Trypanorhynchid cestodes of commercial inshore fishes of the West African coast

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Abstract

A wide spectrum of fish hosts in the Gulf of Guinea was examined for infestation with trypanorhynchid cestodes. A total of 1 341 specimens belonging to 45 species were examined. The following 9 trypanorhynchid species were identified: *Callitetrarhynchus gracilis, Grillotia perelica, Nybelinia* sp., *Otobothrium cysticum, O. dipsacum, Otobothrium* sp., *Poecilancistrum caryophyllum, Ptero-bothrium* sp. and one unidentified species. The pattern of occurrence of *Callitetrarhynchus gracilis* has been used to draw conclusions on a possible 4-host life cycle of the species, involving two obligatory teleost host fish species, small clupeids and large predatory fish. The most abundant parasite was *O. cysticum* which was found in 8 host fishes. In general most other species occurred in one host fish species only. The study confirms the predominance of otobothriid cestodes in the parasite fauna of tropical and subtropical teleost fish species. Since only *Pseudotolithus senegalensis* and *Stromateus fiatola* harboured flesh infestations, trypanorhynchids do not pose serious dangers to the marketability of most commercially important fish species in the area. The method of scanning electron microscopy was used to clarify the details of hooklet arrangement on the tentacular armature of some species for the first time.

Keywords : Gulf of Guinea, Trypanorhyncha, commercial fish, food hygiene, parasite, cestode, life cycle.

Cestodes Trypanorhynches larvaires parasites de poissons côtiers commerciaux de la côte ouest africaine.

Résumé

Un large spectre de poissons du golfe de Guinée a été étudié pour déterminer l'importance du parasitisme par les larves de Cestodes Trypanorhynches. Au total 1 341 individus, appartenant à 45 espèces, ont été examinés. Neuf Trypanorhynches ont pu être identifiés : *Callitetrarhynchus gracilis, Grillotia perelica, Nybelinia* sp., *Otobothrium cysticum, O. dipsacum, Otobothrium* sp., *Poecilancistrum caryophyllum, Pterobothrium* sp. et une espèce non identifiée. La fréquence de *Callitetrarhynchus gracilis* a été utilisée pour conclure à l'existence pour cette espèce d'un cycle biologique à 4 hôtes dont, comme hôtes obligatoires, deux Téléostéens, de petits Clupéidés et de grands poissons prédateurs. Le parasite le plus abondant *O. cysticum* a été trouvé dans 8 espèces de poissons hôtes ; la plupart des autres parasites l'ont été dans une seule espèce de poisson. Cette étude confirme la prédominance des larves d'Otobothiidés dans la faune des Cestodes parasites des Téléostéens tropicaux et sub-tropicaux. Du fait que, seuls *Pseudotolithus senegalensis* et *Stromateus fiatola* ont été trouvés porteurs dans leur chair de larves de Trypanorhynches, il résulte que ces Cestodes ne posent pas de sérieux dangers dans la commercialisation de la plupart des autres poissons étudiés. La microscopie électronique à balayage été utilisée pour la première fois chez plusieurs de ces Trypanorhynches pour mettre en évidence la disposition des crochets des trompes et les détails de leur morphologie.

Mots-clés : Golfe de Guinée, Cestodes, Trypanorhynches, parasites, cycle biologique, poissons commerciaux.

INTRODUCTION

Trypanorhynch cestodes infesting elasmobranchs as final hosts may use teleost fishes as intermediate or paratenic hosts. Although only a few cases of accidental human infestations have been reported (Bates, 1990), their infestation of the body cavity and the musculature of fishes may present marketing problems for commercially exploited species (Petersen *et al.*, 1993). For instance, heavy infestation of the Alaska pollack *Theragra chalcogramma* with plerocercoids of *Nybelinia surmenicola* have reduced the consumable part of the fish to the dorsal musculature (Grabda, 1977). Similarly, infestation with plerocercoids of *Gymnorhynchus thyrsitae* has seriously affected the exploitation of the highly valued *Thyrsites atun* in New Zealand (Mehl, 1970).

