). We are not able to state certainly whether this specimen and our White Sea nematodes belong to the same species. In the description of *G. rapax* from Great Britain, Platt & Warwick (1988) indicated the body length 3.5-4.3 mm, which is close to measurements of our specimens. The nematodes of our material coincide with British specimens in the length of outer labial and cephalic sensilla (7 μ m and 23 μ m, respectively), but differ in the greater width of amphid (13-24.5 μ m *versus* 11-12.5 μ m) and greater number of supplementary organs (21-30 *versus* 7). We suppose the British and White Sea specimens may belong to different species.

Distribution. *G. rapax* was recorded originally from the Barents Sea (type locality) and then from the western Baltic Sea, North Sea, English Channel, western coast of Great Britain, Atlantic coast of North America (North Carolina, USA), and New

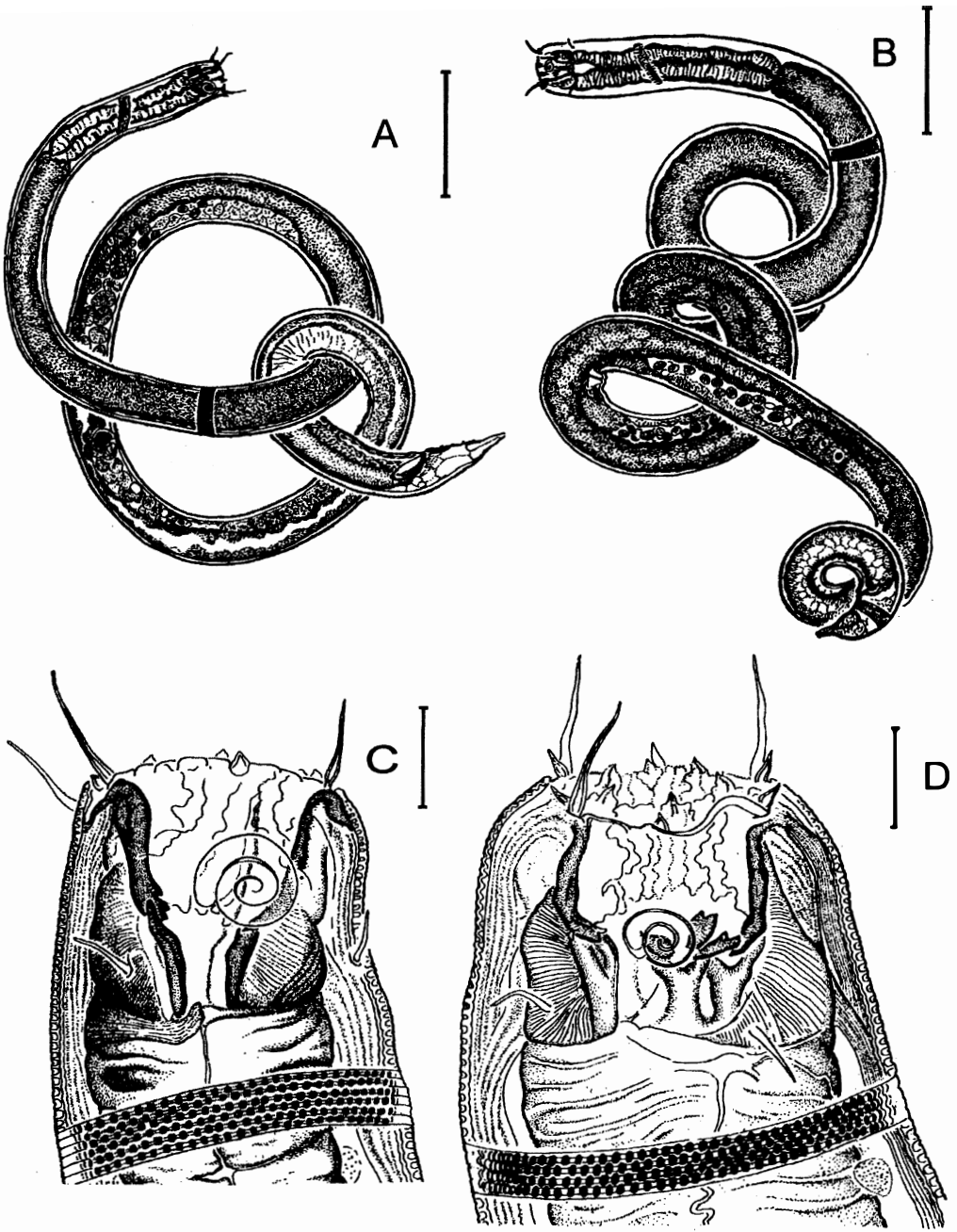


Fig. 6. *Gammanema rapax* Ssaweljev, 1912. A, male, habitus; B, female, habitus; C, male, cephalic end; D, female, cephalic end. Scale bars: A, B – 100 μm ; C, D – 20 μm .

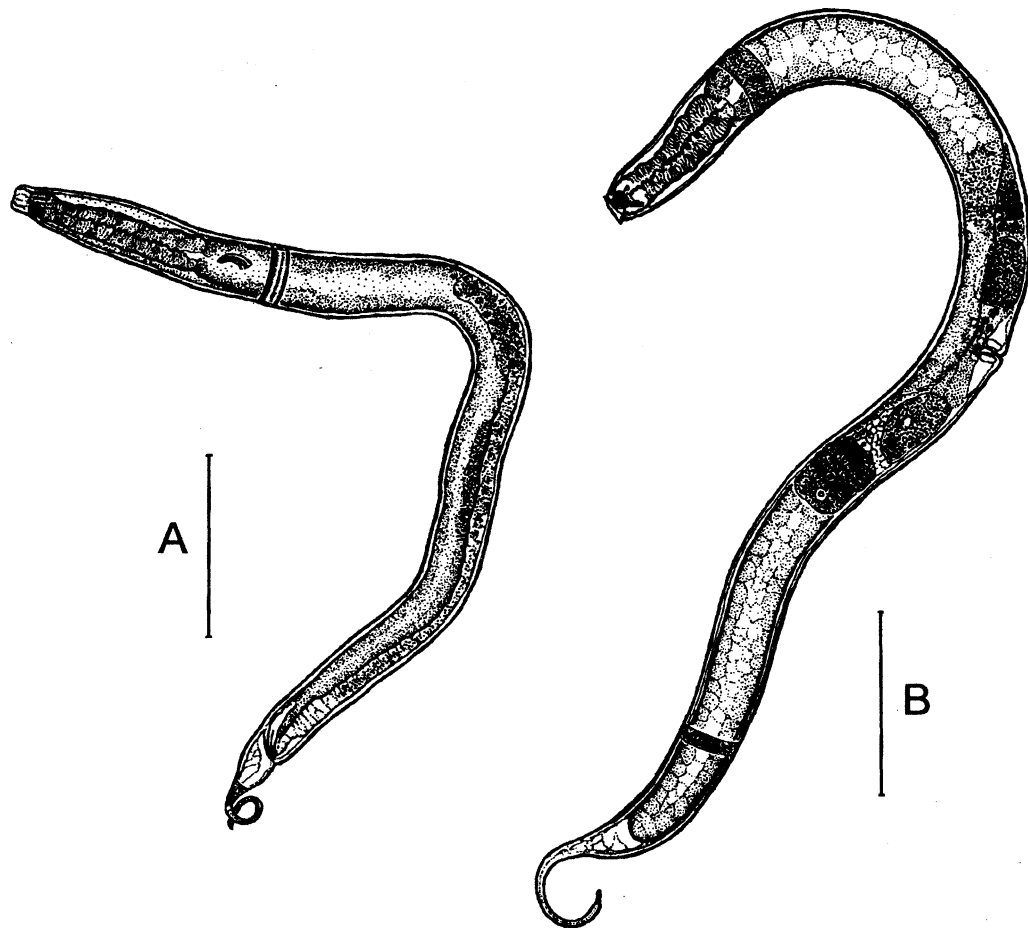


Fig. 7. *Halichoanolaimus minor* Ssaweljev, 1912, habitus. A, male; B, female. Scale bars: 200 μ m.

Hebrides (Pacific Ocean). Since the conspecificity of the specimens cited is questionable, the geographic distribution remains to be dubious.

