

***Akanthepsilonema oceanopolis* sp. nov. (Nematoda: Epsilonematidae), a new free-living marine nematode from the Condor Seamount (North-East Atlantic Ocean)**

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Abstract

Epsilonematids are epifaunal nematodes characterized by an epsilon-shaped body and the presence of ambulatory setae, which are used in their locomotion. Nematodes belonging to this family were recently found in deep sea, especially in cold-water coral and seamount ecosystems. *Akanthepsilonema oceanopolis* sp. nov. (Nematoda: Epsilonematidae) is described from sediments of the Condor Seamount (North-East Atlantic Ocean) at 206 m water depth. Its main features are a heterogeneous cuticule with large horn-like dorsal spines both in anterior and in posterior regions; the presence of eight subcephalic setae arranged in two rows and the ratio maximum/minimum body diameter larger than two. The taxonomic position of this new species within the genus is discussed and a key to all species from the genus was added.

Keywords: *Akanthepsilonema oceanopolis*; nematodes; seamount; epsilonematids; taxonomy

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***Akanthepsilonema oceanopolis* sp. nov. (Nematoda : Epsilonematidae), nouvelle espèce de nématode du mont sous-marin Condor (océan Atlantique nord-est)**

Résumé

Les nématodes de la famille des Epsilonematidae se caractérisent par un corps en forme d'épsilon et par la présence de soies ambulatoires servant à la mobilité. Des représentants de cette famille ont récemment été découverts en environnement marin profond, notamment au niveau des récifs de coraux d'eau froide et des monts sous-marins. La nouvelle espèce *Akanthepsilonema oceanopolis* (Nematoda : Epsilonematidae) est décrite des sédiments du mont sous-marin Condor, situé dans l'Atlantique nord-est, collectés à 206 m de profondeur. Ses principaux caractères sont la présence d'une cuticule hétérogène munie de grandes épines dorsales recourbées, à la fois dans les régions antérieure et postérieure ; la présence de quatre paires de soies subcéphaliques disposées en deux rangées et un ratio diamètre maximal/diamètre minimal du corps supérieur à deux. La position taxinomique de cette espèce au sein du genre *Akanthepsilonema* est discutée et une clé des espèces connues du genre est donnée.

Mots-clés : *Akanthepsilonema oceanopolis* ; nématodes ; mont sous-marin ; Epsilonematidés ; taxinomie

Introduction

Epsilonematids are epifaunal marine nematodes characterized by an epsilon-shaped body and the presence of ambulatory setae, which are used in their locomotion (Lorenzen, 1973; Raes *et al.*, 2006). Nematodes belonging to this family were recently found in deep sea (Neira *et al.*, 2001), especially associated to coral fragments and coarse grained sediments, in cold-water coral banks and seamount ecosystems (Gad, 2002; Raes *et al.*, 2003; Gad, 2004; Raes *et al.*, 2006). Substrates as coarse sediments and coral rubble are ideal for these epifaunal nematodes (Raes *et al.*, 2006).

The genus *Akanthepsilonema* (Epsilonematidae) Gourbault & Decraemer, 1991, is characterized by the presence of eight subcephalic setae, ambulatory setae arranged in six longitudinal rows, an elongated anterior body region and a maximum-to-minimum body diameter of less than two; the presence of dorsal thorns and large dorsal horns is no longer considered a generic feature. At present, the genus has two species described: *Akanthepsilonema helleouetae* Gourbault & Decraemer, 1991 and *Akanthepsilonema sinicornibus* Raes, Decraemer & Vanreusel, 2006. *A. helleouetae* was discovered in supralittoral coarse and calcareous sand of the Ilot Signal Island (New Caledonia). *A. sinicornibus* was discovered in the sediment associated to coral fragments in the Porcupine Seabight (North-East Atlantic Ocean) at 1000 m water depth. Considering the two *Akanthepsilonema* species described, only one is from deep sea. Here a new species of *Akanthepsilonema* recorded in biogenic sediment of the summit of the Condor Seamount (North-East Atlantic Ocean) at 200 m water depth is described.