The complement of larval helminth infestations of commercial fish species of temperate waters is fairly well known as a result of the highly developed fishing industry. The most important commercial species of the North Atlantic, such as *Clupea harengus, Gadus morhua, Hippoglossus hippoglossus, Reinhardtius hippoglossoides, Sebastes fasciatus* and *S. marinus* have been particularly well studied in this regard (Dollfus, 1953; Hemmingsen and MacKenzie, 1993; Lüling, 1951; MacKenzie, 1987; Scott, 1988; Scott and Bray, 1989). The checklist of Bates (1990) shows a preponderance of trypanorhynchid cestodes in fishes from the northern part of the Atlantic which most probably reflects the number of investigations rather than the true geographical distribution of the species. On the other hand, reports on fish cestodes of the South East Atlantic are scarce. Particularly from the gulf of Guinea the only published records are those of Bane (1969), Baudin-Laurencin (1971), Bussieras and Aldrin (1965), Reimer (1984) and Obiekezie *et al.* (1992), all of which are essentially isolated observations on single or a limited number of species.

The increasing exploitation of West African marine inshore fishes for foreign markets requires a thorough understanding of their pathology so as to meet the necessary standards of quality. This study represents the first large-scale investigation of a wide fish-host range in order to determine the spectrum of larval cestodes from a typical West African inshore location. Such data permit regional comparisons and a more effective discussion of the zoogeography of larval cestodes. Particular attention was given to those cestodes which occur in the musculature or have the capability to invade it thereby producing marketing or public health problems. In addition to the establishment of several new host and locality records, the methods of scanning electron microscopy have been used as proposed by Palm *et al.* (1993) for a more accurate documentation of the tentacular hooklet structure of some of the species which hitherto have not been satisfactorily described.

MATERIAL AND METHODS

At different times between 1988 and 1990, a total of 1 121 fish specimens from 45 species and 27 families were examined for trypanorhynch cestodes in their flesh. 776 fish from the same sample were examined for plerocercoids in the stomach wall, intestine wall, mesenteries and the body cavity. In late 1991, an additional sample of 120 commercially highly valuable tongue soles (*Cynoglossus senegalensis*) and 100 schooling pelagic clupeids (*Ethmalosa fimbriata*) were examined for both flesh and viscera infesting cestodes. Fish samples were landed by commercial bottom trawlers and traditional artisanal fishermen operating in the rich fishing grounds on the western shore of the Cross River estuary (East Nigeria) between 8° 10′ and 8° 25′ E; 4° 25′ and 4° 35′ N (*fig.* 1).

Fish were examined fresh or as deep frozen specimens which had been preserved for up to 10 days after capture. They were identified using the FAO identification sheets for the Eastern Central Atlantic (Fischer *et al.*, 1981), and data were taken on individual sex, length and weight of the samples. Body cavity, gastro-intestinal tract and internal organs were searched with the help of a stereo-microscope under 6x magnification for the presence of metacestodes. For determination of musculature infestations, thin fillets were pressed between two acrylic glass plates to a thickness of 3 to 5 mm and examined on a candling table over a fluorescent light source. The dark and opaque cysts of the parasites were easily distinguishable against the transparent background of the muscle fibres.

For scanning electron microscopy (SEM) which was used to study the tentacular armature of some of the species, specimens were fixed in 2.5 % glutaraldehyde, dehydrated in an alcohol series, air dried and sputtered with gold-palladium in an argon atmosphere at 1.2 kV/40 mA. Observations were made using a Joel JSM-35C scanning electron microscope at 15 kV. Material for the SEM of *Otobothrium dipsacum* was obtained from the North East Brazilian coast.

In the taxonomic sections of this paper, the following abbreviations are used for the different body regions of the metacestodes: *pars bothridialis (pbo), pars vaginalis (pv), pars bulbosa (pb)* and *appendix (app.)*. All measurements are given in micrometers unless otherwise indicated.

