

Parasites of South African freshwater fish. IV. Description of *Spirocamallanus daleneae* n. sp. (Nematoda: Camallanidae) from *Synodontis zambezensis* Peters, 1852 (Mochokidae) with comments on *Spirocomallanus spiralis* (Baylis, 1923)

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ABSTRACT

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During a survey of the parasites of fish in the Kruger National Park, a new species of *Spirocamallanus* Olson, 1952 was recovered from the small intestines of squeakers, *Synodontis zambezensis* Peters, 1952. The males of the new species differ from *Spirocamallanus spiralis* (Baylis, 1923) in having more spiral thickenings in the buccal capsule, the different configuration of the buccal capsule and its anterior margin, and in having a longer oesophagus, especially the muscular part. They differ from *Spirocamallanus mazabukae* Yeh, 1957 in having fewer thickenings in the buccal capsule, considerably shorter spicules and more caudal papillae. The new species also differs from the members of the genus described, but not named, by Yeh (1957) and Campana-Rouget (1961). In view of these differences and because of geographical and host differences, the new species is described here as *Spirocamallanus daleneae* n. sp.

Specimens of *Spirocamallanus spiralis* (Baylis, 1923) from *Synodontis eupterus* Boulenger, 1801 were re-examined and additional morphological and morphometrical data are provided.

Two male nematodes, originating from *Synodontis* spp. from Gabon and both labelled *Spirocamallanus spiralis*, were examined. The specimen from *Synodontis haugi* Pellegrin, 1906 conformed to the description of *Spirocamallanus daleneae*. The one from *Synodontis tessmanni* Pappenheim, 1911 had a buccal capsule resembling that of *Spirocamallanus spiralis*, but the principal measurements are different from those of either nematode species. Because of extensive damage to the specimen, it is not named here and should be regarded as a species inquirenda.

INTRODUCTION

Spirocamallanus spiralis (Baylis, 1923) was first recorded from the fish *Clarias anguillaris* (Linnaeus, 1758) (syn. *Silurus anguillaris* Linnaeus, 1758 nec *Heterobranchus anguillaris* Geoffroy St Hilaire, 1827 sensu Baylis, 1923a) in Cairo, Egypt. To the best of

my knowledge, *Heterobranchus anguillaris* is a synonym of *Clarias gariepinus* (Burchell, 1922) which occurs only in southern Africa (Daget, Gosse & Thys van den Audenaerde 1986). The same nematodes were subsequently also recovered from *Synodontis eupterus* Boulenger, 1901, in Khartoum, Egypt (Baylis 1923b).

The 2nd species from Africa, *Spirocamallanus mazabukae* Yeh, 1957 was described from a 'Homa

fish' (*Clarias* sp.) in Zambia (Yeh 1957). Both Yeh (1957) and Campana-Rouget (1961) recorded unidentified *Spirocamallanus* spp. from 'Homa fish' and *Synodontis schall* (Bloch & Schneider, 1801), respectively. A large number of species have been described since, mostly from the Orient and South America, but none were recorded from southern Africa (Khalil 1971; Van As & Basson 1984).

During a survey of the parasites of freshwater fish in the Kruger National Park, numerous specimens of a *Spirocamallanus* sp., that differed from both *Spirocamallanus spiralis* and *Spirocamallanus mazabukae*, were recovered from the small intestine of the squeaker, *Synodontis zambezensis* Peters, 1852. The new species, for which the name *Spirocamallanus daleneae* n. sp. is proposed, is described here.

As part of this study, specimens of *Spirocamallanus spiralis* (Baylis, 1923) from *Synodontis eupterus* were loaned from the British Museum (Natural History) and examined. Specimens in the collection of the Muséum National d'Histoire Naturelle, Paris, France, labelled *Spirocamallanus spiralis* and originating from *Synodontis* spp. in Gabon, were also examined. Additional morphological and morphometrical data are provided for *Spirocamallanus spiralis sensu stricto* and the affinities of the members of the genus in Africa are discussed.