***Halichoanolaimus minor* Ssaweljev, 1912**
(Figs 7, 8)

minor Ssaweljev, 1912: 120-121; Gourbault & Vincx, 1985: 88-90, Figs 1 a-d.

Material examined. 1 σ , 3 f , **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of Moscow State University, Probkina Guba, depth 10 m, silty sand, VIII.1989.

Discussion. Our specimens are close to the male described by Ssaweljev (1912) in the body length and some proportions (male: L 1.6 mm, *a*

40, *b* 6.5, *c* 6.7, spicule length 56 μ m (chord), and female: L 1.3 mm, *a* 20, *b* 6.5, *c* 7.5), but our male is relatively twice thicker. The description of Ssaweljev (1912) was not accompanied with drawings.

Our specimens correspond well also to the redescription by Gourbault & Vincx (1985) made from specimens from abyssal of the SE Atlantic, but differ slightly in the body proportions and longer tail flagellum (*a* 20.6-21.8 and *c* 6.3-8 versus 25-37 and 4.5-5.7, respectively) as well as in number of preanal supplementary papillae (3-4 versus 2).

Distribution. Barents Sea (type locality), Norway Sea, Chile coast, SE Atlantic (off Angola coast). Depth range extends from upper subtidal zone to abyssal.

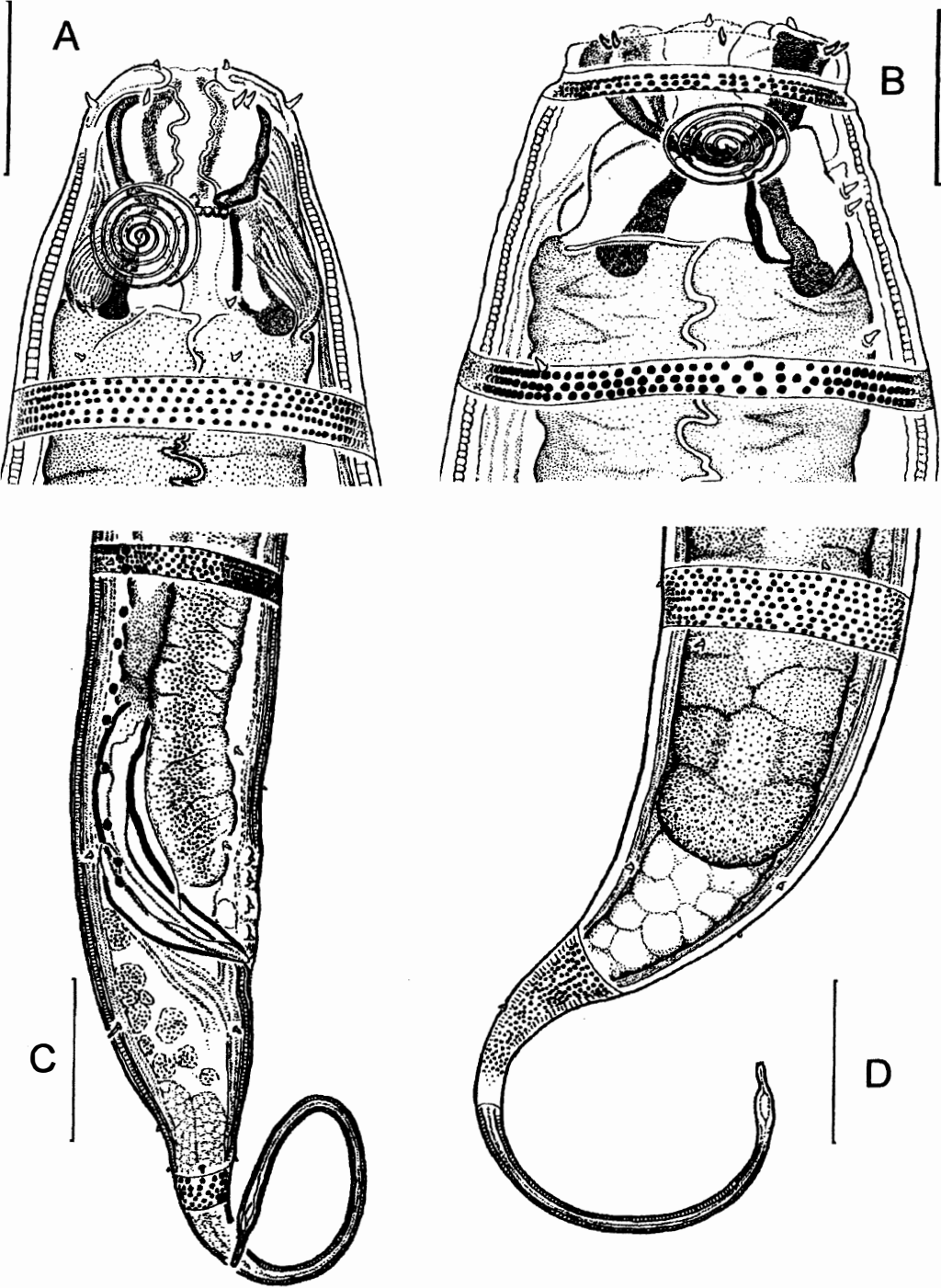


Fig. 8. *Halichoanolaimus minor* Ssaweljev, 1912. A, male, cephalic end; B, female, cephalic end; C, male, posterior body; D, female, posterior body. Scale bars: A, B – 20 μ m; C, D – 40 μ m.