RESULTS

Nine different trypanorhynchids were encountered; tetraphyllid and pseudophyllid plerocercoids could not be isolated. Their various hosts and sites of infestation are listed in *table* 1. Except of *Callitetrarhynchus gracilis, Otobothrium cysticum* and *Otobothrium* sp., the rest represent first records for their hosts and for the gulf of Guinea. Most of the trypanorhynchids occurred in the body cavity and the mesenteries. Musculature
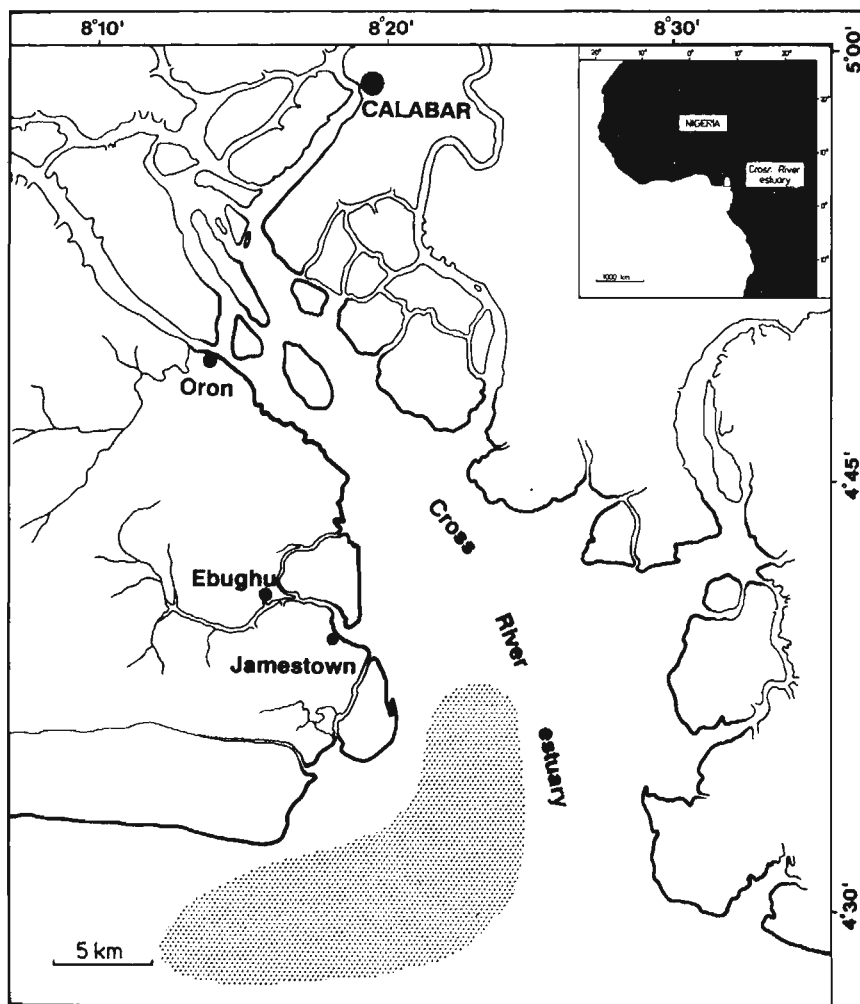
Figure 1. – Map showing fishing grounds in the Cross River estuary (stippled area).

infestation was recorded for *Otobothrium* sp. in *Stromateus fiatola* and *Poecilancistrum caryophyllum* in *Pseudotolithus senegalensis*. Remarks on the individual species isolated, particularly on their taxonomy, zoogeography and capability to invade the fish flesh, are presented below.

Fam. Tentaculariidae

Nybelinia sp.

One specimen of this parasite was found encapsulated in the stomach wall of a *Pomadasys peroteti*. The scolex measured 1 300 μm in total length and showed the typical four bothridia with thickened margins. The following measurements were taken: $pbo = 550$, $pv = 400$, $pb = 300$, $app = 400$. The homeoacanthous armature consists of small sized (10 high) hooklets with 6 to 7 hooks each half turn. The size of hooks on external and internal surface is similar and no specific basal armature is visible. So far 19 species of the genus *Nybelinia* have been reported from teleost fishes of the Atlantic (Palm, 1992). Of these Dollfus (1960) enumerated 13 species from the North West African coast among which *Nybelinia dakari* and *N. estigmena* fall into the same size range and show similar tentacular armature to the present specimen. A definite identification could not be made due to lack of sufficient material. Both species have been reported only from that locality and the present finding implies an extension of their range.

Plerocercoids of *Nybelinia* species often infest the stomach or the stomach wall of several marine teleosts. The low abundance of *Nybelinia* sp. in *Pomadasys peroteti* as well as the limited potential of most *Nybelinia* species to invade the fish flesh imply a low probability of finding parasites of this genus in the musculature of fishes from the gulf of Guinea.

Table 1. – Occurrence of cestodes in commercial fish species from the Nigerian coast (n.i. = not infested).