SPIROCAMALLANUS DALENEAE n. sp.

Type host

Synodontis zambezensis Peters, 1852, from the Sabie river, Kruger National Park, South Africa.

Material examined

The type specimens and numerous additional specimens have been deposited in the collection of the Muséum National d'Histoire Naturelle, Paris, France (MNHN). Holotype male and allotype female, no. MNHN 394 MD. Paratypes, 8 males, 9 females, no. MNHN 395 MD.

Etymology

The species is named after my wife, Dalene, for her continued support of and interest in my work on the helminths of fish and wild animals.

Description

The principal measurements are given in Table 1 and the nematodes are illustrated in Fig. 1–8.

Medium-sized worms, with an elliptical mouth opening bordered by 6 internal labial papillae, 2 amphids, 4 external labial and 4 cephalic papillae (Fig. 1). In lateral, dorsal or ventral view, the buccal capsule is well-sclerotized, globosely funnel-shaped and has 13–14 spiral ridges on the inner surface

(Fig. 2a, b). The anterior margin of the buccal capsule is formed by 4 transverse, smooth, crescent-shaped projections and a well-sclerotized basal ring is present. The outline of a model made of the anterior margin of the buccal capsule is illustrated in Fig. 1b. The oesophagus is divided into a muscular and a glandular part which may be of equal lengths or the one part may be longer than the other. The nerve ring lies approximately in the middle of the muscular oesophagus. Small, inconspicuous deirids are situated near the buccal capsule (Fig. 2a). The excretory pore is small, often difficult to locate, and opens behind the nerve ring. The tail is rounded and in both sexes narrows abruptly near its end to form a short, stumpy projection that may carry a protuberance (Fig. 5, 6 & 8).

Males

The spicules are unequal in size and are weakly sclerotised. The tip of the larger right spicule bears 2 membranous projections that appear different in different views (Fig. 3a–d). The shorter left spicule is shaped like a golf club and bears a weakly sclerotised spur ventrally (Fig. 4a, b). The left spicule appears to act as a guide for the right one.

The caudal alae are narrow and at their cranial junction they form a raised membranous structure, that is quite distinct in lateral view (Fig. 5 & 6). There are 3 pairs pre-cloacal papillae, 2 pairs pericloacal papillae, and 3 pairs subventral and 1 pair lateral post-cloacal papillae; considering the size of the worms, all these papillae are quite small (Fig. 5 & 6).

Females

The vulva is a simple transverse slit in the anterior half of the body, near the middle, and the muscular vagina immediately runs posteriorly. The walls of the 2 uteri are thin and transparent, and their junction with the vagina could not be seen.

Morulae of different sizes and stages of development, each surrounded by a very thin, transparent membrane, are scattered in the uterus. Developing larvae contained within these thin membranes develop to a certain stage before escaping to lie free in the uteri. Younger larvae do not have the spiral thickenings in the buccal capsule, but those closest to the vagina and vulva have a weakly sclerotised buccal capsule in which the spiral thickenings can clearly be seen.

Larvae in the 4th stage and the 4th moult are illustrated in Fig. 7a–d.

SPIROCAMALLANUS SPIRALIS (BAYLIS, 1923)

Type hosts and localities

Clarias anguillaris (Linnaeus, 1758) (syn. *Silurus anguillaris* Linnaeus, 1758), Cairo, Egypt. An incom-

