

Three new Xyalidae species (Nematoda) from South Africa, with a redefinition of the genus *Xyala* Cobb, 1920

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Abstract : Three new Xyalidae species are described from Algoa Bay, South Africa.

Gonionchus africanus sp. n. is described from a beach and is characterized by the anterior position of the amphid, absence of longitudinal cuticular ornamentation, the conical tail and the peculiar shape of the gubernaculum.

Xyala aestuariensis sp. n. is described from an estuary and *Xyala psammonalis* sp. n. from a beach. Both species have a heavily sclerotized buccal cavity and numerous (more than 40) longitudinal striae on the cuticular annules.

Xyala imparis Boucher and Helléouët, 1977 and *Xyala striata* Cobb, 1920 are redescribed from the Southern Bight of the North Sea.

Omicronema Cobb, 1920 is synonymized with *Xyala* Cobb, 1920 and the genus *Xyala* is redefined.

Résumé : Description de trois nouvelles espèces de Xyalidae sud-africains (Algoa Bay).

Gonionchus africanus sp. n., récolté sur un estran, est caractérisé par la position antérieure des amphides, l'absence d'une ornementation cuticulaire longitudinale, la forme conique de la queue et celle très particulière du gubernaculum.

Xyala aestuariensis sp. n. provient d'un estuaire et *Xyala psammonalis* sp. n. du premier estran. Ces deux espèces présentent une cavité buccale fortement cuticularisée et de nombreuses (plus de 40) stries longitudinales sur les anneaux de la cuticule.

Redescription de *Xyala imparis* Boucher et Helléouët et *Xyala striata* Cobb, 1920 de la mer du Nord.

Mise en synonymie de *Omicronema* Cobb, 1920 et *Xyala* Cobb, 1920 et redéfinition du genre *Xyala*.

INTRODUCTION

Three sandy beaches and an estuary were selected to study marine nematodes of South African beaches. The average particle size for the beach is 250 μm and that of the site near the mouth is 200 μm . The rest of the estuary is dominated by conspicuous grey-brown clay.

Three new Xyalidae species were found and compared with material from the Southern Bight of the North Sea.

MATERIAL AND METHODS

South African samples. Intertidal sediment samples were taken with a copper corer (65 cm long and 3.6 cm in diameter). Samples were taken at LWS and MWS at a depth of 0-45 cm. Ten sampling sites were chosen along the entire length (16 km) of the Sundays River estuary. Seven sampling sites were selected

on Sundays River Beach, from close to the mouth to 6 km away from the mouth of the estuary.

Extraction was done by decantation. The specimens were fixed in hot (60 °C) neutral formalin and mounted in glycerine after dehydration.

North Sea samples. Meiofauna was subsampled out of a Van Veen grab. A description of the area is given by Herman *et al.*, 1985. Drawings were made with the aid of a drawing tube on a Leitz Dialux 20 microscope with interference contrast equipment. All measurements are in micrometer; curved structures are measured along the arc. Values in the formula (measurements) are as in Vincx *et al.* (1982). Type material is deposited in the collection of the Instituut voor Dierkunde, Rijksuniversiteit, Gent, Belgium.

RESULTS

Gonionchus africanus sp. n. (Fig. 1 A-I)

Material examined : six males, one female.

Type locality : Sundays River Beach (25° 52' E - 33° 43' S). LWS. Samples 22W, 23W, 4 and 5 km from mouth of estuary. Sampling date : 19 February 1987.

Measurements :

Holotype (δ_1): - 128 202 M 1029

 1117 μm (slide n° 985)
 13 22 22 22 21
 a = 50.8; b = 5.5; c = 12.7; c' = 4.2; spic = 33 μm .

Paratype (φ_1): - 223 331 1051 1139

 1285 μm (slide n° 986)
 23 35 35 32 25
 a = 36.7; b = 3.9; c = 8.8; c' = 5.8; V = 81.8 %

Other paratypes (slides n°: 10244 to 10247) :

males (n=5)

L: 917 - 1146 μm ; a: 41.6 - 48.1; b: 4.5 - 5.7; c: 8.9 - 11.9; c': 4.4 - 5.7;
 spic.: 21 - 27 μm

DESCRIPTION

Males. Body cylindrical, tapering slightly towards the end. Cuticle obviously annulated (each annule 1.5 μm wide) from the anterior level of the amphideal fovea to the tail tip (annules on the tail tip less than 1 μm wide). Longitudinal ornamentation absent. Tail conical, provided with ventral setae. Three caudal glands with separate outlets. No terminal setae.

