

Six new species of the genus *Onyx* Cobb, 1891 (Nematoda: Desmodoridae) from coastal areas in Vietnam

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Summary. Six new species of the genus *Onyx* are described from different coastal zones in Vietnam based on samples collected between 2004 and 2010. *Onyx cangionensis* sp. n. is characterised by the fact that males have 14-16 equal-sized and equal-distantly arranged sigmoidal precloacal tubular shaped supplements. *Onyx blomei* sp. n. is characterised by sexual dimorphism in the shape of the amphidial fovea. The male has an atypical amphid with posterior part spiral shaped with 2.5 turns and anterior part hook shaped, whereas the amphidial fovea in the female is simply multispiral with 2.25 turns. *Onyx orientalis* sp. n. is characterised by its very long cephalic setae and the presence of 18 light-refractive, slightly S-shaped, precloacal tubular supplements in the males. *Onyx cobbi* sp. n. is also characterised by its sexual dimorphism in the shape of the amphidial fovea: an elongated loop in the male and a multispiral in the female. There are 15 slightly S-shaped, precloacal supplements. The anterior supplement is half the size of the others. *Onyx paradimorphus* sp. n. is characterised by a multispiral amphidial fovea, spicules regularly bent, strongly cuticularised, 15 S-shaped supplements and 5 papillae with setae within the spicules region. *Onyx mangrovi* sp. n. is characterised by 17-23 supplements with a complex structure: anterior part is sigmoidal-shaped, posterior part is hook-shaped and by its very short tail with dorsally curved tip.

Key words: Desmodoridae, mangrove, marine nematodes, *Onyx*, shallow water, Vietnam.

The genus *Onyx* was first established and described as *Onyx perfectus* in 1891, the description being rather narrative in style. Before 1994, six species were described as: *O. ferox* (Ditlevsen, 1921); *O. sagittarius* Gerlach, 1950; *O. septempapillatus* Wieser, 1954; *O. rugatus* Wieser, 1959, *O. perfectus* Cobb, 1891 and *O. dimorphus*, Gerlach, 1963. Blome & Riemann (1994) described three new species from sandy beaches of northern New South Wales, Australia: *O. macramphis*, *O. adenophorus* and *O. cannoni* and the authors reviewed the genus *Onyx* annotating the differential characters of all species described so far. The precaudal position of the caudal glands in *O. adenophorus* is unique within the Chromadorea; however, it only has a diagnostic value at the species level. During several investigations carried out in different coastal zones of Vietnam, specimens of six

unknown *Onyx* species were collected, the descriptions of which are provided here.

MATERIAL AND METHODS

From November 2004 to April 2006, twenty stations were chosen for nematode sampling in the subtidal area in the Can Gio mangrove forest near Ho Chi Minh City, Vietnam. In March 2010 nematode samples were taken at the Tra Co beach of the Quang Ninh province, Vietnam. Sediment samples were collected to a depth of 10 cm with perspex cores (diam. = 3.5 cm). The samples were preserved in 4% neutralised formaldehyde heated to 60-70°C. The nematodes were extracted by Ludox solution. Under a stereomicroscope 200 nematodes (or all if lower numbers occurred) were picked out randomly. The transfer of the nematodes into pure glycerol was done following the method of De Grisse (1969). The nematodes were mounted into a small drop of

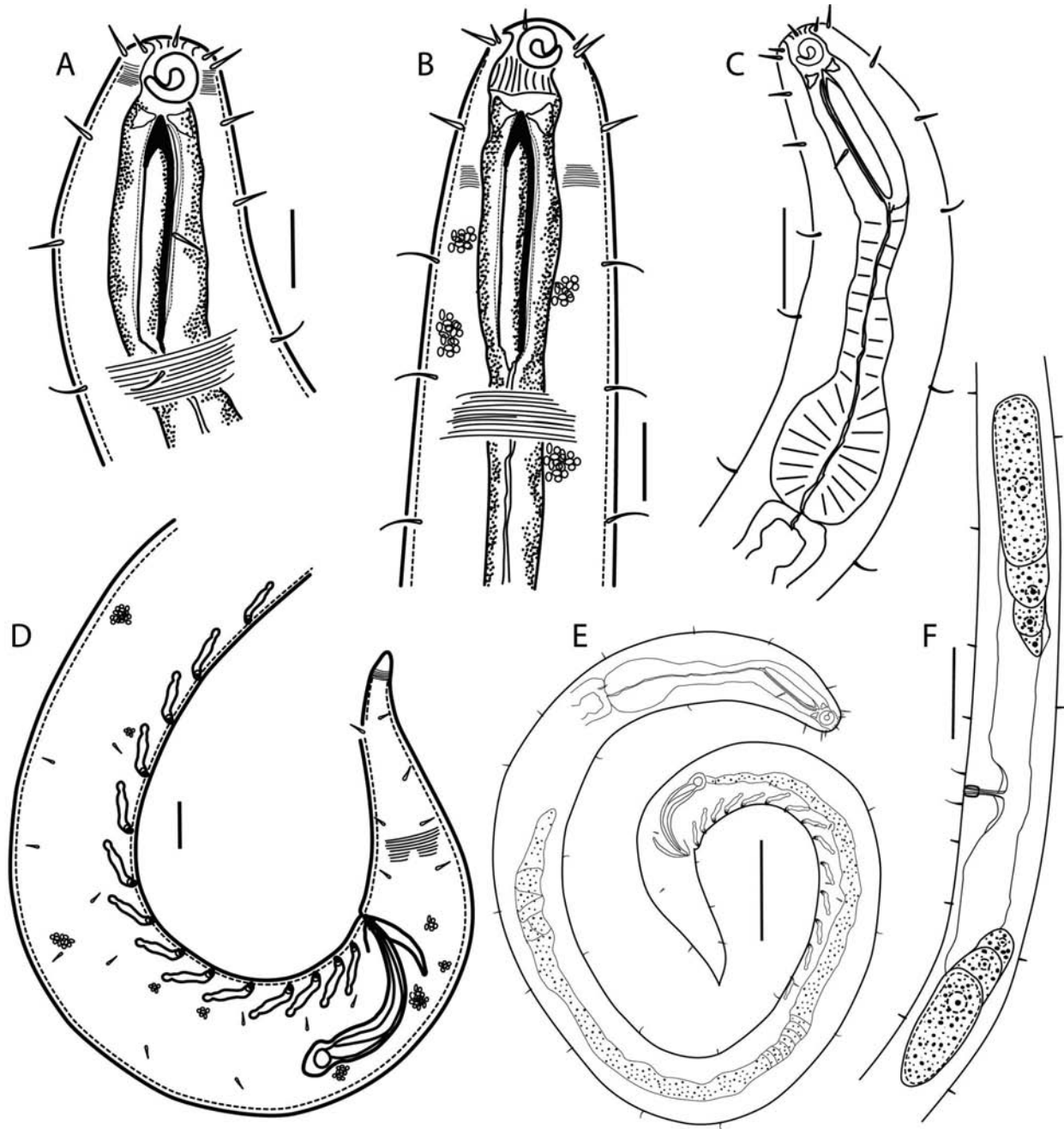


Fig. 1. *Onyx cangioensis* sp. n. A, C, D: holotype, A: head region; C: pharynx region; D: tail region and spicular apparatus; E: total view; B, F: allotype, B: head region; F: vulva region. Scale bars: A, B, D = 10 μ m, C = 20 μ m, E = 50 μ m. F = 40 μ m.

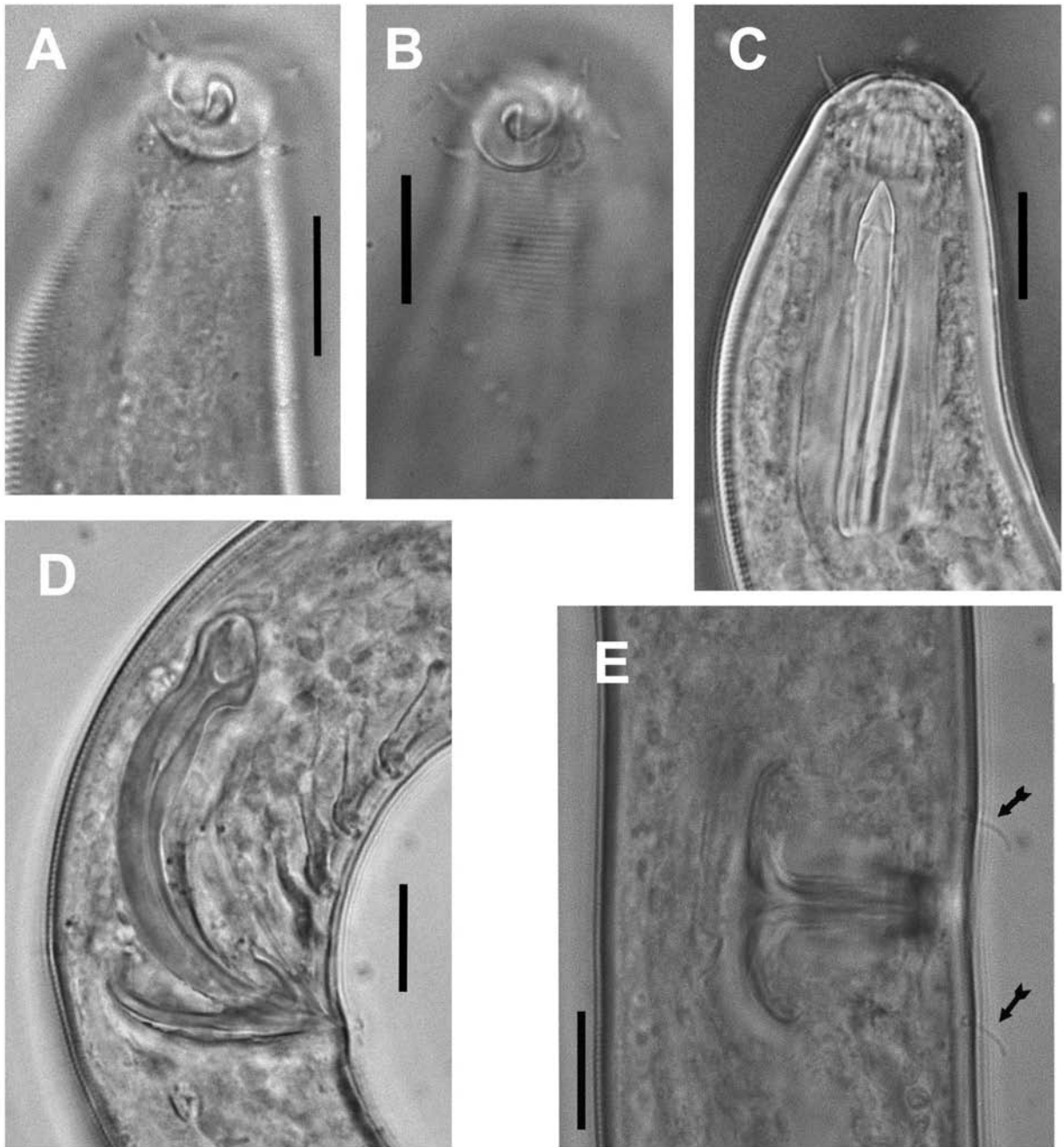


Fig. 2. *Onyx cangioensis* sp. n. A, C, D: holotype, A: head region; C: hollow dorsal tooth; D: spicular apparatus; B, E: allotype, B: head region; E: vulval region. Scale bars: 10 µm. Arrows – advulvar setae.

