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New Desmodoridae (Nematoda : Desmodoroidea) : three new species from *Ceriops* mangrove sediments (Kenya) and one related new species from the North Sea

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Abstract: Three new species of nematodes (*Chromaspirina okemwai* sp.n., *Pseudochromadora interdigitatum* sp. n. and *Eubostrichus africanus* sp. n.) from *Ceriops* mangrove sediments and one new species (*Eubostrichus longosetosus* sp. n.) from the North Sea, along the Belgian coast, are described. *Chromaspirina okemwai* is characterized by four cephalic sensillae and unispiral amphids; *Pseudochromadora interdigitatum* has unique lateral alae where body annules split into two, three or four smaller ones. *Eubostrichus africanus* has short (6 µm) cephalic and subcervical setae and five pairs of strong broad based setae at the tail region; *Eubostrichus longosetosus* has long (14 µm) cephalic and subcervical setae, three pairs of strong setae on the tail and two fine ones at the tail tip. *Eubostrichus parasitiferus* as described by Hopper and Cefalu (1973) is given a new name, *E. hopperi* sp. n. A revision of the genus *Chromaspirina* and *Pseudochromadora* is also included.

Résumé : Trois nouvelles espèces de nématodes, *Chromaspirina okemwai* sp. n., *Pseudochromadora interdigitatum* sp. n. et *Eubostrichus africanus* sp.n., d'une mangrove à *Ceriops* et une nouvelle espèce, *Eubostrichus longosetosus* sp. n., de la Mer du Nord, sont décrites. *Chromaspirina okemwai* est caractérisée par quatre soies céphaliques et par des amphides unispirales ; *Pseudochromadora interdigitatum* a des champs latéraux uniques sur lesquels les rangées transversales sont divisées en deux, trois ou quatre petits anneaux. *Eubostrichus africanus* présente des soies céphaliques et subcervicales courtes et cinq paires de soies robustes dans la région caudale ; *Eubostrichus longosetosus* a des soies céphaliques et subcervicales longues, trois paires de soies robustes sur la queue et deux soies fines à l'extrémité de la queue. L'espèce *E. parasitiferus*, correspondant à la description de Hopper & Cefalu (1973) est renommée *E. hopperi* sp. n. Les genres *Chromaspirina* et *Pseudochromadora* sont révisés.

Keywords: Taxonomy, genera revision, marine nematodes.

Introduction

This study is part of an ecological work done on the *Ceriops* mangrove sediments where a number of genera represented by known and new species were encountered. Desmodoridae were numerically the most important, contributing to 39% of the population.

In this paper, three new desmodorid species of the genera *Chromaspirina* Filipjev, 1918, *Pseudochromadora* Daday, 1889 and *Eubostrichus* Greeff, 1869 are described from the same site. A closely related new species of the genus *Eubostrichus* is described from the North Sea.

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Materials and Methods

The study area in the *Ceriops* mangrove sediments is Gazi bay, 50 kilometers south of Mombasa (Kenya). Samples were collected from the high intertidal zone inundated during high tide only. Description of the area is in Schrijvers *et al* (1995). The North Sea samples were collected along the Belgian coast. The samples were immediately fixed in hot (60°C) 4% formaldehyde solution and nematodes were transferred slowly to glycerine. Drawings were made with the aid of a camera lucida on a Leitz Dialux 20 EB microscope.

Scanning electron microscopic pictures were taken from formalin fixed animals postfixed in OsO_4, dehydrated, dried and coated with 20-25 µm of gold (SEM: JEOL JSM 840).

Type specimens are deposited in the collection of the University of Gent, Department of Ecology, Morphology & Systematics (slides nos. 3888-3897) and the Muséum National d'Histoire Naturelle (MNHN), Paris, France (slides nos. 246-249).

Results

Family Desmodoridae Filipjev, 1922

Genus *Chromaspirina* Filipjev, 1918

Type species: *Chromaspirina pontica* Filipjev, 1918

Emended diagnosis

Spriniinae. Robust animals with rounded head end and conical tail. Cuticle faintly annulated; amphideal fovea always surrounded by the cuticular annulation. Cephalic setae at the level of the amphideal fovea. Amphideal fovea spiral, loop shaped with cuticular outline. Buccal cavity obviously sclerotized with one big dorsal tooth and two smaller subventral ones; a ventral field of small denticles may be developed. Pharynx with weakly developed pear shaped bulb. No ventral gland. Preanal supplements weakly developed. Spicules of variable shape but with capitulum and velum.

Chromaspirina closely resembles *Spirinia* but differs from it in that *Spirinia* has a narrow stoma with a small dorsal tooth and a rounded terminal pharyngeal bulb.

List of valid species:
Chromaspirina chabaudi Boucher, 1975
Chromaspirina crinita Gerlach, 1952
Chromaspirina cylindrocollis Cobb, 1920
Chromaspirina dubia Inglis, 1968
Chromaspirina gerlachi Blome, 1982
Chromaspirina indica Gerlach, 1963
Chromaspirina inglisi Warwick, 1970
Chromaspirina lunatica Gerlach, 1965
Chromaspirina madagascariensis Gerlach, 1953
Chromaspirina multipapillata Jayasree & Warwick, 1977
Chromaspirina parapontica Luc & De Coninck, 1959
Chromaspirina parma Ott, 1972
Chromaspirina pellita Gerlach, 1954, syn. *C. renaudae* Boucher, 1975
Chromaspirina pontica Filipjev, 1918
Chromaspirina thieryi De Coninck, 1943
Chromaspirina okemwai sp. n.

Species inquirendae
Chromaspirina robusta Wieser, 1954 (known from two juveniles).
Chromaspirina paucispira Shuurmans Stekhoven, 1950 (known from one female).
Chromaspirina dimorpha (Hopper, 1961), *Chromaspirina inflexa* (Wieser, 1954) and *Chromaspirina rabosa* (Gerlach, 1956) are transferred again to their original genus, *Desmodora. Chromaspirina longosetosa* Jensen, 1985 is transferred to the genus *Bolbolaimus.*

Discussion

Desmodora inflexa Wieser, 1954, *D. dimorpha* Hopper, 1961 and *Desmodora rabosa* Gerlach, 1956 were transferred to the genus *Chromaspirina* by Gerlach (1963), but we agree with the original status of these species as reinstated by Wieser & Hooper (1967) because the three species are heavy annulate and have a well developed head capsule with the amphids situated outside the rings.

Chromaspirina longosetosus Jensen, 1985 is transferred to *Bolbolaimus* because of the posterior position of the cephalic setae, on a well developed cephalic capsule, minute buccal cavity and long somatic setae.

Chromaspirina okemwai sp. n.

(Table 1, Fig. 1 A-H and 2 A-G)

Material examined, Five males, five females.
Holotype ♂, on slide no. 3888
Allotype ♀, on slide no. 3889
Paratype ♂, on slide no. 3889, 246
Paratype ♀, on slide no. 3890, 247, 3891

Type Locality

All specimens were collected from intertidal sediments of the *Ceriops* mangrove in Gazi Bay, Kenya (4°25'S and 39°50'E), on 17/06/1992. The sediments consist of fine sand (80%) and mud (15%).

Etymology

This species is named in honour of Dr. Ezekiel Okemwa, director of the Kenya Marine & Fisheries Research Institute, Mombasa, Kenya.

Measurements: see Table 1

Description

Males

The body is cylindrical, with blunt head and conical tail (Fig 1H). The cuticle is annulated with annules extending

Table 1. Measurements of *Chromaspirina okemwai* sp.n.
Tableau 1. Dimensions de *Chromaspirina okemwai* sp. n.