TABLE 1 The principal measurements of *Spirocamallanus daleneae* #

	Males		Females	
	Holotype	Paratypes	Allotype	Paratypes
Length (mm)	17,50	11,66–14,66	28,57	20,90–31,09
Width (mm)	285	278–333	618	455–678
Buccal capsule, length	114	107–121	149	116–145
Buccal capsule, width	93	79–97	126	110–121
Muscular oesophagus, length	652	666–730	873	804–959
Glandular oesophagus, length	708	494–621	896	655–850
Oesophagus, total length	1 360	1 224–1 287	1 769	1 614–1 654
Nerve ring from anterior end	333	290–363	425	385–414
Deirids from anterior end	223	184–235	235	193–276
Excretory pore from anterior end	538	569–657	655	583–678
Right spicule, length	207	179–224	–	–
Left spicule, length	152	128–166	–	–
Tail length	269	228–269	173	193–276
Vulva from anterior end (mm)	–	–	12,62	6,90–13,00
Vulva from posterior end (mm)	–	–	15,95	11,15–17,87

All measurements given in μm unless otherwise stated

TABLE 2 Comparison of the principal measurements of *Spirocamallanus spiralis* from different hosts #

	Host species, author and sex of parasites					
	<i>Clarias anguillaris</i>	<i>Synodontis eupterus</i>	<i>Synodontis eupterus</i>	<i>Synodontis tessmanni</i>	<i>Synodontis haugi</i>	
	Baylis, 1923a	Baylis, 1923b	This paper		This paper	This paper
	Male	Female	Males	Female	Male	Male
	Length (mm)	More than 7	22,25	8,34–10,66	21,57	**
Width (mm)	160	400	132–183	448	207	264
Buccal capsule, length	70	90	71–76	100	98+	108
Buccal capsule, width	–	–	59–73	100	76+	93
Muscular oesophagus, length	450	580	333–437	448	**	689
Glandular oesophagus, length	330	520	287–437	477	414	609
Oesophagus, total length	780	1 100	724–770	925	**	1 298
Nerve ring from anterior end	–	270	241–310	279	**	391
Deirids from anterior end	–	–	NS	134	**	205
Excretory pore from anterior end	–	–	NS	NS	**	NS
Right spicule, length	150	–	193–218	–	127	196
Left spicule, length	100	–	126–160	–	99	101
Tail length	–	160	197–259	170	69	176
Vulva from anterior end (mm)	–	9,25	–	8,95	–	–
Vulva from posterior end (mm)	–	–	–	12,45	–	–

All measurements given in μm unless otherwise stated
+ Measured from the drawing by Petter & Thatcher (1988)

** No measurements due to damage
NS Not seen

plete description of the male nematode from this host is given by Baylis (1923a).

Synodontis eupterus Boulenger, 1901, Khartoum, Egypt. Additional characteristics of the male nematodes as well as an illustration of a male caudal end, together with the description of the female of the species from this host, are provided by Baylis (1923b).

Material examined

Five males, 1 mature female, 1 immature female and 1 larva in the 4th stage, all labelled *Spirocamallanus spiralis* and all mounted in glycerine jelly, collected from *Synodontis eupterus*, Khartoum, Egypt, 3-VII-1913 (British Museum (Natural History), no. 1984.3595, 1984.3596, and 1984.3597). Unfortunately all the specimens are in poor condition and

