

## ***Papillonema danieli* gen. et sp.n. and *Papillonema clavatum* (Gerlach, 1957) comb.n. (Nematoda, Desmodoridae) from the *Ceriops* mangrove sediments of Gazi Bay, Kenya**

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### **Abstract**

A new genus, *Papillonema* gen.n., is erected to accommodate the two species *P. danieli* gen. et sp. n. and *P. clavatum* (Gerlach, 1957) comb.n. from intertidal sediments of a tropical mangrove. *Papillonema* gen.n. is characterized by prominent papilliform labial sensillae, an elongate muscular terminal bulb (up to 60% of pharyngeal length), and three precloacal supplements. Comments are given on the use of the terms 'head capsule', 'head region', and 'cervical setae'.

### **Introduction**

In 1957 Gerlach described *Metachromadora clavata* from Brazil. Later, Furstenberg and Vincx (1988) transferred the species to the genus *Chromadoropsis* Filipjev, 1918. But, although the species has characters which resemble and relate to each of those two genera, it shows characters which distinguishes it from both genera; furthermore Wieser & Hopper (1967) already expressed their doubts concerning the position of the species within *Metachromadora* (which contains many subgenera, one of which at that time was *Chromadoropsis*): 'Subgenus doubtful, perhaps a new one to be established'.

The presence of prominent papilliform labial sensillae in contrast to short setiform sensillae in both *Metachromadora* and *Chromadoropsis*, the absence of cervical setae (see remark furtheron), and the presence of three (seldom four) strangely shaped precloacal supplements (many and shaped differently in the other two genera) are only a few examples of the differences between this species and the two genera. The discovery of a new species, *Papillonema danieli* gen. et sp.n., closely related to *P. clavatum* (Gerlach, 1957) comb.n., now justifies the erection of a new genus.

### **Material and methods**

Samples were taken from the intertidal sandy sediments of Gazi Bay (Kenya) using a core of 3.5 cm diameter pushed into the sediment to a depth of 10–12 cm. The samples were immediately fixed in a warm (70°C) 4% formaldehyde-seawater solution. Nematodes were transferred to glycerine by the method of Seinhorst (1959).

Drawings were made with the aid of a camera lucida on a Leitz Dialux 20EB microscope.

Scanning electron microscopic pictures were taken from formalin fixed animals, transferred in OsO<sub>4</sub>, dehydrated, dried and coated with 20–25 nm of gold (SEM: JEOL JSM 840).

### **Abbreviations**

a: body length divided by maximum body diameter; abd: anal body diameter; amph %: diameter of the amphid as a percentage of the corresponding head diameter; aw: amphidial width; b: body length divided by pharyngeal length; bdcs: body diameter at level of the cephalic setae; bdnr: body diameter at level of nerve ring; c: body length divided by tail length; cs:

length of cephalic setae; da: distance from anterior to anus; dcs: distance from anterior edge to cephalic setae; dnr: distance from anterior edge to nerve ring; dv: distance from anterior to vulva; gub: length of the gubernaculum; hw: head width; L: body length; lsp: length of sperm cells; mbd: maximum body diameter; mbd ph: body diameter at level of pharynx; ph: pharyngeal length; spic: length of spicules measured along the arc; t: tail length; tnr: length of non-annulated tail end; V: position of vulva as a percentage of the total body length from anterior; wsp: width of sperm cells.

### Remark

In the genus diagnosis of *Chromadoropsis*, (and also of many other genera of the Desmodoridae which do not have a so called **head capsule** ('helmet' or 'rostrum', Allen and Noffsinger, 1978) *i.e.* a non-annulated, well set off, head region with extra thickening of inner layers of the body cuticle, but an annulated **head region** where the annuli extend to anterior, as far as the lip region), the term **subcephalic setae** is used for special-looking setae in the head region in the vicinity of the amphids. As the term 'subcephalic' should, within the Desmodoroidea, be restricted to *non-labial and non-cephalic setae located on a head capsule, anterior to the first body annule* (see also Verschelde & Vincx (1994)), it is desirable not to use it for, again within the Desmodoroidea, the description of *special looking (i.e. not the same as other somatic setae) setae on the anterior part of the pharyngeal region, posterior to the head capsule or in species without a true head capsule*; in such cases the term **cervical setae** offers an acceptable alternative: 'subcephalic setae' is to be used only when the special looking setae are located on a head capsule, 'cervical setae' when they are located posterior to the head capsule on the first annuli or on an annulated head region.

### Descriptions

Familia Desmodoridae Filipjev, 1922

Genus *Papillonema* gen.n.

#### Diagnosis

Cylindrical body with blunt conical head region and short conical tail. Body cuticle striated with fine, faint annuli extending from the cephalic setae, anterior to the

fovea amphidialis, as far as the short non-annulated tail end. Tiny somatic setae in eight longitudinal rows in the pharyngeal region, possibly in less further on.

Annulated head region. Lip region protrusible. Six internal (inner) and six external (outer) labial papillae (real papillae, not small setae); four thick cephalic setae located at the level of the external labial papillae; no cervical setae. Multispiral, seldom loop-shaped amphids in which sexual dimorphism can occur.

Buccal cavity with a large dorsal tooth and two minute subventral teeth, a crown of denticles (located at the anterior level of the dorsal tooth) can be present but is only clear when lips are protruded. Two-part pharynx long with slender cylindrical corpus and long, broad cylindrical postcorpus (elongated terminal bulb), thick lumen cuticle; postcorpus with two or three slim partitions, two of them located more posteriorly in the postcorpus; partitions in lumen cuticle inconspicuous.

Males with three (seldom four) preloocal supplements: each one consisting of a papilliform base into which a protrusible trunk-shaped distal duct is retracted. Short, arcuate spicules with large capitulum and fine velum. Slightly bent gubernaculum.

*Type species: Papillonema danieli* gen. et sp.n.

*Etymology:* From Latin: *papilla* = nipple; referring to the shape of the internal and external labial sensillae.