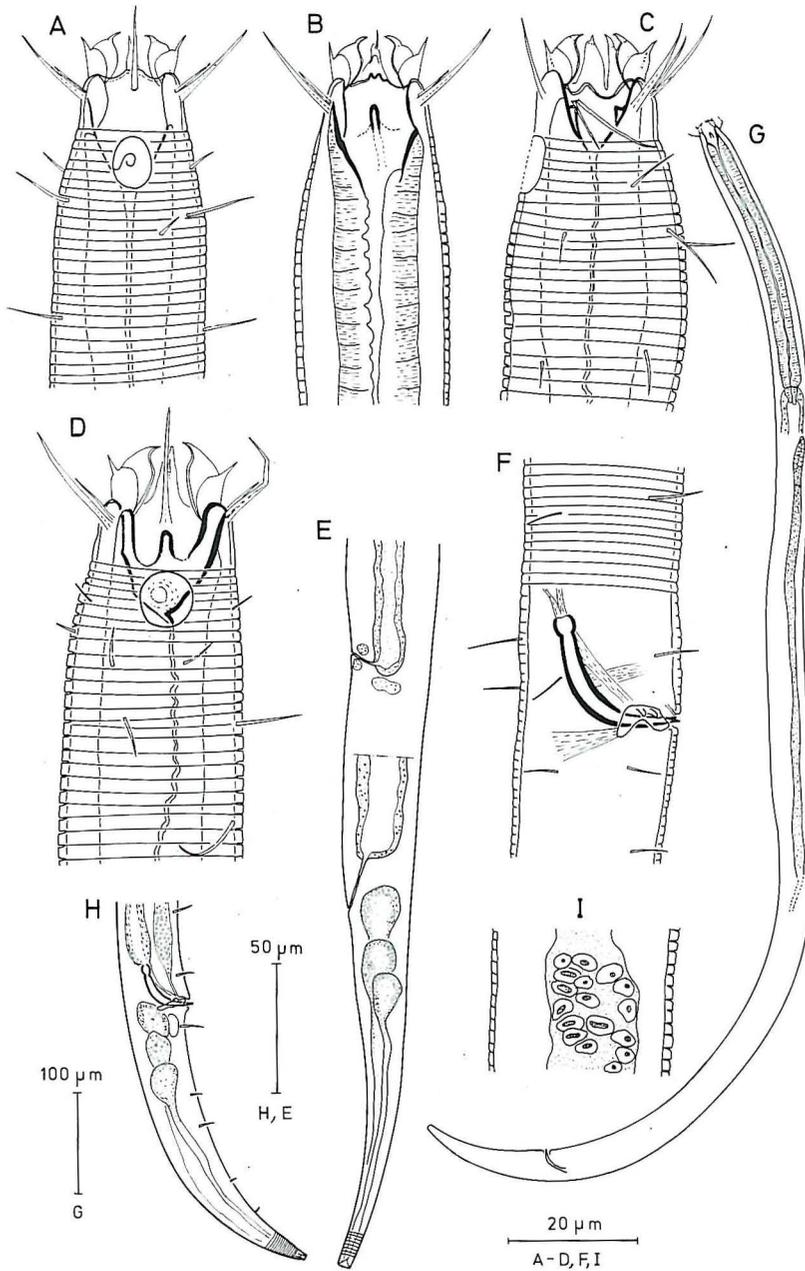


Fig. 1 - *Gonionchus africanus* sp. n.

A: Head end of holotype ♂1; B: Head end of holotype ♂1, buccal cavity; C: Head end ♂2; D: Head end ♀1; E: Tail region ♀1; F: Copulatory apparatus holotype ♂1; G: Total view holotype ♂1; H: Tail region holotype ♂1; I: Sperm cells ♂1.

The six internal labial sensilla (3-4 μm long) are present as protrusions of the basal parts of the elevated lips. The six external labial setae (14 μm) are at the same level with the four cephalic setae (7 μm) and are presumably segmented (only visible when the setae are bent). Numerous cervical setae (between 5 - 11 μm long) are irregularly spread, from the mid-level of the amphideal fovea onwards. The somatic setae are very thin and are situated in eight longitudinal rows. The amphideal fovea has an elliptical contour: the spiral origin is obvious (ventrally wound) by a central spot. The corpus gelatum is also spiralized. Fovea situated at 16 μm from anterior end and is 8 μm long and 5 μm broad (i.e. 27 % of the c.b.d.). The buccal cavity is conical; six very thin, composed lips are situated at the anterior border of the "mouth region", which is demarcated by a zigzag, more sclerotized border of the cuticle. Each lip consists of a basal part which is separated from an apical part by a rather thin boundary. The apical part ends in a flap-like protrusion. The inner wall of the lips is more sclerotized than the outer parts. Two ventrosublateral tooth-like protrusions are present on the sclerotized walls of the conical buccal cavity. Pharynx cylindrical, muscular throughout its length and surrounds the buccal cavity partly. Cardia 19 μm long. Nerve ring at 63 % of the neck length. Ventral gland and pore not observed. Dioorchic with longest anterior testis at the left and the short posterior testis at the right of the intestine. Sperm cells amoeboid with oval, dense nucleus (4 μm diameter). Spicules equal, regularly curved with well developed capitulum and bifid distal tip. The gubernaculum surrounds the distal part of the spicules and is provided with two lateral protrusions at each side. Two caudal apophyses are developed at each lateral piece of the gubernaculum.

The musculature of the copulatory system is well developed. The rotator muscle extends from halfway the shaft of the spicule to the subventral body wall. Two pairs of ejaculatory glands probably open in the cloaca.