	Hol.♂	Par.♂♂ n = 4		All.♀	Par.♀♀ n = 4	
		Min.	Max.		Min.	Max.
L	1 081	966	1 231	1 140	1 220	1 425
cs	5	3	5	5	5	6
amph %	33	36	43	30	32	36
aw	8	8	8	7	8	13
hw	22	19	24	23	23	26
damph	7	8	13	8	7	9
dnr				81	56	79
bdnr				34.8	35	38
ph	145	141	146	150	146	153
bd	29	28	29	28	29	31
mbdph	37	36	39	37	38	44
mbd	44	37	46	49	48	58
dv				627		698
V				55		55
spic	52	41	50			
abd	33	31	33	25.5	28	30
gub	25	19	23			
t	62	62	81	72	60	78
a	25	23	27	23.4	22	26
b	7.5	6.6	8.5	8	8	9
c	17	14.5	17.4	16	18	22.9

Abbreviations used in Tables a: L/maximum diameter; abd: anal body diameter; amph%: diameter of amphid as a percentage of the corresponding head diameter; aw: amphidial width; b: L/pharynx length; bd: maximum bulb diameter; bdnr: body diameter at nerve ring; c: L/tail length; c': tail length/anal body diameter; cs: length of cephalic setae; damph: distance from anterior to mid level of the amphid; dnr: distance from anterior edge to nerve ring; dv: distance from anterior to vulva; gub: length of the gubernaculum; hw: head width; mbd: maximum body diameter; L: Total body length; mbdph: maximum body diameter at pharynx; ph: pharyngeal length; spic: length of spicules measured along the curve; t: tail length; V: position of vulva as a percentage of the total body length from anterior.

N.B. All measurements (but not ratios) are in micrometers (µm).

Abréviations utilisées dans les Tableaux : a : L/ diamètre maximum ; abd : diamètre du corps au niveau anus ; amph% : diamètre de l'amphide en pourcentage du diamètre correspondant de la tête ; aw : largeur de l'amphide ; b : L/ longueur du pharynx ; bd : diamètre maximum du bulbe ; bdnr : diamètre du corps au niveau de l'anneau nerveux ; c : L/longueur de la queue ; c' : longueur de la queue/diamètre du corps au niveau anus ; cs : longueur des soies céphaliques ; damph : distance entre le niveau antérieur et le niveau moyen de l'amphide ; dnr : distance du bord antérieur à l'anneau nerveux ; dv : distance du bord antérieur à la vulve ; gub : longueur du gubernaculum ; hw : largeur de la tête ; mbd : diamètre maximum du corps ; L : longueur totale du corps ; mbdph : diamètre maximum du corps au niveau du pharynx ; ph : longueur du pharynx ; spic : longueur des spicules mesurée le long de la courbe ; t : longueur de la queue ; V : position de la vulve en pourcentage de la longueur totale du corps.

N.B. Toutes les mesures (sauf les rapports) sont en micromètres (µm).

till the anterior (seven annules per 10 µm) (Fig. 1G). There are eight longitudinal rows of short somatic setae. The cuticle is covered with fine hair-like structures [(2 µm long (Fig. 2C)], clearly visible in SEM pictures; they anteriorly begin on the annule behind the amphid (Fig. 2D) and extend posteriorly until the tail region (Fig. 2G). These structures were already present in the premoult phase of a newly made cuticle (Fig. 2F). It is possible therefore, that these are cuticular structures as proposed by Gerlach (1951, 1954) and Warwick (1970) and not Cyanophycous algae as was put as an alternative for cuticular structures in *Chromaspirina pontica* by Gerlach (1951) and in *Chromaspina inglisi* Warwick (1970). But on the other hand they are so loosely attached to the cuticle (all specimens that were sonicated for SEM preparation were almost devoid of such hairs at the tail region Fig. 2E) that it remains doubtful if they are true cuticular structures.

In one specimen we found the cuticle covered with long filamentous structures (Fig. 3) especially at the tail region. Probably these are microbial organisms similar to those commonly found in association with *Eubostrichus* and also mentioned by Gerlach (1951) and Warwick (1970). From his drawing Gerlach (1954) indicates rather long and sparsely distributed structures [compared with our observation in the scanning pictures (Fig. 2C)], thus they are likely to be filamentous organisms rather than cuticular structures. On the other hand the specimens of Warwick (1970) have short densely distributed structures which are more likely to be cuticular structures. Attached to the cuticle are suctorial Protozoa which may cause wounds on the cuticle (Fig. 1F and 2G).

Six internal and six external tiny labial sensilla (only seen by means of SEM pictures, Fig. 2B). Four cephalic setae, located at the anterior level of the amphids just in front of the first body annule (Fig. 1G and 2B). Amphids unispiral; fovea having the appearance of two concentric circles (Fig. 2B). Lip region intrusible (Fig. 2A). Stoma with one dorsal tooth and two smaller subventral ones (Fig. 1D). Pharynx cylindrical with a slightly swollen terminal bulb (Fig. 1D).

The reproductive system is monorchic, outstretched, located to the right of the intestine (Fig. 1H) and contains large sperm cells (19-22 µm in diameter). The spicules are arcuate, with a strongly sclerotized capitulum and a thin velum with a typical shape (Fig. 1E). Gubernaculum is half as long as the spicule. Tail conical (twice anal body diameter); with a wide anterior part that quickly narrows down posteriorly (Fig. 1E). Non-annulated tail end is one third of the tail length. Three caudal glands open at the tip through a spinneret.

Females

The females are similar to the males in general body shape, pattern of somatic setae, anterior setae (Fig.2A), amphids (Fig. 1B, 2A) and pharyngeal region. The repro-

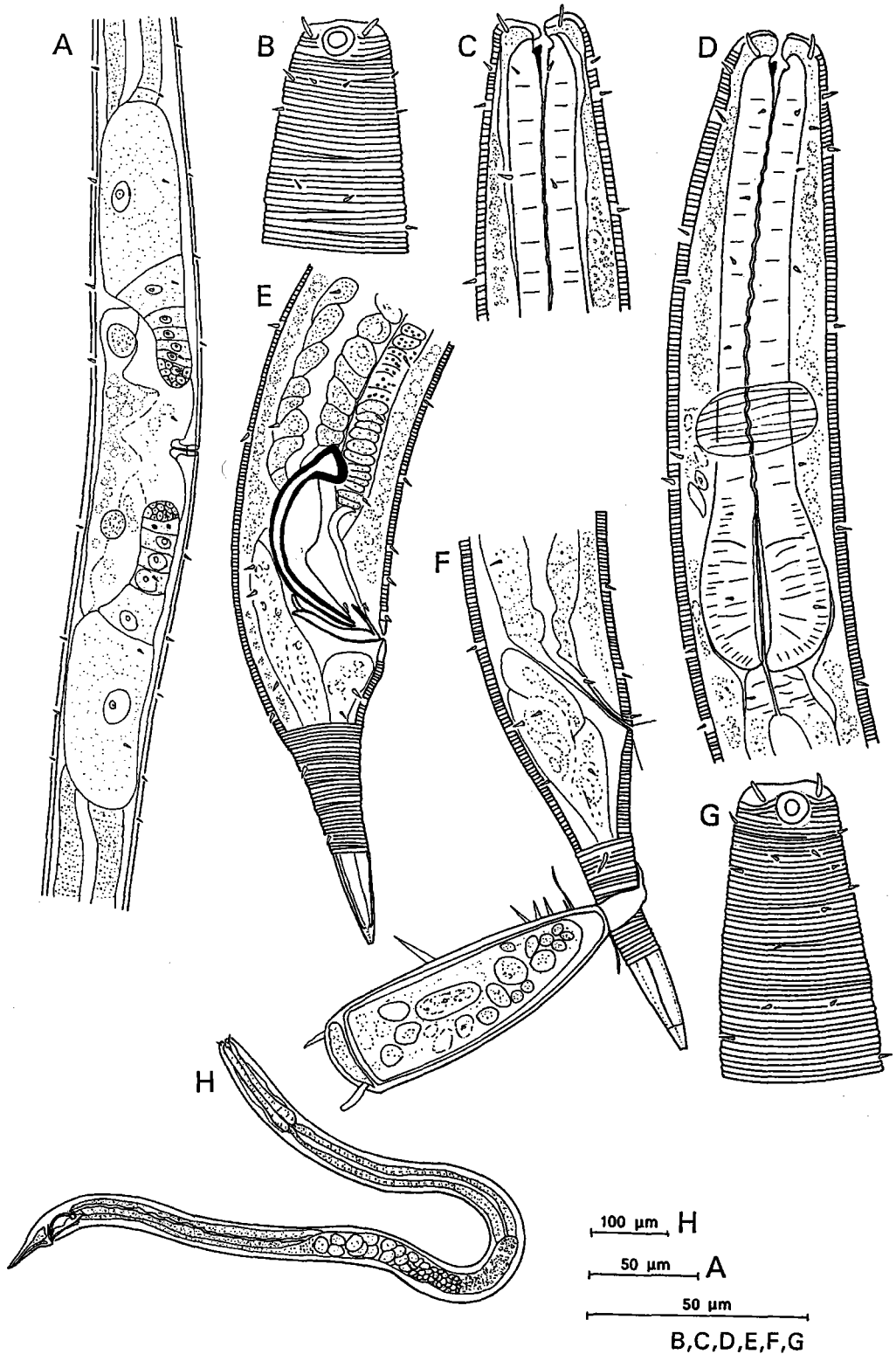

Figure 1. *Chromaspirina okemwai* sp. n.