#### Differential diagnosis

*Papillonema* gen.n. differs from all other genera of the Desmodoridae by the presence of its internal and prominent external labial papillae. *Papillonema* gen.n. resembles *Metachromadora* and *Chromadoropsis* but differs from them in shape of (internal and) external labial sensillae (setae in *M.* and *C.*), and in number (three (to four) in *P.*, more in *M.* and *C.*) and shape of the preloocal supplements.

*Papillonema danieli* gen. et sp. n. (Fig. 1; Table 1)

*Material:* 5 males, 3 females.

*Holotype male:* slide RIT 449 (KBIN).

*Allotype female:* slide RIT 450 (KBIN).

*Other paratypes:* slide RIT 451 (KBIN), slides BN 244–245 (MNHN).

Table 1. Measurements (in  $\mu\text{m}$ ) of *Papillonema danieli* gen. et sp.n.

	Hol. ♂		Par ♂♂ n = 4			All. ♀		Par ♀♀ n = 2	
	min	max	min	max	avg	std	min	max	
L	1306	1136	1260	1194	51	1313	1130	1193	
cs	6	4	6	6	1	5	6	7	
amph %	27	27	29			26	24		
aw	7	6	7			7	6		
hw	26	21	26	25	2	27	25	27	
dnr	87	85	91	88	3	99	85		
ph	279	260	282	268	9	346	281	288	
mbd ph	49	36	43	40	2	48	41	42	
mbd	52	39	46	42	3	55	47	49	
bdnr	44	36	37	37	1	42	40		
spic	45	40	49	44	5				
gub	25	26	28	26	1				
dv						791	632	689	
V						60	58	58	
da	1250	1114	1193	1154	40	1250		1057	
abd	43	33	39	36	2	34	30	33	
t	62	57	69	62	5	52	54	55	
a	23	24	31,6	28,5	2,9	23	22	25,5	
b	4,3	4,3	4,7	4,5	0,2	3,8	3,9	4,1	
c	19,4	16,8	22	19,3	2,7	23	20	21,6	

*Type locality:* The specimens were collected from the intertidal muddy sand sediments in the *Cerriops* mangroves of Gazi Bay, Kenya; 17-06-1992.

*Etymology:* The species has been named in honour of Done Daniel.

*Measurements:* See Table 1.

#### *Description*

*Males:* The body is cylindrical and measures 1136–1260  $\mu\text{m}$  in length (Fig. 1A). The cuticle is very finely striated (24 striations over 10  $\mu\text{m}$ ). Eight longitudinal rows of very short and fine somatic setae.

Head region blunt with body annuli extending to anterior (Fig. 1E). The six internal and six external labial sensillae are (true) papillae; internal labial papillae situated on the lip edge (inconspicuous under light microscope), external ones prominent and located just in front of the cephalic setae (Fig. 1E). Four cephalic setae. Multispiral fovea amphidialis, 1.5 whirls (Fig. 1E).

Stoma with one large dorsal tooth and two small subventral ones (Fig. 1F). Pharynx anteriorly slightly swollen to incorporate the muscles supporting the tooth. Short cylindrical corpus with strong elongated terminal bulb (postcorpus 60% of pharynx length) (Fig. 1B, C); terminal bulb shows three unclear partitions (Fig. 1C, arrows). Nerve ring located just in front of elongated bulb.

Reproductive system monorchic, outstretched and located at the right of the intestine (Fig. 1A). Spicules arcuate with large capitulum (40–49  $\mu\text{m}$ ) and fine velum (Fig. 1I, J). Gubernaculum 25–28  $\mu\text{m}$  long. Usually three, seldom four (one specimen) ventral precloacal supplements, equidistant from each other (Fig. 1I, J); they have a papilliform base with a pointed tip that can be protruded and retracted. Normally, two supplements are located within the spicule region, and one anterior to it (Fig. 1I, J); in one specimen all three supplements were located within the range of the spicule region. Anterior to the precloacal supplements, there is a ventral row of about ten local thickenings of the cuticle resembling implantation sites of setae, but no somatic setae are visible.

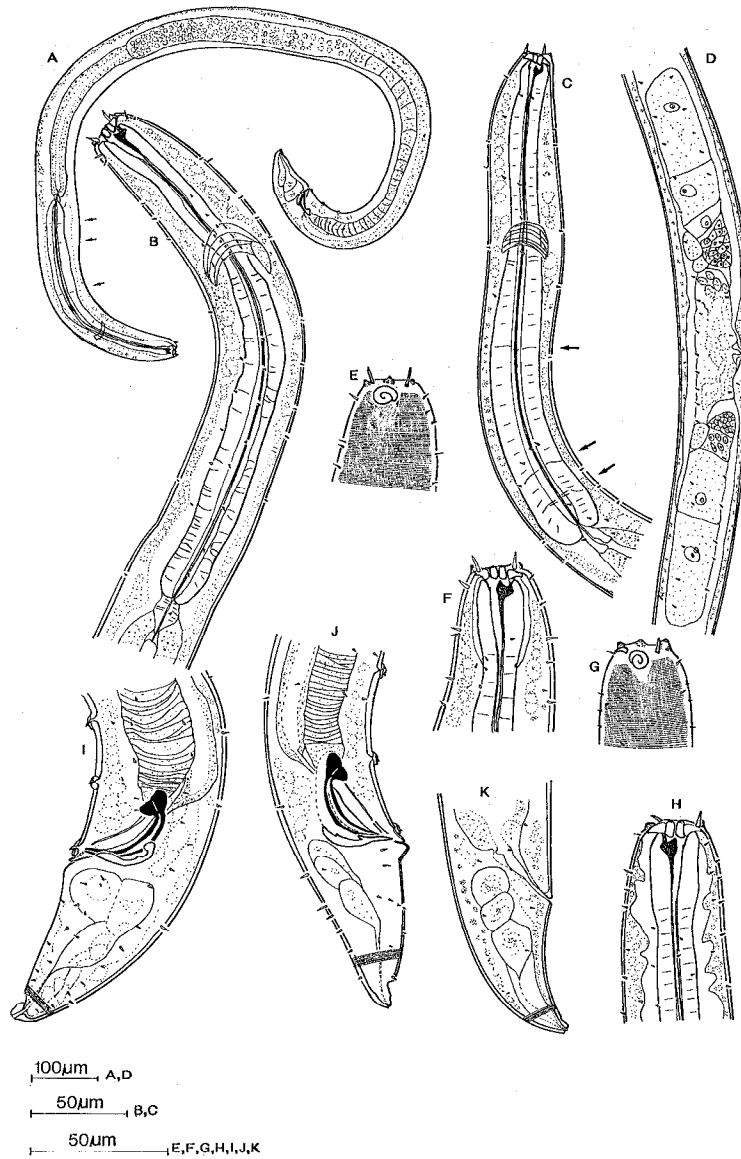


Fig. 1 *Papillonema danieli* gen. et sp.n.