Female. Similar to the males, except for the longer tail and fewer somatic setae. Tail without setae.

This specimen is a very young female, which makes the genital system not fully developed. Monodelphic with outstretched ovary situated at the left side of the intestine. Two prominent vaginal glands. Vagina directed posteriorly.

Diagnosis

Gonionchus africanus sp. n. is characterized by the absence of longitudinal cuticular ornamentation, presence of cervical setae in both sexes and long somatic setae in the males, position of the amphideal fovea (at the basal part of the buccal cavity), equal spicules and by the shape of the lateral pieces of the gubernaculum and by the conical tail.

DISCUSSION

Gonionchus africanus sp. n. differs from all the known *Gonionchus* species by the anterior position of the amphideal fovea (at the level of the base of the buccal cavity), by its short, conical tail and by the peculiar shape of the gubernaculum.

Xyala aestuariensis sp. n. (Fig. 2 A-H)

Material examined : two males, one female.

Type locality : Sundays River estuary. MWS. Samples 1b/14 and 1b/33, 0.5 km from mouth. Sampling date : 9 February 1987.

Measurements :

Holotype (δ_1): - ? 306 M 1630

 1739 μm (slide n° 987)
 13 ? 39 35 31
 a = 44.6 ; b = 5.7 ; c = 16.0 ; c' = 3.5 ; spic = 31 μm

Paratype (φ_1): - 143 277 1380 1467

 1577 μm (slide n° 988)
 15 31 35 31 27
 a = 50.9 ; b = 5.6 ; c = 14.4 ; c' = 4.1 ; V = 87.5 %

Other paratype : δ 2 (slide n° 10248) :

L = 1372 μm ; a = 47.0 ; b = 5.1 ; c = 15.7 ; c' = 4.0 ; spic = 38 μm

DESCRIPTION

Males. Body cylindrical with narrowing ends. Cuticle obviously annulated ; each annule about 1.5 μm wide and provided with numerous faint longitudinal striae (50-60 striae in the cervical region) ; this ornamentation is present to the tail tip. Only the head end (about 15 μm) is not annulated. Tail cylindro-conical with blunt end ; three caudal glands with separate outlets.

Somatic setae short and present throughout the body length, arranged in eight longitudinal rows.

The six internal labial sensilla are 3 μm long ; the six external labial setae (14 μm long), the four cephalic setae (8 μm long) and one additional lateral setae (at each side ; 11 μm long) are situated in one circle on the non-annulated part of the head. The amphideal fovea is circular, 5 μm diameter (i.e. 27 % of the c.b.d.) and at 19 μm from the anterior end. No spiral origin obvious. Six lips very prominent. The buccal cavity is large (19 μm deep), cylindrical, well sclerotized, sometimes with irregular basal part ; only the base of the buccal cavity is surrounded by pharyngeal tissue. Pharynx cylindrical and muscular. Cardia 15 μm long. The wall of the intestine is composed of large cells which have an outer granulated part and a translucent inner part.