Host species	Body cavity				Musculature			
	Length cm	n	Cestode species	Prevalence (%)	Length cm	n	Cestode species	Prevalence (%)
Ariidae								
Arius heudeloti	44-49	2	n.i.		21-63	49	n.i.	
A. latiscutatus	23-29	26	Otobothrium cysticum	3.8	23-35	38	n.i.	
Bagridae								
Chrysichthys nigrodigitatus	18-29	15	n.i.		18-29	15	n.i.	
Batrachoididae								
Batrachoides liberiensis	13-20	13	n.i.		13-20	13	n.i.	
Carangidae								
Caranx hippos	17-34	28	n.i.		17-34	28	n.i.	
C. senegallus	18-40	11	Grillotia perelica	81.8	18-40	11	n.i.	
			Otobothrium cysticum	18.2				
Chloroscombrus chrysurus	22-24	5	n.i.		22-24	5	n.i.	
Selene dorsalis	19-28	5	n.i.		19-28	5	n.i.	
Clupeidae								
Ethmalosa fimbriata	10-25	103	Callitetrarhynchus gracilis	50	10-25	103	n.i.	
Ilisha africana	10-18	8	n.i.		10-18	8	n.i.	
Cynoglossidae								
Cynoglossus browni	54-61	5	n.i.		32-61	11	n.i.	
C. sengalensis	23-52	191	Otobothrium dipsacum	4.7	23-52	200	n.i.	
Drepanidae								
Drepane africana	14-21	6	n.i.		14-21	6	n.i.	
Elopidae								
Elops lacerta	25-37	8	n.i.		25-37	8	n.i.	
Ephippidae								
Chaetodipterus goreensis	22-29	3	n.i.		22-29	3	n.i.	
Lobotidae								
Lobotes surinamensis	18-49	5	n.i.		18-49	5	n.i.	
Monacanthidae								
Unidentified	25.5	1	Callitetrarhynchus gracilis	100	25.5	1	n.i.	
Monodactylidae								
Psettias sebae	16-21	35	Otobothrium cysticum	62.9	14-21	50	n.i.	
Mormyridae								
Petrocephalus bane	10-15	23	Otobothrium dipsacum	4.3	10-15	23	n.i.	
Mugilidae								
Mugil sp.	16-18	10	n.i.		16-18	10	n.i.	
Mullidae								
Pseudupenaeus prayensis	20-24	4	n.i.		20-24	4	n.i.	
Muraenesocidae								
Cynoponticus ferox	63-101	5	Otobothrium cysticum	20	–	–	–	–
Polynemidae								
Galeoides decadactylus	11-31	35	Pterobothrium sp.	2.9	11-31	81	n.i.	
			Trypanorhynchidea	2.9				
Pentanemus quinquarius	17-20	6	n.i.		17-20	6	n.i.	
Polydactylus quadrifilis	22-54	41	n.i.		21-55	56	n.i.	
Pomadasyidae								
Plectorhynchus macrolepis	22-39	12	n.i.		22-39	12	n.i.	
Pomadasys jubelini	22-34	6	n.i.		15-34	51	n.i.	
P. peroteti	17-41	38	Nybelinia sp.	2.6	17-41	50	n.i.	
Psettodidae								
Psettodes belcheri	12-30	4	n.i.		12-30	4	n.i.	

Table 1. – To be continued.

Host species	Body cavity				Musculature			
	Length cm	n	Cestode species	Prevalence (%)	Length cm	n	Cestode species	Prevalence (%)
Sciaenidae								
Brachydeuterus aurita	15-18	9	n.i.		15-18	10	n.i.	
Pseudotolithus elongatus	19-36	74	*Otobothrium cysticum*	18.9	19-36	93	n.i.	
P. brachygnathus	22-57	35	*Otobothrium cysticum*	8.6	22-57	50	n.i.	
P. epipercus	11-25	31	n.i.		11-25	31	n.i.	
P. moori	20-37	59	n.i.		20-37	70	n.i.	
P. senegalensis	14-18	24	n.i.		10-51	79	*Poecilancistrum caryophyllum*	1.3
P. typus	24-49	36	*Otobothrium cysticum*	19.4	23-49	78	n.i.	
Pteroscion peli	15-17	3	n.i.		15-17	3	n.i.	
Scombridae								
Scomberomorus tritor	33-39	5	n.i.		33-39	5	n.i.	
Serranidae								
Epinephelus aeneus	25-40	16	*Callitetrarhynchus gracilis*	12.5	25-40	16	n.i.	
Soleidae								
Synaptura cadenati	23-38	16	n.i.		23-38	16	n.i.	
Sparidae								
Dentex filosus	18-34	5	n.i.		18-34	5	n.i.	
Pagellus bellottii	18-31	4	n.i.		18-31	4	n.i.	
Sphyraenidae								
Sphyraena guanchancho	32-41	8	*Otobothrium cysticum*	25	32-41	8	n.i.	
Stromatidae								
Stromateus fiatola	21-36	9	n.i.		21-36	9	*Otobothrium* sp.	44.4
Trichiuridae								
Trichiurus lepturus	60-66	3	n.i.		60-66	3	n.i.	