A: ♂<sub>1</sub>, habitus of holotype male

B: ♂<sub>1</sub>, pharynx

C: ♂<sub>2</sub>, pharynx of paratype male

D: ♀<sub>1</sub>, reproductive system of allotype female

E: ♂<sub>1</sub>, head region

F: ♂<sub>1</sub>, buccal cavity

G: ♀<sub>1</sub>, head region

H: ♀<sub>1</sub>, buccal cavity

I: ♂<sub>1</sub>, tail

J: ♂<sub>2</sub>, tail

K: ♀<sub>1</sub>, tail

Table 2. Measurements (in  $\mu\text{m}$ ) of *Papillonema clavatum* (Gerlach, 1957) comb.n.

	$\sigma\sigma$ <i>n</i> = 7				$\text{♀♀}$ <i>n</i> = 7			
	min	max	aver	std	min	max	aver	std
L	1061	1295	1210	84,27	1074	1256	1175	54,88
cardia	8	13	11	2,00	8	12	10	4,16
cs	3	6	4	0,98	4	7	5	1,13
dcs	1	3	2	1,00	2	4	3	0,69
amph %	38	45	41	2,65	32	38	35	2,23
lsp	11	16	13	1,62	8	12	10	1,62
wsp	6	8	7	0,79	6	8	7	0,69
dnr	73	92	83	7,21	73	87	80	5,28
ph	189	227	212	14,87	197	228	215	10,75
mbd ph	30	33	31	1,07	33	36	34	1,13
mbd	30	34	32	1,51	34	41	36	2,58
bdnr	29	33	30	1,25	30	32	31	0,76
hdcs	12	14	13	0,76	13	15	14	0,82
spic	36	41	37	1,89				
gub	18	23	21	1,90				
dv					573	633	615	19,20
V					50	53	52	1,21
da	1000	1233	1146	83,50	1020	1206	1120	56,08
abd	31	34	32	1,35	28	34	30	2,34
t	45	60	55	5,22	48	58	54	3,21
tmr	7	14	10	2,31	8	13	10	1,90
a	32.1	43.2	38.4	3,92	29.3	36.9	32.7	2,66
b	5.3	6.1	5.7	0,27	5.2	6.1	5.4	0,34
c	17.7	28.6	22.0	3,33	20.5	23.7	22.0	1,11

Short, conical tail (t 1.5–2 times abd) with a ventral indentation just in front of the non-annulated tail tip. Clear spinneret, three caudal glands.

*Females:* Females similar to males in general body shape (1130–1193  $\mu\text{m}$ ), anterior sensilla, pattern of somatic setae, stoma (Fig. 1H) and tail shape (Fig. 1K). Multispiral fovea amphidialis (1.5 whirls; Fig. 1G).

Buccal cavity with large dorsal tooth, and two tiny subventral teeth; denticles could be present but were too hard to distinguish with certainty. Pharyngeal shape similar to males.

Reproductive system didelphic, amphidelphic with reflexed ovaries (Fig. 1D). Reproductive system located at the left of the intestine. Small vulva, cuticular vagina vera and short vagina uterina.

Tail without indentation (Fig. 1K). Prominent spinneret.

*Juveniles:* not found.

#### Diagnosis

*Papillonema danieli* gen. et sp.n. is characterized by multispiral amphids, elongated terminal bulb with three partitions lined with thick lumen cuticle. Males are characterized by their three, seldom four, equidistant precloacal supplements and indented tail.

*Papillonema clavatum* (Gerlach, 1957) comb.n. (Fig. 2–4, Plate 1, 2; Table 2,3)

*Material:* 13 males, 11 females, 7 juveniles.

*Specimens:* slide RIT 452 (KBIN; 2  $\sigma\sigma$ , 1  $\text{♀}$ ), slide RIT 453 (KBIN; 1  $\sigma$ , 4  $\text{♀♀}$ , 3 J), slide 10279 (MBRUG; 1  $\sigma$ , 1  $\text{♀}$ ).

*Locality:* Kenya, Gazi, 07-08-1989: sediment sample (coarse coral sand) taken at the foot of a *Bruguiera* tree, near the field lab hut.