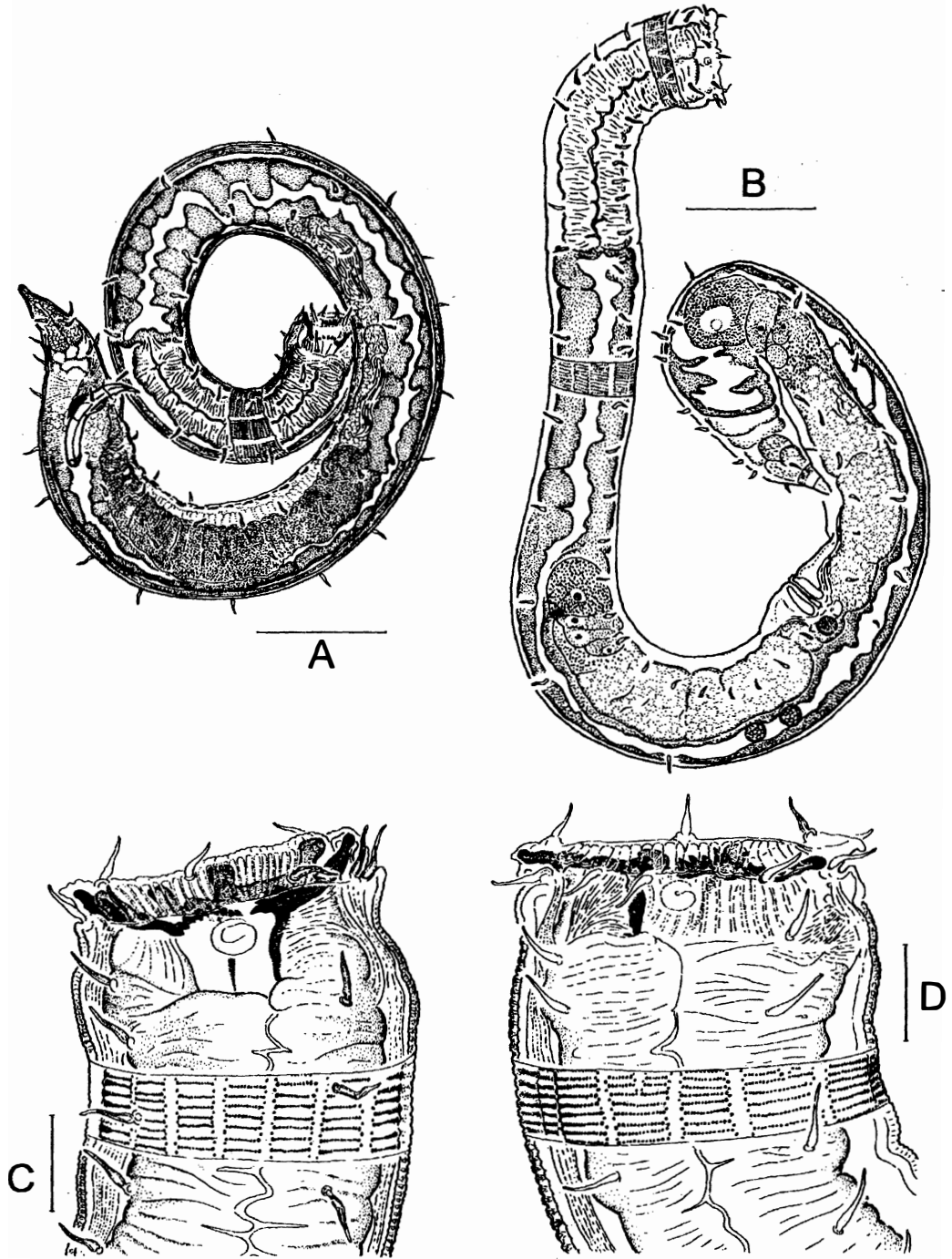


Fig. 9. *Latronema aberrans* (Allgen, 1947). A, male, habitus; B, female, habitus; C, male, cephalic end; D, female, cephalic end. Scale bars: A, B – 100 μm ; C, D – 20 μm .