Table 1. Measurements of *Onyx cangioensis* n. sp. (all measurement in μm , except ratios).

Characteristic	Holotype	Paratypes					Allotype	Paratypes		
	♂1	♂2	♂3	♂4	♂5	♂6	♀1	♀2	♀3	♀4
Body length	685	693	736	679	713	759	808	547	711	810
a	21.8	21.5	21.9	20.9	22.5	22.9	24.9	16.0	20.2	22.1
b	5.9	5.6	6.1	5.1	5.4	6.3	6.7	4.3	6.0	6.0
c	10.1	9.6	8.5	9.9	10.2	10.9	11.7	8.7	9.5	11.6
c'	2.5	2.5	3.0	2.4	2.5	2.5	3.3	3.3	3.8	3.9
Head dia.	14.0	14.0	15.0	15.0	13.5	14.0	16.0	16.0	15.0	16.0
Outer labial setae	3.0	3.0	3.5	3.0	3.5	3.0	3.0	3.0	3.0	3.0
Cephalic setae	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Pharynx length	117	124	121	134	132	121	120	127	119	134
Max. body dia.	31.0	32.0	34.0	32.0	32.0	33.0	32.5	34.0	35.0	37.0
Dorsal tooth length	34.0	36.0	32.0	34.0	31.5	32.5	34.0	34.0	32.0	33.0
Amphideal fovea										
width	8.5	8.0	8.0	8.0	8.0	8.0	7.0	7.0	8.0	8.0
c.b.d.	15.8	16.2	15.3	15.7	16.1	15.0	14.3	15.1	14.9	15.8
Vulva from anterior	-	-	-	-	-	-	400	387	361	398
V%	-	-	-	-	-	-	49.5	70.9	50.8	49.1
Spicule length	48.5	49.0	47.0	47.0	46.0	45.0	-	-	-	-
Gubernaculum length	22.0	21.0	21.0	22.0	20.0	22.0	-	-	-	-
S'	1.8	1.7	1.7	1.6	1.7	1.6	-	-	-	-
Number of supplements	14	14	16	15	14	16	-	-	-	-
Supplement length	12.0	12.5	13.5	12.0	13.0	13.0	-	-	-	-
Anal width	27.3	28.3	28.5	28.7	27.5	27.9	21	18.9	19.8	18.2
Tail length	68.0	72.0	87.0	68.5	70.0	67.0	69.0	63.0	75.0	70.0

glycerol on a glass slide and sealed with a beeswax ring. Measurements and drawings were made with a microscope Olympus CH30RF200.

DESCRIPTION

Onyx cangioensis sp. n. (Table 1; Fig. 1, 2)

Measurements. See Table 1.

Males. Cuticle reddish brown, finely striated. Head anteriorly rounded and not striated. Inner labial papillae not seen. Six outer labial papillae. Four short cephalic setae. Somatic setae (6 μm long) regularly distributed in the entire body. Amphidial fovea located forward on the head, single loop, about 50% of corresponding body diameter. Buccal cavity large, deep 10 μm , cup shaped, with strong hollow dorsal tooth (34 μm length). Pharynx short, 117 μm , anterior part of pharynx only weakly enlarged, posterior end enlarged to an oval bulb

with a slight constriction in the middle. Secretory-excretory system not seen. Reproductive system monorchic with anterior, outstretched testis (distal end 50 μm from end of pharynx) subventrally right of intestine. Spermatozoa rounded and weakly light-refractive, small (2 μm), *vas deferens* weakly and uniformly developed. Spicule regularly bent, 48.5 μm long (1.8 times anal body diameter), rounded head, strongly cuticularised. The gubernaculum 22 μm long, embracing the distal part of the spicule laterally. There are 14 strong (12 μm long), sigmoidal precloacal tubular supplements, more or less of equal-size and equi-distantly arranged on the ventral side of the body. Tail short, 68 μm (2.5 x anal body diameter), conical tip unstriated, dorsally with conspicuous, short setae (4 μm). Caudal gland not seen.

Females. Similar to male in general appearance. Outer labial papillae, four cephalic setae. Amphidial fovea single loop, 7 μm wide, similar to male.

Hollow dorsal tooth 34 μm long. Vulva at mid-body. Reproductive system didelphic, amphidelphic with reflexed ovaries, with both branches on right side of the intestine. Two pairs of long, strong, subventral advulvar setae, 7 μm long. Tail short, 68 μm (3.3 times anal body diameter). Caudal glands not seen.

Differential diagnosis. *Onyx cangioensis* sp. n. is characterised by males with 14-16 equal-sized and equal-distantly arranged sigmoidal precloacal tubular supplements. This new species is similar to *O. sagittarius* Gerlach, 1950 in general body shape, type of amphidial fovea, arrangement of cephalic and somatic setae, but differs by having longer spicules (45 - 49 μm in *Onyx cangioensis* sp. n. vs 35 μm in *O. sagittarius* Gerlach, 1950), and showing a difference in number of precloacal supplements (14-16 in *Onyx cangioensis* sp. n. vs 22-24 in *O. sagittarius* Gerlach, 1950).

Type material. Holotype, adult male, slide UGMD 104152. Allotype, adult female, slide UGMD 104153, deposited at the Museum of Zoology University Ghent, Belgium. Paratypes. three females and five males (5♂, 3♀, slides UGMD 104152 - 56), deposited at the Museum of Zoology University Ghent, Belgium.

Type locality. Can Gio mangrove forest Ho Chi Minh City, Vietnam, subtidal at 0.5 m depth, sediment = silt, sample station CG16 (10°29'196" N and 106°54'994" E).

Etymology: The species name refers to Can Gio mangrove forest where it was found.

Onyx blomei sp. n. (Table 2; Fig. 3, 4)

Measurements. See Table 2.

Males. Cuticle brown-yellowish, finely striated. Head anterior rounded and not striated. Inner labial papillae not seen. Outer labial papillae. Four cephalic setae 6 μm long. Four cervical setae (5 μm long), just behind the amphidial fovea. Somatic setae (5 μm) in the pharynx region shorter than at the rest of the body (12 μm). Amphidial fovea 10 μm high and 6.5 μm wide and an atypical shape: posterior part spiral shaped with 2.5 turns (6 μm) and anterior part hook shaped (6 μm high x 4 μm wide). Buccal cavity large, deep 10 μm , cup shaped vestibulum, with strong hollow dorsal tooth (29 μm long). Anteriorly the pharynx widened into a bulb, followed by a cylindrical part, posterior end enlarged to an elongated bulb of 50 μm long and 24 μm wide. Secretory-excretory system not seen. Reproductive system monorchic with anterior, outstretched testis (distal end 60 μm from end of pharynx) subventrally right of intestine.

Spermatozoa rounded and weakly light-refractive, small (2 μm), *vas deferens* weakly and uniformly developed. Spicule regularly bent, weakly cuticularised, 35 μm long (1.5 times anal body diameter), rounded head. The gubernaculum 14 μm long, embracing the distal part of the spicules laterally. There are eight, weakly light-refractive, precloacal supplements, (12 μm long), slightly S-shaped, tubular, more or less equal size and equidistantly arranged on the ventral side of the body. Tail short, 83 μm (3.7 x anal body diameter), conical tip unstriated. Four rows of each four somatic setae (6 μm long) in tail region. Two additional long (13 μm) setae on the dorsal side close to the tail tip. Caudal glands not seen.

Females. Similar to male in general appearance. Outer labial papillae, four cephalic setae. Amphidial fovea spiral with 2.25 turns, 5 μm wide. Hollow dorsal tooth 26 μm long. Vulva at mid-body. One egg present in uterus (52 x 32 μm). Ovaries opposed, reflexed, left of the intestine. Tail short, 62 μm long (3.3 times anal body diameter). Caudal glands not seen.

Differential diagnosis. *Onyx blomei* sp. n. is characterised by the sexual dimorphism in the shape of the amphidial fovea and the atypical shape of it in the male: spiral shaped with 2.5 turns posterior and hook shaped anterior; amphidial fovea in female multispiral with 2.25 turns. There are 7-8 weakly light-refractive, precloacal supplements and four rows of somatic setae in the tail region. The new species *Onyx blomei* is similar to *O. dimorphus* Gerlach, 1963 by its sexual dimorphism in the amphidial fovea, its general body shape, and its arrangement of cephalic and somatic setae, but differs by having shorter spicules (34.6 μm in *Onyx blomei* sp. n. vs 45 μm in *O. dimorphus* Gerlach, 1963) and showing a difference in number of precloacal supplements (7 - 8 in *Onyx blomei* sp. n. vs *O. dimorphus* Gerlach, 1963 having 10 strongly developed preanal supplements).

Type material. Holotype, adult male, slide UGMD 104154. Allotype, adult female, slide UGMD 104158, deposited at the Museum of Zoology University Ghent, Belgium. Paratypes. 2♂, slides UGMD 104157 - 58, deposited at the Museum of Zoology University Ghent, Belgium.

Type locality. Can Gio mangrove forest Ho Chi Minh City, subtidal at 0.5m depth, sediment = silt, sample station CG16 (10°29'196" N and 106°54'994" E).

Another locality. Tra Co (21°28'.390" N and 108°01'.231" E), Quang Ninh province, Vietnam.

Etymology: The species name is given in honour of Dr Blome in recognition of his contribution to the nematode taxonomy and review of the genus *Onyx*.

