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Parasites of South African freshwater fish. V. Description of two new species of the genus *Spinitectus* Fourment, 1883 (Nematoda: Cystidicolidae)

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ABSTRACT

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Spinitectus petterae n. sp. was recovered from catfish, *Clarias gariepinus* (Burchell, 1822) and *Spinitectus zambezensis* n. sp. from squeakers, *Synodontis zambezensis* Peters, 1852 in the Kruger National Park. The nematodes are easily differentiated from each other in that *Spinitectus petterae* has an additional pair of papillae on the pseudolabia, the males have considerably longer spicules and a different configuration of the tips of the left spicule, and the vulva of the females is considerably closer to the anus than is the case with *Spinitectus zambezensis*. The new species differ from *Spinitectus allaeri* Campana-Rouget, 1961, *Spinitectus mormyri* Campana-Rouget, 1961 and *Spinitectus thurstonae* Ogden, 1967 in having more spines per row in the 1st 2 rows. Despite possible conspecificity with *Spinitectus polli* Campana-Rouget, 1961, *Spinitectus zambezensis* should be regarded as a valid species because of the morphological, geographical and host differences.

INTRODUCTION

The genus *Spinitectus* Fourment, 1883 is represented by a large number of species in marine and freshwater fish, some amphibians and a mammal. In Africa, *Spinitectus allaeri* Campana-Rouget, 1961, *Spinitectus mormyri* Campana-Rouget, 1961, *Spinitectus polli* Campana-Rouget, 1961, *Spinitectus thurstonae* Ogden, 1967, and unnamed male and female *Spinitectus* spp. have been recorded from freshwater fish (Campana-Rouget 1961; Ogden 1967; Khalil 1970). *Spinitectus camerunensis* Vaucher & Durette-Desset, 1980 has been recovered from an amphibian (Vaucher & Durette-Desset 1980) and *Spinitectus menzalei* Hugot, 1979 from an otter shrew, *Potamogale* sp. (Hugot 1979). The last named species is, as far as is known, the only species of the genus to occur in a mammal. No members of this genus have as yet been recorded from South Africa.

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During a survey of the parasites of fish in the Kruger National Park, a new species of this genus was recovered from catfish, *Clarias gariepinus* (Burchell, 1822) and another from the squeaker, *Synodontis zambezensis* Peters, 1852. Numerous worms, all deeply embedded in the mucosa of the stomach, were found in both host species.

In this paper these parasites, for which the names *Spinitectus petterae* n. sp. for the species recovered from catfish and *Spinitectus zambezensis* n. sp. for that from squeakers are proposed, are described and their affinities with other members of the genus in Africa are discussed.

DIAGNOSIS OF THE GENUS *SPINITECTUS* FOURMENT, 1883

Pseudolabia relative large, without teeth and with enlarged anterior borders, covering the greater part of the oral opening; papillae usually reduced to 4 at the base of the pseudolabia, but sometimes 8 are present. Pharynx cylindrical, relatively short; oesophagus clearly divided into anterior muscular and posterior glandular parts. Head retractile. Cuticle with transverse rows of posteriorly directed spines; anteriorly, the rows are closer together and interrupted laterally, forming 2 semi-circles; spines decreasing in size and number posteriorly and semi-circles no longer evident. Males with spirally coiled tail, narrow caudal alae; usually 4 pairs of pre-cloacal papillae, but these may be absent; denticular ridges (area rugosa) anterior to cloaca sometimes observed; spicules lightly sclerotized, unequal in length. Females usually straight; vulva in posterior part of the body (pre-equatorial in some Indian species). Oviparous; eggs small with a thick shell, sometimes with polar plugs with filaments (amended from Baylis & Daubney 1926; Chabaud 1975; Skryabin 1991).

DESCRIPTION OF *SPINITECTUS PETTERAE* n. sp.

Type host

Clarias gariepinus (Burchell, 1822) from the Crocodile river, Kruger National Park, South Africa.

Material examined

All the type specimens together with numerous additional specimens have been deposited in the collection of the Muséum National d'Histoire Naturelle, Paris, France (MNHN).

C. gariepinus, holotype male and allotype female, MNHN 578 MD; paratypes, 9 males and 8 females, MNHN 578 MD.

Etymology

The species is named after Dr Annie J. Petter, Laboratoire de Biologie Parasitaire, Muséum National d'Histoire Naturelle, Paris, France in recognition of her extensive contribution to the knowledge of nematodes of freshwater fish.