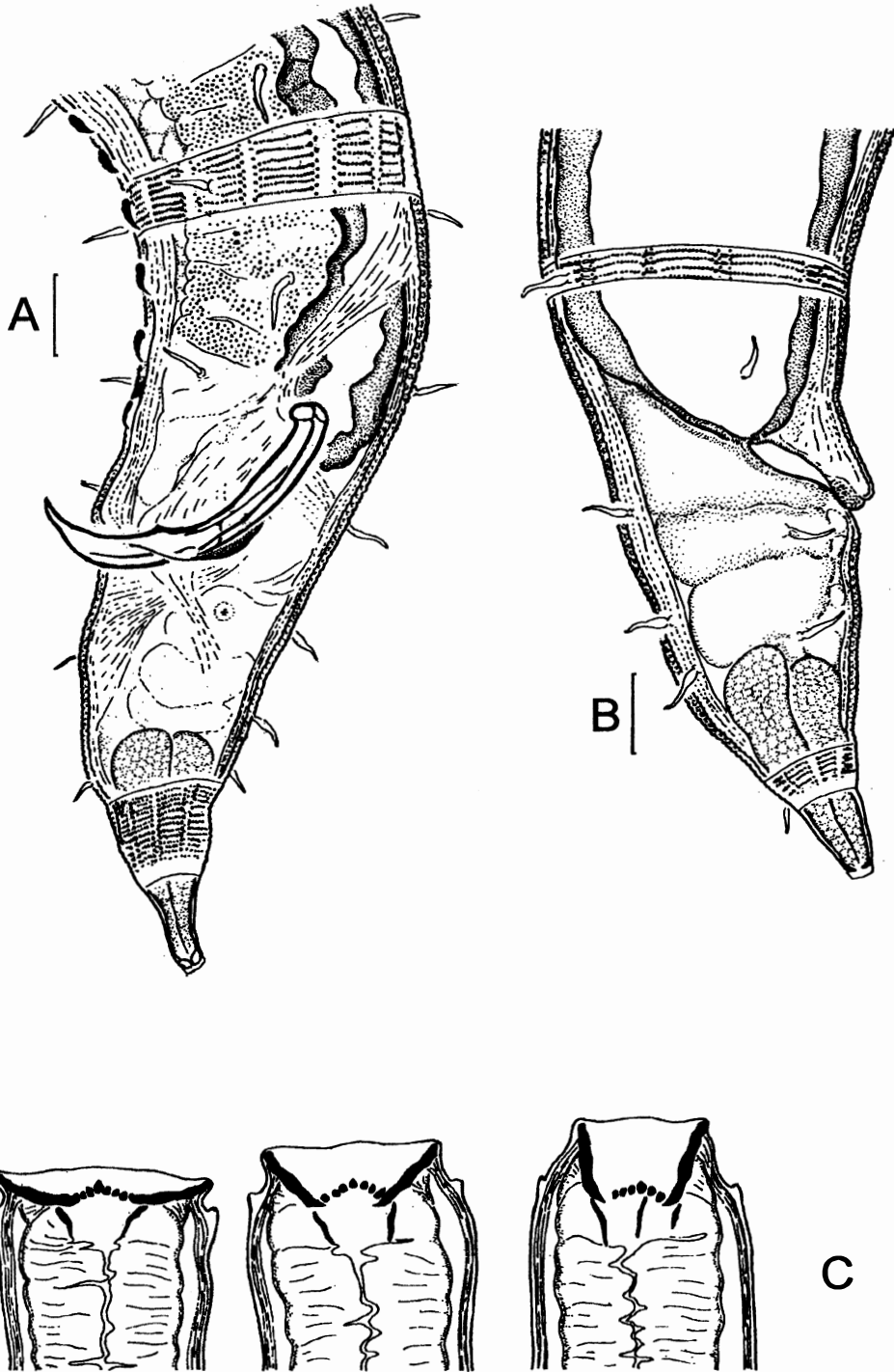


Fig. 10. *Latronema aberrans* (Allgen, 1947). A, male, posterior body; B, female, tail; C, states of the flexible stoma. Scale bars: A, B – 20 μ m.

Halichoanolaimus robustus (Bastian, 1865)

robustus Bastian, 1865: 166, Figs 226-227 (*Spiliphera*); Ssaweljev, 1912: 126; Allgen, 1947: 142-143, Figs 46 a-c; Gerlach, 1964: 31-32, Figs 6 a-e; Galtsova, 1976: 213-214, Fig. 25; Palacin, 1985: 39-40, Figs 4 d-e; Platt & Warwick, 1988: 300-301, Figs 137 a-d. – *clavicauda* Filipjev, 1918: 200-202, Figs 38 a-c (syn. Gerlach, 1964). – *hinemoae* Ditlevsen, 1930: 230-232, Figs 47-49 (*Halichoanolaimus*; syn. Gerlach, 1964).

Material examined. 6 ♂, 6 ♀, 1 juvenile, **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, intertidal zone, silty sand, 19.VII.1999.

Discussion. Our specimens correspond well, with minor exceptions, to the descriptions cited above.

Distribution. *H. robustus* was recorded almost worldwide: Norway Sea, North Sea, Baltic Sea, English Channel, Black Sea, Mediterranean, New England, California, Maldive Islands, New Zealand, Hawaii, Australia. The species was also found and briefly described from the White Sea (Galtsova, 1976).

Latronema aberrans (Allgén, 1935) (Figs 9, 10)

Material examined. 10 ♂, 5 ♀, 1 juvenile (probably, of J2 stage), **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of Moscow State University, depths 8-12 m, medium to coarse sands, VII.1994 and VII.1998.

Remark. Males of *L. aberrans* possess filiform spermatozoa unlike rounded spermatozoa of other examined White Sea selachinematids.