Fam. Lacistorhynchidae

Callitetrarhynchus gracilis (Rudolphi, 1819)

C. gracilis infested three fish species in two widely differing size forms. Small-sized plerocercoids (blastocysts, 1.5-7.0 mm; scolex, 2.8 mm mean total length) were found only in the pelagic clupeid *Ethmalosa fimbriata* at a prevalence rate of 50%. Larger forms (blastocyst, 1.3-1.9 cm; scolex 1.5 cm mean total length) occurred in *Epinephelus aeneus* and an unidentified Monacanthidae. The morphological characteristics of the scolices agree with the descriptions of Dollfus (1942) and Carvajal and Rego (1985).

C. gracilis is cosmopolitan in tropical, subtropical and south temperate waters. Dollfus (1942) listed 55 teleost fishes as second intermediate hosts for the species. Records from the gulf of Guinea are those of Dollfus (1942) from *Lutjanus goreensis* and Bane (1969), Baudin-Laurencin (1971), Bussieras and Aldrin (1965) from the yellowfin tuna, *Thunnus albacores*, which are both generally large predatory fishes. The occurrence in *Ethmalosa fimbriata* in a distinctly smaller size form represents a new record in this pelagic clupeid.

Fam. Grillotiidae

Grillotia perelica (Shuler, 1938)

Plerocercoids of *G. perelica* were highly host and organ specific to the swim bladder of *Caranx senegallus* (fig. 2). The results show a direct relationship between host length and numbers of the cestode, the largest individuals (<30 cm) harbouring up to 100 plerocercoids in the swim bladder. Histological sections of the kidney in heavily infested fish showed extreme cellular infiltration which indicated a strong host response.

G. perelica was first described as *Tentacularia perelica* by Shuler (1938) from the spiral valve of the lemon shark, *Hypoprion brevirostris*, from the North West Atlantic. Dollfus (1942) placed it within the genus *Grillotia* and gave a more detailed description of the tentacular armature. Scanning electron micrographs (fig. 2c-e), however, show some hitherto unidentified features of hooklet morphology and arrangement. The row of small hooks on the external surface, typical for the poeciloacanthous armature, ends in a field of small hooks which is limited by a group of horizontally inserted hooks with rounded tips (fig. 2e). This is a third type of hook tip beside the normal spiny and

Figure 2. – *Grillotia perelica* from *Caranx senegallus. a*) Mass of plerocercoids in the swim bladder (scale bar = 1 cm); *b*) Isolated worm like plerocercoid (scale bar = 1 mm); *c*) Metabasal armature on internal tentacle surface (scale bar = 10 μm); *d*) Row of small hooklets on external tentacle surface (scale bar = 10 μm); *e*) Basal armature on external surface: cluster of small hooklets (H) terminating in forms with rounded apices (scale bar = 10 μm).

bifid forms known from *Callitetrarhynchus gracilis* (Palm, 1992) and *Pterobothrium acanthotruncatum* (Escalante and Carvajal, 1984). On the internal surface no specifically formed hooks were visible.

Long after the description of the adult stage, plerocercoids of *G. perelica* were found for the first time in the musculature of Mugilidae from the South East African coast (Schramm, 1991). The present report

represents the second observation of this remarkable metacestode in a new host but with different organ preferences. Like other trypanorhynchids *G. perelica* has the potential to invade different habitats in its hosts. It seems that in some Trypanorhynchidea, site of infestation in the second intermediate host not only depends on the cestode species but also is dependent on host fish and locality.