Description of the species

The principal measurements are given in Table 1.

Spinitectus with 40–52 spines in the 1st row (Fig. 2). The spines are large and lightly sclerotized and, in lateral view, appear to be implanted on a chitinous base (Fig. 1a–c, 18a). First row of spines slightly smaller than those of the 2nd row, 1st 2 rows closer together than subsequent rows. Spines becoming smaller from the 3rd row, and from about the middle of the body onwards, the spines are reduced to triangular prickles (Fig. 18). In the posterior half of the female body, the prickles are irregularly scattered and in the males, virtually absent.

The mouth opening is oval and is bordered by 2 pseudolabia with enlarged anterior borders. Eight sub-median papillae and the amphids are situated on the pseudolabia (Fig. 2a).

The oesophagus is clearly divided into a relatively short muscular and a long glandular part. In both sexes the ratio of the muscular to the glandular parts is 1:2,68–3,57. The deirids were not seen and the nerve ring is situated in the anterior third of the muscular oesophagus, between the 1st and 2nd rows of spines (Fig. 1a). The excretory pore opens ventrally at the level of the 4th row of spines (Fig. 1a).

Males

There are 40–44 spines in the 1st row (Fig. 2b). The caudal alae are weakly developed. There are 4 pairs of pre-cloacal and 6 pairs of post-cloacal papillae. The latter are arranged in 3 pairs of large papillae immediately posterior to the cloaca and a cluster of 3 smaller papillae on each side near the tip of the tail (Fig. 3). The spicules are lightly sclerotized and unequal in length. The tip of the larger left spicule is twisted and bears 2 membranaceous structures (Fig. 5). The right spicule is curved and bears 2 large membranaceous alae, and in ventral view is boat-shaped and hollow. It appears to be a guide for the left one. The tips of both spicules bear membranous bulbs (Fig. 4 & 5).

Females

There are 50–52 spines in the 1st row (Fig. 2a). The vulva is a slightly raised, transverse slit near the anus. The ovejector runs anteriorly (Fig. 6) and, in the females examined, the junction with the 2 uteri was indistinct. The tail is fairly slender with a rounded tip (Fig. 6 & 7). Eggs are ovoid, thick-shelled and smooth, and contain a larva when laid (Fig. 8).

DESCRIPTION OF *SPINITECTUS ZAMBEZENSIS* n. sp.

Type host

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

Material examined

The type specimens as well as additional material consisting of numerous males and females have been deposited in the collection of the Muséum National d'Histoire Naturelle, Paris, France. Holotype