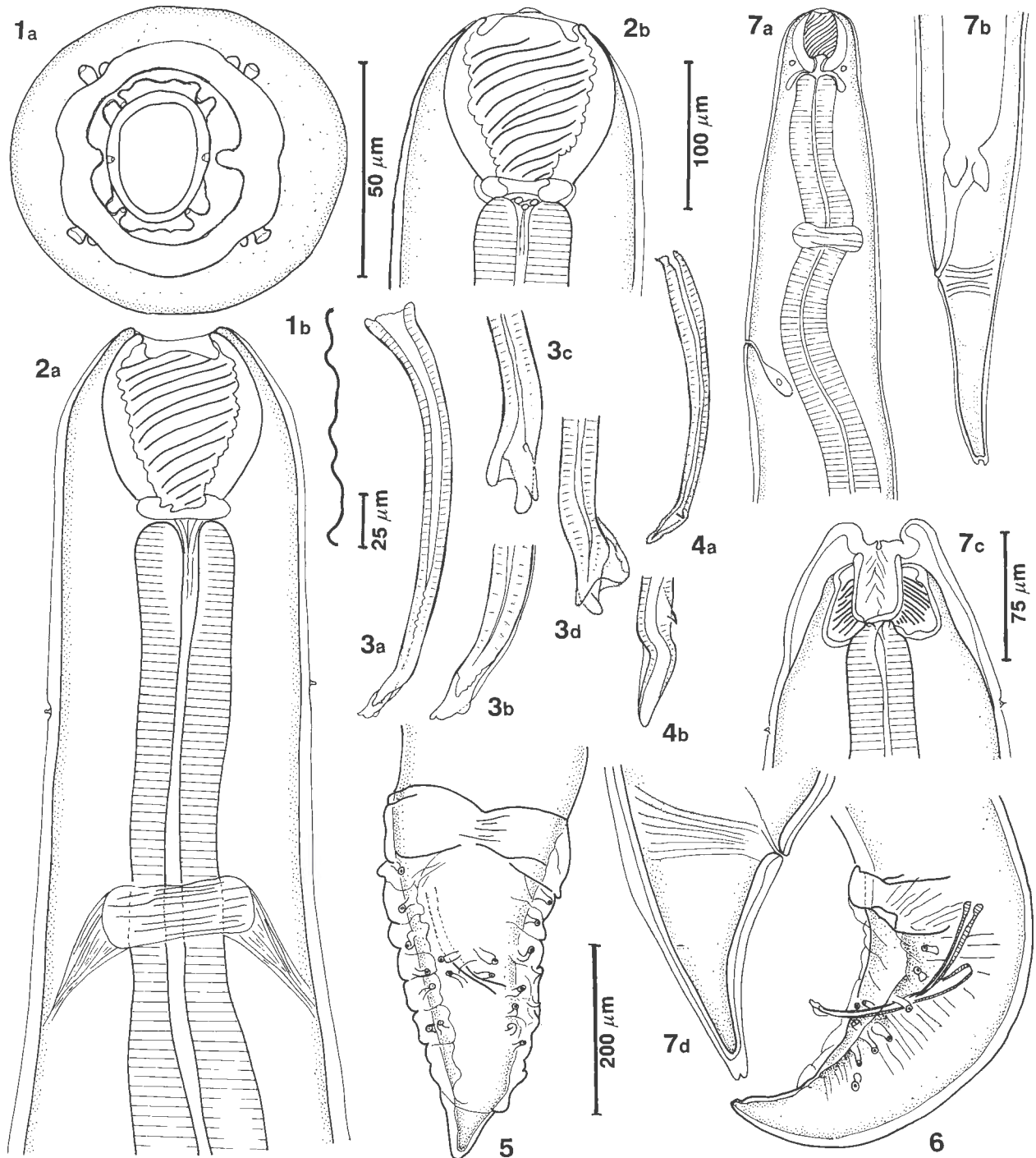


FIG. 1-7 *Spirocamallanus daleneae* from *Synodontis zambezensis*

- FIG. 1 Apical view of (a) the head of a female and (b) schematic representation of the anterior margin of the buccal capsule
- FIG. 2 Lateral view of (a) the anterior part and (b) dorsal view of the head of a male
- FIG. 3 The right spicule in (a) lateral view and its tip in (b) lateral, (c) ventral and (d) dorsolateral views
- FIG. 4 The left spicule in (a) lateral view, and its tip in ventrolateral view

- FIG. 5 Ventral view of the caudal area of the male
- FIG. 6 Lateral view of the caudal area of the male
- FIG. 7 Lateral view of (a) the anterior part and (b) the tail of an early 4th stage larva, and (c) ventral view of the head and (d) lateral view of the tail of a 4th larval moult

Scale bars: 25 μm—FIG. 1, 3a, 4a
 50 μm—FIG. 3b, 3c, 3d, 4b
 75 μm—FIG. 2a, 2b, 7c, 7d
 100 μm—FIG. 7a, 7b
 200 μm—FIG. 5, 6

all the measurements could therefore not be made, nor could the specimens be adequately illustrated. These nematodes are illustrated in Fig. 12–15.