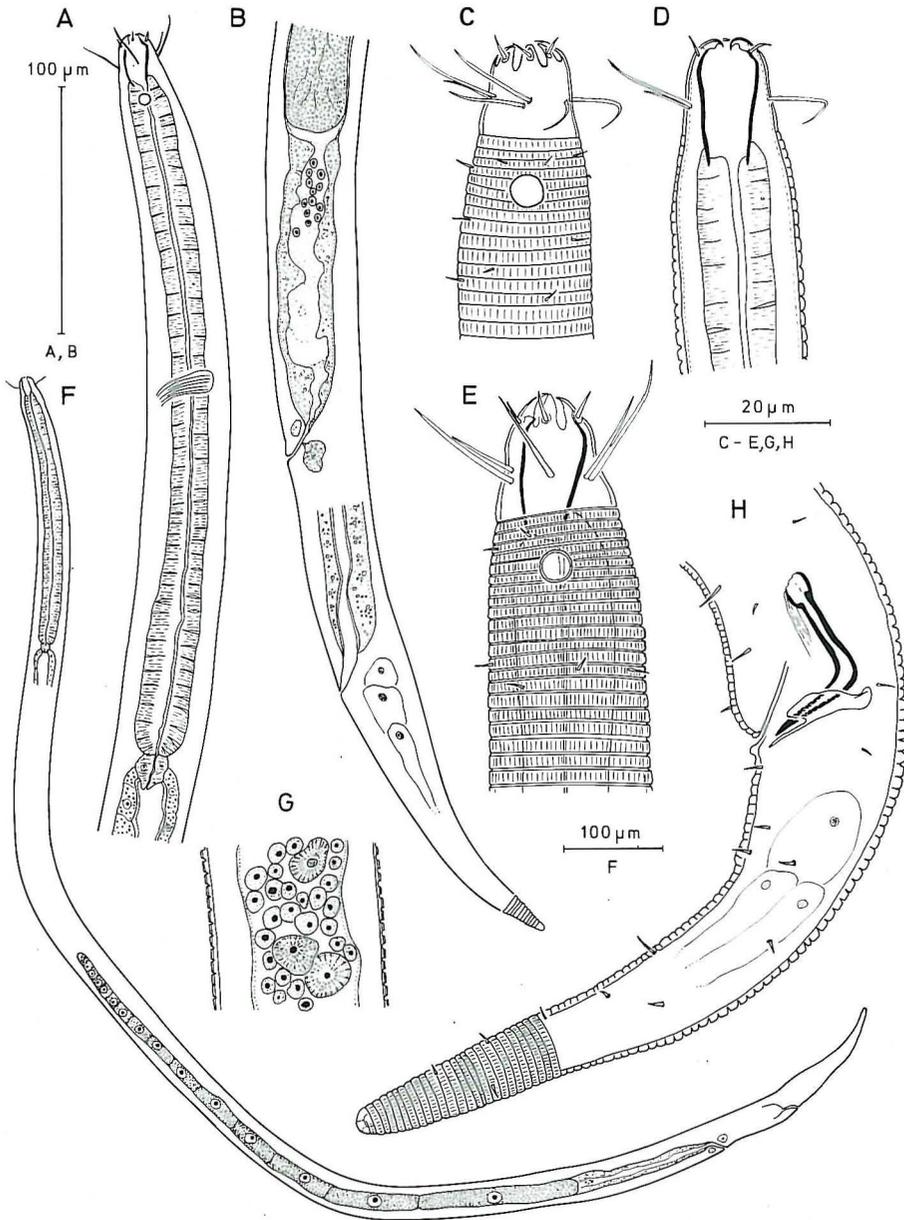


Fig. 2 - *Xyala aestuariensis* sp. n.

A : Pharyngeal region ♀1 ; B : Tail region ♀1 ; C : Head end holotype ♂1 ; D : Head end holotype ♂1, buccal cavity ; E : Head end ♀1 ; F : Total view ♀1 ; G : Sperm cells ♂1 ; H : Tail region and copulatory apparatus holotype ♂1.

Diorchic, both testes outstretched and at the left side of the intestine. Anterior testis the largest one. Two types of sperm cells are found (6 μm and 4 μm diameter respectively). Spicules are equal and rectangularly curved; the capitulum is well developed. Gubernaculum with small dorsal apophyses (17 μm long). Copulatory muscles not very prominent.

Female. Resembles males in most aspects.

The additional lateral cephalic setae are lacking and about 80 longitudinal striae are present on the cuticular annulation. Somatic setae less numerous.

Monodelphic with anterior ovary at the left of the intestine. Vagina weakly sclerotized; two vaginal gland cells. Only the smallest type of sperm cells present in the proximal part of the uterus.

Diagnosis

Xyala aestuariensis sp. n. is characterized by the deep, cylindrical buccal cavity, the annulation of the cuticle which is provided with numerous (50-80) longitudinal striae and which is clearly separated from the non-annulated head.

DISCUSSION

Because of the numerous striae on the cuticular annulation, *Xyala aestuariensis* sp. n. resembles *Xyala exigua* Wieser, 1956. However, last species has very long somatic setae and is only known from one juvenile, and is therefore considered as a species inquirenda.

Xyala psammonalis sp. n. (Fig. 3A-G)

Material examined: two males; one female.

Type locality: Sundays River Beach (25° 52' E - 33° 43' S). LWS. Samples 23W and 24W, 0.5 and 4 km from mouth of estuary. Sampling date: 19 February 1987.

Measurements

Holotype (δ_1):	-	122	253	M	908	
						1025 μm (slide n° 989)
		16	28	28	32	32
	a =	32.0	b =	4.1	c =	8.9 ; c' = 3.6 ; spic = 38 μm
Paratype (φ_1):	-	131	281	958	1057	
						1195 μm (slide n° 990)
		16	32	32	35	30
	a =	34.1	b =	4.3	c =	8.7 ; c' = 4.6 ; V = 80.2 %

Other paratype (slide n° 10249):

Male δ_2 : L = 1660 μm ; a = 46.1; b = 6.4; c = 13.2; c' = 4.2; spic = 36 μm .