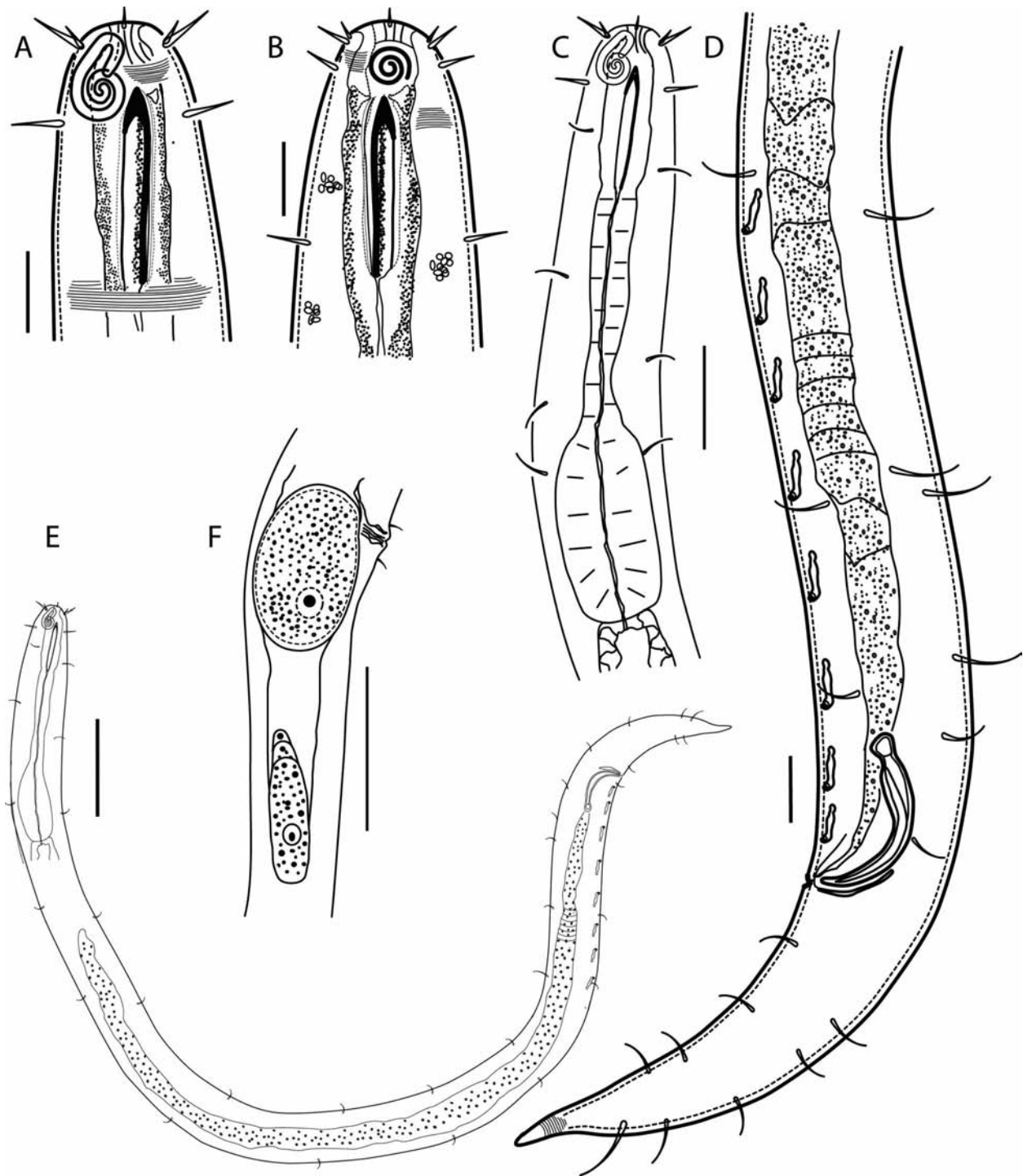


Fig.3. *Onyx blomei* sp. n. A, C-E: holotype, A: head region; C: pharynx region; D: tail region and spicular apparatus; E: total view; B, F: allotype, B: head region; F: vulvar region. Scale bars: A, B, D: 10 µm; C: 20 µm, E, F: 50 µm.



Fig. 4. *Onyx blomei* sp. n. A, C, D, F: holotype, A: head region; C: posterior of pharynx; D: hollow dorsal tooth; F: spicular apparatus. B, E: allotype, B: head region; E: vulval region. Paratype male. G: spicular apparatus. Scale bars: 10 µm.

Table 2. Measurements of *Onyx blomei* sp. n. (all measurements in µm, except ratios).

Characteristic	Holotype ♂1	Paratypes		Allotype ♀1
		♂2	♂3	
Body length	756	697	722	620
a	27.3	25.5	25.2	15.4
b	5.3	5.9	5.4	5.3
c	9.2	9.6	9.0	10.0
c'	3.7	3.5	3.7	3.3
Head dia.	11.0	11.0	10.5	11.5
Outer labial setae	3.0	3.0	3.5	3.0
Cephalic setae	6.0	6.0	6.5	5.0
Pharynx length	143	117	132	117
Max dia.	28.0	27.0	29.0	40.0
Dorsal tooth length	29.0	27.0	26.0	26.0
Amphideal fovea				
width	6.5	6.0	6.0	5.5
length	10.0	11.0	9.5	6.0
dia.	16.0	16.0	16.0	15.0
Vulva from anterior	–	–	–	302.0
V%	–	–	–	49.0
Spicule length	35.0	34.0	35.0	–
S'	1.5	1.7	1.6	–
Gubernaculum length	14.0	16.0	15.0	–
Number of supplements	8	7	8	–
Supplement length	12.0	12.5	13.5	–
Anal dia.	22.5	21.0	22.0	19.0
Tail length	83.0	73.0	80.0	62.0
Tail setae	12.5	12.0	13.0	12.5

***Onyx orientalis* sp. n.**
(Table 3; Fig. 5, 6)

Measurements. See Table 3.

Males. Cuticle brown-yellowish and finely striated. Head rounded and not striated. Inner labial papillae not seen. Six outer labial setae 3 µm long. Four cephalic setae very long, 16 µm long. Cervical setae 7 µm long, situated at 10 µm from amphidial fovea. Amphidial fovea a single donut-shaped loop, 7 µm (45% corresponding body diameter). Buccal cavity with a small, cup-shaped vestibulum, 7 µm deep, and with a strong hollow dorsal tooth (25 µm length). Secretory-excretory system not seen. Pharynx 155 µm length, anterior part of pharynx only weakly enlarged, posterior end enlarged to a double bulb with a slight constriction in the middle, lumen well sclerotised. Reproductive system monorchic with anterior, outstretched testis (distal end 55 µm from end of pharynx) positioned subventrally and right of intestine. Spermatozoa rounded and weakly light-refractive, small, *vas deferens* weakly and uniformly developed. Spicules regularly bent, cephalate, strongly cuticularised, 38 µm long (1.8 times anal body diameter). Gubernaculum 14 µm long. Eighteen strongly light-refractive, slightly S-shaped, precloacal supplements 12 µm long, tubular, more or less equal-sized and equi-distantly arranged on the ventral side of the body. Ten supplements in precloacal, staggered (in

two rows) position. Tail short, conical, 59 µm long (2.8 × anal body diameter), conical, tip unstriated. Two groups of three 10 µm long setae positioned in two lateral-ventral lines close to tail tip. Caudal glands not seen.

Females. Similar to male in general appearance. Outer labial papillae 3 µm long, four cephalic setae 17 µm long. Amphidial fovea single loop, 7 µm wide (43% corresponding diameter). Hollow dorsal tooth 26.8 µm long. Vulva at 635 µm from anterior end (V = 61%). Ovaries opposed, reflexed. Two pairs of short, slender, subventral advulvar setae, 4 µm long. Tail short with 56 µm and conical (3 × anal body diameter). Caudal glands not seen.

Differential diagnosis. *Onyx orientalis* sp. n. is characterised by its very long cephalic setae and 17-18 light-refractive, slightly S-shaped, precloacal tubular supplements more or less equal-sized in the males, of which the 10 posterior supplements are staggered, and the two groups of three long subterminal setae on the tail.

Remark. *Onyx orientalis* sp. n. is close to *O. adenophorus* Blome & Riemann, 1994 by its double posterior pharyngeal bulb and the similar number of supplements and their staggered position, by the similar body shape, the shape of the amphidial fovea, the long cephalic setae and the somatic setae but differs by having longer cephalic setae (15-17 µm

Table 3. Measurements of *Onyx orientalis* n. sp. (all measurement in µm, except ratios).

Characteristic	Holotype ♂1	Paratypes				Allotype ♀1	Paratypes		
		♂2	♂3	♂4	♂5		♀2	♀3	♀4
Body length	978	1002	987	1003	974	1049	1094	1003	986
a	43.9	41.2	45.7	39.0	40.1	40.0	36.1	34.7	38.4
b	6.3	6.1	6.5	6.1	6.1	7.6	7.8	7.3	6.9
c	16.6	16.5	16.0	17.1	16.1	18.6	18.7	18.2	16.4
c'	2.8	2.7	2.7	2.8	2.5	3.0	3.0	2.7	2.8
Head dia.	14.0	13.0	12.5	15.0	15.0	13.0	14.0	14.0	13.0
Outer labial setae	3.0	3.0	3.0	3.0	3.5	3.0	3.0	3.0	3.0
Cephalic setae	16.0	17.0	16.0	17.0	15.0	17.0	17.0	17.0	17.0
Pharynx length	155	165	153	163	160	138	140	137	143
Max dia.	22.0	24.0	21.5	26.0	24.0	26.0	30.0	29.0	25.5
Dorsal tooth length	25.0	26.5	24.0	25.0	26.0	27.0	26.5	25.0	26.0
Amphideal fovea									
width	7.0	6.5	7.0	6.0	7.0	7.0	7.0	6.0	7.0
c.b.d	15.5	16.5	16.0	17.0	15.0	16.0	17.0	15.0	17.0
Vulva from anterior	-	-	-	-	-	636	621	643	620
V%	-	-	-	-	-	61.0	57.0	64.0	63.0
Spicule length	38.0	39.5	40.0	30.0	38.5	-	-	-	-
S'	1.8	1.8	1.7	1.8	1.6	-	-	-	-
Gubernaculum length	14.0	15.0	15.0	15.0	15.0	-	-	-	-
Number of supplements	18	18	17	18	17	-	-	-	-
Supplement length	9.0	9.0	8.5	8.0	9.5	-	-	-	-
Anal dia.	21.4	22.5	23.1	20.6	24.5	-	-	-	-
Tail length	59.0	61.0	62.0	59.0	61.0	56.0	59.0	55.0	60.0
Tail setae	10.0	10.5	10.0	11.0	9.0	10.0	10.0	11.0	9.0

vs 10 µm in *O. adenophorus* Blome & Riemann, 1994), and by the presence of two groups of long setae near the tail tip. Moreover, all supplements in *Onyx orientalis* sp. n. are equal in size.