Fam. Otobothriidae

Otobothrium cysticum (Mayer, 1842)

This was the most frequently occurring trypanorhynchid cestode with the widest host range. Eight out of the 45 fish species examined harboured *O. cysticum*. Prevalence of infestation varied between 4 % in *Arius latiscutatus* and 63 % in *Psettias sebae* (*table* 1). Connective tissue capsules were found near the stomach and the intestine which harboured the blastocyst within the scolex was embedded in a fatty covering (*fig. 3 a*). Morphological characteristics of the scolex agree with the description of *O. cysticum* from *Dentex macrophthalmus* by Dollfus (1942). Scanning electron micrographs of the armature (*fig. 3 b-d*) show the typical heteroacanthous arrangement of hooklets particularly in the basal region. *O. cysticum* is widely distributed along the West African coast (Dollfus, 1942). The present results greatly extend the host range for the species.

Several otobothriid species are known to invade the flesh of fish, although this could not be demonstrated for *O. cysticum* during this study in spite of its wide host range.

Otobothrium dipsacum (Linton, 1897)

O. dipsacum was isolated from the mesenteries of the freshwater fish *Petrocephalus bane* and the tongue sole *Cynoglossus senegalensis* at a prevalence rate of 4 and 5 % respectively (*fig. 4 a*). Neither the original description by Linton (1897) nor those of later authors (Southwell, 1929; Cruz-Reyes, 1973) contain sufficient details of the tentacular armature. We present scanning electron micrographs using material from the North East Brazilian coast which show the remarkable arrangement of the tentacular hooklets (*fig. 4 b-d*). The internal surface is covered with 5-6 slender, rose-thorn shaped hooks closely arranged in definite calary rows (*fig. 4 b*). On the bothridial and antibothridial surfaces up to 10 similar hooks diminishing in size graduate into rows of 30 to 35 smaller hooks on the external surface (*fig. 4 c-d*).

O. dipsacum has been recorded earlier from the North West Atlantic, gulf of Mexico and Indian Ocean (Cruz-Reyes, 1973). The present findings represent the first record of the species from the West African and the North East Brazilian coast. *O. dipsacum* seems to have a world wide distribution in tropical and subtropical waters, using several teleost fish species as second intermediate hosts in the different localities. Although the site of infestation has always been reported to be the body cavity and the mesentery, 6 *Otobothrium* sp. isolated from the flesh of *Otoperca aurita* and *Polynemus quadrifiliis* in the Congo were assigned to *O. dipsacum* by Dollfus (1942).

Fam. Pterobothriidae

Pterobothrium sp.

The scolex measurements of two specimens of a *Pterobothrium* sp. from the mesenteries of a *Galeoides decadactylus* were as follows: total length = 2 650 μm, pbo = 600, pv = 1 000, pb = 1 250. The heteroacanthous armature consisted of rows of 4 calary hooks (30-50) on the internal and bothridial (antibothridial) surfaces and rows of small hooks (5-8) on the external surface. Dollfus (1942) listed 8 species of *Pterobothrium* mostly from tropical and subtropical parts of the world ocean. Of these *Pterobothrium heteracanthum* is known to invade the fish flesh of various host fish species (Overstreet, 1977; Reimer, 1984) whereas other known species mainly infest the viscera and the internal organs.

Trypanorhynchidea (not further identified)

Out of a *Galeoides decadactylus* one 7 mm long blastocyst of an unidentified trypanorhynchid cestode was isolated from the mesenteries. It contained a 1.5 mm long scolex with 4 bothridia and a short pars bulbosa. On the basis of these characteristics the parasite could be assigned to the Gilquiniidae.

Two other otobothriid species have been reported in a previous communication from the same area (Obiekezie *et al.*, 1992). Two plerocercoids of *Poecilancistrum caryophyllum* were isolated from the musculature of 1 out of 79 *Pseudotolithus senegalensis* examined. This cosmopolitan, musculature-invading parasite mainly infests sciaenids as reported for the gulf of Mexico by Overstreet (1977; 1978). However, the infestation rate observed in the gulf of Guinea was much lower than in other geographical regions. Another fish species, *Stromateus fiatola*, was heavily infested whith an *Otobothrium* sp. They were distributed throughout the musculature and between the vertebrae. Four of the 9 fish investigated were found to be infested with this trypanorhynchid in their flesh, which has been reported earlier from the same host in Senegal by Reimer (1984). It could be concluded that along the entire West African coast, *Stromateus fiatola* is similarly heavily infested with *Otobothrium* sp.

