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Namibnema papillata gen. et sp.n. and *Axonolaimus deconincki* sp.n. (Nematoda, Axonolaimoidea) from marine and estuarine beaches of southern Africa

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Namibnema papillata gen. et sp.n. is closely related to *Nicascolaimus punctatus* Riemann, 1986. The presence of twelve stomatal rugae, the punctated cuticle and the shape of the pre-anal supplements indicate a relationship with species of the Chromadorina. *Axonolaimus deconincki* sp.n. is characterized by the complex nature of the gubernaculum.

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Introduction

Riemann (1986) described a new species, *Nicascolaimus punctatus*, which provided new arguments in favour of linking the Axonolaimidae with the Comesomatidae, as proposed by Lorenzen (1981) and Inglis (1983); these authors classified Axonolaimidae and Comesomatidae as members of the superfamily Axonolaimoidea.

Among nematode specimens from marine and estuarine beaches of southern Africa two new species were found, one of which, *Namibnema papillata* gen. et sp.n., is closely related to the genus *Nicascolaimus* Riemann, while the other is a new species of *Axonolaimus* de Man.

Material and methods

Nematodes were collected in 1986 and 1987 along the entire length (16 km) of the Sundays river estuary. Samples were taken at LWS and MWS.

Stratified samples (0–15 cm, 15–30 cm, 30–45 cm and 45–60 cm) were taken from Langstrand (S.W.A.) during July 1986 and from Cape Receife Beach (R.S.A.) during 1987. A copper corer with a diameter of 3.6 cm was used.

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

Drawings were made with the aid of a drawing tube on a Leitz Dialux 20 microscope with interference contrast equipment.

All measurements are in μm; curved structures are measured along the arc. Values in the formulae (measurements) are as in Vincx *et al.* (1982).

Holotypes male and one paratype female of each species are in the nematode collection of the Instituut voor Dierkunde, Gent, Belgium. Other paratypes are in the same collection or in the Department of Zoology, University of Port Elizabeth, Port Elizabeth, Republic of South Africa.

Namibnema gen.n.

Generic diagnosis. Axonolaimidae. Cuticle obviously annulated with punctations between the annules; ring-like pores absent; lateral field provided with longitudinal rows of more pronounced punctations; buccal cavity conical; large cup-shaped, chromadorid supplements; gubernaculum with two strongly sclerotized apophyses.

Type species: *Namibnema papillata* sp.n.

Namibnema papillata sp.n. (Figs. 1–2)

Type material. Three males, 2 females. Holotype male on slide no. 955; 1 paratype female on slide no. 956.

Type locality. Langstrand, Bay of Cusp, Namibia (S.W.A.), (22°04'S, 14°10'E), 15–30 cm HWS.

Other localities. Cape Receife Beach, Port Elizabeth, South Africa, 34°O'30"S, 22°41'30"E, (6 m above LWS, 1–15 cm; 15–30 cm above LWS and 12 m above LWS, 45–60 cm).

Measurements

Holotype (δ_1)

–	99	99	189	M	1934	2040 μm
12	24	24	25	29	29	

$a = 70.3$ $b = 10.8$ $c = 19.2$ $c' = 3.7$ *spic* = 39 μm

Paratype (φ_1)

–	93	97	174	1017	1642	1742 μm
12	23	23	23	24	23	

$a = 72.6$ $b = 10.0$ $c = 17.4$ $c' = 4.3$ $V = 58.4\%$

Other paratypes

	$\delta\delta$ ($n = 2$)	φ ($n = 1$)
L:	1677; 2042	1682
a:	69.0; 79.4	73.6
b:	10.2; 11.5	9.6
c:	16.3; 21.7	19.6
c':	4.2; 3.6	3.8
spic/*V*:	39; 37	60.6