A: ♀$_1$ reproductive system
B: ♀$_1$ head region
C: ♀$_1$ stoma
D: ♂$_1$ pharynx
E: ♂$_1$ tail
F: ♂$_1$ tail
G: ♂$_1$ head region
H: ♂$_1$ habitus

Figure 1. *Chromaspirina okemwai* sp.n.

A : ♂$_1$ appareil reproducteur
B : ♂$_1$ région céphalique
C : ♂$_1$ région buccale
D : ♂$_1$ pharynx
E : ♂$_1$ queue
F : ♂$_1$ queue
G : ♂$_1$ région céphalique
H : ♂$_1$ habitus

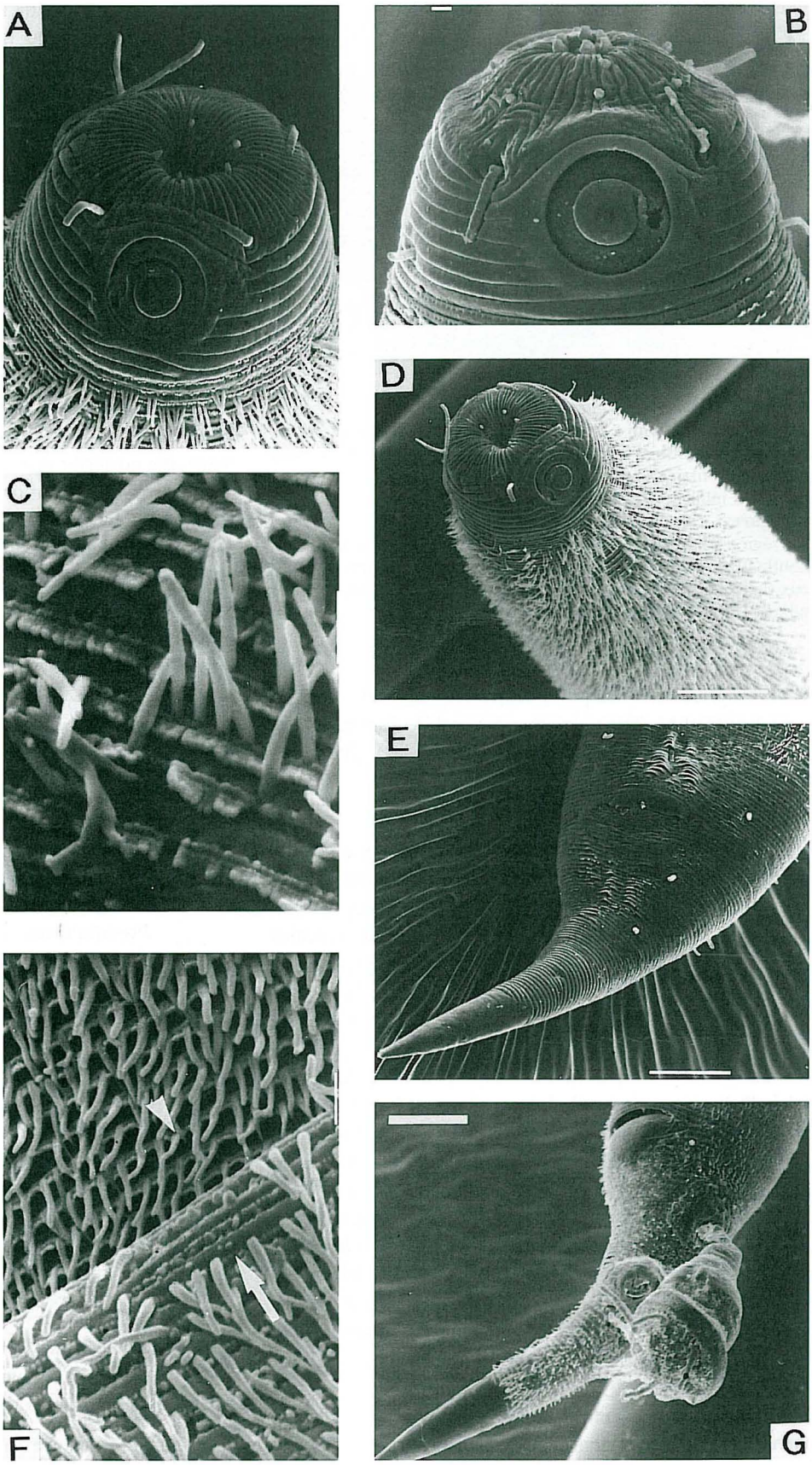

Figure 2. *Chromaspirina okemwai* sp. n.
A: ♀2 head region on lateral view.
B: ♀2 head region
C: ♀2 cuticular structures (fine hairs)
D: ♀2 showing spine-like setae on body
E: ♂2 tail (devoid of fine hairs)
F: ♀2 new and old cuticle covered with the fine hairs (arrow head indicates new cuticle, arrow indicates old cuticle)
G: ♂3 tail region showing presence of the fine hairs on non-sonicated specimens (note also the suctorian protozoa)
(Scale bars indicate 1 µm in A, B, C and F; 10 µm in D, E, and G.

Figure 2. *Chromaspirina okemwai* sp. n.
A : ♀2 région céphalique en vue latérale
B : ♀2 région céphalique
C : ♀2 structures cuticulaires (soies fines)
D : ♀2 montrant des soies en forme d'épines sur le corps
E : ♂2 queue (dépourvue de soies fines)
F : ♀2 cuticule nouvelle et ancienne couverte de soies fines (la tête de flèche indique la cuticule nouvelle, la flèche indique la cuticule ancienne)
G : ♂3 région caudale montrant de fines soies sur les spécimens non traités aux ultrasons (noter le protozaire Suctoria)
(Echelles = 1 µm pour A, B, C et F ; 10 µm pour D, E, et G).

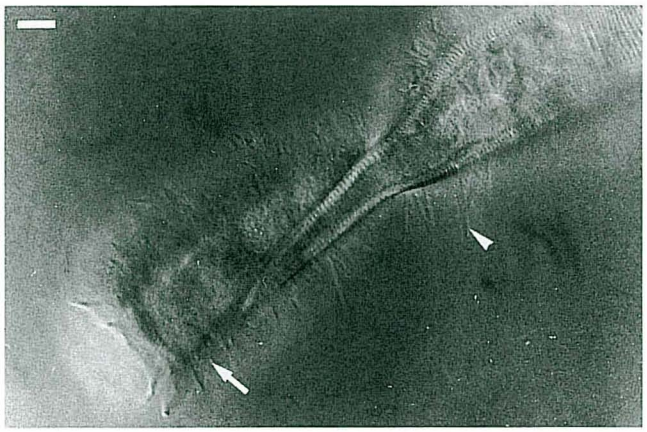

Figure 3. *Chromaspirina okemwai* sp.n.
♀3 posterior part, with a Protozoa attached to the tail, showing the filamentous microbial organisms covering the cuticle (arrow head indicates the filamentous organisms, arrow indicates the protozoa). (Scale bar indicate 10 µm)

Figure 3. *Chromaspirina okemwai* sp. n.
♀3 région postérieure, avec un protozoaire attaché à la queue, montrant la cuticule recouverte d'organismes microbiens filamenteux (la tête de flèche indique les organismes microbiens, la flèche indique le protozoaire). (Echelle = 10 µm).

ductive system is didelphic, amphidelphic with reflexed ovaries (Fig. 1A). The vulva is a pore while vagina vera is cuticular and vagina uterina muscular (Fig. 1A). The tail is also similar to that of the males (Fig. 1F).