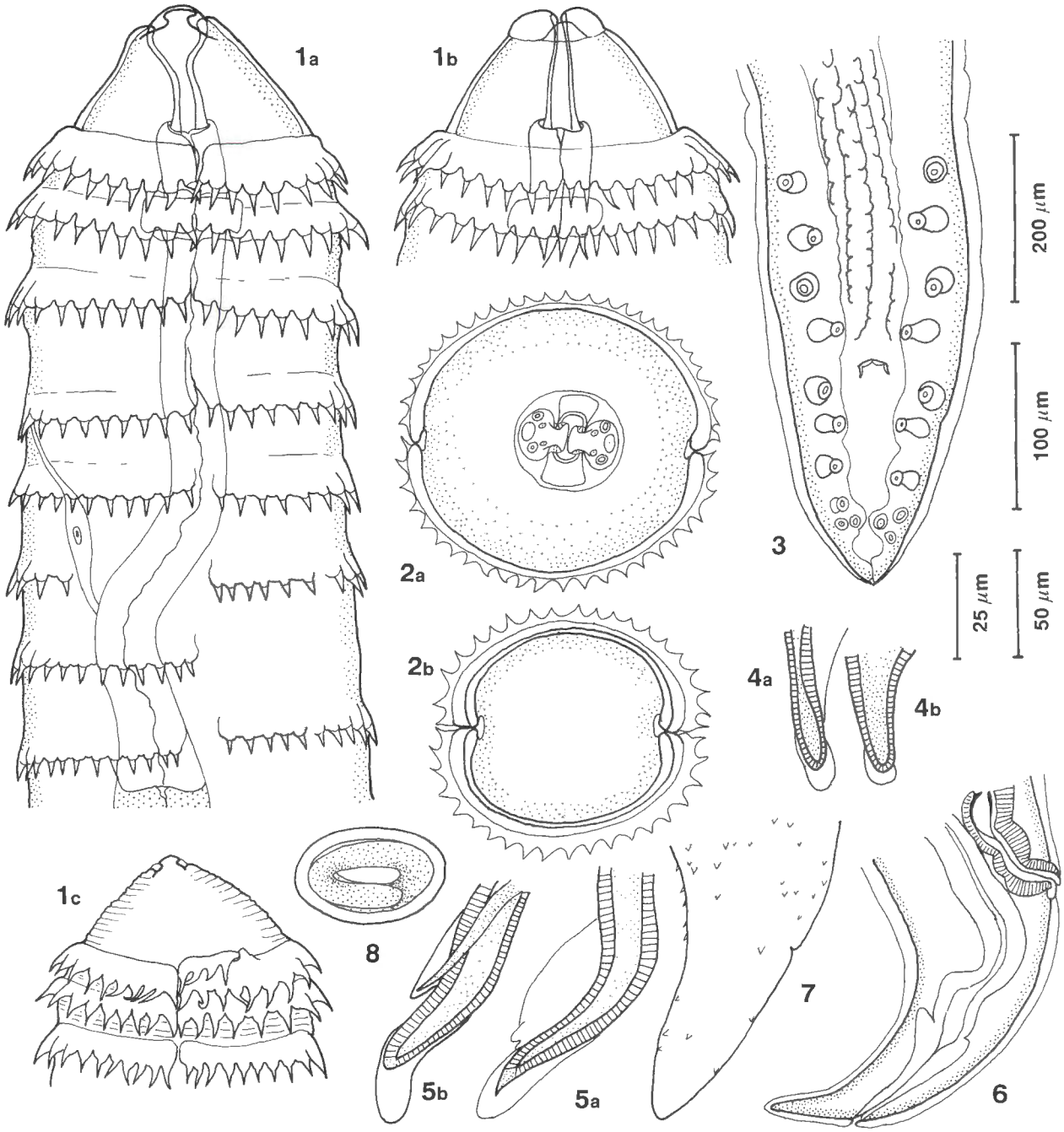

FIG. 1–8 ***Spinitectus petterae***

FIG. 1 Anterior end of (a) the holotype male in lateral view, showing a large interruption in the spines of row 6 and an additional semi-circle of spines between rows 6 and 7, (b) a paratype male in median view and (c) a male with a few spines in front of row 1

FIG. 2 Cross-section at the level of the 1st row of spines of (a) a female and (b) a male. The apical structures are illustrated in the inner circle in Fig. 2a

FIG. 3 Ventral view of the caudal end of a male, showing the arrangement of the caudal papillae

FIG. 4 The tips of the shorter right spicule in (a) lateral and (b) dorsal views

FIG. 5 The tips of the longer left spicule in (a) lateral and (b) ventral views

FIG. 6 Caudal end of a female, showing the proximity of the vulva to the anus

FIG. 7 The tail of a female showing the spinulation

FIG. 8 An egg containing a larva

Scale bars: 25 µm—FIG. 4, 5, 8
50 µm—FIG. 1a, 1b, 2, 7
100 µm—FIG. 1c, 3
200 µm—FIG. 6

TABLE 1 The principal measurements of *Spinitectus petterae* n. sp.*

	Males		Females	
	Holotype	Paratypes	Allotype	Paratypes
Length (mm)	4,524	4,281–5,747	5,759	4,420–6,370
Width	191	131–226	233	213–269
Distance of nerve ring from end of pharynx	59	31–128	42	60–77
Distance of excretory pore from end of pharynx	111	52–132	84	153–178
Pharynx length	63	56–77	70	62–76
Muscular oesophagus length	295	230–372	336	304–483
Glandular oesophagus length	1 103	965–1 603	1 319	944–1 985
Total length of oesophagus	1 398	1 235–1 878	1 665	1 266–2 468
Left spicule length	790	644–790	–	–
Right spicule length	153	93–146	–73	–
Tail length	132	113–202	423	69–135
Distance of anus from vulva	–	–	496	242–404
Distance of vulva from tip of tail	–	–	37	328–502
Eggs, in utero, length	–	–	23	34–37
Eggs, in utero, width	–1:3,74	–	1:3,48	22–26
Ratio of muscular:glandular oesophagus		1:3,04–5,83		1:2,58–4,11