Description

Males. Body cylindrical, slightly narrowing to its head end

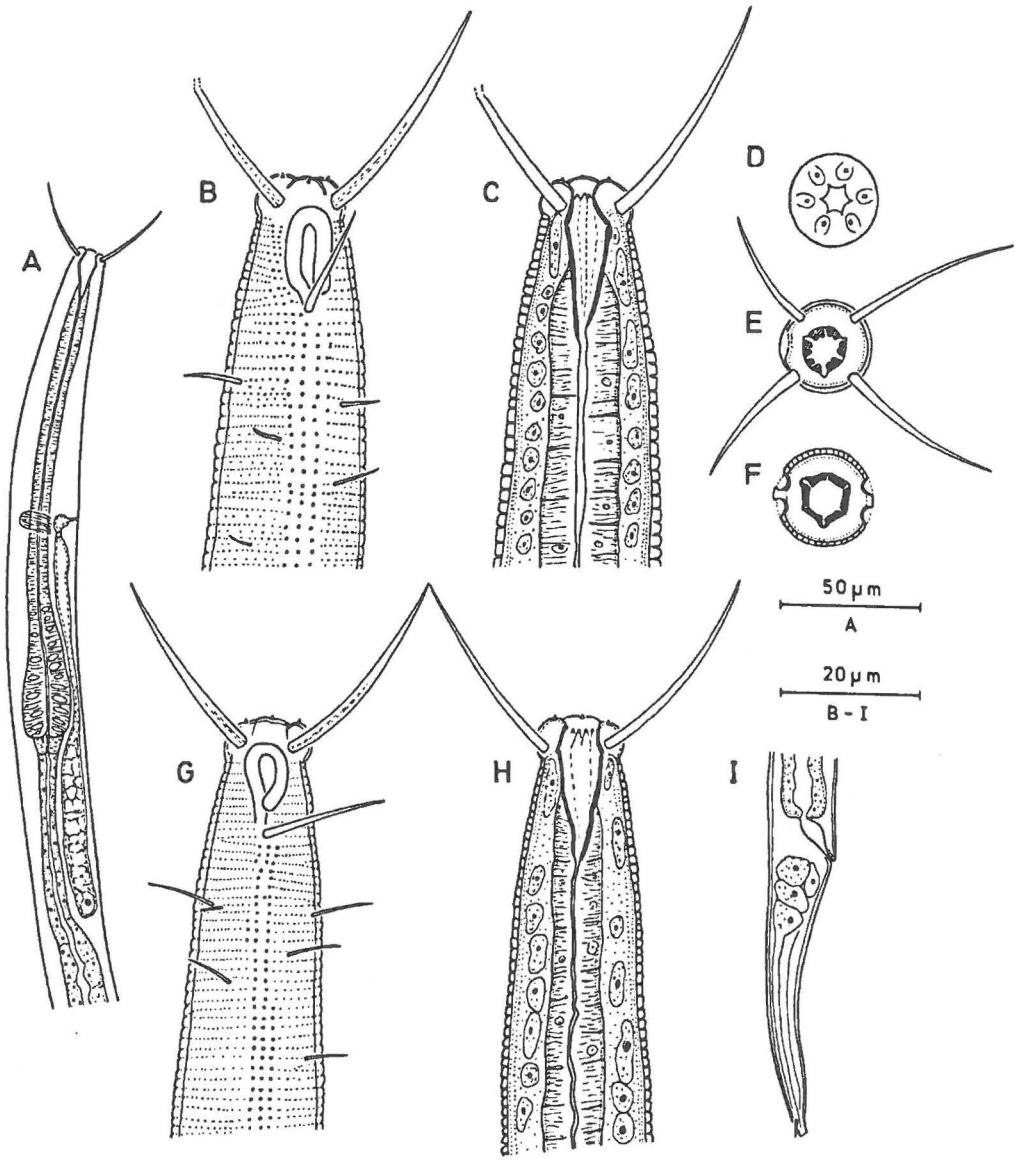

Fig. 1. Namibnema papillata gen. et sp.n.—*A*. Anterior end ♀$_1$.—*B*. Head end (surface view) ♂$_1$.—*C*. Head end (buccal cavity) ♂$_1$.—*D*. Apical view (lip region).—*E*. Transverse section (level of cephalic setae).—*F*. Transverse section (amphideal level).—*G*. Head end (surface view) ♀$_1$.—*H*. Head end (buccal cavity) ♀$_1$.—*I*. Tail ♀$_1$.

with a cylindro-conical tail.