Type material. Holotype, adult male, slide UGMD 104159. Allotype, adult female, slide UGMD 104159, deposited at the Museum of Zoology University Ghent, Belgium. Paratypes. 4♂, 3♀, slides UGMD 104159 – 62, deposited at the Museum of Zoology University Ghent, Belgium.

Another locality. Tra Co (21°28'.390" N and 108°01'.231" E), Quang Ninh province, Vietnam.

Type locality. Can Gio mangrove forest Ho Chi Minh City, subtidal at 0.5m depth, sediment = silt, sample station CG13 (10°33'532" N and 106°53'788" E).

Etymology: The species name refers to oriental mangrove forest and mudflat where it was found.

Onyx cobbi sp. n. (Table 4; Fig. 7, 8)

Measurements. See Table 4.

Males. Body wall transparent and finely striated. Head anteriorly rounded and not striated. Internal labial papillae not seen. Six outer labial setae (12 µm long). Four cephalic setae very long: 21 µm. Numerous and very long cervical setae (22 µm). Amphidial fovea an elongated loop, 10 µm high and 9 µm wide (40% corresponding body diameter). Buccal cavity with vestibulum 12 µm deep, cup shaped, with strong hollow dorsal tooth 39 µm long. Secretory-excretory system not

seen. Pharynx 187 µm in length, anterior part of pharynx only weakly enlarged, posterior end enlarged to an elongated double bulb with slight constriction in the middle, lumen well sclerotised. Reproductive system monorchic with anterior, outstretched testis subventrally right of intestine. Spermatozoa rounded to elongated and large (12.0 x 6.4 µm), *vas deferens* weakly and more or less uniformly developed. Spicules regularly bent, strongly cuticularised, 46 µm long (1.3 times anal body diameter), proximally rounded. Gubernaculum 26 µm long. Fifteen strongly light-refractive, slightly S-shaped, precloacal supplements, (12 µm long), tubular, equi-distantly arranged on the ventral side of the body; the anterior one about half the length of the others. Tail short, conical, 119 µm (3.3 × anal body diameter), conical, tip unstriated. There are five setae positioned in two lateral-ventral fields on the tail, shorter than somatic setae (11 µm). Caudal glands not seen.

Females. Similar to male in general appearance. However, there is the sexual dimorphism in the shape of amphidial fovea and shorter outer labial papillae (9 µm long) and cephalic setae (19 µm long). Amphidial fovea multispiral (2.25 turns), 8 µm wide (30% corresponding diameter). Hollow dorsal tooth 41 µm long. Vulva at mid-body. Ovaries opposed, reflexed. Tail 107 µm long and conical (3.5 × anal body diameter). Two pairs of short, slender, subventral advulvar setae, 5 µm long. Setae in tail 10 µm long. Caudal glands not seen.

Table 4. Measurements of *Onyx cobbi* n. sp. (all measurements in µm, except ratios).

Characteristic	Holotype ♂1	Paratypes		Allotype ♀1	♀2
		♂2	♂3		
Body length	1334	1544	1421	1214	1321
a	31.2	39.2	39.0	20.9	22.0
b	7.1	7.8	7.1	6.1	6.7
c	11.2	11.9	12.9	11.3	11.1
c'	3.3	3.7	3.0	3.5	3.8
Head dia.	27.0	28.0	25.0	27.0	25.5
Outer labial setae	12.0	12.0	12.5	9.0	10.5
Cephalic setae	21.0	22.0	21.0	19.0	18.5
Pharynx length	187	198	200	200	198
Max dia.	43.0	39.0	36.0	58.0	60.0
Dorsal tooth length	39.0	43.0	42.0	41.0	42.0
Amphideal fovea					
width	9.5	8.0	8.0	8.0	9.0
high	10.0	10.5	11.0	8.0	10.0
dia.	24.5	24.0	22.0	26.0	25.0
Vulva from anterior	–	–	–	560	610
V%	–	–	–	46.0	46.0
Spicule length	46.0	42.0	45.0	–	–
S'	1.3	1.2	1.2	–	–
Gubernaculum length	26.0	26.0	28.0	–	–
Supplements	15	16	15	–	–
Anal dia.	36.0	35.0	36.0	30.0	31.0
Tail length	119	129	110	107	119
Tail setae	11.0	10.0	12.0	10.0	11.0

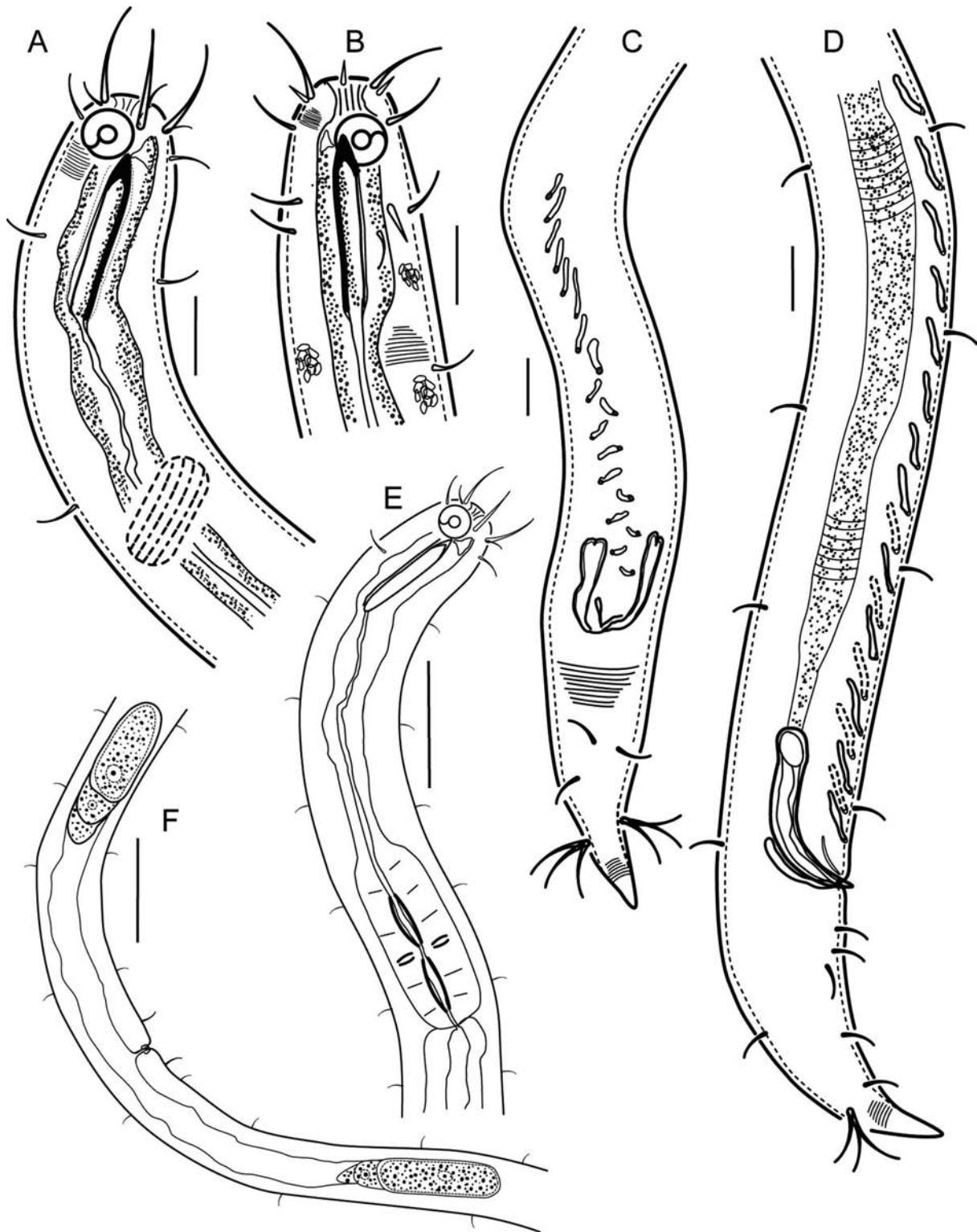


Fig. 5. *Onyx orientalis* sp. n. A, D, E: holotype, A: head region; D: tail region and spicular apparatus; E: pharynx region; B, F: allotype, B: head region; F: vulva region; C: paratype male, ventral view with two rows of supplements. Scale bars: A-D: 10 μ m, E, F: 50 μ m.