* All measurements given in μm except where otherwise indicated

TABLE 2 The principal measurements of *Spinitectus zambezensis* n. sp.*

	Males		Females	
	Holotype	Paratypes	Allotype	Paratypes
Length (mm)	4,770	2,840–4,360	7,970	4,665–7,640
Width	147	117–159	218	172–258
Distance of nerve ring from end of pharynx	52	16–114	55	18–66
Distance of excretory pore from end of pharynx	182	153–183	NS	70–117
Pharynx length	67	52–79	76	64–101
Muscular oesophagus length	213	152–186	230	179–254
Glandular oesophagus length	958	780–1 006	1 184	965–1 329
Total length of oesophagus	1 171	953–1 158	1 414	1 158–1 559
Left spicule length	461	366–462	–	–
Right spicule length	81	77–90	–95	–
Tail length	126	97–124	2 034	64–104
Distance of anus from vulva	–	–	2 129	1 087–1 668
Distance of vulva from tip of tail	–	–	41	1 160–1 772
Eggs, in utero, length	–	–	23	38–41
Eggs, in utero, width	–1:4,50	–	1:5,15	24–28
Ratio of muscular:glandular oesophagus		1:4,51–6,62		1:4,05–7,34

* All measurements given in μm except where otherwise indicated

male and allotype female, No. MNHN 394 MD; paratypes, 10 males and 8 females, MNHN 395 MD.

Etymology

This nematode species is named after its host.

Description of the species

The principal measurements are given in Table 2.

Spinitectus with 48–51 spines in the 1st row. The spines are large and in lateral view appear to be implanted on lightly sclerotized bases (Fig. 10a, 11). Subsequent rings are progressively further removed from each other and contain fewer and smaller spines (Fig. 18). In the posterior half of the body, the spines are reduced to prickles in the female worms and are virtually absent in the males.

The configuration of the apical structures of the mouth is essentially the same as that of the previous species but only 4 submedian papillae are present (Fig. 11b).

The oesophagus is divided into muscular and glandular parts and the ratio of the muscular to the glandular parts is 1:4,51–6,62 in the males and 1:4,05–