DISCUSSION

This study, which for the first time provides information on the spectrum of trypanorhynch infestations of commercially exploited inshore teleost
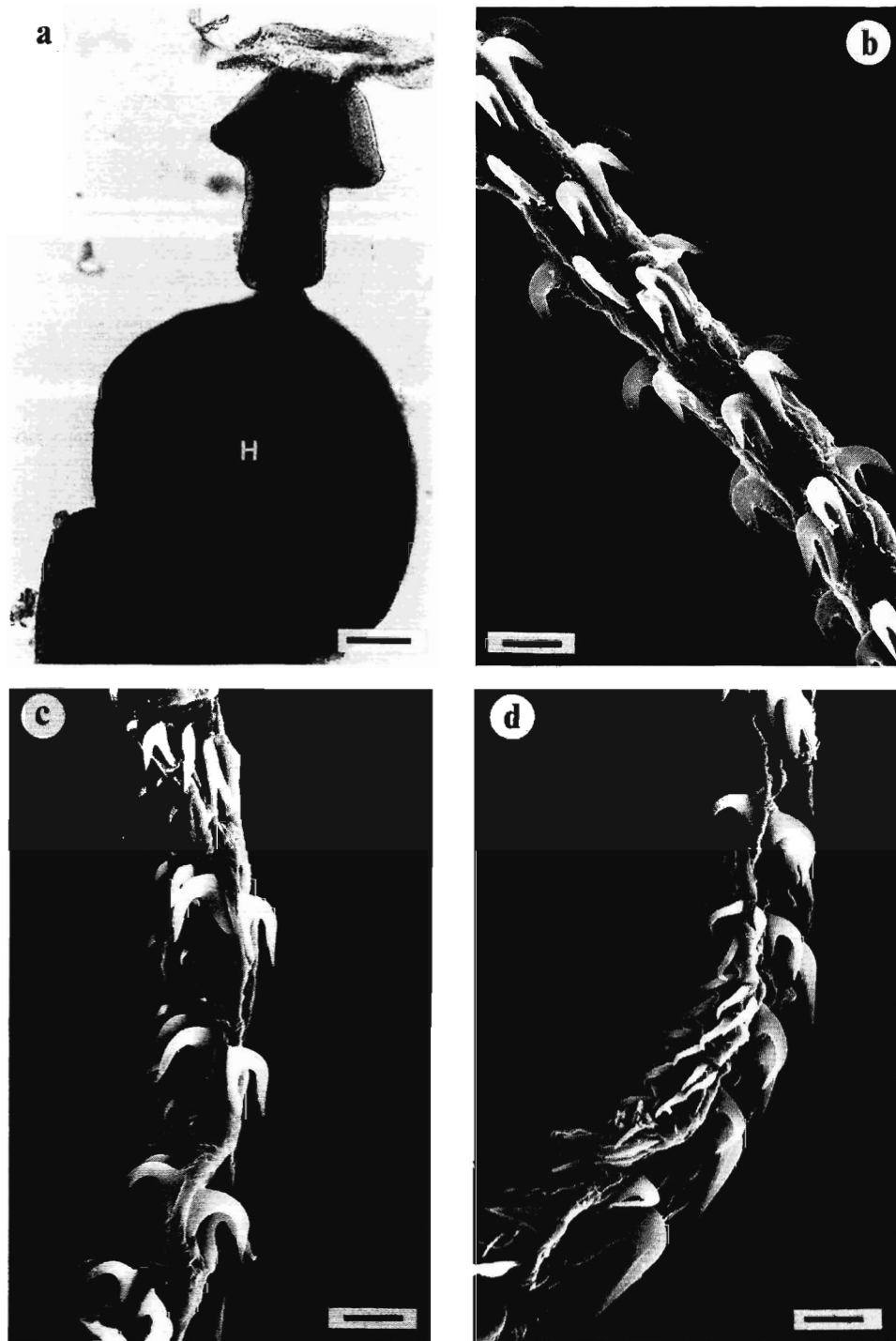
Figure 3. – *Otobothrium cysticum* from *Pseudotolithus elongatus. a*) Scolex still attached to its fatty covering (H) (scale bar = 100 μm); *b*) SEM of metabasal tentacular armature: internal surface (scale bar = 5 μm); *c*) SEM of basal tentacular armature: internal surface (scale bar = 5 μm); *d*) SEM of basal tentacular armature: bothridial surface (scale bar = 5 μm).