Differential Diagnosis

Chromaspirina okemwai can be recognized by a combination of the following characters: four cephalic setae (labial sensilla are only visible by means of SEM), annulate head region and unispiral amphids. Male have arcuate spicules with a velum which has a shape typical for the species.

Chromaspirina okemwai can be distinguished from *C. dubia* and *C. lunatica* by the presence of denticles in the stoma in the latter two species. In *C. thieryi*, *C. pellitta*, *C. madagascariensis*, *C. lunatica* and *C. indica*, the terminal bulb has two plasmatic interruptions and in *C. crinita* there is only an expansion of the pharynx and no clear bulb. The presence of pre-cloacal supplements, which are lacking in *C. okemwai* distinguishes it from *C. chabaudi*, *C. multipapillata* and *C. parapontica*. The shape of the spicule capitulum in *C. okemwai* differs from those of *C. chabaudi*, *C. indica*, *C. madagascariensis* and *C. thieryi* which are more or less round to oval shaped, it differs from that of *C. dubia* which is hooked and from those of *C. pontica* and *C. parapontica* which are pointed proximally and not well set off.

Chromaspirina okemwai closely resembles *C. gerlachi* but differs from it in that *C. gerlachi* has a larger dorsal tooth, the labial sensilla are short conspicuous setae and the velum of the spicule is a simple curve. *Chromaspirina okemwai* also resembles *C. inglisi* but it differs from it in that *C. inglisi* is a long (1610-1620 µm) and a relatively thin (a = 43-48) species, it has long anterior sensilla; outer labial sensilla (which Warwick (1970) referred to as shorter cephalic setae) are 6 µm while the cephalic ones (which he referred to as longer cephalic setae) are 11 µm long.

Genus *Pseudochromadora* Daday, 1889

Type species: *Pseudochromadora quadripapillata* Daday, 1889

Emended diagnosis

Desmodorinae. Cephalic capsule well developed, consists of two parts: the apical part bears the four cephalic setae, the posterior part has the amphideal fovea. The fovea is unispiral, the spiral origin is obvious by its central spot. Lip region obviously cuticularized. No subcephalic setae on the cephalic capsule. Lateral alae present. Buccal cavity with one dorsal tooth. Terminal pharyngeal bulb is prominent and it is a fifth to a sixth of the pharyngeal length. Pore-like precloacal supplements can be present. A ventral row of stout pre-cloacal setae can be present in the male (Fig 5D).

List of valid species:

Pseudochromadora cazca (Gerlach 1956), 1963

Pseudochromadora quadripapillata Daday, 1889 syn. *Micromicron cephalatum* Cobb, 1920 and *Micromicron luticola* Timm, 1952

Pseudochromadora incubans Gourbault & Vincx, 1990

Pseudochromadora interdigitatum sp. n.

Pseudochromadora interdigitatum sp. n.

(Table 2, Fig. 4 A-J and 5 A-F).

Material studied, Five males, five females.
Holotype ♂ on slide no. 3892
Allotype ♀ on slide no. 3893
Paratype ♂*s,* on slide no. 3892, 3893, 248
Paratype ♀*s,* on slide no. 3893, 248

Type Locality

All the specimens were collected from intertidal sediments of the *Ceriops* mangroves Gazi Bay, Kenya (4° 25'S and 39° 50'E) on 17/06/1992. The sediments consist of fine sand (80%) and mud (15%).

Etymology

The species name is derived from latin, meaning criss-crossing finger-like structures. The name was chosen as it describes the nature of the body annules at the lateral alae.

Measurements: see Table 2

Table 2. Measurements of *Pseudochromadora interdigitatum* sp. n.

Tableau 2. Dimensions de *Pseudochromadora interdigitatum* sp. n.

	Hol.♂	Par.♂♂ n = 4		All.♀	Par.♀♀ n = 4	
		Min.	Max.		Min.	Max.
L	841	735	938	912	791	908
cs	3		4	4		4
amph%	21	20	30	24	21	26
aw	5	5	7	5	6	
hw	25	23	25	25	23	24
damph	10	10	14	6	5	6
dnr				74	71	84
bdnr				37	35	37
ph	139	106	142	137	133	147
bd	30	26	29	30	28	30
mbdph	37	36	40	41	37	41
mbd	40	40	44	67	49	62
dv				576	485	612
V				63	61	69
spic	45	44	46			
abd	29	22	31	20	20	21
gub	20	18	20			
t	94	88	94	81	74	82
a	21.3	18	21.5	13.7	14.3	16.2
b	6	5.9	7	6.6	5.9	6.5
c	8.9	8	10	11.3	9.6	12

Description

Males

Body cylindrical with blunt head end, curved anterior pharyngeal region and conical pointed tail (Fig. 4D). The cuticle is heavily annulated with prominent interannular spaces; each body annule is ornamented with a long conspicuous vacuole (Fig. 4F). A lateral field extends from approximately 30 µm posterior of the terminal bulb until the tail region. At the level of the lateral alae, body annules split up into two, three but mostly four narrow annules and interdigitate a short distance away from and towards the raised alae (Fig. 4F). Eight longitudinal rows of strong somatic setae (Fig. 4D). The head capsule is set off from the rest of the body and it consists of two parts; the anterior part is smooth and contains the lips with the six internal and six external tiny labial sensillae and four cephalic setae (Fig. 4C). The posterior part has vacuoles and contains the unispiral amphids (Fig. 5A), which look like two concentric circles.

The stoma has one large dorsal tooth and two small subventral ones. Cylindrical pharynx with slightly swollen buccal region and a terminal bulb with well developed valves (Fig. 4B).

The male reproductive system is monorchic with outstretched testis situated to the left of the intestine (Fig. 4D). Spicules are arcuate with a well developed funnel shaped capitulum and a velum (Fig. 4G). Gubernaculum is half as long as the spicules. There are 15-17 ventral precloacal thorn-like setae extending from the cloaca to about 125 µm anteriorly (Fig. 4D, G). A group of ventral copulatory thorns is found anterior to the thorn-like setae at around 125-163 µm anterior of the cloaca. Anterior to the copulatory thorns there is a ventral row of short single thorns (Fig. 4D, J), extending till the level of the tip of the testes (these single thorns are also found in females, Fig. 4I). The tail is conical with a non-annulated tip (non-annulated part about one fifth of the tail). A group of post-cloacal thorns at about half way the tail length (Fig. 5E). Three caudal glands terminate in a prominent spinneret.

Females

The body of most mature females appears swollen all along the reproductive system (Fig. 4I). The head capsule, anterior sensilla (Fig. 4A), stoma (Fig. 4H) and tail shape (Fig. 4E) are however similar to those of the males. The females only have the ventral row of single thorns that extends from the anterior region of the antepundendum (genital tubes proceeding anteriorly from the vulva), (Maggenti, 1981) to the vulva. The reproductive system is didelphic, amphidelphic with reflexed ovaries (Fig. 4I). The vagina vera is cuticularized and the vagina uterina is short. The tail lacks the post-cloacal thorns (Fig. 4E).

Differential diagnosis

Pseudochromadora interdigitatum is characterized by the position of the cephalic setae (located halfway on the first part of the head capsule); the heavily annulated cuticle; the lateral alae which are unique in the way the body annules split up in two, three, mostly four fine annules, just before the raised part of the alae and interdigitate with one another (in most other species the annules split into two or three).

Pseudochromadora interdigitatum closely resembles *P. cazca* Gerlach, 1956 but differs from it in the shape of the spicule; *P. interdigitatum* sp. n. has a funnel shaped capitulum and it is ventrally pointed while in *P. cazca* the capitulum is triangular. The copulatory thorns are in three groups and they are raised in *P. cazca*. *Pseudochromadora interdigitatum* also resembles *P. incubans* Gourbault & Vincx, 1990 but differs from it in the position of the cephalic setae, which are situated at the second part of the cephalic capsule in *P. incubans*, and in the shape of the amphideal fovea, which is loop-shaped with a circular profile.