One male, broken in half, in the collection of the Muséum National d'Histoire Naturelle, no. MNHN 43 KG, from *Synodontis haugi* Pellegrin, 1906 from Gabon. Petter & Thatcher (1988) erroneously refer to the host as *Synodontis hangi*. The nematode is illustrated in Fig. 9–11.

One male in the collection of the Muséum National d'Histoire Naturelle, no. MNHN 35 KG, from *Synodontis tessmanni* Pappenheim, 1911 from Gabon. The head of this specimen had been removed previously and was illustrated by Petter & Thatcher (1988). The male nematode and a 4th stage female larva are illustrated in Fig. 16–19.

Description

The measurements that could be made are listed in Table 2.

Medium-sized worms with an elliptical mouth opening around which the apical structures are arranged as illustrated in Fig. 1 & 16a. The buccal capsule is well-sclerotized, globose and bears 9–11 fine, weakly sclerotized spiral ridges on the inner surface (Fig. 12a, b). The anterior margin of the buccal capsule is formed by 4 processes, 2 of which are small and usually triangular in the males and trapezoidal in the female, with smooth or usually serrated edges, and 2 of which are in the shape of double crescents next to each other, but unequal in height, usually with smooth edges. The outline of a model made of the anterior part of the buccal capsule is illustrated in Fig. 12c. The oesophagus consists of a muscular and glandular part, which may be of equal length or the one part may be longer than the other. The nerve ring lies in the posterior half to third of the muscular oesophagus. The deirids and the excretory pore were not seen in the available specimens.

Males

The spicules are unequal and lightly sclerotised. Due to the method and state of preservation, the tips of the spicules could not be made out. The caudal alae are narrow, and the number and arrangement of the caudal papillae is in accordance with the description of Baylis (1923a, b). The tail appears conical in lateral view and apparently does not bear mucrons (Fig. 13).

Females

The females are similar to those of the previous species as regards the position of the vulva and the configuration of the uterus. Few larvae, however, were seen in the uterus. The tail narrows abruptly

a short distance behind the anus and ends in a sharp point and, as far as could be ascertained, mucrons are absent (Fig. 14).

The head and tail of a larva in the 4th moult are illustrated in Fig. 15.

DISCUSSION

Baylis (1923a) created the genus *Procamallanus* for those nematodes that resembled *Camallanus* Raillet & Henry, 1915, but whose buccal capsule was not divided into 2 shell-like valves. Subsequently, Olson (1952) created the genus *Spirocamallanus* for those species of *Procamallanus* having spiral thickenings in the buccal capsule. The genus *Spirocamallanus* has been accepted by most workers. Moravec & Amin (1978), however, found that spiral ridges, the main distinguishing characteristic of the genus *Spirocamallanus*, were always present in the buccal capsule of female *Procamallanus siluri* Osmanov, 1964, but always absent in the males. The genus *Spirocamallanus* is therefore considered a subgenus of *Procamallanus* by Moravec & Amin (1978), De & Moravec (1980) and Moravec & Sey (1988).

Numerous species have been described since, mostly from South America and the Orient. *Spirocamallanus daleneae* is the 3rd species to be recorded from Africa and the 1st species from South Africa. It differs from *Spirocamallanus mazabukae* in having considerably shorter spicules (Table 2) and having only 4 pairs of post-cloacal papillae as opposed to the 6 pairs seen in *Spirocamallanus mazabukae*, as illustrated by Yeh (1957).