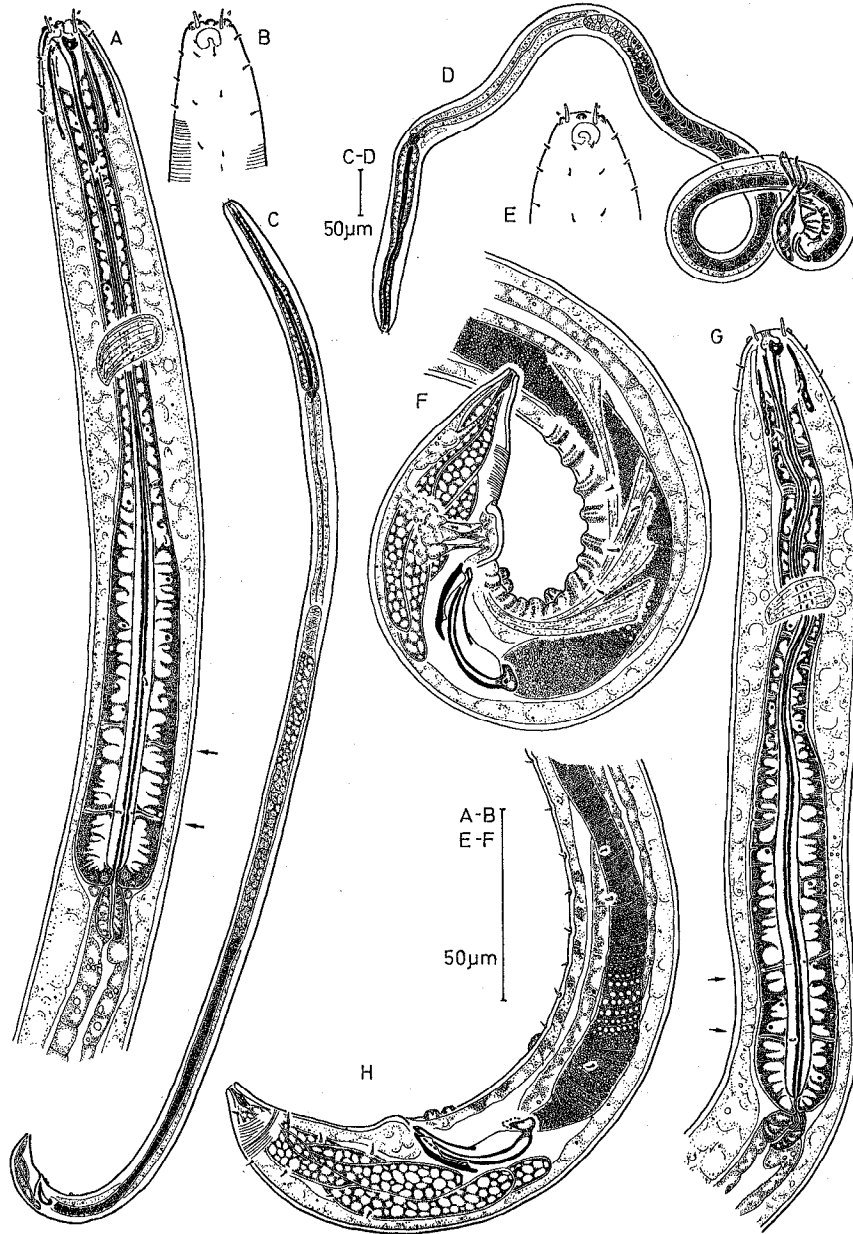


Fig. 2 *Papillonema clavatum* (Gerlach, 1957) comb.n.

A: ♂<sub>a</sub>, pharynx

B: ♂<sub>a</sub>, head region, view on left hand side

C: ♂<sub>a</sub>, habitus

D: ♀<sub>b</sub>, habitus

Scale bars equal 50 μm)

E: ♀<sub>b</sub>, head region, view on left hand side

F: ♀<sub>b</sub>, tail, curled up

G: ♀<sub>b</sub>, pharynx

H: ♂<sub>a</sub>, tail, outstretched

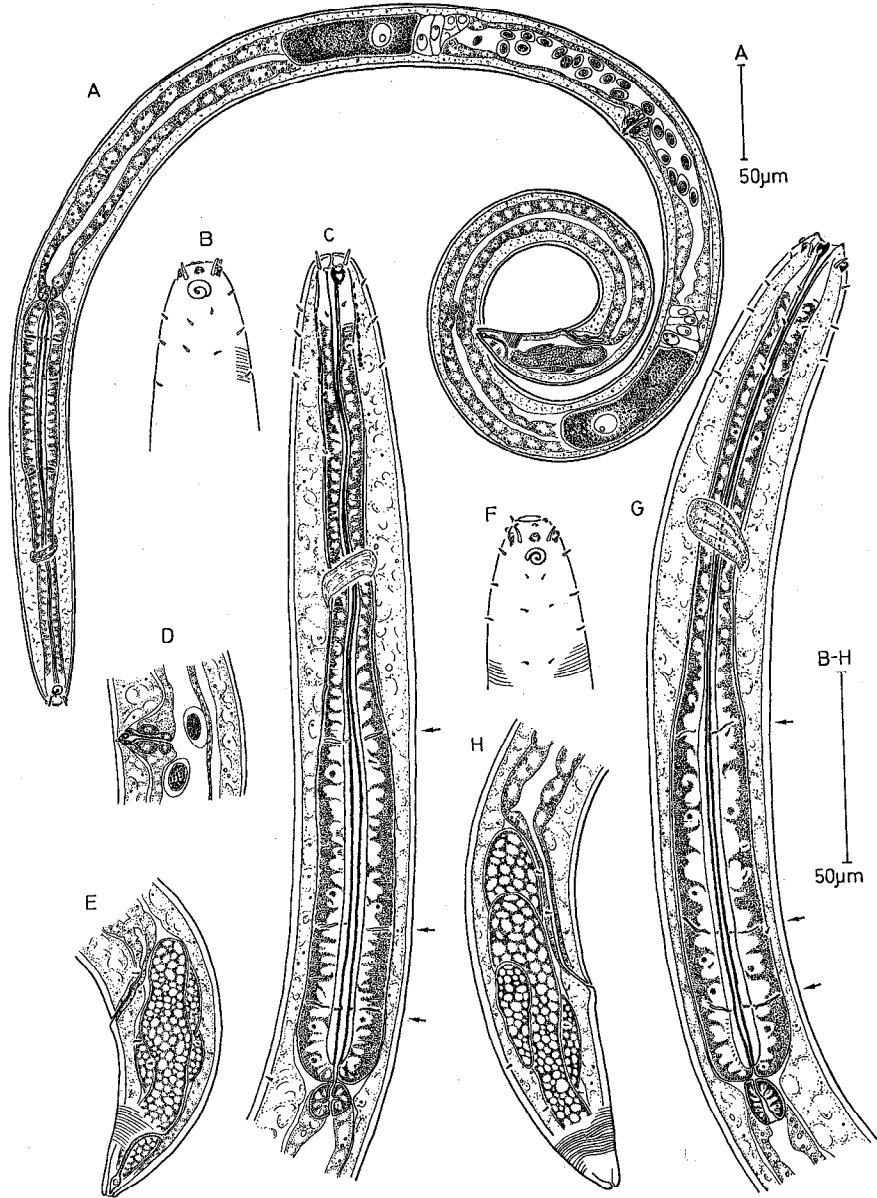


Fig. 3. *Papillonema clavatum* (Gerlach, 1957) comb.n.