Cuticle obviously annulated between level of cephalic setae and tail tip; borders of annules consisting of prominent punctation rows; punctations in the lateral field larger and more pronounced and arranged in 2 (cervical region) or 3 (remainder of the body) longitudinal rows (Figs. 1B, G). Each annule bearing also a row of smaller points in some specimens; 10 annules occupying a distance of 17 µm.

Internal labial sensilla not found (not even in apical view; cf. Fig. 1D). The 6 external labial sensilla papilliform, situated on tops of the 6 swollen lips. Lips surrounding a hexaradial cheilostome. The 4 cephalic setae 27–30 µm long (i.e., 2.3–2.5 × corresponding body diameter, *c.b.d.*), situated at anterior border of amphideal fovea.

A lateral post-amphideal seta (20 µm long) situated close to canalis of amphid. Somatic setae present throughout body length, arranged in 6–8 rows; setae more numerous and larger in cervical region and on ventral side of tail. Dorsal tail tip bearing 1 long (17–20 µm) and 1 very short (2 µm) seta (Fig. 2A).

Amphideal fovea elongated loop-shaped, ventrally wound and with distinct contours; 12 µm long, 7 µm wide (i.e. 14% of c.b.d.).

Buccal cavity deep conical, consisting of two parts: anterior part 4 µm long, composed of 6 plates each with 2 ridges (Fig. 1E) ending in 12 small teeth at the apical side (Fig. 1C); posterior part conical, 16 µm deep, consisting of 6 plates; pharynx surrounding posterior half of posterior part of buccal cavity.

Pharynx very muscular with pyriform terminal bulb.