Discussion

Because of the emended diagnosis, a lot of the species originally in *Pseudochromadora* are transferred to other genera of Desmodorinae. The following species of the sub-

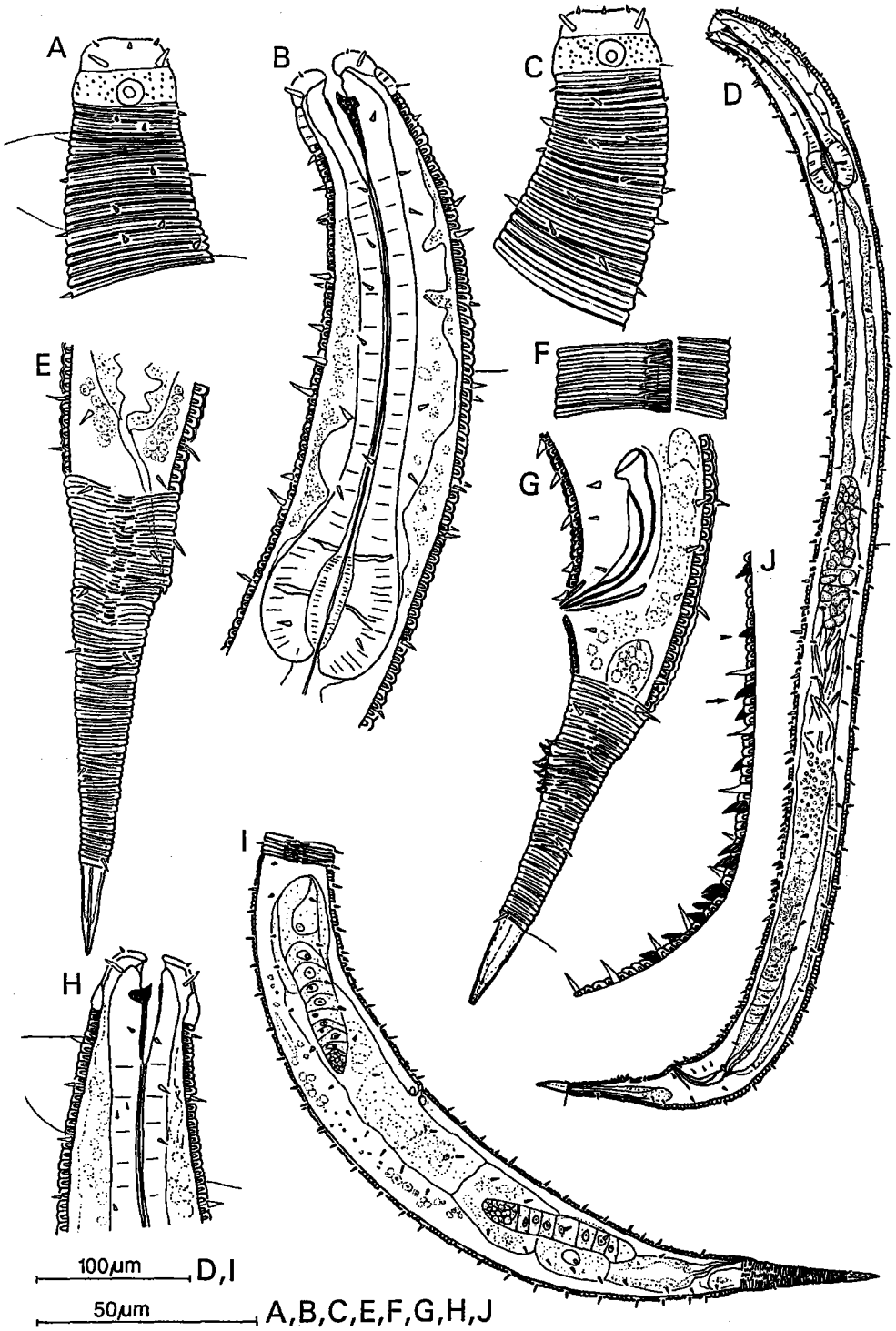

Figure 4. *Pseudochromadora interdigitatum* sp. n.

A: ♀1 head region
B: ♂1 pharynx
C: ♂1 head region
D: ♂1 habitus
E: ♀1 tail
F: ♂1 lateral alae
G: ♂1 tail
H: ♀1 stoma
I: ♀1 reproductive system
J: ♂3 thorns, copulatory thorns and thorn-like setae (arrow head indicates the last single thorn, arrow indicates the first copulatory thorn)

Figure 4. *Pseudochromadora interdigitatum* sp. n.

A : ♀1 région céphalique
B : ♂1 pharynx
C : ♂1 région céphalique
D : ♂1 habitus
E : ♀1 queue
F : ♂1 carène latérale
G : ♂1 queue
H : ♀1 région buccale
I : ♀1 appareil reproducteur
J : ♂3 épines, épines copulatrices et soies en forme d'épines (la tête de flèche indique la dernière épine isolée, la flèche indique la première épine copulatrice).

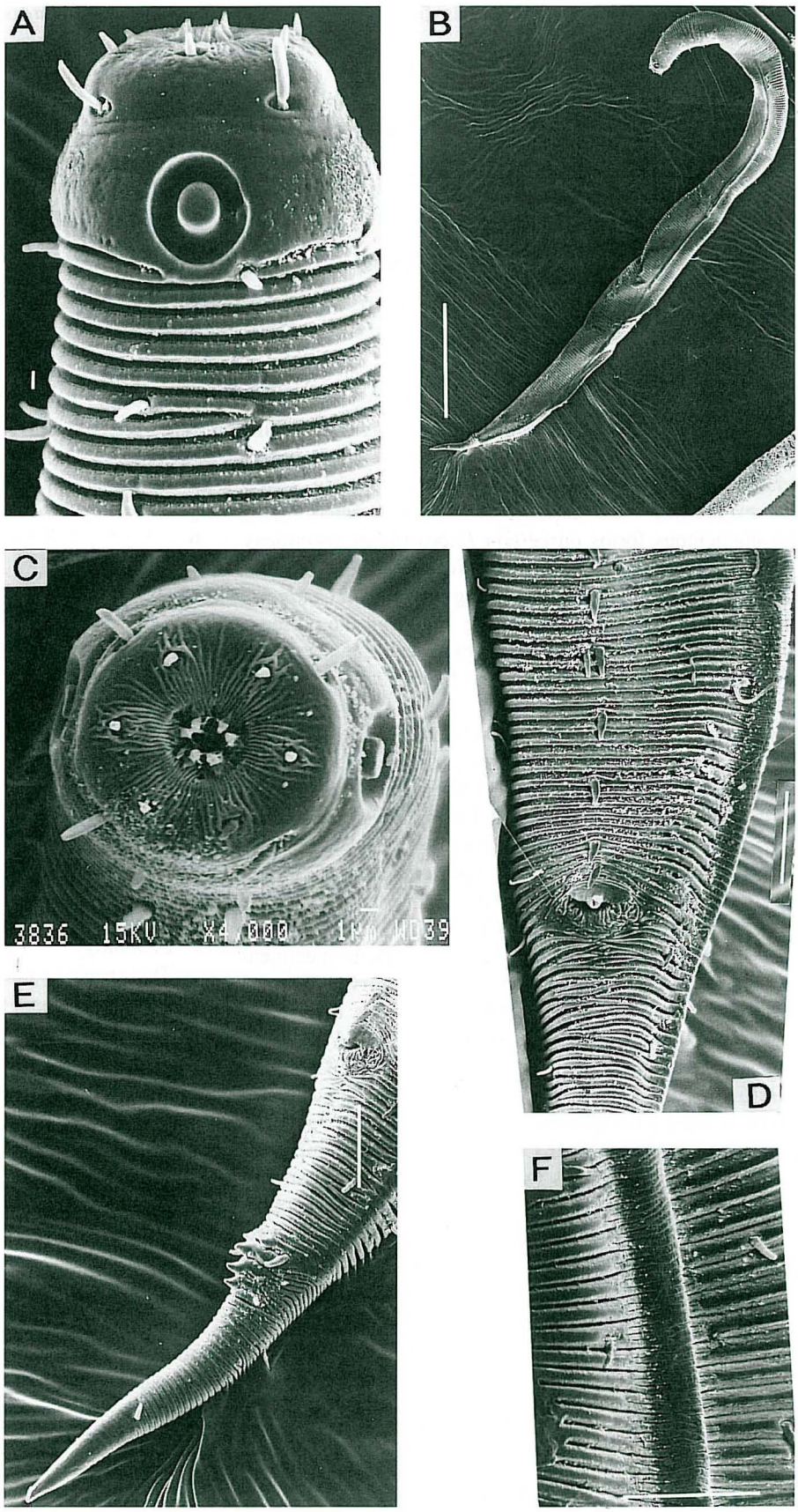

Figure 5. *Pseudochromadora interdigitatum* sp. n.
A: ♂2 head region on lateral view
B: ♂2 habitus
C: ♂2 head region anterior view
D: ♂2 ventral view showing pre-cloacal thorn-like setae and cloaca
E: ♂1 tail showing post cloacal thorns
F: ♀2 showing the lateral alae. (Scale bars indicate 1 µm in A, C; 10 µm in B, D, E and F)