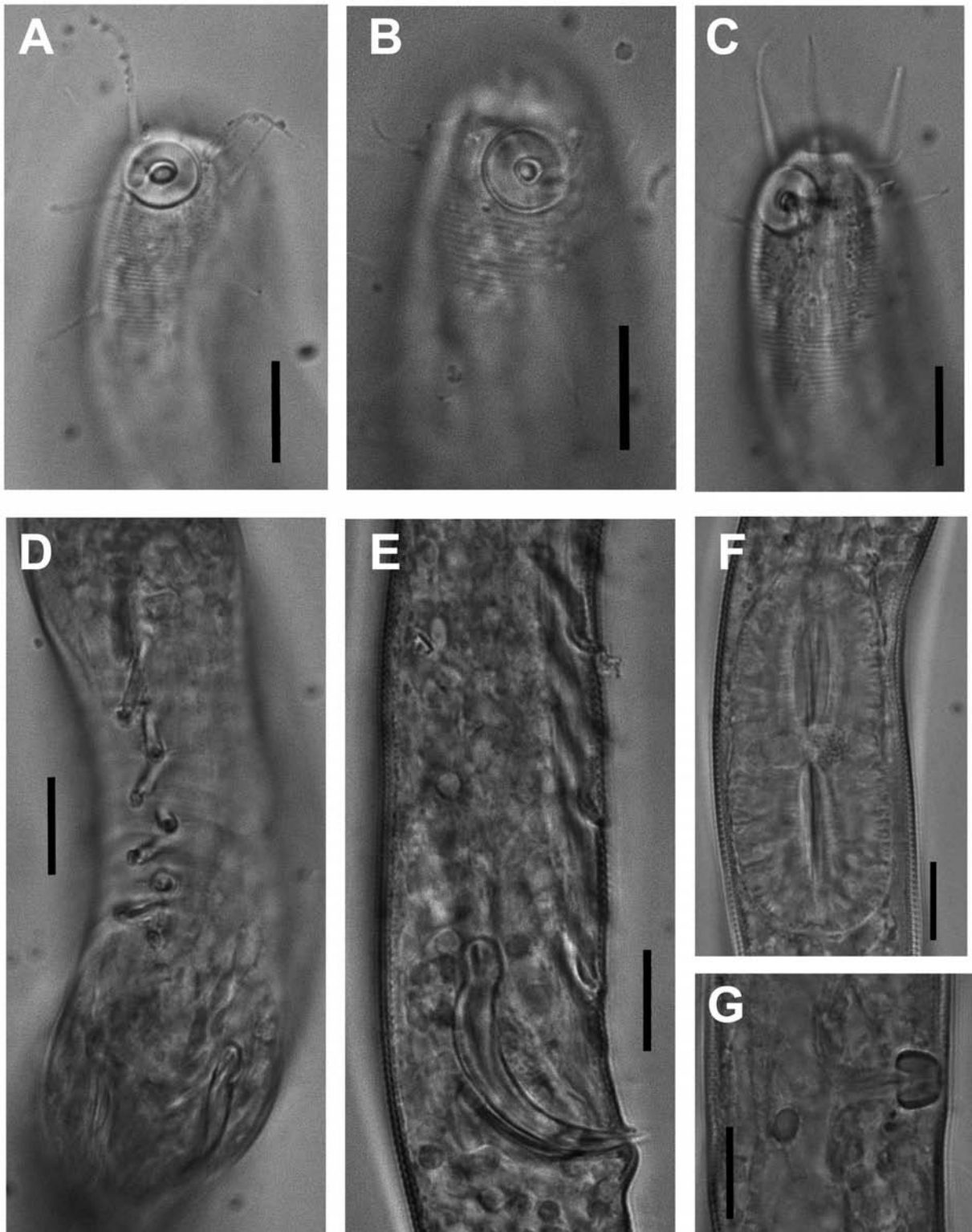


Fig. 6. *Onyx orientalis* sp. n. A, E: holotype, A: head region; E: spicular apparatus. B, F, G: allotype, B: head region; F: posterior of pharynx; G: vulva region; C, D: paratype male, C: head region; D: supplements. Scale bars: A-G: 10 μm.

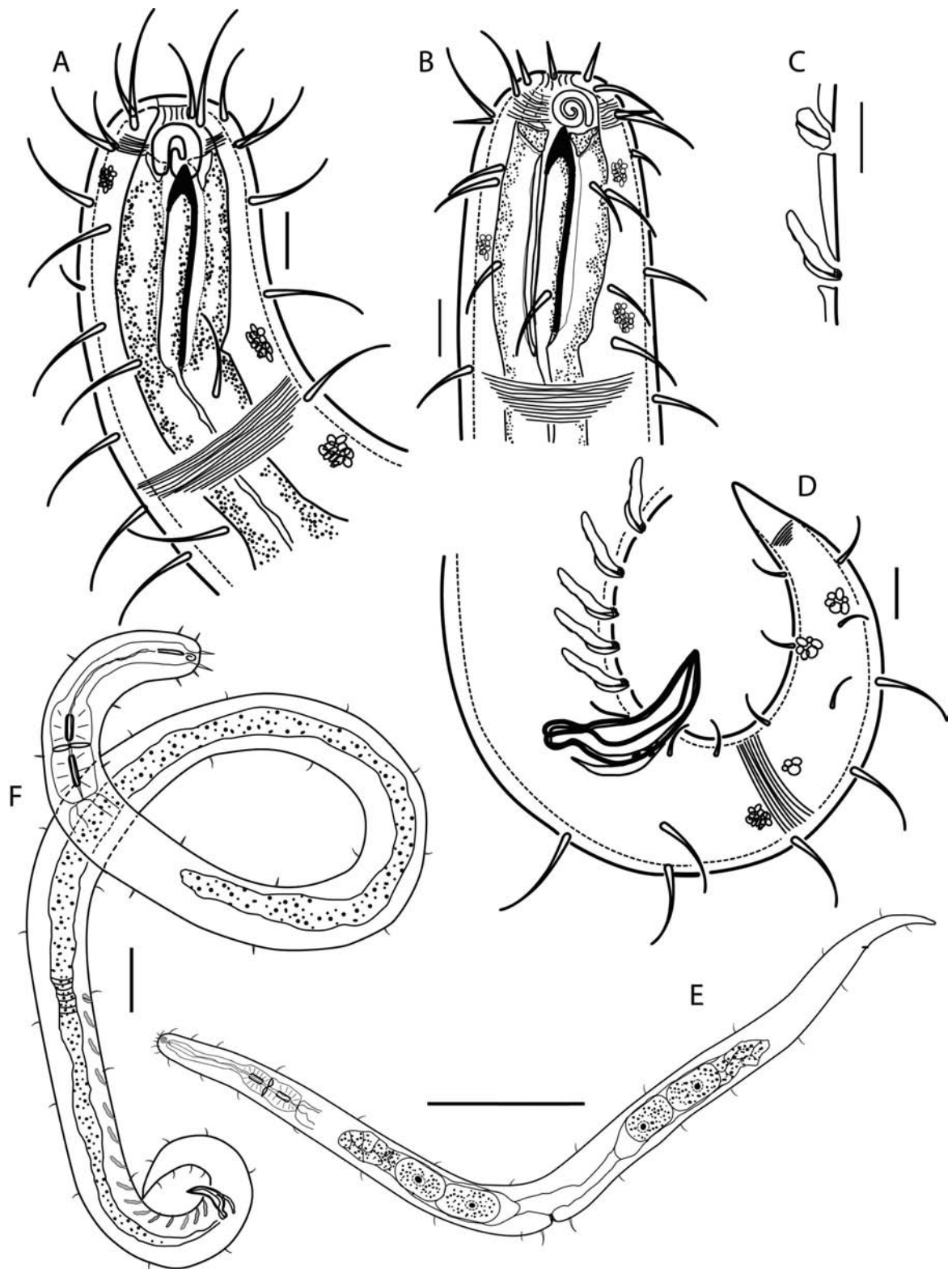


Fig. 7. *Onyx cobbi* sp. n. A, C, D, F: holotype, A: head region; C: anterior part of supplement region; D: spicular apparatus; F: Total view; B, E: allotype, B: head region; E: total view. Scale bars: A – D: 10 µm. E: 100 µm; F: 50 µm.

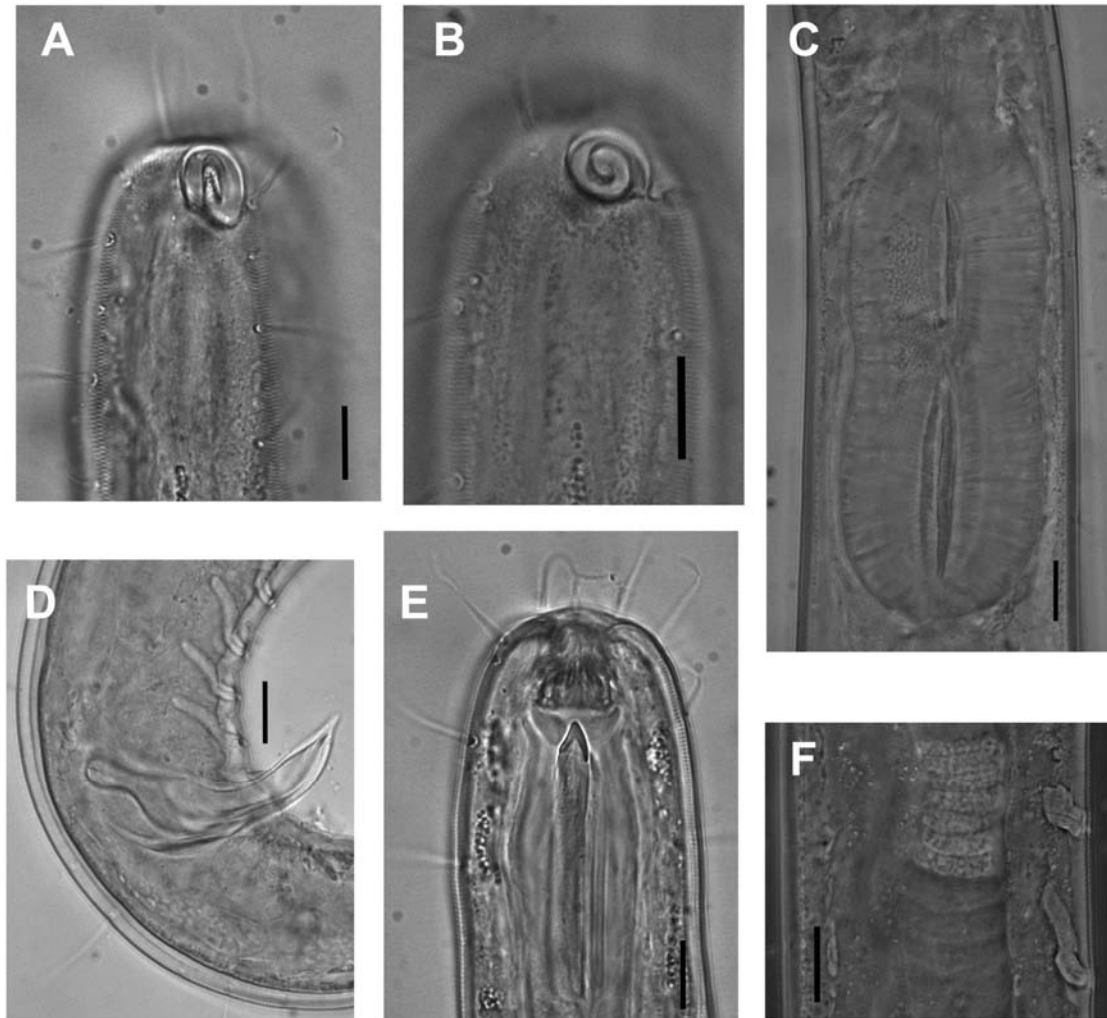


Fig. 8. *Onyx cobbi* sp. n. A, D, E: holotype, A: Head region; D: Spicular apparatus; E: Hollow tooth; B, C, F: allotype, B: head region; C: posterior of pharynx; F: anterior of supplement region. Scale bars: A-F: 10 μ m.