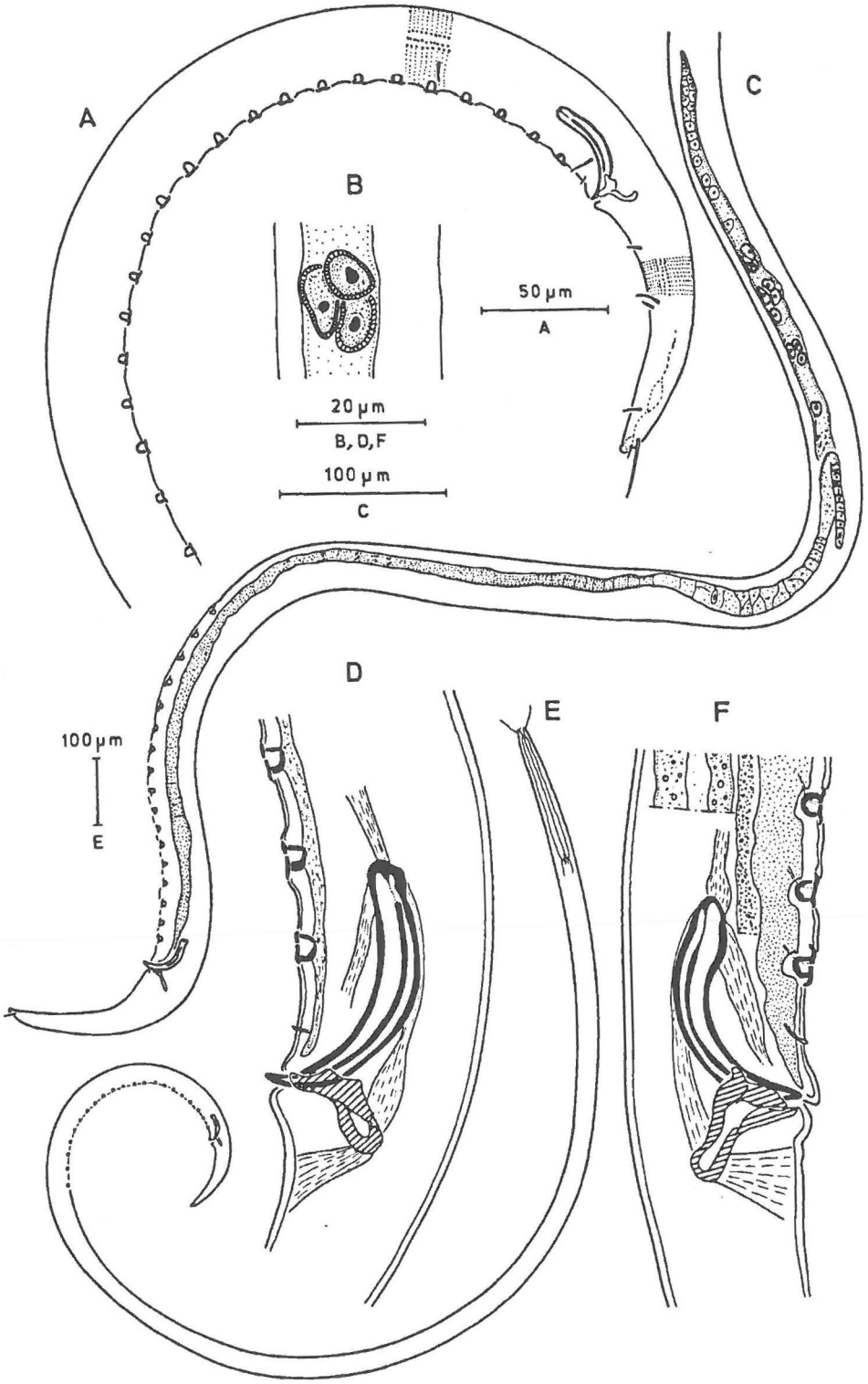

Fig. 2. Namibnema papillata gen. et sp.n.—*A*. Tail region ♂1.—*B*. Sperm cells ♂2.—*C*. Genital system ♂2.—*D*. Copulatory apparatus ♂1.—*E*. Total view ♂1.—*F*. Copulatory apparatus ♂3.

Cardia 7 µm long (Fig. 1A).

Nerve ring situated at 52% of pharyngeal length.

Ventral gland prominent; ampulla opening at level of nerve ring.

Diorchic; anterior testis outstretched, situated to the left of intestine; posterior testis with reflexed top and situated to the right of intestine. Sperm cells oval, 8–12 µm long with refractive nuclei and striated outer protoplasm (Figs. 2B, C).

Spicules equal, regularly curved with median stiffening

piece and weakly developed capitulum. Musculature prominent. Gubernaculum consisting of a median plate supporting distal part of spicules, and 2 well sclerotized apophyses (10–16 μm long). 16–21 cup-shaped, pre-anal supplements situated between 18–22 μm and 250–376 μm from cloacal opening, with 12–15 μm intervals. Supplements connected with 1(?) large ventral gland with a fine granular content. Halfway between posterior-most supplement and cloacal opening, a tubiform papilla is present and also connected with that gland (Figs. 2D, F).

Tail cylindro-conical, with 3 caudal gland cells; spinneret 2–3 μm long.

Females. Very similar to males except for following characteristics: fewer setae on tail; only 1 short dorsal seta (6 μm) near tail tip (Fig. 1I).

Both females are very young and have a weakly developed genital system: didelphic with outstretched ovaries; anterior one to the right, posterior one to the left of intestine.

Specific diagnosis. Namibnema papillata is characterized by very long cephalic setae, a lateral post-amphideal seta, 16–21 cup-shaped pre-anal supplements in the males and a sexual dimorphism in the setation of the tail.

Differential diagnosis. The new species is closely related to *Nicascolaimus punctatus*, as indicated by the presence of a conical buccal cavity, a loop-shaped amphideal fovea and the punctated cuticle.

However, the following important differences justify the erection of a new genus for our new species.