A: ♀<sub>a</sub>, habitus

B: ♀<sub>a</sub>, head region, view on left hand side

C: ♀<sub>a</sub>, pharynx

D: ♀<sub>a</sub>, vagina

(Scale bars equal 50 µm)

E: ♀<sub>a</sub>, tail

F: ♀<sub>a</sub>, head region, view on right hand side

G: ♀<sub>b</sub>, pharynx

H: ♀<sub>b</sub>, tail

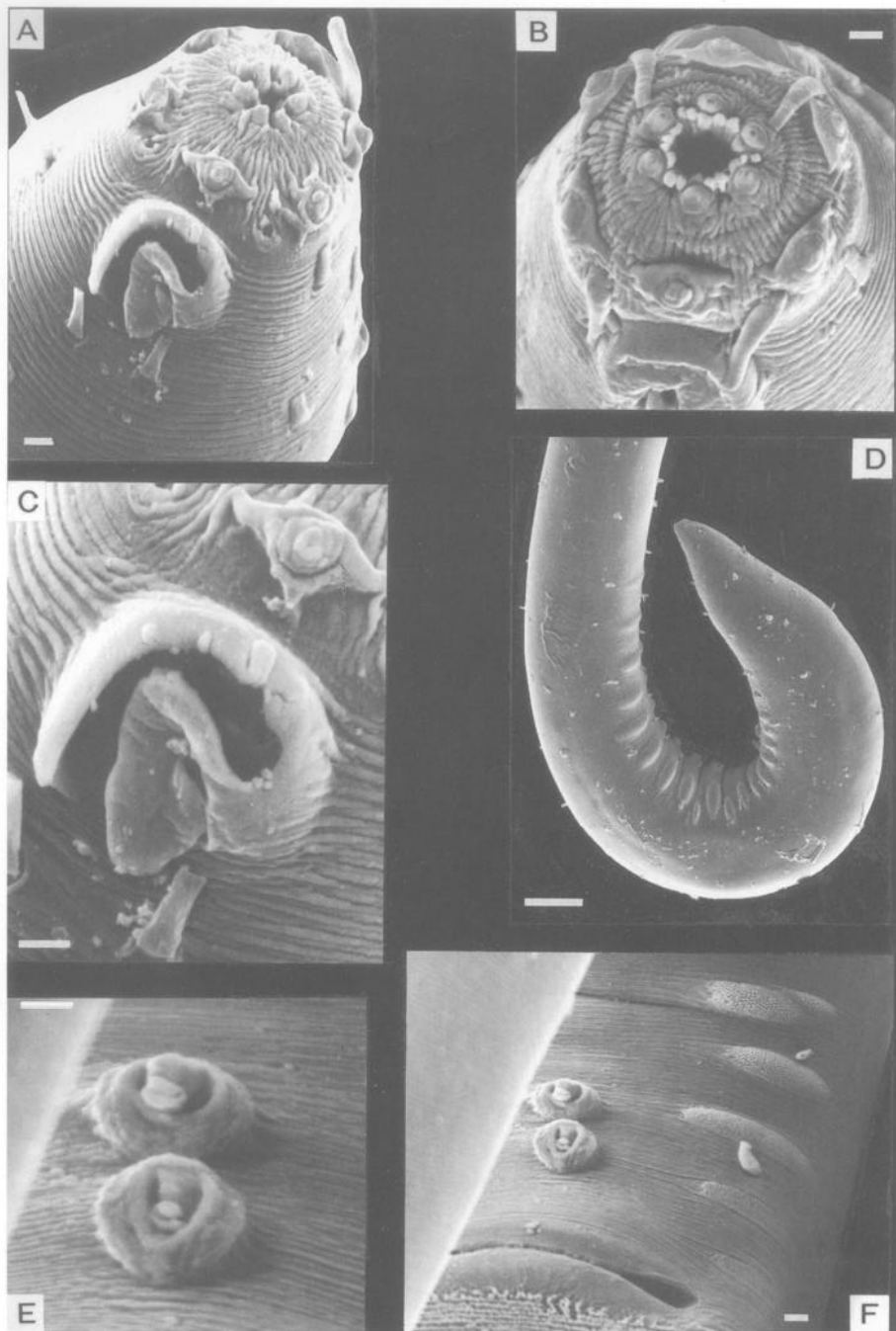


Plate 1. *Papillonema clavatum* (Gerlach, 1957) comb.n.

A: ♂<sub>c</sub>, head region

B: ♂<sub>d</sub>, labial papillae, frontal view

C: ♂<sub>c</sub>, amphid

(Scale bars equal 1 μm in A–C, E, F; 10 μm in D)