Material and methods

The nematodes studied in this paper were collected with an interface multicorer (Midicorer Mark II 400) equipped with four core tubes (100 mm diameter). The samples were collected during a cruise onboard of the R.V. *Noruega* between 26 and 31 July 2010. Samples were taken on the top of the Condor Seamount (38°32.94'N, 29°02.87'W, 206 m water depth, figure 1). The Condor summit showed a different sediment grain composition compared to its flanks and bases, being composed by gravelly bioclastic sand, rich in shell fragments, rounded pumex clasts, polished lava pebbles and planktonic foraminifera shells (Zeppilli *et al.*, 2013). All of the samples were preserved in buffered 4 % formalin solution and stained with Rose Bengal. Sediment samples were pre-sieved through a 1000 µm-mesh net, and the organisms were retained on a 20 µm-mesh net. This latter fraction was resuspended and processed according to the protocol reported by Danovaro (2010). Nematodes were picked up and mounted on slides for detailed morphological observation using the formalin-ethanol/glycerol technique described by Seinhorst (1959) and Vincx (1996). Drawings and photos were made on Leica DM IRB microscope equipped with live-camera (Image-Pro software) and on Zeiss AxioZoom microscope equipped with live-camera (Zen software).

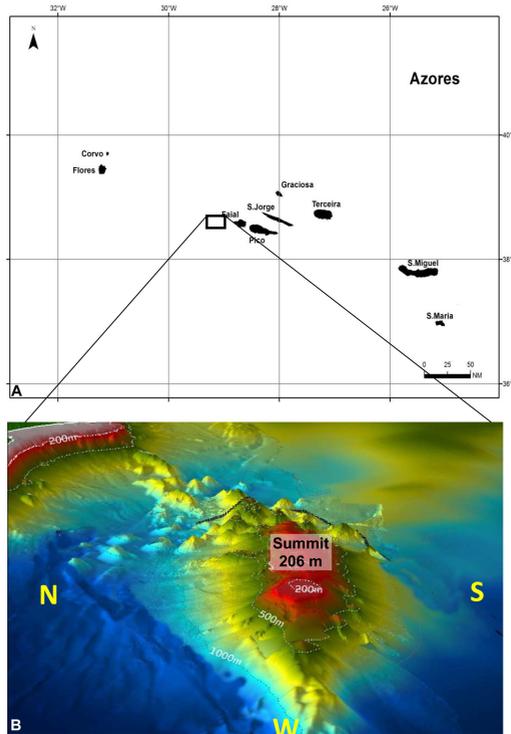


Figure 1: Location of the Condor Seamount in the North-East Atlantic Ocean (A) and 3D image of the Condor Seamount (B) (© Fernando Tempera).

Type material is deposited in the collections of the Laboratoire Environnement Profond (LEP), Ifremer, Brest, France.

Descriptions

Familia: Epsilonematidae Steiner, 1927

Subfamilia: Epsilonematinae Steiner, 1927

Genus: *Akanthepsilonema* Gourbault & Decraemer, 1991

Akanthepsilonema oceanopolis sp. nov. (figures 2-6)

Type specimens: Holotype male on slide Condor9.1R13_5V1N1. Paratype female on slide Condor9.1R21_3V2N10.

Type locality: Condor Seamount (North-East Atlantic Ocean). Coordinates: 38°32.94'N, 29°02.87'W, 206 m water depth.

Type habitat: Sediments of the summit of the Condor Seamount, characterized by gravely bioclastic sand, rich in shell fragments, rounded pumex clasts, polished lava pebbles and planktonic foraminifera shells.

Relative abundance: This species comprises 4 % of the total nematode community at the type locality.

Etymology: Named after Océanopolis, the Brest aquarium involved in meiofauna outreach activities.

Measurements: Table 1.