Spirocamallanus daleneae differs from the unnamed *Spirocamallanus* sp. described by Campana-Rouget (1961) in not having the chitinized structures encircling the buccal capsule, in having a larger buccal capsule with more spiral thickenings, and in having shorter spicules. Campana-Rouget (1961) states that there are 4 or 5 pairs of post-cloacal papillae, whereas *Spirocamallanus daleneae* has only 4 pairs.

Although the principal measurements of the unnamed *Spirocamallanus* sp. female described by Yeh (1957) are comparable to those of the females of *Spirocamallanus daleneae*, the former species has 10 spiral thickenings in the buccal capsule and the vagina runs anteriorly, as opposed to the 13–14 spiral thickenings and the posteriorly directed vagina in the latter.

Baylis (1923a) did not record the number and arrangement of the caudal papillae from the damaged male *Spirocamallanus spiralis* from *Clarias anguillaris*. Baylis (1923b), however, recorded the specimens from *Synodontis eupterus* as having 7 pairs

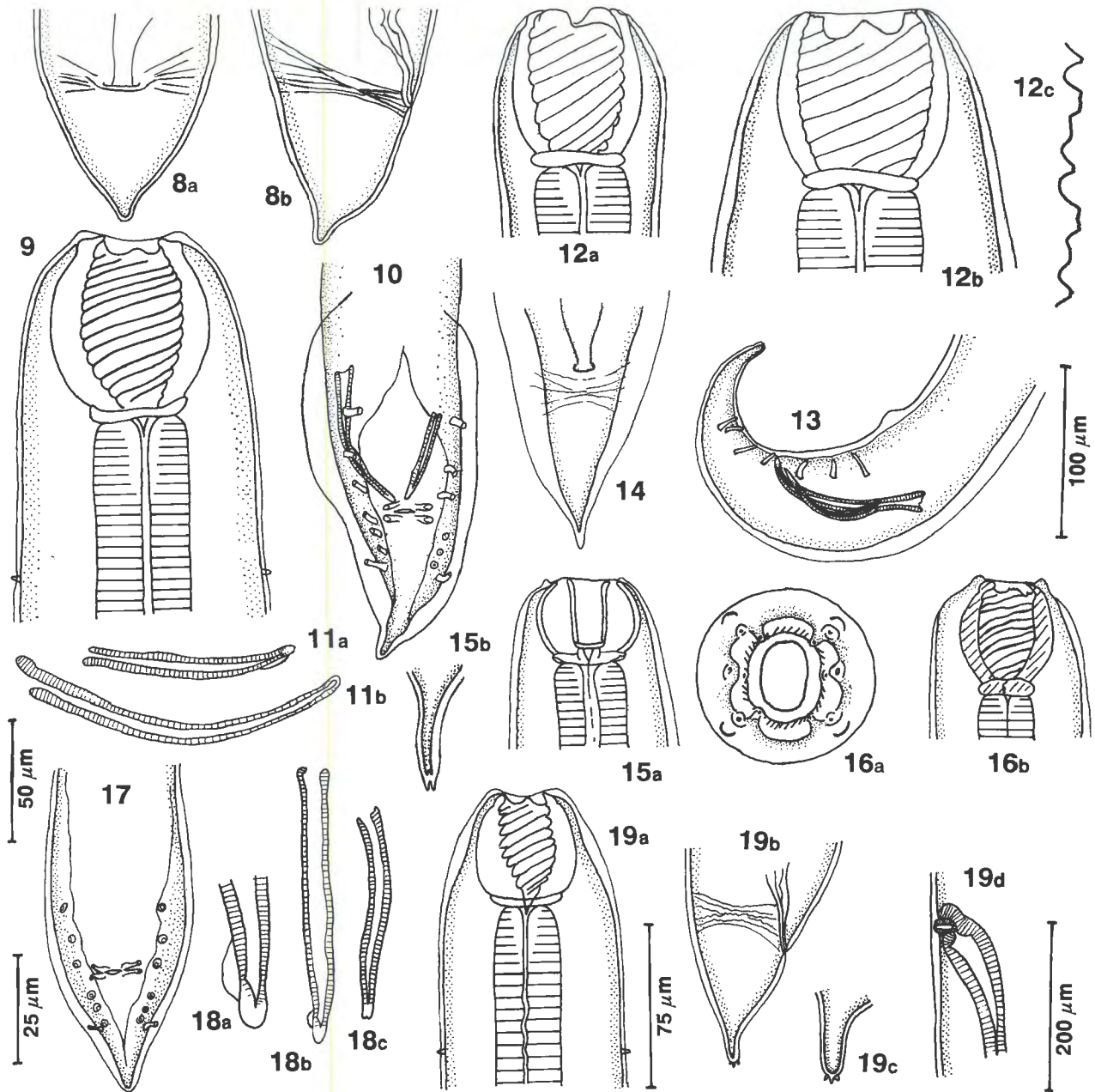


FIG. 8 *Spirocamallanus daleneae* from *Synodontis zambezensis*. Tail of a female in (a) ventral and (b) lateral views

FIG. 9–11 *Spirocamallanus daleneae* from *Synodontis haugi*

FIG. 9 Lateral view of the head of the male

FIG. 10 Ventral view of the caudal region of the male

FIG. 11 Lateral view of (a) the left and (b) the right spicules

FIG. 12–15 *Spirocamallanus spiralis* from *Synodontis eupterus*

FIG. 12 Median view of (a) the head of the male and (b) the female and (c) a schematic representation of the anterior margin of the buccal capsule

FIG. 13 Lateral view of the caudal area of a male

FIG. 14 Ventral view of the female tail

FIG. 15 Female 4th stage larvae, (a) head in lateral view and (b) the tip of the tail