Figure 5. *Pseudochromadora interdigitatum* sp. n.
A : ♂2 région céphalique en vue latérale
B : ♂2 habitus
C : ♂2 région céphalique vue antérieure
D : ♂2 vue ventrale montrant les soies pré-cloacales en forme d'épine et le cloaque
E : ♂2 queue montrant les épines post-cloacales
F : ♀2 montrant la carène latérale. (Echelles = 1 µm pour A et C; 10 µm pour B, D, E, et F).

genus "*Pseudochromadora*" are transferred to the genus *Desmodora*:

Desmodora brachypharynx (Allgén), 1947
Desmodora campbelli (Allgén), 1932
Desmodora coniseta (Schuurmans & Steckhoven), 1950
Desmodora deconincki (Inglis), 1968
Desmodora microchaeta (Allgén), 1922
Desmodora pontica (Filipjev), 1922

Genus *Eubostrichus* Greeff, 1869

Type species: *Eubostrichus filiformis* Greeff, 1869

Diagnosis

The diagnosis of *Eubostrichus* is based on that of Platt & Warwick (1988) and Hopper & Cefalu (1973).

The microbial associations of *Eubostrichus* are filamentous and crescent forms, while those of *Catanema* (a related genus) are coccoid forms (Hopper & Cefalu, 1973). However, some coccoid forms have been detected among the filamentous forms on certain *Eubostrichus* specimens. (This is also the case in the North Sea specimens). *Eubostrichus* can therefore be distinguished from *Catanema* (synonym *Robbea*, Platt and Zhang 1982), by the presence of an annulation at the cephalic capsule and the absence of a well developed anterior muscular buccal bulb, present in *Catanema*.

Eubostrichus was first described from the English channel by Greeff (1869). Up to now, eight species are described in that genus, *i.e. E. gerlachi* (Hopper and Cefalu, 1973) Platt & Zhang, 1982; *E. filiformis* Greeff, 1869; *E. parasitiferus* Chitwood, 1936; *E. phalacrus* Greeff, 1869, *E. dianeae* Hopper & Cefalu, 1973, *E. africanus* sp.n., *E. longosetosus* sp. n. and *E. hopperi* sp. n.

Eubostrichus parasitiferus Chitwood, 1936 has been redescribed by Hopper & Cefalu (1973). Their specimens were characterized by the presence of eight cervical setae at the anterior border of the amphid and eight behind the amphid; the body length varies between 2140 and 2680 µm. The original description of *E. parasitiferus* by Chitwood (1936) only mentioned twice 4 cervical setae and a shorter tail (c' = 2.5-2.6 for specimens of Chitwood; c' = 3.4-4.9 in specimens of Hopper and Cefalu, 1973). *E. parasitiferus* sensu Gerlach (1963) has two strong porids and two fine ones posterior to the cloaca while the specimens of Hopper & Cefalu have three strong and two fine porids. Therefore, we consider *E. parasitiferus* as described by Hopper and Cefalu (1973) as a new species and we propose the name *Eubostrichus hopperi* sp. n. The descriptions of Gerlach (1963, 1964) of *E. parasitiferus* conform with the original description of that species.

Eubostrichus africanus sp. n.

Tab. 3, Fig. 6 A-G

Material studied, three males, five females.

Table 3. Measurements of *Eubostrichus africanus* sp.n.
Tableau 3. Dimensions de *Eubostrichus africanus* sp. n.

	Hol.♂	Par.♂♂ n = 2		All.♀	Par.♀♀ n = 4	
		Min.	Max.		Min.	Max.
L	3 392	3 105	3 381	3 623	3 657	3 854
cs	6	6	6	6	6	8
hw	16	15	18	6	16	19
ph	99	87	99	88	85	98
bd	16	14	16	15	15	16
mbdph	19	17	19	18.7	19	19
mbd	19.8	17	19	22.9	20	23
dv				1 733	1 642	1 806
V				47.8	45	47
spic	33	31	32			
abd	19	16	16	13	12	13
gub	19	17	19			
t	68	60	74	78	64	81
a	174	176.1	187.1	158	160.3	194.6
b	34	34.2	35.5	41	39.4	43.1
c	50	45.8	51.5	46	45.3	58.8

Holotype ♂ on slide no. 3894
Allotype ♀ on slide no. 3895
Paratype ♂*s* on slide no. 3895
Paratype ♀*s* on slide no. 3894, 3895

Type locality

All specimens were collected from intertidal sediments of the *Ceriops* mangroves in Gazi Bay, Kenya (4° 25'S and 39° 50'E) on 17/06/1992. The sediments consist of fine sand (80%) and mud (15%).

Etymology

This species name is derived from the name of the continent (Africa) where the type material was collected.

Measurements: see Table 3

Description

Males

Body filiform with blunt anterior end and cylindrical tail. Anterior cervical region slightly swollen (Fig. 6C). Cuticle with very fine striations (Fig. 6B) and sometimes symbiotic bacteria attached in a typical *Eubostrichus* association. Anterior labial sensilla are tiny setae hardly visible with the light microscope. Four cephalic and four cervical setae of the same length (Fig. 6B) located at the level of the amphids; four more cervical setae immediately posterior to the amphids and eight to ten other cervical setae located 20 µm posterior to the amphids. Amphids spiral but not distinct. Stoma small without teeth. Pharynx with a pyriform terminal bulb (Fig. 6C). Cardia not distinct. Male reproductive system monorchic; testis outstreched located to the right