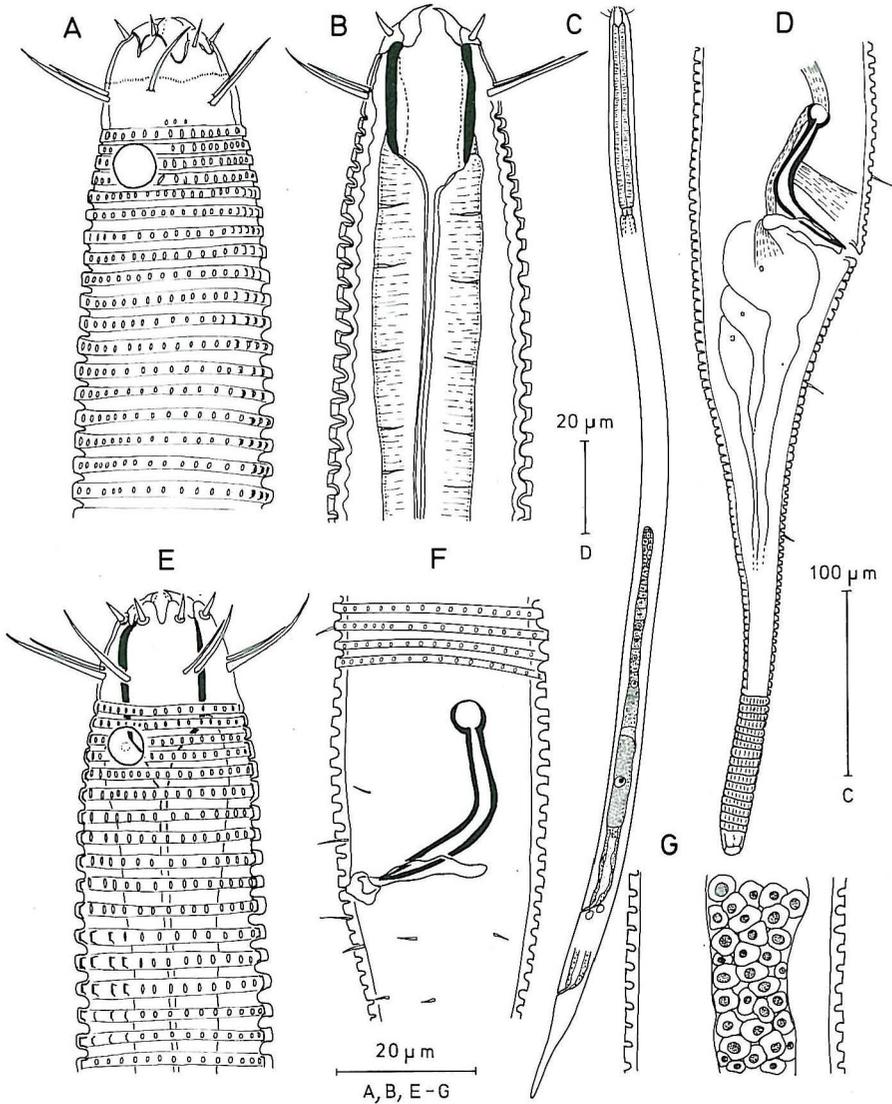


Fig. 3 - *Xyala psammonalis* sp. n.

A : Head end holotype ♂1 ; B : Head end holotype ♂1, buccal cavity ; c : Total view ♀1 ; D : Tail region and copulatory apparatus ♂1 ; E : Head end ♀ ; F : Copulatory apparatus ♂2 ; G : Sperm cells ♂2.

DESCRIPTION

Males. Body cylindrical with narrowing tail. Cuticle obviously annulated; each annule is provided with about 40 longitudinal crests, which are present on the elevated part of the annules. The annules are separated among each other by prominent interannular regions, which are, in the cervical region, almost as wide as the elevated part (2.5 μm) of the annules. In the remainder of the body, the interannular parts become less prominent. The annulation extends from the anterior level of the amphid until the tail tip. On the cylindrical part of the tail, the longitudinal crests are less prominent. Tail with filiform last part. Three caudal glands end separately.

The six internal labial sensilla (3-4 μm) are situated at the basal part of the six prominent lips. The six external labial sensilla (14 μm) and the four cephalic setae (11 μm) are arranged in one circle at the mid-level of the buccal cavity. Somatic setae scarce. The amphideal fovea is circular; situated at 18 μm of the apical end at the level of the base of the buccal cavity and with a diameter of 6 μm (i.e. 27 % of the c.b.d.). Buccal cavity cylindrical with heavily sclerotized walls, 18 μm deep; only its base is surrounded by pharyngeal tissue. Pharynx cylindrical and muscular. Cardia 7 μm long. Nerve ring at 48 % of the neck length. Ventral gland and pore not found.

Diorchic, both testes outstretched and at the left of the intestine. Sperm cells globular, 4 μm in diameter. Spicules rectangularly curved, with well developed capitulum. Copulatory muscles well developed, also with a prominent rotator muscle on the spicule (cf. Fig. 3D). Gubernaculum (22 μm) with two dorsal apophyses.

Female. Resembles males in most aspects.

Monodelphic, with outstretched ovary at the left of the intestine. Two caudal vaginal gland cells present.

Differential diagnosis

Xyala psammonalis sp. n. is differentiated from the other *Xyala* species by the presence of the heavily sclerotized buccal cavity, the prominent and numerous longitudinal crests on the cuticular annulation and the filiform part of the tail.

Xyala imparis Boucher and Helléouët, 1977 (Fig. 4A-E)

Material examined: one male, one female.

Locality: Southern Bight of the North Sea. Sublittoral medium sand.