Discussion. Allgen (1934) described the only juvenile, so that comparison with that description is difficult. The holotype is smaller and slenderer in comparison with the White Sea adults. Nematode in the figures of Allgen is very similar to our specimens. Our specimens scarcely differ from those described by Gerlach (1964: 40-41, Figs 12 a-d).

Distribution and ecology. *L. aberrans* was first discovered in Öresund and thereafter redescribed from Kiel Bight (Gerlach, 1964).

Family **RICHTERSIIDAE****Richthersia inaequalis** Riemann, 1966

Riemann, 1966: 145-147, Figs 37 c-i; Platt & Warwick, 1988: 306-307, Figs 140 a-e.

Material examined. 5 ♂, 5 ♀, 1 juvenile, **Russia**, White Sea, Kandalaksha Bay, Karelian Shore, Velikaya Salma Strait, vicinity of the White Sea Biological Station of Moscow State University, depth 12 m, medium sand, 5.VII.1998.

Discussion. Our specimens correspond well to the original diagnosis of Riemann (1966), except

for some minor details in males (indices $a = 7.8-10.7$ and $b = 9.3-11.7$ versus respectively 12-14.4 and 12.7-13.9) and females (body length 483-612 μm versus 695 μm). White Sea specimens are slightly shorter and thicker than those described by Platt & Warwick (1988), but the measurements overlap (body length 466-622 μm and $a = 7.4-11.3$ versus 600-800 μm and $a = 8-14$ respectively).

Distribution. *R. inaequalis* was previously found in the North Sea (vicinity of the Elbe mouth), English Channel and western coast of Great Britain. Up to now the species was not recorded for the White Sea.

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