Description:

Male (♂) Figures 2-4. Body ε-shaped and relatively stout. The anterior region is slender elongated as typical for the genus but in contradiction to the two known species the maximum-to-minimum body diameter ratio is larger than two, in the male. Cuticle with 120 annules. Annules broadest at the level of the pharynx, and finest at the level of ambulatory setae, and ornamented with heterogeneous vacuoles of various sizes. Vacuoles becoming more numerous and irregular from the 34th annule onwards to the ventral curvature. At the 34th annule a field of dorsally-subdorsally located spines and large medio-dorsal hollow thick horns (between 16.2 and 38.3 μm in length) was present. Posterior to the third horn, two rows of little horns alternate one long single horn, except in the annule 38, where two horns are consecutives. Median horns are the longest (38.3 μm). Posterior to the annule 75 one row of spines alternate one long single horn. Annules 95, 96 and 97 host three horns. Somatic setae are present in the pharyngeal region. Ambulatory setae bended and arranged in 6 rows. Cephalic capsule as atruncated cone with a thick cuticle (14.7 μm width and 22.1 length); lip region retracted. Eight subcephalic setae arranged in two circles (6+2). Amphideal fovea large (75 %), spiral with 3 turns. Buccal cavity toothless. Pharynx with a well-developed muscular terminal bulb. Paired long spicules (26.5 μm) arcuated posteriorly, capitulum hook-shaped, velum absent. No gubernaculum. Copulatory horns located at widest body region, opposite posterior part of ambulatory zone. Tail short and conical with 12 annules counted ventrally including smooth tail tip.

Table 1: Morphometric data of *Akanthepsilonema oceanopolis* sp. nov. Measurements in μm . L: total body length. N: number of cuticular rings, smooth tail tip included. dcs: distance from the anterior edge of the head capsule to the insertion point of the cephalic setae. hdw: maximal width of the head capsule. hdl: length of the head capsule. bda: body diameter at the level of the amphids. amphw: amphidial width. amph%: $(\text{amphw} / \text{ddw}) \times 100$. ph: pharyngeal length, measured from the anterior end of the head capsule up to the posterior border of the pharyngeal bulb. lvAsl: length of the anterior most lateroventral ambulatory seta. osvAsl: length of the anterior most ambulatory seta in the outer subventral rows. isvAsl: length of the anterior most ambulatory seta in the inner subventral rows. asup: length of the anterior most modified somatic or supporting seta. psup: length of the posterior most modified somatic or supporting seta. tail: tail length. tmr: length of the smooth tail tip. mbd ph: body diameter at level of the pharyngeal bulb. mbd: maximal diameter of the posterior body region. (mbd): minimal body diameter. mbd/(mbd): proportion of the minimal body diameter to the maximal body diameter. abd: anal body diameter. spic: length of the spicule, measured along the arc. gub: length of the gubernaculum. V%: position of the vulva, expressed as a percentage of L. measured from the anterior end. a: de Man a-ratio, i.e., L/mbd. b: de Man b-ratio, i.e., L/ph. c: de Man c-ratio, i.e., L/tail.

	♂	♀
L	389	396
N	120	106
hdw	15	13
hdl	22	19
bda	15	13
amphw	9	7
amph%	75	56
ph	68	77
lvAsl	16	13
asup	18	13
psup	15	9
tail	47	46
tmr	12	11
mbd ph	28	28
mbd	35	52
(mbd)	12	16
mbd/(mbd)	3	3
abd	12	15
spic	26	-
V%	-	69
a	11	8
b	6	5
c	8	8.5

Female (♀). Similar to male in habitus. Body cuticle with 106 annules. Similar cuticular ornamentation (figure 5) and ambulatory setae arrangement. Shape of head capsule, number and position of cephalic setae as in male. Amphid smaller than in male, spiral with 1.5 turns. Reproductive system didelphic. amphidelphic with reflexed ovaries. Vagina cuticularized. Vulva situated at 69 % of total body length from anterior. Tail with 14 annules and smooth tail tip.