FIG. 16–19 *Spirocamallanus* sp. indet from *Synodontis tessmanni*

FIG. 16 Apical (a) and lateral (b) views of the head (redrawn from Petter & Thatcher 1988)

FIG. 17 Ventral view of the caudal area of the male

FIG. 18 Lateral views of (a) the left spicule, (b) the right spicule and (c) the tip of the right spicule

FIG. 19 Lateral views of (a) the head, (b) the posterior end and (c) the tip of the tail, and (d) ventrolateral view of the vulvar region of a female 4th stage larva

Scale bars: 25 μm—FIG. 18a

50 μm—FIG. 16a, 16b

75 μm—FIG. 12a, 12b, 18b, 18c

100 μm—FIG. 9, 11a, 11b, 15a, 15b, 19a, 19c

200 μm—FIG. 8a, 8b, 10, 13, 14, 17, 19b, 19d

of subventral and 2 pairs of pari-anal papillae which are identical to those of *Spirocamallanus daleneae* and *Spirocamallanus spiralis sensu lato* from the 2 *Synodontis* species from Gabon (Fig. 10 & 17). However, the buccal capsule illustrated by Baylis (1923a) is unlike that of *Spirocamallanus spiralis* from *Synodontis eupterus* examined in this study (Fig. 12a, b). It is possible that Baylis (1923a, 1923b) could have dealt with 2 different species and, in the absence of material from *Clarias anguillaris*, we consider the species from *Synodontis eupterus* as *Spirocamallanus spiralis*, as both sexes were available for examination.

Spirocamallanus spiralis differs from *Spirocamallanus daleneae* in that the buccal capsule of both sexes is more globular with fewer and finer striations and that the configuration of the processes forming the anterior margin of the buccal capsule is entirely different (Fig. 1b & 12c). In addition, particularly the muscular, but also the glandular parts of the oesophagi are considerably shorter in *Spirocamallanus spiralis* than in *Spirocamallanus daleneae*, and this appears to be irrespective of the length of the nematode.