Namibnema papillata: (1) has very big pre-anal supplements which resemble those of most Chromadoridae spp.; (2) has no pharyngeal marginal tubes immediately behind the stoma, as are present in *N. punctatus* and in most Comesomatidae; (3) lacks the ring-shaped cuticular pores present in *N. punctatus* and in some Comesomatidae and Chromadoridae and in most Cyatholaimidae.

Discussion

The presence of twelve stomatal rugae (on six plates), the punctated cuticle and the shape of the pre-anal supplements indicate a relationship between the new species and species of the Chromadorina: according to Lorenzen (1981) the 12 stomatal rugae are the holapomorphic character for the Chromadorina.

On the other hand, there is no doubt that the general body shape, the shape of the buccal cavity, the arrangement of the anterior setae, the loop-shaped amphid and the structure of the genital system indicate that the new species belongs to the Axonolaimidae, where it does not fit in any of the existing genera (cf. Differential diagnosis). Moreover, Chitwood & Chitwood (1950: 71) have already mentioned that "12 weak longitudinal sclerotizations of the cheilostom are usually evident in *Axonolaimus* species. In *Odontophora angustilaima* these 12 sclerotizations are anteriorly fused forming 6 large outwardly acting odontia." However, the generalization of this character within the Axonolaimoidea should be affirmed for the other genera too. The 12 stomatal rugae are therefore no longer considered as the holapomorphic character for the Chromadorina.

The relationship with the Comesomatidae is less clear, because of the absence of the marginal pharyngeal tubes and the shape of the pre-anal supplements.

The existence of this new species weakens the relationship between the Axonolaimidae and the Comesomatidae.

Nevertheless, the resemblances with *Nicascolaimus punctatus*, which is considered as an intermediate species between the Axonolaimidae and the Comesomatidae (Riemann 1986) is very striking.

Axonolaimus de Man, 1889

Axonolaimus deconincki sp.n. (Figs. 3–4)

Type material. Five males, 5 females. Holotype male on slide no. 957, 1 paratype female on slide no. 958.

Type locality. Sundays River estuary (LWS and 20 m above LWS, respectively); sand, salinity 35‰; 0.5 km from mouth.

Other localities. Sundays River estuary (LWS and 3 m above LWS, respectively); moderate clay, salinity 21‰; 7 km from mouth.

Measurements

Holotype (δ_1)

$$\frac{-\ ?\ 161\ 271\ M\ 1696}{13\ ?\ 31\ 31\ 35\ 35}\ 1923\ \mu m$$

$a = 54.9$ $b = 7.1$ $c = 8.5$ $c' = 6.5$ $spic = 45\ \mu m$

Paratype (φ_1)

$$\frac{-\ ?\ 145\ 275\ 970\ 1661}{13\ ?\ 32\ 33\ 48\ 31}\ 1862\ \mu m$$

$a = 38.8$ $b = 6.8$ $c = 9.3$ $c' = 6.6$ $V = 52.1\%$

Other paratypes

	$\delta\delta$ (= 4)	$\varphi\varphi$ (n = 4)
L:	1871–1949	1858–1958
a:	39.8–48.0	35.8–39.5
b:	6.6–7.5	6.8–7.4
c:	9.0–9.2	9.3–10.0
c':	4.8–5.9	5.6–6.4
spic/V:	41–47	52.9–56.7

Description

Males. Body cylindrical with tapering head end and cylindrical tail.

Cuticle very faintly annulated between posterior part of amphideal fovea and tail tip; 10 annules occupying a distance of 18 μm (Fig. 3C).

Internal labial sensilla not found, not even in apical view.

The 6 external labial sensilla papilliform, situated on tops of 6 slightly swollen lips. The 4 cephalic setae 12–14 μm long, situated at anterior border of amphideal fovea. Four rows of cervical setae present (each row consisting of 2 setae); setae 7–12 μm long, situated at level posterior to buccal cavity.

Somatic setae arranged in 4–6 rows over whole body, but especially numerous in cervical and tail regions. Numerous setae present on ventral side of whole tail and on dorsal side of posterior part of tail.