Measurements:

δ_1 :	-	144	415	M	1075		
		<hr/>				?	(slide n° 991)
		22	35	35	39	29	
		(tail broken)					

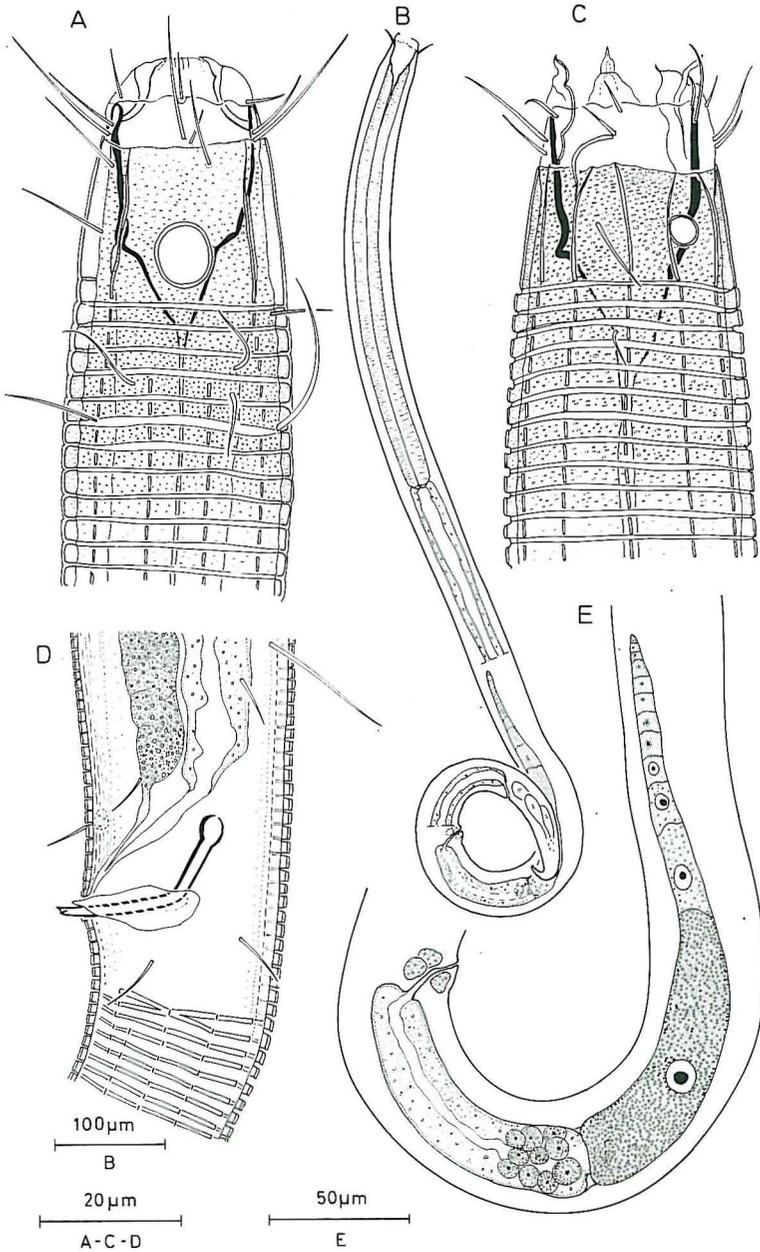


Fig. 4 - *Xyala imparis* Boucher and Helléouët, 1977

A : Head end ♂1 ; B : Total view ♀ ; C : Head end ♀1 ; D : Copulatory apparatus ♂1 ; E : Genital system ♀1.

♀ ₁ :	-	136	414	932	1304		1420 μm (slide n° 992)
		24	38	39	41	24	
		a = 34.6 ; b = 3.4 ; c = 12.2 ; c' = 4.8 ; V = 65.6 %					

DESCRIPTION

Xyala imparis is fully described by Boucher and Helléouët (1977). Only additional information or aberrations are noted.

Cuticle annulated ; the first ten anterior cervical annules and the cephalic capsule are vacuolated ; 10 to 14 longitudinal crests are present throughout the body ; these longitudinal elevations extend to the anterior border of the cephalic capsule in the female ; the sublateral crests in the male do not reach the cephalic capsule.

Spicules with well developed capitulum and bifid distal tip. Gubernaculum weakly sclerotized. Muscles not obvious. Two testes ; anterior at the left, posterior at the right side of the intestine. One pair of ejaculatory gland cells ; outlet not seen. One ovary situated at the left side of the intestine. Oviduct very short ; anterior part of uterus filled with sperm cells ; three vaginal glands ; vagina weakly sclerotized.

DISCUSSION

See Discussion of *Xyala striata*.

Xyala striata Cobb 1920 (Fig. 5A-G)

Material examined : ten males and ten females.

Locality : Southern Bight of the North sea ; sublittoral fine to medium sand.

Measurements

♂ ₁ :	-	200	607	M	1527		1680 μm (slide n° 993)
		27	38	39	39	36	
		a = 43.1 ; b = 2.8 ; c = 11.0 ; c' = 4.3 ; spic = 45 μm					

♀ ₁ :	-	194	607	1438	1604		1770 μm (slide n° 994)
		28	50	52	66	39	
		a = 26.8 ; b = 2.9 ; c = 10.7 ; c' = 4.3 ; V = 81.2 %					

Other specimens

	males (n=9)	females (n=9)
L:	1200 - 1680 μm	1290 - 1530 μm
a:	31.8 - 43.1	26.7 - 34.0
b:	2.8 - 3.7	2.8 - 3.2
c:	8.9 - 11.0	4.0 - 4.6
c':	4.0 - 5.0	4.0 - 4.6
sp./V:	44 - 47 μm	79.0 - 81.2 %

DESCRIPTION

Specimens from the Southern Bight of the North Sea are in accordance with the descriptions of *X. striata* found in the literature (Cobb, 1920; Gerlach, 1951; Nichols, 1979). Only additional morphological features are discussed.