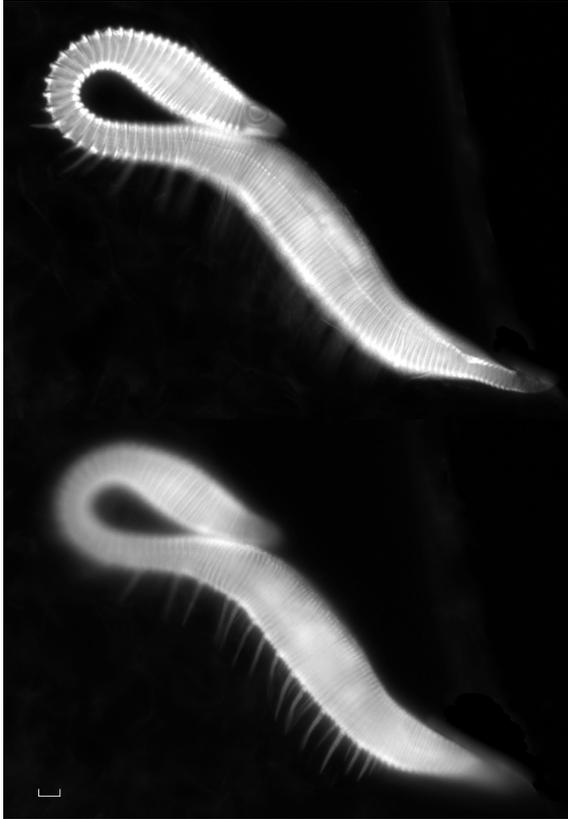


Figure 2: *Akanthepsilonema oceanopolis* sp. nov. holotype ♂. Scale bar 10 μ m.

D i a g n o s i s: *Akanthepsilonema oceanopolis* sp. nov. is characterized by its habitus with a rather slender, elongated anterior body region but with a maximum-to-minimum body ratio of three, the annulated body cuticle (120 annules in male; 106 in female measures dorsally) and heterogeneous cuticular ornamentation with a string of dorsal spines associated with horn-like subdorsal expansion of the annules in the anterior and posterior body regions. Eight subcephalic setae on head capsule arranged in two rows (6+3) (figure 6). Ambulatory setae bended and arranged in six rows. Male with eight well-developed main copulatory horns, spicules arcuated posteriorly, capitulum hook-shaped. No gubernaculum.

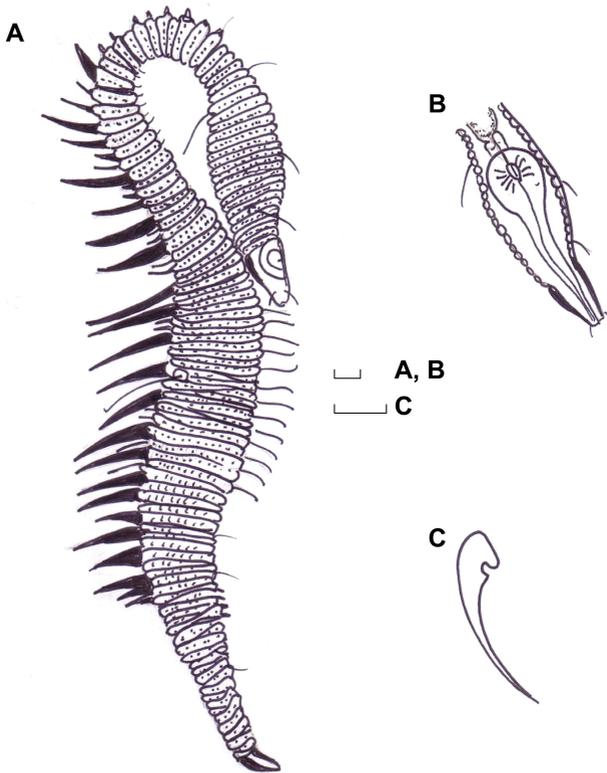


Figure 3: *Akanthepsilonema oceanopolis* sp. nov. holotype ♂. A. Habitus. B. Pharyngeal region. C. Spicule. Scale bars 10 μ m.

Differential diagnosis: *Akanthepsilonema oceanopolis* sp. nov. resembles *A. helleouetae* Gourbault & Decraemer, 1991, in the following features: i) large spines and horns, ii) presence of eight subcephalic setae on head capsule, iii) the presence of six rows of ambulatory setae. It differs from this species in the following features: i) in different arrangement of subcephalic setae, ii) horns presents not only in the posterior part, iii) amphid with 3 turns and wider in male, iv) gubernaculum absent and shorter spicules. *Akanthepsilonema oceanopolis* sp. nov. resembles *A. sinicornibus* Raes, Decraemer & Vanreusel, 2006, in the following features: i) presence of eight subcephalic setae on head capsule, ii) the presence of six rows of ambulatory setae, iii) amphid wider in male. It differs from this species in the following features: i) presence of large spines and horns, ii) gubernaculum absent and shorter spicules.