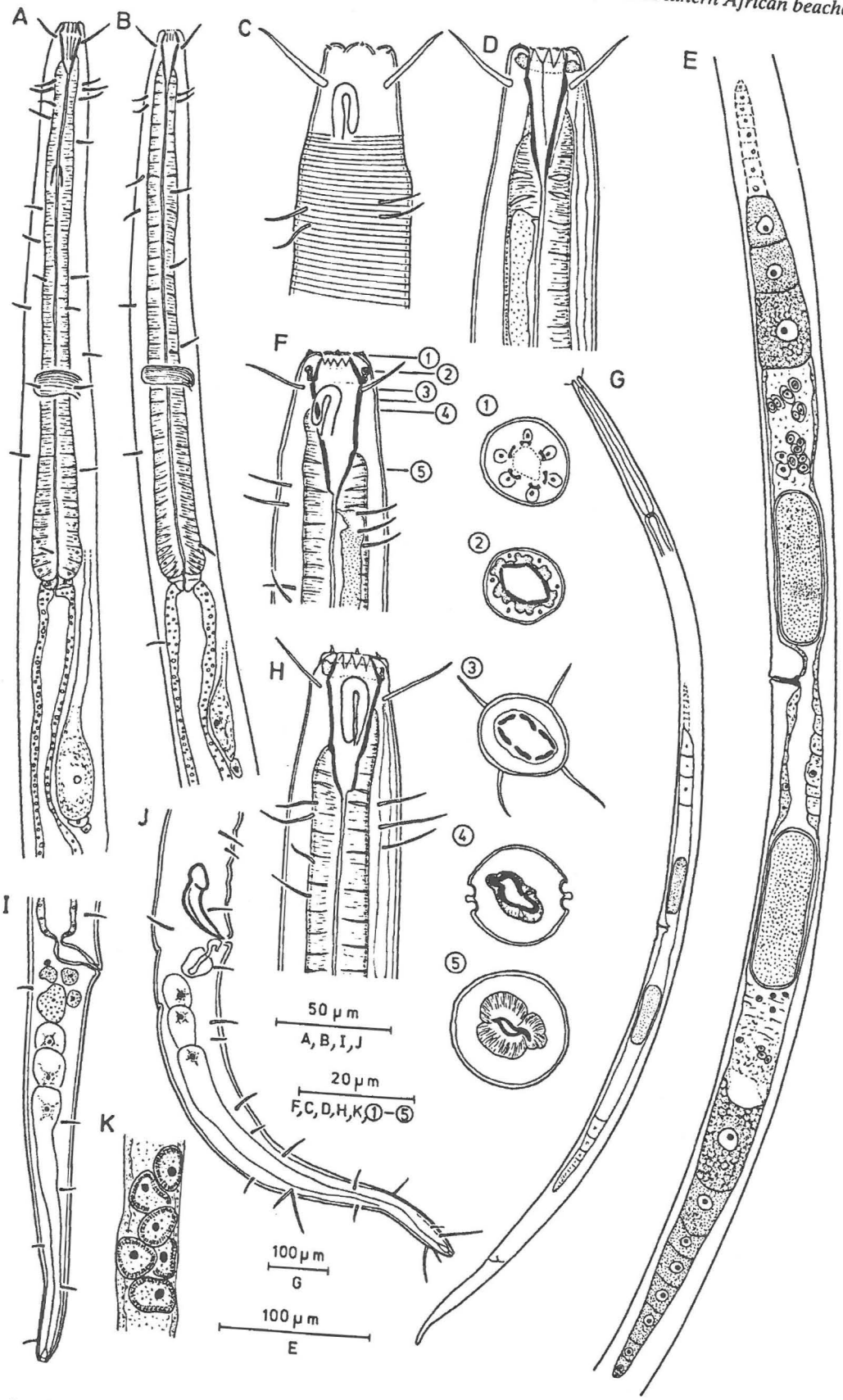

Fig. 3. Axonolaimus deconincki sp.n.—*A*. Pharyngeal region ♀$_2$.—*B*. Pharyngeal region ♂$_1$.—*C*. Head end (surface view) ♂$_1$.—*D*. Head end (buccal cavity) ♂$_1$.—*E*. Genital system ♀$_5$.—*F*. Head end ♀$_1$, *1–5* transverse section at different levels of *F*.—*G*. Total view ♀$_5$.—*H*. Head end ♀$_2$.—*I*. Tail ♀$_2$.—*J*. Tail ♂$_1$.—*K*. Sperm cells ♂$_1$.