Males. Cuticular ornamentation consists of transverse body annules; each annule provided with 20 - 32 cuticular crests which are arranged in longitudinal rows. The longitudinal crests start immediately at the first body annule, what makes the distinction between the "head" and the body very pronounced. Three caudal glands with separated outlets. No terminal setae on the tail.

The six internal labial sensilla (12 μm) are situated at the base of the very thin, but well developed lips; each lip consists of an apical part which is striated and a broader basal part. Lips are separated from the remainder of the cephalic capsule by an outer zigzag ring. The six external labial sensilla (22 μm) and the four cephalic setae (12 μm) are in the same circle. The presence of a lateral "subcephalic" seta (12 μm) at the level of the lateral external labial setae is not obvious in all specimens; both lateral setae are weakly sclerotized and coincide very often. Six subcephalic setae (12 μm) are present at the base of the cephalic capsule (or at the level of the first cuticular annules). Very thin somatic setae (7-14 μm) are arranged in 6 to 8 rows throughout the body length. Amphideal fovea circular (23-30 % of c.h.d.) and weakly sclerotized. The corpus gelatum consists of concentric lamellae but the central part (apertura) is not "lamellated". Buccal cavity very large and cylindrical with sclerotized walls, conically attenuated towards the posterior end which is continuous with the lumen of the pharynx. The anterior cylindrical part is not surrounded by the pharynx. Pharynx cylindrical and muscular. Nerve ring at 30-35 % of neck length. Ventral gland and pore not found.

Diorchic: anterior testis at the left and posterior testis at the right of the intestine. Three pairs of ejaculatory glands; prominent outlet of the most posterior gland cell ends through a well developed ampulla, probably in the cloaca. This is