D: ♂<sub>d</sub>, posterior body region

E: ♂<sub>c</sub>, precloacal supplements

F: ♂<sub>c</sub>, cloacal region



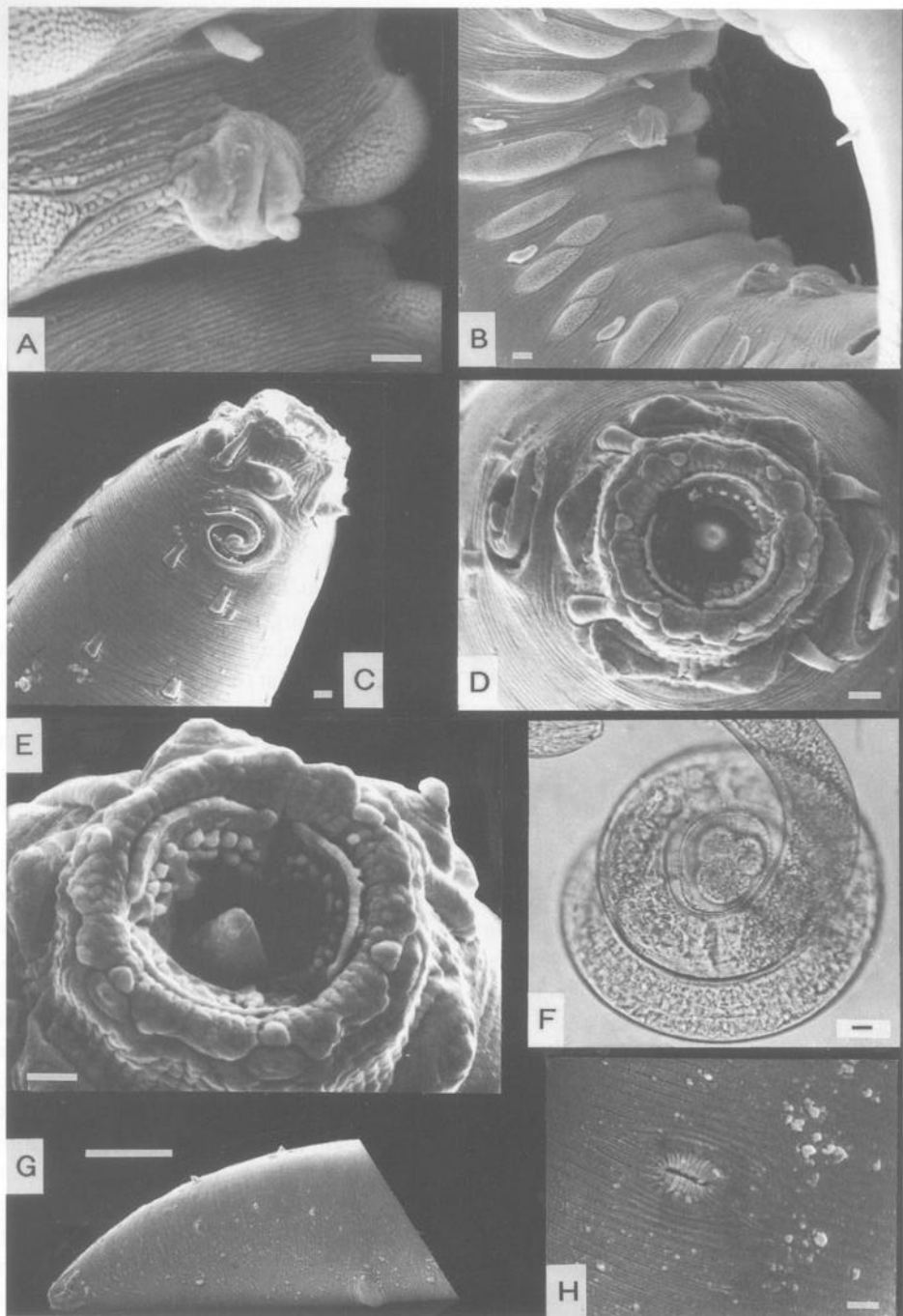


Plate 2. *Papillonema clavatum* (Gerlach, 1957) comb.n.

A: ♂<sub>c</sub>, anterior precloacal supplement

B: ♂<sub>c</sub>, precloacal supplements and 'cushions' of tiny papillae

C: ♀<sub>b</sub>, head region

D: ♀<sub>b</sub>, labial papillae, frontal view

(Scale bars equal 1 μm in A–e, H; 10 μm in F, G)

E: ♀<sub>b</sub>, buccal cavity with dorsal tooth and denticles

F: ♀<sub>c</sub>, egg caught up in curled body

G: ♀<sub>b</sub>, tail

H: ♀<sub>b</sub>, vulva

Table 3. Measurements (in  $\mu\text{m}$ ) of *Papillonema clavatum* (Gerlach, 1957) comb.n.

	J4	J3	J3'	J2
L	1045	1016	972	760
aw	6	4	4	4
cs	4	3	4	4
dcs	3	2	2	2
amph %	40		28	32
dnr	76	59	74	63
ph	198	174	202	157
mbd ph	32	33	30	28
mbd	34	34	28	29
bdnr	31	31	29	28
bdc	12		12	12
da	991	955	911	709
abd	28	31	26	24
t	54	56	54	51
tmr	11	12	11	9
a	30.7	29.9	34.7	26.2
b	5.3	5.8	4.8	4.8
c	19.4	18.1	18.0	14.9

Measurements: See Table 2, 3.

#### Additional description

**Males:** Body cylindrical with blunt conical head region and conical tail (Fig. 2C, D). Body cuticle striated with numerous, very slender body annuli extending to the anterior edge of the fovea amphidialis (Plate 1A, C); annuli visible in tail region, faintly visible in pharyngeal region, almost invisible along the rest of the body. Tiny, hyalin somatic setae are very hard to distinguish: in the pharyngeal region, they are arranged in eight longitudinal rows of three (to four) setae (Fig. 2B, E); the first are located at the posterior edge (or half) of the amphids, therefore Gerlach (1957) previously named these setae 'subcephalic setae' (i.e. cervical setae, see remark above), but we regard them as somatic setae because there is no head capsule and they do not differ one bit from the rest of the somatic setae. Anterior to the precloacal supplements, there is a ventral row of eight to ten characteristic somatic setae which are only visible when the posterior body region is not curled up (compare Fig. 2F with Fig. 2H), these setae are connected with gland cells (not drawn).

No head capsule. Head region with six small internal lip papillae, six larger external lip papillae and four cephalic setae (Plate 1A, B). External lip papil-

lae and cephalic setae situated at anterior edge of the fovea amphidialis. Fovea amphidialis broad, open loop-shaped (Fig. 2B, E; Plate 1C).