Differential diagnosis. *Onyx cobbi* sp. n. is characterised by its sexual dimorphism in the shape of the amphidial fovea: an elongated loop in the male and a mutispiral in the female and the presence of 15-16 slightly S-shaped, precloacal supplements. Anterior supplement is half the length of the others. *Onyx cobbi* sp. n. is similar to *O. perfectus* Riemann, 1966 by its very long cephalic and somatic setae and by the number of supplements but differs by the sexual dimorphism in the amphidial fovea, absent in *O. perfectus* Riemann, 1966.

Type material. Holotype, adult male, slide UGMD 104163. Allotype, adult female, slide UGMD 104163, deposited at the Museum of Zoology University Ghent, Belgium. Paratypes. 2♂, 1♀, slides UGMD 104163 – 65, deposited at the Museum of Zoology University Ghent, Belgium.

Type locality. Can Gio mangrove forest Ho Chi

Minh City, subtidal at 0.5m depth, sediment = silt, sample station CG 13 (10°33'532" N and 106°53'788" E) and CG16(10°29'196" N and 106°54'994" E).

Another locality. Tra Co (21°28'.390"N and 108°01'.231" E), Quang Ninh province, Vietnam.

Etymology: The species name is given in honour of Dr Nathan Cobb, a famous nematologist.

***Onyx paradimorphus* sp. n.**
(Table 5; Fig. 9, 10)

Measurements. See Table 5.

Males. The cuticle is reddish brown and finely striated. Head anterior rounded and not striated. Internal labial papillae not seen. Six outer labial setae (7 μ m long). Four cephalic setae very long (18 μ m). Four cervical setae 18 μ m long, posterior to amphidial fovea. Amphidial fovea 19 μ m high and

16 µm wide (50% corresponding body diameter), irregularly wound sausage-shaped spiral with three turns. Buccal cavity large, 13 µm deep, anterior part cup shaped, with strong hollow dorsal tooth (43 µm long). Secretory-excretory system not seen. Pharynx 178 µm long, anterior part of pharynx only weakly enlarged, posterior end enlarged to a double bulb with a slight constriction in the middle. Reproductive system monorchic with anterior, outstretched testis subventrally right of intestine (distal end 120 µm from end of pharynx). Spermatozoa small, rounded to elongated, *vas deferens* sclerotised and uniformly developed. Spicules regularly bent, strongly cuticularised, 43.5 µm long (1.5 × anal body diameter), head drop-shaped. Gubernaculum 22 µm long, ‘candle’-shaped, embracing distal part of spicules laterally. Fifteen strongly light-refractive, slightly S-shaped, precloacal supplements 12 µm long, tubular, more or less equal-sized and equidistantly arranged on the ventral side of the body. The additional five papillae with setae within the spicules region; distance from cloaca to the first supplement 38 µm. Tail 128 µm (4.3 × anal body diameter) long, conical, tip unstriated. Setae in the tail region shorter than somatic setae (7 µm). Caudal glands not seen.

Females. Not encountered in the samples.

Differential diagnosis. *Onyx paradimorphus* sp. n. is characterised by its multispiral amphidial fovea, spicules that are regularly bent, 15 strongly cuticularised, S-shaped supplements and 5 papillae with setae within the spicules region. *Onyx paradimorphus* sp. n. is similar to *O. dimorphus* Gerlach, 1963 by the long cephalic and somatic setae, and large elongated multispiral amphidial fovea. However, it differs by the number of turns of the amphidial fovea (*O. paradimorphus* sp. n. has 3 turns vs 2.25 in *O. dimorphus* Gerlach, 1963) and the number of supplements (15 vs 10 in *O. dimorphus* Gerlach, 1963). Additionally, *O. paradimorphus* sp. n. has 5 preanal papillae with setae in the anal region.

Type material. Holotype, adult male, slide UGMD 104193, deposited at the Museum of Zoology University Ghent, Belgium.

Type locality. Can Gio mangrove forest Ho Chi Minh City, Vietnam, subtidal at 0.5m depth, sediment = silt, sample station CG16 (10°29'196" N and 106°54'994" E).

Etymology: The specific name refers to the similarity of amphidial fovea in new species with that of *Onyx dimorphus* Gerlach, 1963.

Table 5. Measurements of *Onyx paradimorphus* n. sp. (all measurements in µm, except ratios).

Characteristic	Holotype (♂1)	♂2
Body length	1003	1196
a	25.3	30.1
b	5.6	–
c	7.9	10.1
c'	4.3	4.2
Head dia.	29.0	28.0
Outer labial setae	8.0	–
Cephalic setae	18.0	–
Pharynx length	178	–
Max dia.	40.8	40.0
Dorsal tooth length	44.0	–
Amphideal fovea	–	–
width	16.5	16.0
length	19.0	–
dia.	33.0	32.0
Spicule length	43.5	41.0
S'	1.5	1.5
Gubernaculum length	22.0	22.0
Number of supplements	15	15
Anal dia.	29.5	28.0
Tail length	128	119

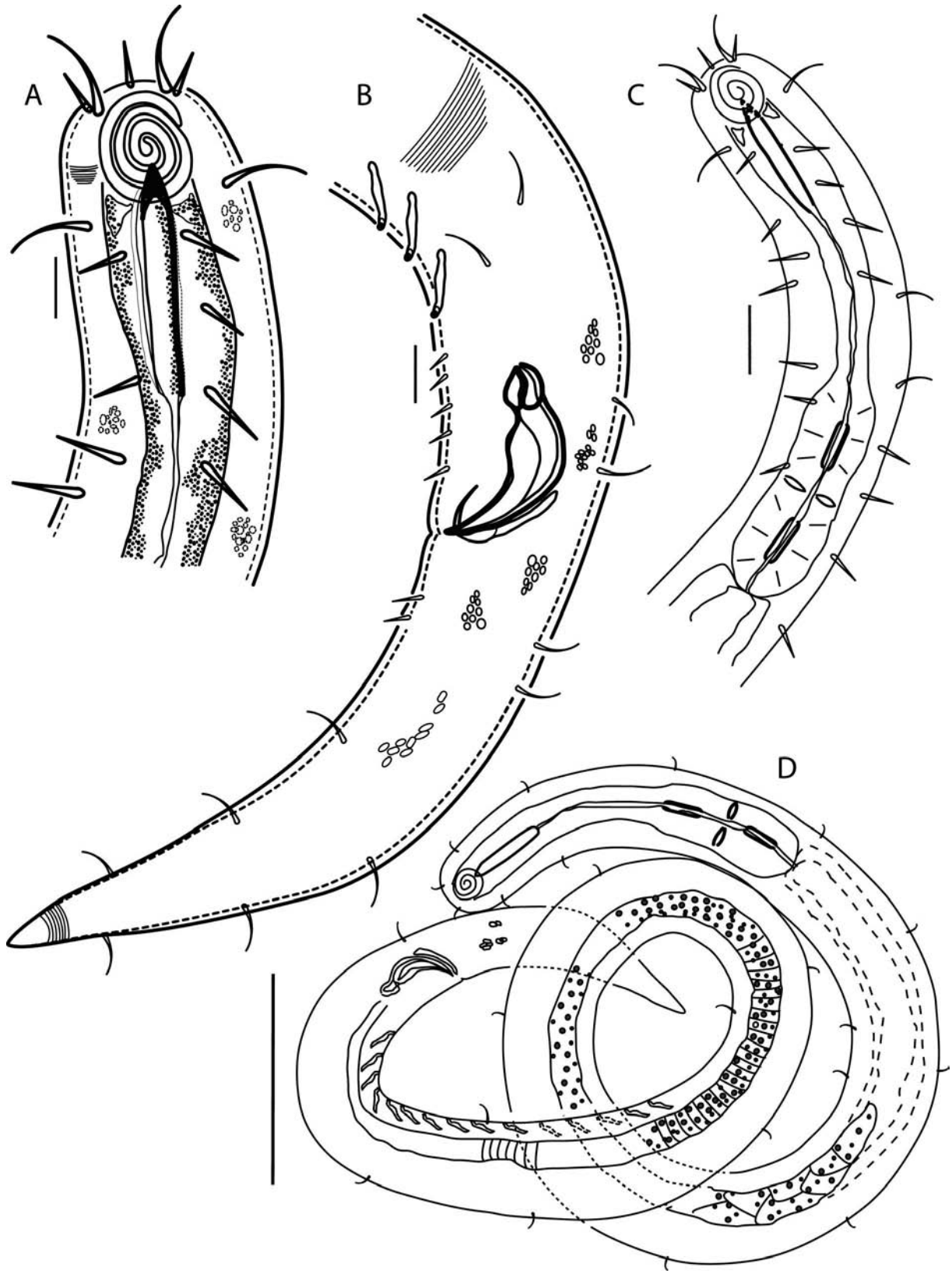


Fig. 9. *Onyx paradimorphus* sp. n. A, B, C, D: holotype, A: Head region; B: Spicular apparatus; C: Pharynx region; D: Total view. Scale bars: A – B: 10 μ m. C: 20 μ m; D: 100 μ m.