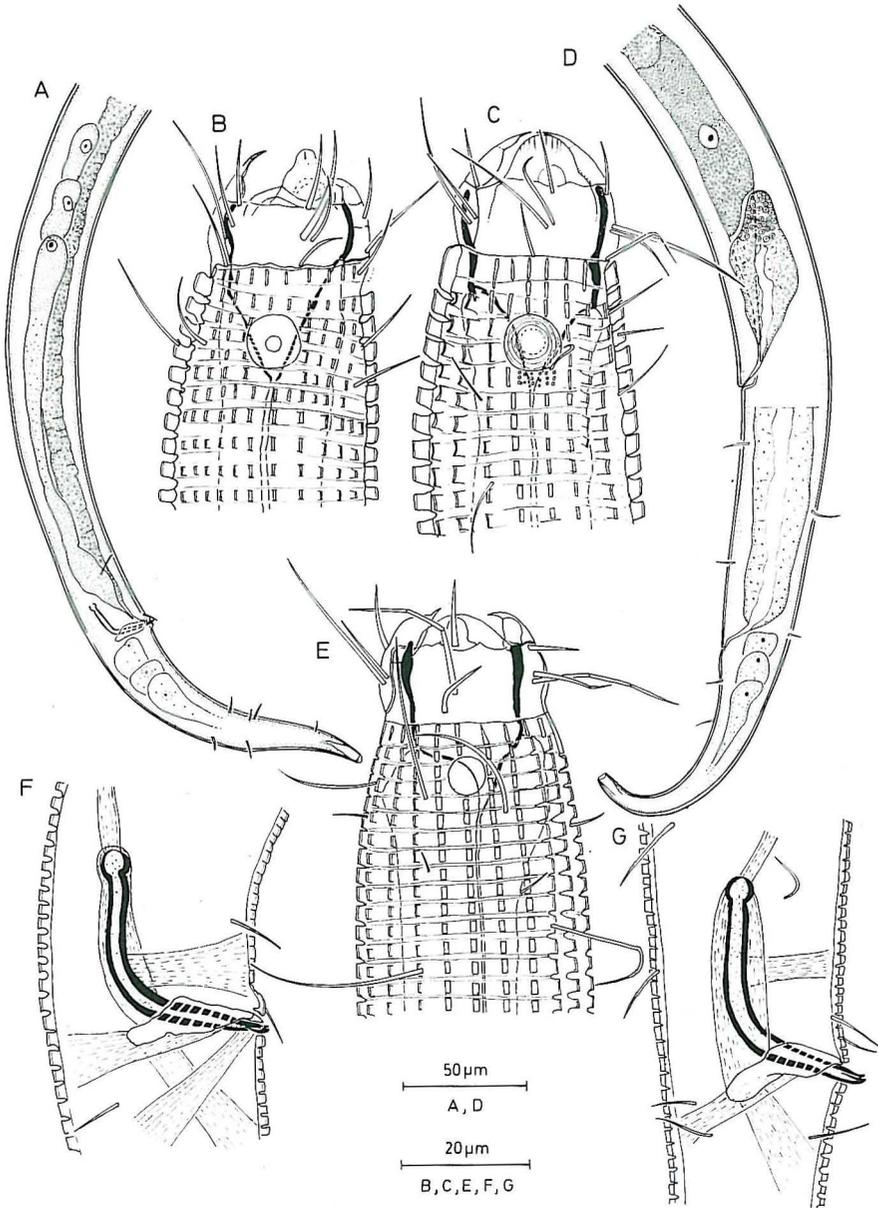


Fig. 5 - *Xyala striata* Cobb, 1920

A : Caudal region with ejaculatory glands $\delta 3$; B : Head end $\delta 1$; C : Head end $\delta 2$; D : Tail region $\text{♀} 1$; E : Head end $\text{♀} 1$; F : Copulatory apparatus $\delta 3$; G : Copulatory apparatus $\delta 4$.

typical for all males examined. Outlets of the first and second gland cells not found. Spicules 44-47 μm long with prominent capitulum and a bifid distal tip. Gubernaculum paired with well developed dorsally or dorso-caudally orientated apophyses. Spicular protractors extend between the dorsal and ventral side of the spicular capitulum and the gubernacular apophyses. Spicular retractor between apical part of the capitulum and the sublateral body wall. A rotator extends between the middle part of the shaft of the spicule and the subventral body wall. Protractor of the gubernaculum extends between the ventral part of the apophysis and the subventral body wall; retractor of the gubernaculum between the apophysis and the dorsal body wall.

Females. Only differences with the males are noted.

Lateral subcephalic setae are not at the same level of the external labial setae. Other subcephalic setae are not present on the cephalic capsule. Amphideal fovea circular (19 % of c.h.d.). Longitudinal crests of the cuticle vary between 24-30 in the cervical region and diminish from the vulval level (here about 30) onward.

Monodelphic, ovary at the left of the intestine; oviduct and uterus very short; well developed prevulvar spermatheca filled in its apical part with sperm cells. Vagina short. No genital accessory glands present in the postvulvar region.

DISCUSSION

The variability in following morphological features is large in the North Sea specimens (even for animals of the same locality):

- longitudinal ornamentation varies between 20 and 30 crests;
- position of the amphideal fovea: anterior border of the circular amphid situated between the first and the third cuticular ring; in some specimens the amphid is not obvious at all;
- number and position of the subcephalic and cervical setae (the lateral subcephalic setae are not very obvious in all specimens; the cervical setae are also very thin and not always obvious);
- shape and orientation of the gubernacular apophysis (dorsally or dorso-caudally orientated).

GENERAL DISCUSSION

Cobb, 1920 described two species in two different genera, i.e. *Omicronema* Cobb, 1920 and *Xyala* Cobb, 1920. Both genera are mainly distinguished on the cuticular ornamentation and the sclerotization of the buccal cavity. However, several intermediate species exist; e.g. *Xyala aestuariensis* sp.n.; *Xyala psammonalis* sp. n. and *Omicronema litorium* Cobb, 1920.

The shape of the buccal cavity (cylindrical or cylindrical with a conical basal part) depends on the contraction of the pharyngeal muscles (cf. Fig. 2D-E); the

pharyngeal muscles only surround the basal part of the buccal cavity (e.g. *X. aestuariensis* sp. n., *X. psammonalis* sp.n.), or surround the buccal cavity completely (e.g. *X. oxybiota* Jensen, 1986) or only partly (e.g. *X. striata* Cobb, 1920).

The number of additional cephalic setae is also variable.

Therefore, we consider the genus *Omicronema* Cobb, 1920 identical with *Xyala* Cobb, 1920.

Xyala Cobb, 1920 is characterized by following features :

- Xyalidae (definition cf. Lorenzen, 1981); - annulated cuticle provided with longitudinal striae or crests; - the internal labial setae are situated at the base of the lips and the base of the setae is obvious; - buccal cavity consists of a sclerotized cylindrical part (not surrounded by the pharynx) and a very short conical basal part (surrounded by pharyngeal musculature). No teeth.

List of valid species :

Type species : *Xyala striata* Cobb, 1920

- *Xyala aestuariensis* sp. n.
- *Xyala clavulatum* (Gerlach, 1957) comb. n.
syn. n. *Omicronema clavulatum* Gerlach, 1957
- *Xyala imparis* Boucher and Helléouët, 1977
- *Xyala litorium* (Cobb, 1920) comb. n.
syn. n. *Omicronema litorium* Cobb, 1920
- *Xyala oxybiota* Jensen, 1986
- *Xyala psammonalis* sp. n.
- *Xyala riemanni* Boucher and Helléouët, 1977

Omicronema nidrosiense Allgén, 1933 and *Omicronema truncatum* Stekhoven, 1950 are considered (cf. Gerlach & Riemann, 1973) as species *incertae sedis*.

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