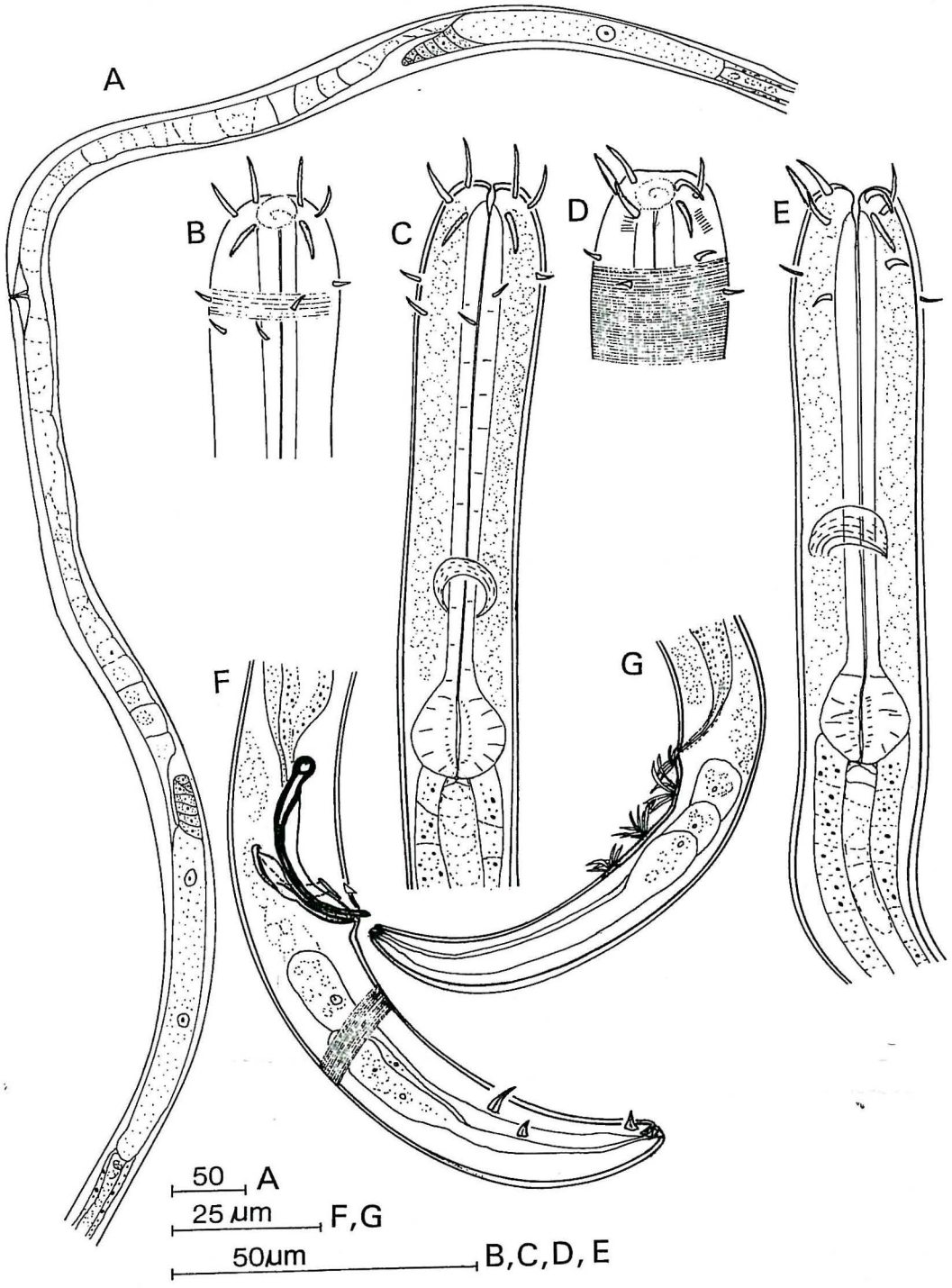

Figure 6. *Eubostrichus africanus* sp. n.
A: ♀1 reproductive system
B: ♂1 head region
C: ♂1 pharynx
D: ♀2 head region
E: ♀2 pharynx
F: ♂1 tail
G: ♀2 tail

Figure 6. *Eubostrichus africanus* sp. n.
A : ♀1 appareil reproducteur
B : ♂1 région céphalique
C : ♂1 pharynx
D : ♀2 région céphalique
E : ♀2 pharynx
F : ♂1 queue
G : ♀1 queue

of the intestine; it contains small rounded to oval shaped sperm cells. Spicules arcuate with a rounded capitulum (Fig. 6F). Gubernaculum about half as long as the spicules and hooked distally and narrow proximally. Subventrally, short broad precloacal setae and five pairs of special strong setae, that are referred to as porids by Hopper and Cefalu (1973) (porids = tubular setae serving as outlets for glands, Cobb 1925), are found at the end of the conical tail (c' = 3.6 and 4.3) (Fig. 6F). The three caudal glands open through a spinneret.

Females

Females are similar to males in general body shape, anterior sensillae (Fig. 6D), cervical setae and pharyngeal region (Fig. 6E). Reproductive system is didelphic, amphidelphic with reflected ovaries (Fig. 6A). Vulva and vagina simple. Tail lacks setae and is more slender (c' = 5) than in males (Fig. 6G).

Differential diagnosis

Eubostrichus africanus has a finely striated body cuticle, slightly swollen anterior cervical region, labial sensillae, tiny setiform, hardly visible with the light microscope, while the four cephalic setae are as long as the four cervical ones. Five pairs of `porids' subventrally at the tail end in the males.

Eubostrichus africanus can be distinguished from all other described species by its slightly swollen anterior cervical region. It differs from *E. filiformis* by the total length (discussion) and from *E. phalacrus* by the length of the cephalic and cervical setae (discussion). It differs from *E. dianeae* in the number and position of the cervical setae (16 setae that are close to the amphid in *E. dianeae*), the pyriform terminal bulb and the broad spicule with a flat capitulum in *E. dianeae*. *Eubostrichus hopperi* sp. n. has longer cephalic and cervical setae and the amphideal fovea in the male are also wider compared to those of *E. africanus*. *Eubostrichus parasitiferus* sensu Gerlach (1963), has two strong porids and two fine ones on the tail and it is shorter and wider (table 5) compared to *E. africanus*. *Eubostichus africanus* closely resembles *E. longosetosus* sp. n., but differs from it in that *E. longosetosus* has long cephalic and cervical setae and large sperm cells.

***Eubostrichus longosetosus* sp. n.**

Tab. 4, Fig. 7 A-I

Material studied, Two males, one female.
Holotype ♂ slide no. 3896
Allotype ♀ slide no. 3897
Paratype ♂ slide no. 249

Type locality

Southern Bight of the North Sea; three localities (51° 28'N and 02° 15'E; 51° 19'N and 02° 40'E; 51° 15'N and 02° 37'E) along the Belgian coast at water depths of 32 m, 15 m and 14 m respectively. The sediment composition was 15.3% gravel, 0.93% silt and the median of the sand fraction was 255 µm diameter for the first locality, 3.42% gravel, 0.3% silt and the median of the sand fraction was 654 µm diameter for the second locality while the last locality had no gravel, 0.15% silt and the median of the sand fraction was 211 µm diameter.

Table 4. Measurements of *Eubostrichus longosetosus* sp.n.
Tableau 4. Dimensions de *Eubostrichus longosetosus* sp. n.

	Hol.♂	Par.♂ n = 1	All.♀
L	2 670	2 985	3 145
cs	14	14	11
hw	13	14	
dnr	54	54	
ph	104	109	87
mbdph	17		21
mbd	16	19	26
dv			1 503
V			48
spic	30	29	
abd	16	18	19
gub	13	16	
t	76	88	89
a	157	157.1	121
b	25.6	25.6	36.1
c	35.7	33.9	35.3

Etymology

The species name is derived from Latin meaning long setae. This name was chosen as it describes the nature of the cephalic setae.

Measurements: see Table 4

Description

Males

Body filiform with blunt head end and blunt tail (Fig. 7A). Cuticle very faintly annulated (33 annules per 10 µm in the amphidial region and 15 annules over 10 µm from the cervical to posterior end); annulation starts at the level of the cephalic setae and ends at the rounded tail tip. The six inner labial sensillae were not found; the six outer labial sensilla are tiny setae, with a rather broad basis (i.e. they are more or less conical); the four cephalic setae are more or less at the same level with the four cervical setae, both at anterior level of the amphidial fovea (Fig. 7B and 6C). Four other cervical setae are present immediately behind the amphid. At 20-27 µm from the front end, there are four to eight other obvious cervical setae.