Lip region protrusible. Buccal cavity (stoma) with large dorsal tooth, two minute subventral teeth, and a crown of denticles (Fig. 2G); when lips are closed (not protruded) denticles are hardly visible by means of light microscope. In the stomatal region there are eight epidermal glands. Pharynx (clavate) with slender buccal bulb (stoma), slender corpus and long, broad cylindrical postcorpus (terminal bulb, about 47% of the total pharyngeal length); the pharynx shows three fine partitions: one at the transition from corpus to postcorpus and two distally in the posterior half of the postcorpus (so terminal bulb itself with two partitions; Fig. 2G, arrows); lumen lined with a thick cuticle. Nerve ring situated anterior to the postcorpus at about 39% of the total pharyngeal length (Fig. 2A). Long cardia (8–13  $\mu\text{m}$ ).

Reproductive system monorchic: long outstretched testis with large sperm cells ( $l = 13\mu\text{m}$ ,  $w = 7\mu\text{m}$ ) which were also found in the uterus of each female. Testis located at the right of the intestine in all males; vas deferens located ventrally to the intestine in most males, at the left of the intestine in one male. Arched spicules with birdhead-shaped capitulum and broad but thin velum (Fig. 2F, H). Thick gubernaculum which proximally embraces the spicule tips.

Three ventral precloacal supplements consisting of a button-shaped to conical base ( $h = 1\mu\text{m}$ ,  $w = 3.5\mu\text{m}$ ) with a protrusible slender, trunk-shaped extension retracted into it (Plates 1E, F and 2A, B); two out of three are located 5  $\mu\text{m}$  anterior to the cloaca, the third 39  $\mu\text{m}$  in front of it (Fig. 2F, H). Anterior to the third precloacal supplement, there is a ventral row of eight to ten short setae which are not visible when the tail is curled up (Fig. 2F). A series of muscles (Fig. 2F) are present to curl up the tail region during copulation; when this happens, the ventral precloacal region folds (Fig. 2F; Plate 1D); one each fold there are paired subventral 'cushions' of tiny papillae, clearly visible by means of SEM pictures (Plate 2A, B), but only visible as gland-enriched areas in the epidermis by means of light microscope; when the tail region is straight, only pairs of local, slightly risen cuticle and the epidermal glands give away the position of the cuticular papillae.

Conical tail with three pairs of latero-ventral somatic setae and three (four) pairs of dorso-lateral setae. Large hyalin caudal glands; spinneret with clear valve, valve muscle attached to dorsal body wall. Non-

annulated tail end with one pair of short dorso-lateral somatic setae (Fig. 2H).

*Females:* Body shape, body annuli, pattern of somatic setae, pattern of labial papillae (Plate 2D), cephalic setae, pharynx, cardia and tail (Plate 2G) similar to males.

Head region as in males. Fovea amphidialis multispiral (1.5 whirls, sexual dimorphism: loop-shaped in males; Fig. 3B, F; Plate 2C).

Stoma with large dorsal tooth, two small subventral teeth and a crown of denticles (located anterior to the dorsal tooth; Plate 2E). Partitions of pharynx and postcorpus more clear than in males (postcorpus makes out 47% of the total pharyngeal length; Fig. 3C, G, see arrows). Posterior in the intestine there are two cells forming a sort of valve. Rectal valve present.

Reproductive system didelphic, amphidelphic with reflected ovaries (Fig. 3A, D); position to intestine variable: in some females both branches located to the left of the intestine; in others, antepudendum located to the right and postpudendum to the left of the intestine. Vulva inconspicuous (not distinct by means of light microscope; Plate 2H); vagina vera consisting of two cuticular plates, vagina uterina with clear sphincter muscle (Fig. 3D). Sperm cells ( $l = 10\mu\text{m}$ ,  $w = 7\mu\text{m}$ ) are always found within the uterus. In one female, an egg was caught between the coils of her curled up body (Plate 2F), what opens the chance of some kind of brood protection.

*Juveniles:* Body shape, annuli, pattern of somatic setae, labial papillae, and cephalic setae as in adults.

*Fourth stage juvenile:* (Fig. 4A–D). Fovea amphidialis ( $6\mu\text{m}$ ) multispiral (1.5 whirls). Stoma with large dorsal tooth, in which the tooth of the next stage is already present. Nerve ring clear.

Reproductive system of a juvenile female is already present: primordium for vagina consisting out of two groups of three cells. Didelphic, amphidelphic uterus and oviducts with straight ovaries with a few germ cells.

*Third stage juveniles:* (Fig. 4E–G). Multispiral (1.5 whirls) fovea amphidialis ( $4\mu\text{m}$ ). Stoma with large dorsal tooth, in which the tooth of the next (possibly two next) juvenile stage is present. Nerve ring not clear.

Developing reproductive system in both sexes consists out of a slender hyalin cell strand in which individual cells cannot be recognized.

*Second stage juvenile:* (Fig. 4H–J). Multispiral fovea amphidialis ( $4\mu\text{m}$ ). Buccal cavity with large dorsal tooth in which the tooth of the next stage is already present. Nerve ring not clear.

Genital primordium consists out of a small group of a few cells.

*First stage juvenile:* not found.

#### Remark

*Papillonema clavatum* (Gerlach, 1957) comb.n. was first described from the mangrove bushes of Cananéia (Brazilian coast; Gerlach, 1957). Later it was also found on the Maldives Islands (Gerlach, 1963) and finally on the Sarso Islands (Red Sea; Gerlach, 1967). The Kenyan specimens resemble mostly the specimens found on the Sarso Islands, although these specimens are larger than the Kenyan specimens. Kenyan males have similar labial papillae and fovea amphidialis as the Sarso Islands males, but differ from those of the Maldives (papillae and amphids) and from those of Cananéia (amphids). Spicules from Kenyan specimens show a broad, but very thin velum, which has not been described by Gerlach, although this could just have been overlooked because the velum is really thin.