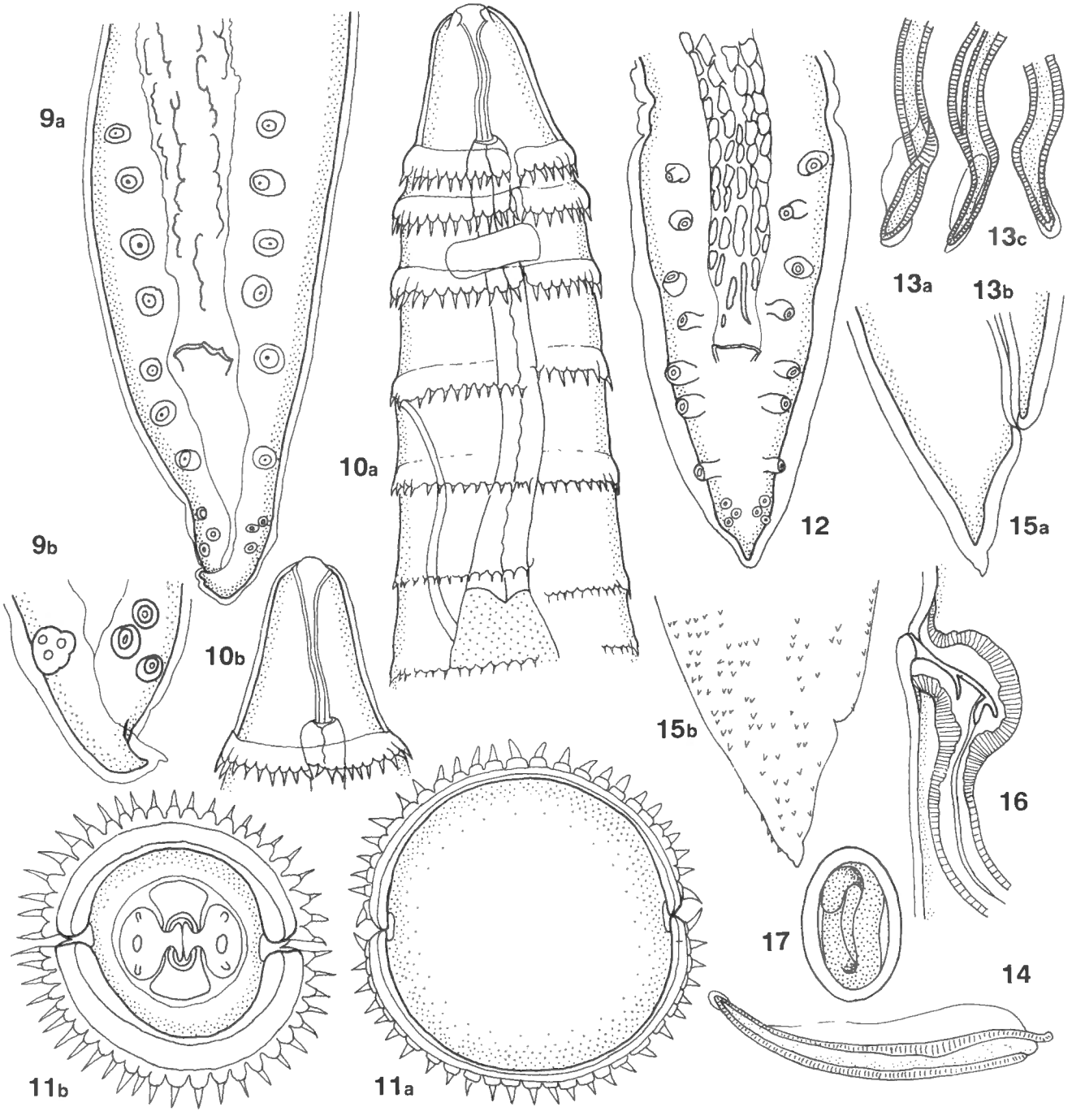

FIG. 9 Abnormalities in the configuration of the caudal papillae; (a) papilla 6 on the left side absent and (b) fusion of papillae 8—10 on the right side

FIG. 10–17 ***Spinitectus zambezensis***

FIG. 10 Anterior end of (a) the holotype male in lateral view and (b) a paratype male in dorsal view

FIG. 11 Cross-section at the level of the 1st row of spines of (a) a female and (b) a male; the innermost circle illustrates the apical structures

FIG. 12 Ventral view of the caudal end of the male, showing the arrangement of the caudal papillae

FIG. 13 The tip of the longer left spicule in (a) ventrolateral, (b) ventral and (c) lateral views

FIG. 14 The shorter right spicule in lateral view

FIG. 15 The caudal end of a female showing (a) the short stumpy tail and (b) the spinulation

FIG. 16 Vulvar region and ovejector of a female (down is anteriorly)

FIG. 17 An egg containing a larva

Scale bars (cf. Fig. 1–8): 25 μm—FIG. 9b, 11, 13, 14, 17
50 μm—FIG. 10, 12, 15
100 μm—FIG. 9a, 16

7,34 in the females. The deirids were not seen. The nerve ring is situated between the 2nd and 3rd rows and the excretory pore opens ventrally at the level of the 4th row of spines Fig. 10a).

Males

The caudal alae are weakly developed and there are 4 pairs of precloacal and 6 pairs of post-cloacal papillae; the latter are arranged in 3 pairs of large papillae behind the cloaca and a group of 3 papillae on each side of the body near the tip of the tail (Fig. 12). The spicules are lightly sclerotized and unequal in length. The smaller right spicule is curved and bears large membranaceous alae (Fig. 14). In ventral view the right spicule is boat-shaped and hollow and appears to act as a guide for the left spicule. The tip of the longer left spicule is twisted and bears a small membranaceous ala on the ventral aspect (Fig. 13). The tips of both the spicules bear small transparent, membranaceous bulbs (Fig. 13 & 14).

Females

The vulva is a slightly raised, simple transverse slit at least 1 mm from the posterior end. The ovejector runs anteriorly, (Fig. 16) but the junction of the uteri with the ovejector could not be seen. The tail is short and stumpy with an acute tip (Fig. 15). The eggs are ovoid, thick-walled and contain a fully developed larva when laid (Fig. 17).