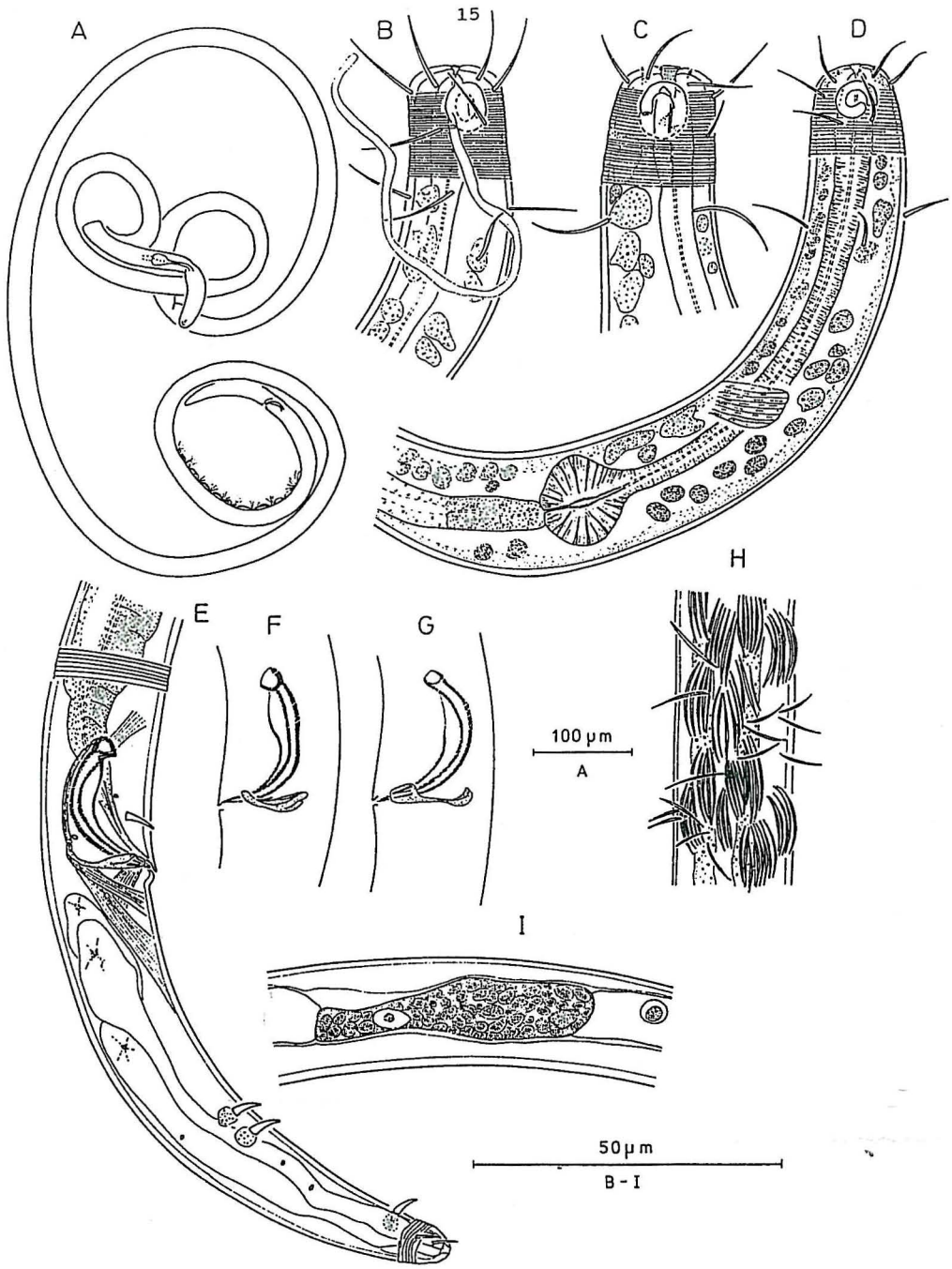

Figure 7. *Eubostrichus longosetosus* sp. n.
A: ♂2 habitus
B: ♂1 head region
C: ♂2 head region
D: ♀1 head region
E: ♂2 tail
F: ♂1 left spicule
G: ♂1 right spicule
H: ♀1 crescent-shaped microbes around mid body
I: ♂1 sperm cell

Figure 7. *Eubostrichus longosetosus* sp. n.
A: ♂2 habitus
B: ♂1 région céphalique
C: ♂1 région céphalique
D: ♀1 région céphalique
E: ♂2 queue
F: ♂1 spicule gauche
G: ♂1 spicule droit
H: ♀1 bactéries en forme de croissant dans la région moyenne du corps
I: ♂1 spermatozoïde

Numerous epidermal gland cells are spread over the whole body length in eight longitudinal rows. The amphidial fovea are spiral, loop shaped and ventrally wound; the corpus gelatum may be extruded and is then visible as a very long ribbon-like structure (88 µm in δ_1); the anterior border of the amphidial fovea is more heavily sclerotized than the posterior border which is not so pronounced (Fig 6B). Buccal cavity slit-like, very small and without teeth. Pharynx very narrow except for the well developed rounded muscular terminal bulb. In its anterior part, the pharynx is slightly broader than in the middle part. Cardia very long (16 µm) with no clear cellular structure. Nerve ring at 54% of the neck length (Fig 6D).

Monorchic with outstretched testis located to the right of the intestine. Very large sperm cells, i.e. 45 µm long and 9 µm wide with granular appearance are present at the posterior end of the testis (Fig. 7I). Spicules consist of three strongly sclerotized ribs from which the ventral one is often less developed. Depending on the angle of view, the capitulum is open or closed on its proximal part; distal tip pointed (Fig. 7F, G). Spicular protractor muscles extend between the dorsal part of the gubernaculum and between the ventral part of the capitulum and the ventral body wall (Fig. 7E). Gubernaculum is 13 µm (δ_1) or 16 µm (δ_2) long and is provided with strong protractors and retractors.

One thick precloacal subventral seta is present at both sides. Three pairs of caudal subventral thick ('porids') setae are also well-developed on the tail (Fig. 7E). These are in connection with the underlying gland cells. The tail has a blunt tip on which two pairs of setae are found; three caudal glands are present and open through a rather broad terminal opening. The body is surrounded by numerous crescent-shaped bacteria which considerably hide the internal structures (Fig. 7H).

Females

No drawings were made of the single female found, because many structures were completely hidden by the bacteria (even the head end). Following observations were made:

- strong setae are absent on the tail;
- two reflexed ovaries (anterior, located on the right, posterior, located on the left, of the intestine) are present.

Differential Diagnosis

Eubostrichus longosetosus is characterized by the presence of four cervical setae at the same level as the cephalic setae, by eight cervical setae, four in front of the amphid and four immediately behind it; the body is very slender (a = 121-157) and the tail is rather long (c' = 4.7-4.9). *Eubostrichus longosetosus* is very similar to *E. parasitiferus* because of the arrangement of the anterior sensilla. However, *E. longosetosus* can be differentiated from *E. parasitiferus* by the presence of an additional row of cervical setae far behind the amphid, the number (three and four pairs respectively) of the setae ('porids') at the tail, the more slender body (a= 75-100 in *E. parasitiferus*) and the longer tail (c'= 2.5-2.6 in *E. parasitiferus*) (Table 5). *Eubostrichus longosetosus* also resembles *E. hopperi* but differs from it in that *E. hopperi* has eight cervical setae in front and behind the amphid. *Eubostrichus longosetosus* differs from *E. dianea* in the shape of the terminal bulb, the short cardia and the copulatory apparatus (refer diagnosis for *E. africanus*). *Eubostrichus longosetosus* resembles *E. africanus* but it can be differentiated from it because of the shorter cephalic and cervical setae, the smaller sperm cells and the short and broad based tail setae ('porids') in *E. africanus*.

Table 5. Comparison of lengths, **a and c'** values of *Eubostrichus* species

Tableau 5. Comparaison des longueurs et valeurs **a et c'** des espèces de *Eubostrichus*.

	Length	a	c' ♂	c' ♀
E. africanus	3105-3854	158-195	3.6-4.3	5
E. longosetosus	2670-3145	121-157	4.8-4.9	4.7
E. parasitiferus	2800-2920	75-100	2.5-2.6	3.5
E. hopperi	2140-2680		3.4-3.9	4.5-4.9
E. gerlachi	3690	70	1.7	1.8
E. dianeae	2550-3370	53-55	2.4	2.7

Discussion

Eubostrichus longosetosus is the first new species described, since 1869, from a site adjacent to the type locality of the first described species, *E. phalacrus* Greeff, 1869. Two undescribed *Eubostrichus* species were reported by Boucher (1980) from a close by site. Important differences are however present between *E. longosetosus* and other *Eubostrichus* species; *E. phalacrus* is characterized by very long cephalic setae (about 1.5-2 times the cephalic diameter) while these are about a third head diameter in *E. africanus* and one head diameter in *Eubostrichus longosetosus*. *Eubostrichus filiformis* seems to lack (?) cephalic setae (not drawn and not mentioned in the description) and moreover it is about 8 mm long, while the new species from the *Ceriops* sediments, *E. africanus*, is about 4 mm, and the one from the North sea, *E. longosetosus,* is less than 4 mm long.

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