#### Discussion

*Papillonema clavatum* (Gerlach, 1957) comb.n. resembles *P. danieli* gen. et sp.n. but differs from it in shape of the amphids (sexual dimorphism in *P. clavatum*, multispiral in *P. danieli*), relative length of the pharyngeal postcorpus (47% in *P. clavatum* compared to 60% in *P. danieli*), and the arrangement of the precloacal supplements in males (in *P. danieli* all three precloacal supplements are arranged at an equal distance for one another).

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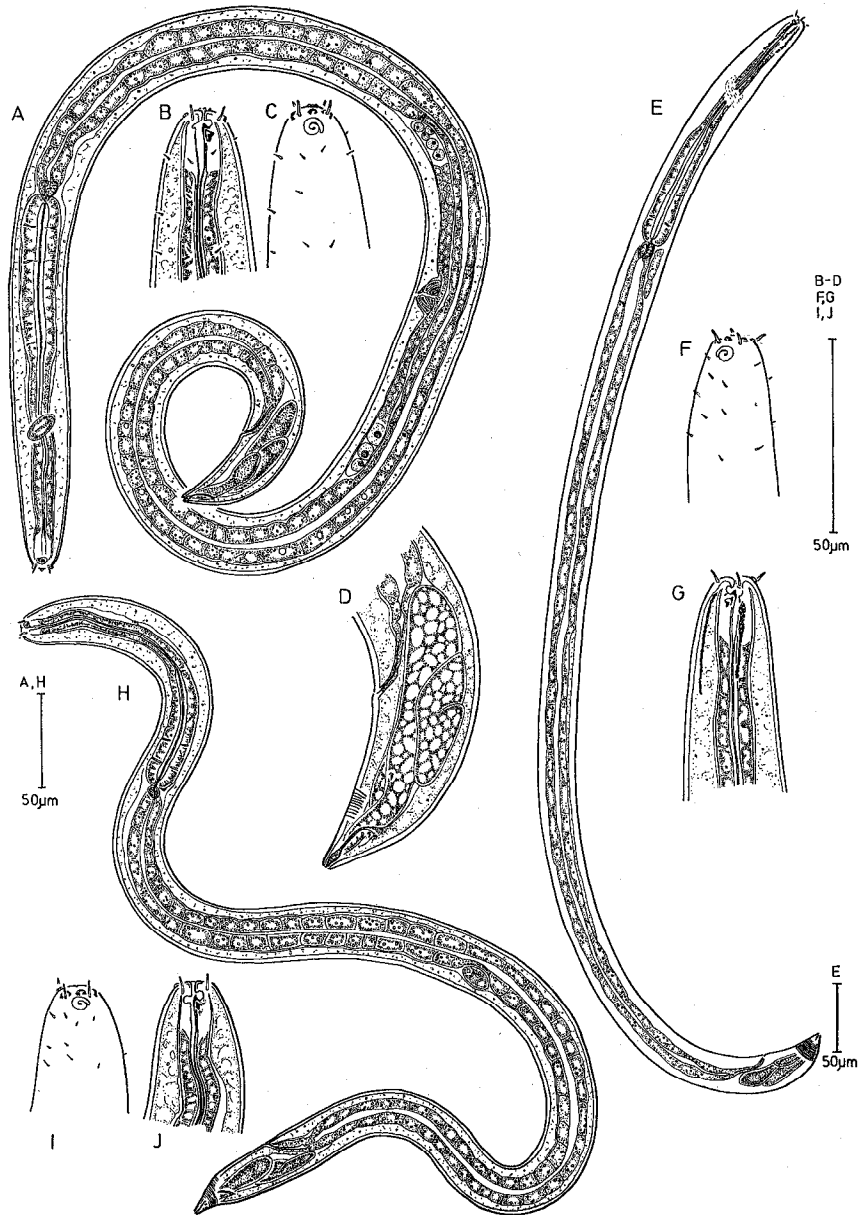


Fig. 4. *Papillonema clavatum* (Gerlach, 1957) comb.n.

A: J<sub>4</sub>, habitus

B: J<sub>4</sub>, buccal cavity

C: J<sub>4</sub>, head region, view on left hand side

D: J<sub>4</sub>, tail

E: J<sub>3</sub>, habitus

(Scale bars equal 50 μm)

F: J<sub>3</sub>, head region, view on right hand side

G: J<sub>3</sub>, buccal cavity

H: J<sub>2</sub>, habitus

I: J<sub>2</sub>, head region, view on left hand side

J: J<sub>2</sub>, buccal cavity

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## References

- Allen, M. W. & E. M. Noffsinger, 1978. A revision of the marine nematodes of the superfamily Draconematidae Filipjev, 1918 (Nematoda: Draconematina). Berkely-Los Angeles-London, Univ. of Calif. Press, Univ. Calif. Publis. Zool., 109: i-viii, 133 pp.
- Furstenberg, J. & M. Vincx, 1988. Three new *Chromadoropsis* species (Nematoda: Desmodoridae) from southern Africa and the North Sea. S. Afr. J. Zool., 23: 215-223.
- Gerlach, S. A., 1957. Marine nematoden aus dem mangrove-Gebiet von Cananea. Abh. Math. -Naturw. Kl. Akad. Wiss. Mainz., 5: 129-176.
- Gerlach, S. A., 1963. Freilebende Meeresnematoden von den Malediven II. Kieler Meeresforsch. 19: 67-103.
- Gerlach, S. A., 1967. Freilebende Meeres-Nematoden von den Sarso-Inseln (Rotes Meer) 3. Beitrag der Arbeitsgruppe Litoral-forschung. 'Meteor' Forschergebn., (D) (2): 19-43.
- Seinhorst, J. W., 1959. A rapid method for the transfer of nematodes from fixative of anhydrous glycerin. Nematologica 4: 67-69.
- Vershelde, D. & M. Vincx, 1994. Epsilonematidae (Nematoda: Desmodoroidea) from the East African coast, with a discussion on the external morphology of cuticular appendages. Nematologica 40: 78-105.
- Wieser, W. & B. Hopper, 1967. Marine nematodes of the east coast of North America. I. Florida. Bull. Mus. Comp. Zool. Harv. 135: 239-344.