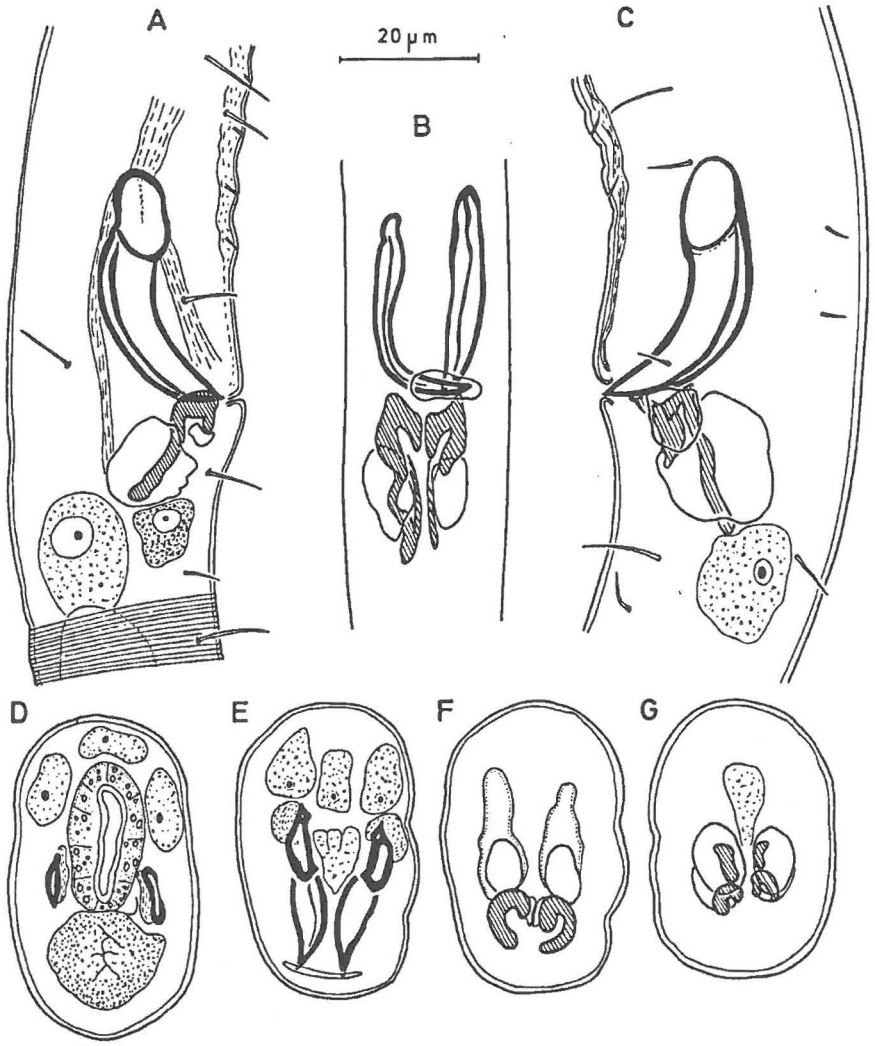

Fig. 4. Axonolaimus deconincki sp.n.—*A*. Lateral view copulatory apparatus δ_1.—*B*. Ventral view copulatory apparatus δ_5.—*C*. Lateral view copulatory apparatus δ_4.—*D*. Transverse section at the level of the spicular capitulum.—*E*. Transverse section through the shaft of the spicules.—*F*. Transverse section at the anterior level of the gubernaculum.—*G*. Transverse section at the posterior level of the gubernaculum.