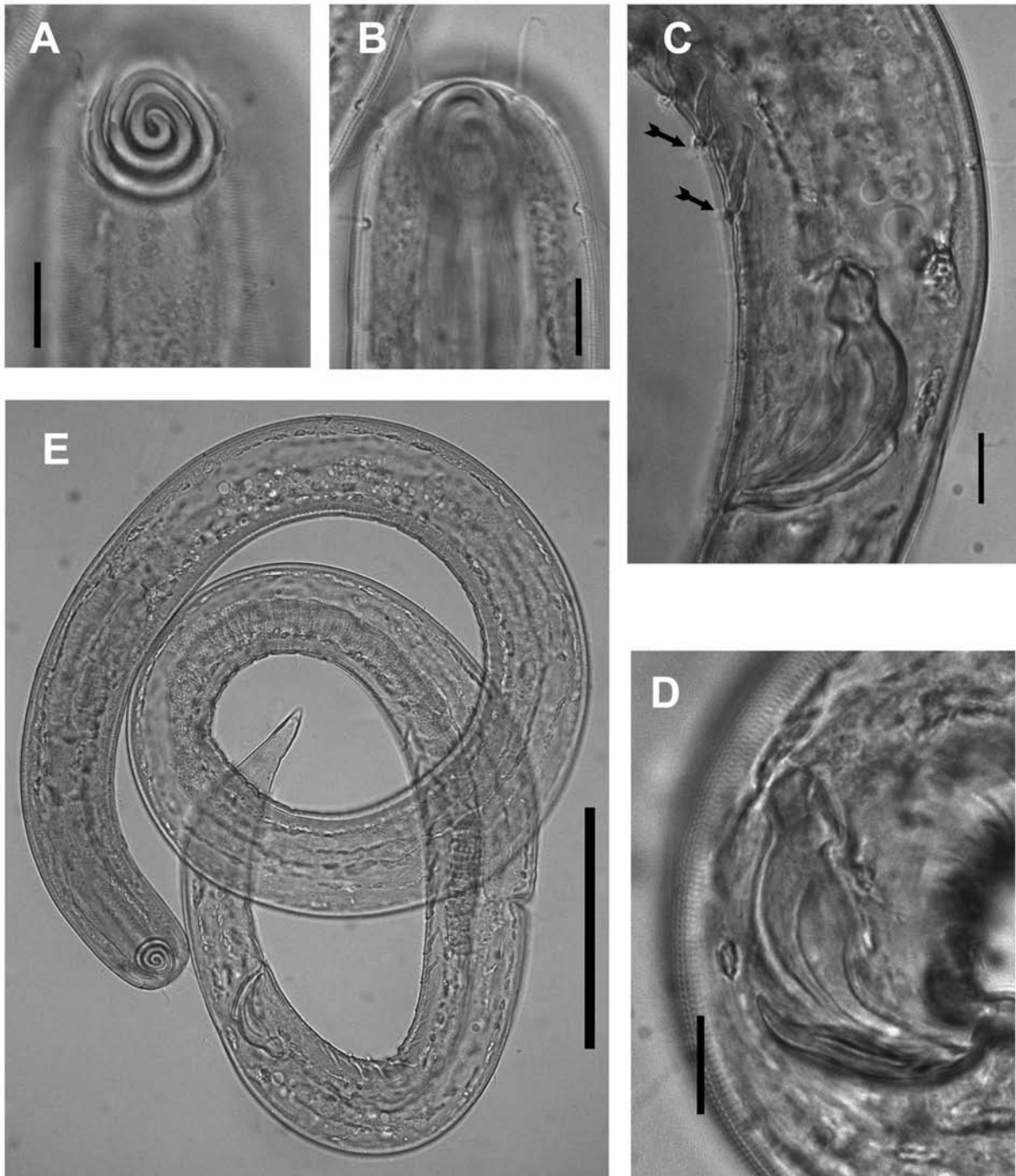


Fig. 10. *Onyx paradimorphus* sp. n. A, D, C, E: Male 1, A: Amphidial fovea; B: Cephalic setae; C: Spicular apparatus; E: Total view; D: Male 2, Spicular apparatus. Scale bars: A-D: 10 μ m. E: 100 μ m. Arrows – supplements.

Table 6. Measurements of *Onyx mangrovi* n. sp. (all measurements in μm , except ratios).

Characteristic	Holotype σ^1	Paratypes					Allotype σ^1	Paratypes				
		σ^2	σ^3	σ^4	σ^5	σ^6		σ^2	σ^3	σ^4	σ^5	σ^6
Body length	565	591	523	568	591	546	520	552	543	581	590	562
a	12.9	14.3	12.9	13.1	13.3	12.9	8.9	13.1	9.0	10.3	11.4	9.8
b	4.0	3.8	4.0	4.0	3.9	3.8	3.5	3.9	3.7	3.7	3.7	3.9
c	16.2	17.8	17.4	19.2	16.6	15.7	16.3	17.7	17.8	16.6	19.9	17.8
c'	1.3	1.3	1.2	1.1	1.4	1.3	1.0	1.3	0.9	1.1	1.0	0.9
Head dia.	15.1	16.6	17.2	15.3	14.8	13.6	16.0	–	–	–	–	–
Oesophagus length	141	154	132	143	151	143	150	141	147	159	161	144
Max dia.	44.0	41.0	41.0	43.0	45.0	42.5	59.0	42.0	60.5	56.0	52.0	57.0
Dorsal tooth length	34.0	31.0	30.0	34.0	36.0	33.0	45.0	32.0	40.0	35.5	33.0	34.0
Amphideal fovea												
width	6.0	7.0	6.5	6.0	–	–	4.0	–	–	–	–	–
dia.	17.0	18.0	16.0	16.5	–	–	14.0	–	–	–	–	–
Vulva from anterior	–	–	–	–	–	–	316	316	304	320	320	300
V%	–	–	–	–	–	–	61.0	57.0	56.0	55.0	54.0	53.0
Anal dia.	27.0	25.0	24.0	27.5	26.0	27.0	30.5	24.0	33.0	33.0	30.0	35.0
Number of supplements	17.0	22.0	20.0	17.0	19.0	23.0	–	–	–	–	–	–
Supplement length	13.0	12.5	13.5	12.0	13.5	12.5	–	–	–	–	–	–
Spicule length	38.0	39.0	40.0	37.0	36.0	40.0	–	–	–	–	–	–
S'	1.4	1.6	1.7	1.3	1.4	1.5	–	–	–	–	–	–
Gubernaculum length	14.0	13.0	14.0	13.0	13.0	14.5	–	–	–	–	–	–
Tail length	35.0	33.0	30.0	30.0	35.5	35.0	32.0	31.0	30.5	35.0	30.0	31.5
Tail length portion	11.0	11.0	10.5	11.5	11.0	10.5	13.0	13.5	12.5	12.0	13.0	12.5

***Onyx mangrovi* sp. n.**
(Table 6; Fig. 11, 12)

Measurements. See Table 6.

Males. Cuticle reddish brown, finely striated. Head anteriorly rounded and not striated. Inner labial papillae and outer labial papillae not seen. Four cephalic setae 3 μm long. Amphidial fovea single loop, 6 μm wide (47% corresponding body diameter). Buccal cavity large, anterior part 12 μm deep and cup shaped, with strong hollow dorsal tooth (34 μm long). Pharynx short 141 μm , anterior part of pharynx only weakly enlarged, posterior end enlarged to elongated bulb with slight constriction in the middle. Secretory-excretory system not seen. Reproductive system monorchic with anterior, outstretched testis (distal end 25 μm from end of pharynx) positioned subventrally and left of intestine. Spermatozoa rounded and weakly light-

refractive, *vas deferens* weakly and uniformly developed. Spicules regularly bent, 38 μm long (1.4 times anal body diameter), heads rounded, strongly cuticularised. Gubernaculum 14 μm long. Seventeen strong, 13 μm long supplements; each proximally sigmoidal in shape and distally hook-shaped. Tail short, 35 μm (1.3 \times anal body diameter), conical with tail tip curved dorsally at about 2/3 of tail length; tip unstriated over 9 μm , several short setae 4 μm present. Caudal glands not seen.

Females. Similar to males in general appearance. Inner and outer labial papillae not seen, four short cephalic setae 3 μm long present. Amphidial fovea single loop 4 μm wide shaped as in male. Hollow dorsal tooth 45 μm long. Vulva at 316 μm from anterior end ($V = 61\%$). Ovaries opposed, reflexed, left from intestine. Subventral advulvar setae not seen. Tail short, 32 μm or as long as anal body diameter. Caudal glands not seen.

Differential diagnosis. *Onyx mangrovi* sp. n. is characterised by having 17-23 supplements with a complex structure: proximally sigmoidal-shaped and distally hook-shaped, and the very short tail with dorsally curved tip. *Onyx mangrovi* sp. n. is similar to *Onyx cangioensis* sp. n. in body shape, amphidial fovea and cephalic setae structure, but differs by having shorter cephalic setae (3 μm in *Onyx mangrovi* sp. n. vs 5 μm in *Onyx cangioensis* sp. n.), shorter spicules (38 μm in *Onyx mangrovi* sp. n. vs 48.5 μm in *Onyx cangioensis* sp. n.), more numerous precloacal supplements (17-23 in *Onyx mangrovi* sp. n. vs 14-16 in *Onyx cangioensis* sp.

n.), and shorter tail (35 μm in *Onyx mangrovi* sp. n. vs 68 μm in *Onyx cangioensis* sp. n.).

Type material. Holotype, adult male, slide UGMD 104166. Allotype, adult female, slide UGMD 104166, deposited at the Museum of Zoology University Ghent, Belgium. *Paratypes.* 6♂, 5♀, slides UGMD 104166 – 70, deposited at the Museum of Zoology University Ghent, Belgium.

Type locality. Can Gio mangrove forest Ho Chi Minh City, Vietnam, subtidal at 0.5 m depth, sediment = silt, sample station CG16 (10°29'196" N and 106°54'994" E).

Etymology: The species name refers to the Cangio mangrove forest where it was found.