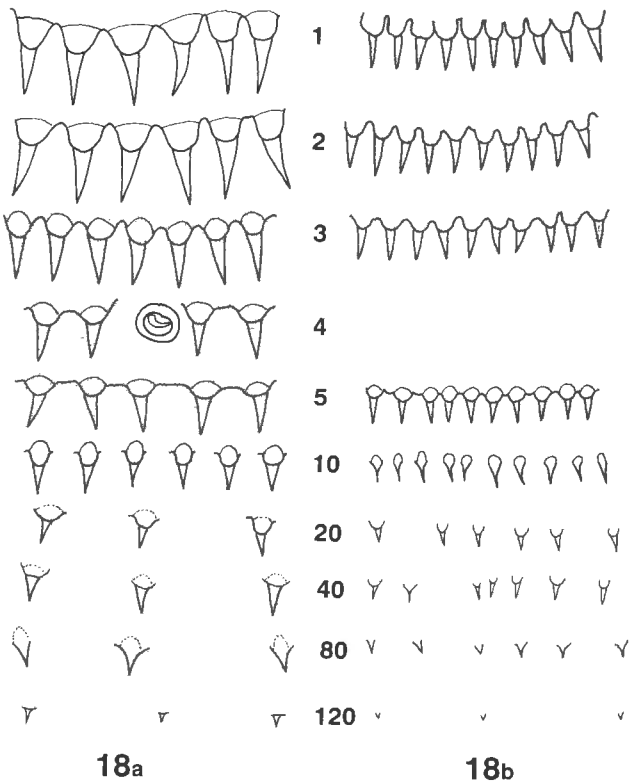

FIG. 18 Spinulation of the holotype males of (a) *Spinitectus petterae* and (b) *Spinitectus zambezensis* drawn to the same scale. Row numbers are indicated, as is the large excretory pore between the spines of row 4 of *Spinitectus petterae*

Scale bar (cf. Fig. 1–8): 25 μm

DISCUSSION

It is difficult to distinguish between the various species of the genus that occur in freshwater fish because of the relatively constant arrangement of the caudal papillae in the males and the general lack of specific characteristics. Furthermore, the head is retractile, and its shape as well as the distances of the nerve ring and excretory pore from the anterior end are therefore highly variable within a species (Baylis & Daubney 1926; Ogden 1967). Specific characteristics include the configuration of the anterior rows of spines, the position of the excretory pore in both sexes, and the distance of the vulva from the anus in the females.

Spinitectus petterae can be distinguished from *Spinitectus zambezensis* according to the following characteristics: in apical view, each of the lateral lips of the former species bears 4 papillae as opposed to the 2 in the latter; the spicules of the males of *Spinitectus petterae* are considerably longer than those of *Spinitectus zambezensis* and the configuration of the tip of the left spicule differs in the 2 species. The females can be distinguished in that the vulva of *Spinitectus petterae* is much nearer to the anus than that of *Spinitectus zambezensis*, the tip of the tail is rounded and the spinulation on the tail is much less dense in the former species as opposed to the more acute tail with dense spinulation in the latter. The ratio of the muscular to the glandular oesophagus of especially the females of *Spinitectus petterae* is smaller than that of *Spinitectus zambezensis,* indicating that the muscular oesophagus of the former species is longer.

Petter (1984) illustrates the apical views of the heads of *Spinitectus mormyri*, *Spinitectus polli* and *Spinitectus camerunensis,* and Ogden (1967) that of *Spinitectus thurstonae*. From these illustrations it is apparent that the pseudolabia of *Spinitectus zambezensis* have a configuration similar to that of the other *Spinitectus* species of freshwater fish and differ from *Spinitectus camerunensis*, which was recovered from an amphibian, in lacking the additional pair of labial papillae. *Spinitectus petterae*, however, has the same papillae configuration on the pseudolabia as *Spinitectus camerunensis*.

Spinitectus petterae and *Spinitectus zambezensis* differ from *Spinitectus allaeri*, *Spinitectus mormyri* and *Spinitectus thurstonae* mainly in having more spines per row in the 1st 2 rows. *Spinitectus zambezensis*

appears to be closely related to *Spinitectus polli* and the 2 species may be conspecific. However, attempts to obtain positively identified material of *Spinitectus polli* were unsuccessful and, in view of the morphological, geographical and host differences, *Spinitectus zambezensis* should be regarded as a valid species.

While it is entirely possible that *Spinitectus petterae* and *Spinitectus zambezensis* may be conspecific with some of the Indian species, the lack of a recent revision of the latter precludes this determination.

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