Amphideal fovea elongated loop-shaped, ventrally wound, 10–16 µm long, 4–5 µm wide (i.e. 36–38% of c.b.d.); fovea situated at level of buccal cavity.

Buccal cavity conical, whole length 22–26 µm. Three parts can be recognized: anterior part very short, consisting of 6 plates (Fig. 3F2) and surrounded by a sclerotized ring formed by 6 fused plates, the latter plates each consisting of 2 sharply pointed parts (Fig. 3F1). Posterior part of buccal cavity much longer, can be divided into 2 regions: anterior region only partly surrounded by the pharyngeal tissue and consisting of 6 plates (Fig. 3F3), while posterior region completely surrounded by the pharyngeal tissue and consisting of 3 plates, which are not equally developed (Fig. 3F4). Dorsal sector and right ventro-sublateral sector of the surrounding pharynx larger than left ventro-sublateral sector (Fig. 3F5).

Pharynx very muscular, with a slightly swollen base. Cardia 7 µm long.

Nerve ring situated at 52–68% of pharyngeal length.

Ventral gland cell body very prominent, ventral pore probably situated in lip region (Fig. 3D), although not found in apical view.

Diorchic, with 2 opposed testes, anterior one to the left, posterior one to the right of intestine. Sperm cells globular (10 µm diameter) with bright nuclei and granulated outer protoplasm. Spicules equal, regularly curved with demarcated round capitulum and pointed distal tip; shaft provided with a median stiffening piece (Figs. 4A, C); in transverse section (Fig. 4E) the shaft is an hollow structure divided by a dorsal rib into 2 parts. Gubernaculum complex structure which is composed of two kinds of demarcations: one part yellow in glycerine slides (i.e. schematically striated in Figs. 4A–C, F, G) and consisting of 2 dorsal ribbon-like apophyses; their apical ends plate-like, supporting distal part of spicules. Two small ventral apophyses also present. Remaining part consisting of 4, in glycerine slides white, structures with a sclerotized appearance; these structures located on lateral side of each gubernacular apophysis.

Twenty-four or twenty-five ventral pre-anal tubuli con-

nected with a ventral gland. These supplements not always found (only when posterior region is ventrally curved).

Tail cylindro-conical with 3 caudal glands; spinneret weakly developed.

Females. Resembling males in most respects, except for somatic setation; the 4 rows of cervical setae consisting of 3 setae in dorso-lateral position and 4 setae in ventro-lateral position. Setae on tail shorter and less numerous than in males (see Figs. 3I, J).

Didelphic, amphidelphic, with outstretched ovaries; anterior tip of anterior ovary to right of intestine; remainder of genital tract situated to left of intestine. One egg 100 μm long, 32 μm broad; proximal part of uteri filled with sperm cells. Vagina well sclerotized, 18 μm long; vaginal musculature not obvious.

Diagnosis. Axonolaimus deconincki is characterized by the position, number, length and sexual dimorphism of the cervical setae, the elongated loop-shaped amphideal fovea, cylindro-conical tail, the complex nature of the gubernaculum and by the presence of 24–25 pre-anal supplements in the males.

Discussion

Except for the gubernacular structure, which is unique within the genus *Axonolaimus*, the new species resembles *A. drachi* Luc & De Coninck, 1959 (known from two females) and *A. paraponticus* Hopper, 1963 (known from males and females).

The head end of *A. drachi* resembles that of *A. deconincki*, except for the ventral pore, which is clearly situated at the amphideal level in *A. drachi*. The latter species is longer (2765–3020 μm) than the new species (<2000 μm). The amphideal fovea forms a closed loop in its posterior part in *A. drachi*, but is open in *A. deconincki*.

Axonolaimus paraponticus has the same body measurements as *A. deconincki*, but its cervical setae are fewer. Hopper (1963) also reported five eggs (47–57 μm long, 30–35 μm wide) in each uterus at a time, while *A. deconincki* females have only one (much longer) egg in each uterus at a time.

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