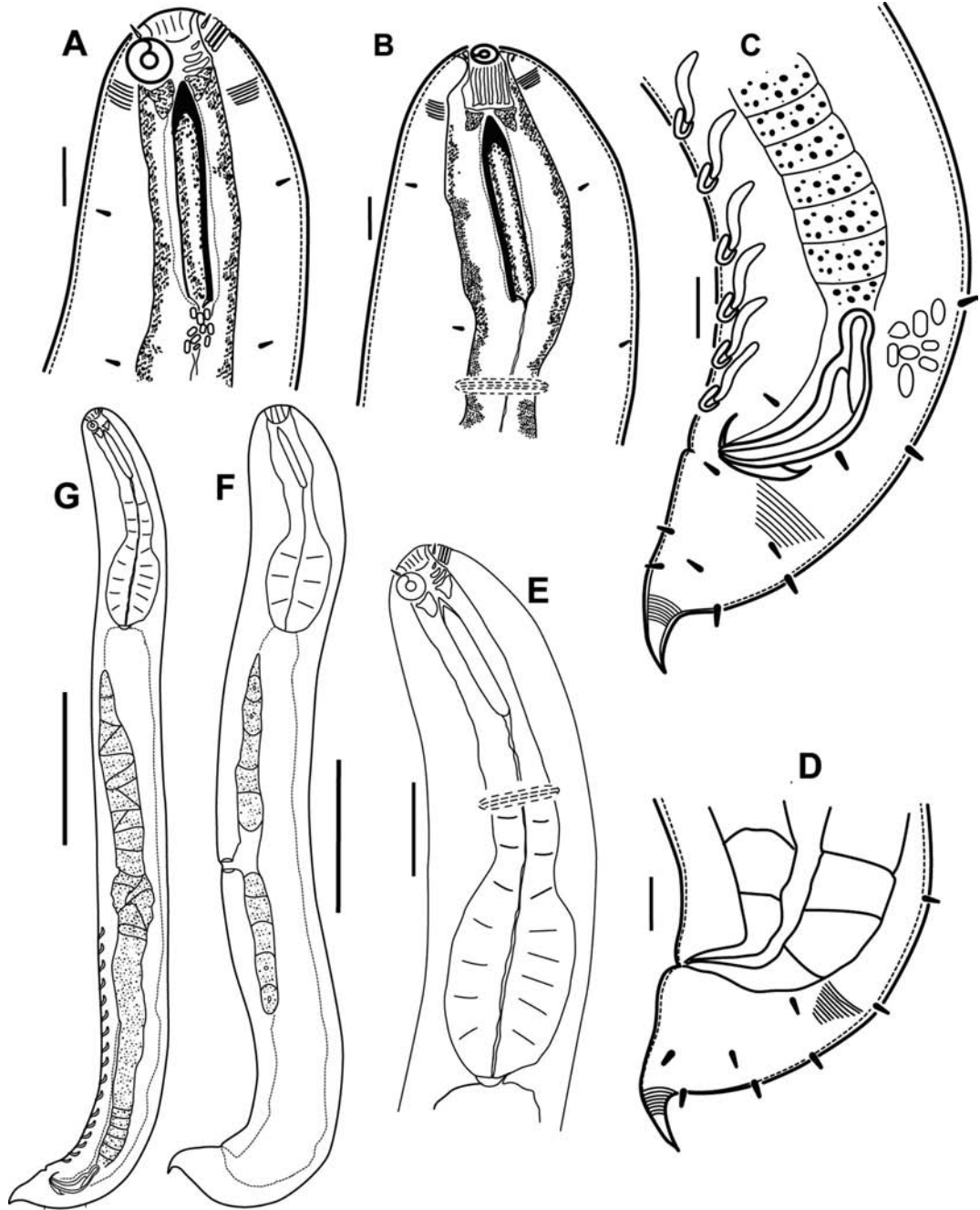


Fig. 11. *Onyx mangrovi* sp. n. A, C, E, G: holotype, A: Head; C: Spicular apparatus; E: Pharynx region; G: Total view; B, D, F: allotype, B: Head; D: Tail region; F: Total view. Scale bars: A- D: 10 μ m; E: 30 μ m. F- G: 100 μ m.

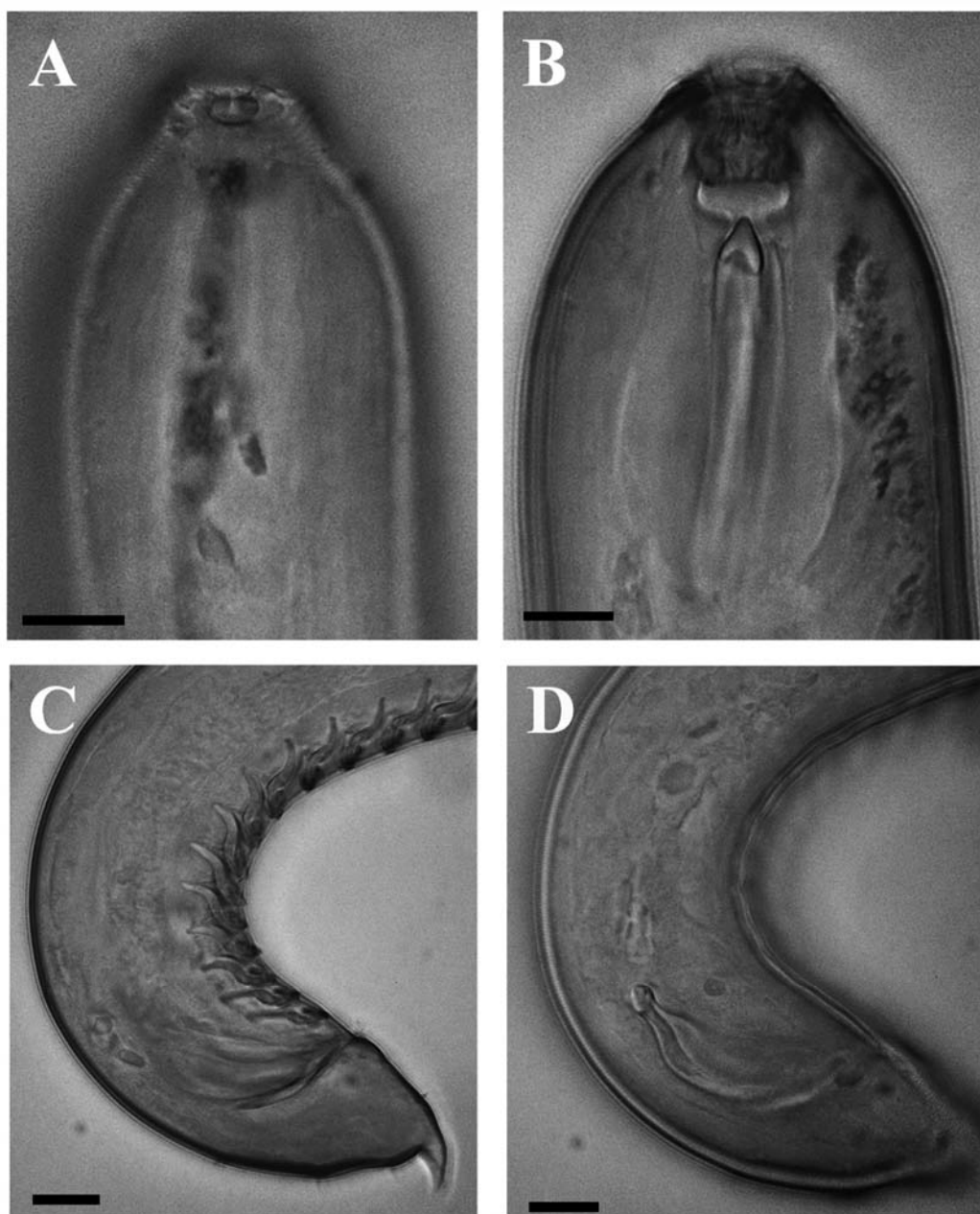


Fig. 12. *Onyx mangrovi* sp. n. Paratype - male 1: A: Amphidial fovea; B: Hollow dorsal tooth; C: Posterior body end; D: Spicules, proximal ends. Scale bars: A-D: 10 μ m.

Identification key to *Onyx* species

There is only one immature female known of *Onyx ferox* Ditlevsen, 1921. Therefore, we agree with Blome & Riemann (1994) to regard this species as “species inquirenda”, hence we do not include it in this identification key.

1. All supplements in staggered row2

- All supplements uniform and not in staggered row4
- 2. Male with equally sized supplements*O. orientalis* sp. n.
- Male with supplements different in size3
- 3. Male with 18 supplements in 4 different size groups*O. adenophorus* Blome & Riemann, 1994
- Male with 15 supplements in 3 different size groups *O. cannoni* Blome & Riemann, 1994

4. Male amphidial fovea large, multispiral5
 Male amphidial fovea with a single loop6
 5. Amphidial fovea in male with 4-5 turns, broader than the corresponding body diameter, 14 supplements*O. macramphis* Blome & Riemann, 1994
 - Amphidial fovea elongated, 2 turns, 10 supplements*O. dimorphus* Gerlach, 1963
 - Amphidial fovea elongated, 3 turns, 15 supplements*O. paradimorphus* sp. n.
 - Amphidial fovea atypical: posterior part spiral with 2.5 turns and anterior part hook shaped, 8 supplements*O. blomei* sp. n.
 6. Tail short, less than 1.5 × the anal diameter*O. mangrovi* sp. n.
 - Tail longer than 2 × the anal diameter7
 7. Male amphidial fovea a single loop8
 - Male amphidial fovea elongated-oval, 15 supplements. Female amphidial fovea spiral, 2 turns*O. cobbi* sp. n.
 8. Male with 7 preloacal supplements*O. septempapillatus* Wieser, 1954
 - Male with 14-16 supplements, cephalic setae short (5 µm, 0.3 × c.b.d.)*O. cangioensis* sp. n.
 - Male with 13 - 17 supplements, cephalic setae long (22 - 28 µm, 0.5 - 1 × c.b.d.) ...*O. perfectus* Cobb, 1891
 - Male with 22 preanal supplements of atypical structure*O. rugatus* Wieser, 1959
 - Male with 22-24 preloacal supplements*O. sagittarius* Gerlach, 1950

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Nguyen Dinh Tu, Nic Smol, Ann Vanreusel, Nguyen Vu Thanh. Шесть новых видов рода *Onyx* Cobb, 1891 (Nematoda: Desmodoridae) из прибрежных вод Вьетнама.

Резюме. По материалам проб, собранных в 2004-2010 гг. в прибрежных водах Вьетнама, описано шесть новых видов рода *Onyx*. *Onyx cangioensis* sp. n. характеризуется наличием 14-16 равновеликих сигмоидальных трубчатых супплекментов. *Onyx blomei* sp. n. отличается половым диморфизмом в строении амфидов: у самцов нетипичная задняя часть амфида спиральная (2.5 завитка), у самок – весь амфид мультиспиральный (2.25 завитка). *Onyx orientalis* sp. n. характеризуется очень длинными головными щетинками и наличием 18 S-образных трубчатых супплекментов у самцов. Половой диморфизм в строении амфидов отмечен и у *Onyx cobbi* sp. n.: у самцов амфид в виде удлинённой петли, у самок – мультиспиральный. У этого вида 15 слабо S-образных супплекментов, причем передний вдвое меньше остальных. *Onyx paradimorphus* sp. n. отличается мультиспиральным отверстием амфида, загнутыми спикулами, 15 сильно кутикуляризованными S-образными супплекментами, и 5 папиллами с щетинкой на уровне спикул. У *Onyx mangrovi* sp. n. 17-23 супплекмента сложной структуры: передняя часть – сигмоидальная, задняя часть – крюковидная. Хвостовой конец тонкий с дорсально загнутым терминусом.