Spirocamallanus spiralis sensu lato from *Synodontis haugi* seems to be very similar to *Spirocamallanus daleneae* as far as the principal measurements and the configuration of the buccal capsule, and the spicules and caudal end of the male are concerned (Fig. 9–11). It is probably conspecific with *Spirocamallanus daleneae* and is provisionally assigned to that species until more material becomes available.

Spirocamallanus spiralis sensu lato from *Synodontis tessmanni* appears to be very similar to *Spirocamallanus spiralis sensu lato* Baylis (1923a, b) in so far the configuration of the buccal capsule is concerned (Fig. 16b). The tip of the right spicule, however, seems to be nearer to *Spirocamallanus daleneae* (Fig. 18a–c). The principal measurements that could be made are less than those of either *Spirocamallanus spiralis* or *Spirocamallanus daleneae*. In view of these differences, but also because of extensive damage, this species has to remain unnamed until more material becomes available.

Despite the arrangement of the apical structures being the same in *Spirocamallanus daleneae* and the *Spirocamallanus* sp. indet. (and probably also *Spirocamallanus spiralis*), there are several morphological and host differences between the African species of the genus. The name *Spirocamallanus daleneae* n. sp. is therefore proposed for the species recovered from *Synodontis zambezensis* from South Africa.

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REFERENCES

- BAYLIS, H.A. 1923a. Report on a collection of parasitic nematodes, mainly from Egypt. Part III. Camallanidae etc., with a note on *Probstmayria* and an appendix on Acanthocephala. *Parasitology*, 15:24–38.
- BAYLIS, H.A. 1923b. Note on *Procamallanus spiralis* Baylis 1923 (Nematoda). *Parasitology*, 15:137–138.
- CAMPANA-ROUGET, Y. 1961. Nematodes de poissons. *Exploration hydrobiologique des lacs Kivu, Edouard et Albert (1952–1954). Resultats Scientifiques*, 3:1–60.
- DAGET, J., GOSSE, J.P. & THYS VAN DEN AUDENAERDE, D.F.E. 1986 (Eds). *Check-list of the freshwater fishes of Africa*. Vol. I–IV. Brussels: Institut Royal des Sciences Naturelles de Belgique; Tervuren: Musée Royal de l'Afrique Centrale; Paris: Office de la Recherche Scientifique et Technique Outre-Mer.
- DE, N.C. & MORAVEC, F. 1980. Redescription of the nematode *Procamallanus spiculogubernaculus* with notes on related forms. *Vestník Československé Společnosti Zoologické*, 44: 81–91.
- KHALIL, L.F. 1971. *Check list of the helminth parasites of African freshwater fishes*. (Technical Communication, no. 42 of the Commonwealth Institute of Helminthology: i–xi + 80).
- MORAVEC, F. & AMIN, A. 1978. Some helminth parasites, excluding Monogenea, from fishes of Afghanistan. *Acta scientiarum naturalium Academiae Scientiarum bohemoslovacae—Brno*, 12:1–45.
- MORAVEC, F. & SEY, O. 1988. Nematodes of freshwater fishes from north Vietnam. Part I. Camallanoidea and Habronematoida. *Vestník Československé Společnosti Zoologické*, 52:128–148.
- OLSEN, L.S. 1952. Some nematodes parasitic in marine fishes. *Publications of the Institute of Marine Science, Texas*, 11:173–215.
- PETTER, ANNIE J. & THATCHER, V.E. 1988. Observations sur la structure de la capsule buccale de *Spirocamallanus inopinatus* (Nematoda), parasite de poissons brésiliens. *Bulletin de Muséum national d'Histoire naturelle*, series 4(10):685–692.
- VAN AS, J.G. & BASSON, LINDA 1984. Checklist of freshwater fish parasites from southern Africa. *South African Journal of Wildlife Research*, 14:49–61.
- YEH, L.S. 1957. On a new nematode, *Spirocamallanus mazabukae* sp. nov., from freshwater fish in southern Africa. *Journal of Helminthology*, 31:126–130.