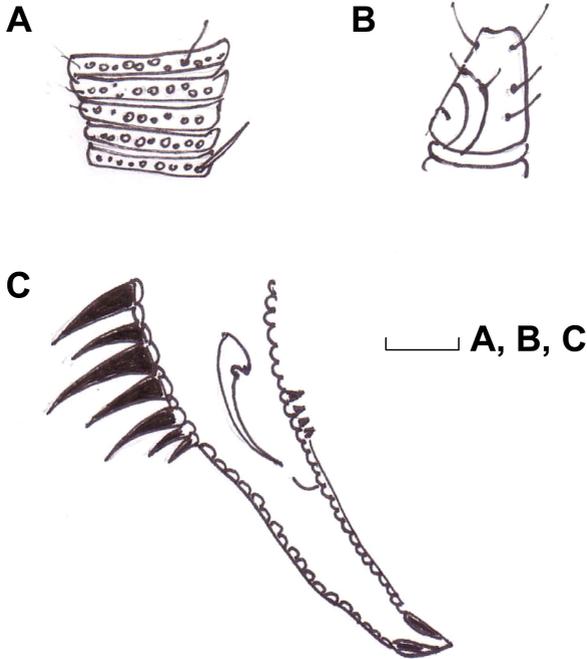


Figure 4: *Akanthepsilonema oceanopolis* sp. nov. holotype ♂. A. Detail of the cuticle. B. Head capsule. C. Copulatory region. Scale bar 10 μ m.

Emended genus diagnosis: The genus *Akanthepsilonema* Gourbault & Decraemer, 1991, was originally separated from other Epsilonematidae genera for the presence of copulatory thorns, ventral and dorsal spines, and large dorsal horns. In 2002, Gad demonstrated that spines or dorsal horns can evolve in response to similar environmental conditions. Raes *et al.* (2006) proposed an emended genus diagnosis for *Akanthepsilonema* proposing the combination of an elongated anterior body region, a maximum-to-minimum body diameter ratio of less than two, six rows of ambulatory setae situated around the vulva and eight subcephalic setae not displaced toward the anterior part of the head capsule as genus diagnosis. Copulatory thorns, large spines, and horns are present or absent.



Figure 5: *Akanthepsilonema oceanopolis* sp. nov. Allotype ♀, habitus. Scale bar 10 µm (specimen stained with Rose Bengal).

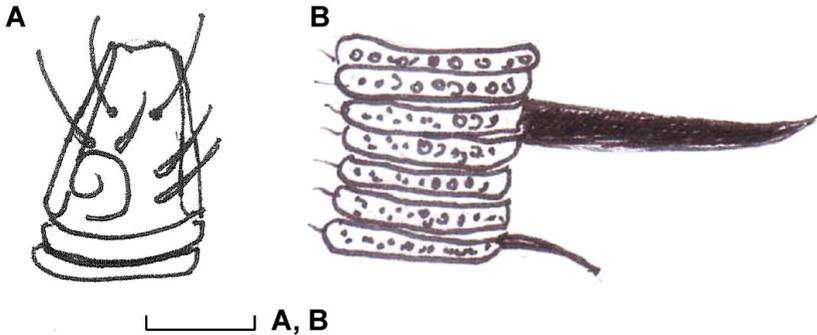


Figure 6: *Akanthepsilonema oceanopolis* sp. nov. Allotype ♀, A. Head capsule. B. Detail of the cuticle. Scale bar 10 µm.

Key for the species of genus *Akanthepsilonema* (for construction of this key only male characters were considered).

- 1. Presence of large spines or horns. 2
 - 2. Male amphid with 3 turns and spicule 26 µm long. *A. oceanopolis* sp. nov.
 - 2. Male amphid with 1 turn. *A. helleouetae* Gourbault & Decraemer, 1991
- 1. Absence of large spines or horns.
 - *A. sinicornibus* Raes, Decraemer & Vanreusel, 2006

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