fishes of the gulf of Guinea, complements previous isolated data from this locality. 17 host and 7 locality records have been established. The diversity of

the cestode fauna is comparable to the situation in some other tropical areas, such as gulf of Mexico (Overstreet, 1977; 1978) or the East coast
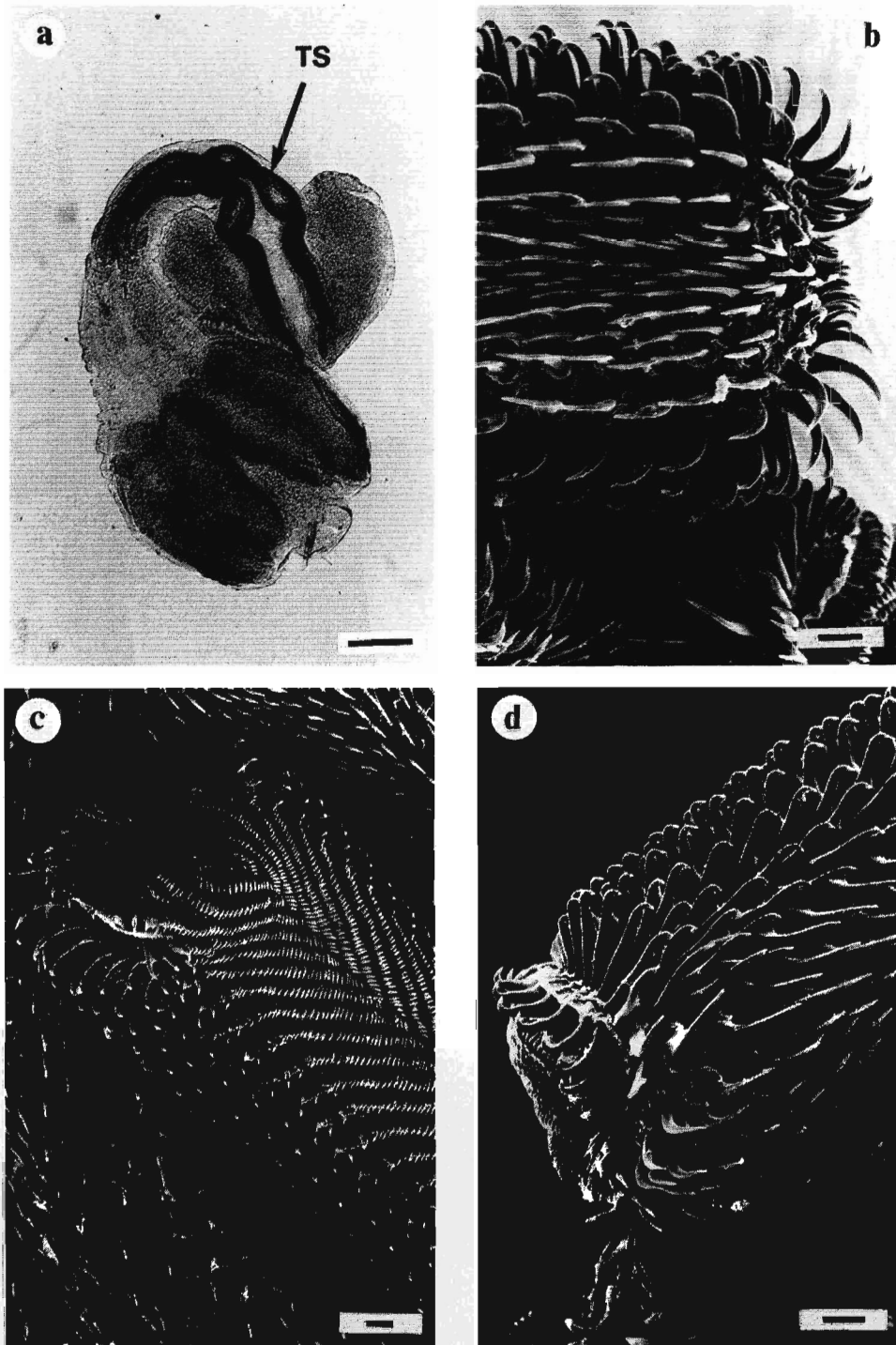
Figure 4. – *Otobothrium dipsacum* from *Pseudupeneus maculatus*. *a*) Scolex: the two bothridia, bulbs and tentacle sheats (TS) are clearly visible (scale bar = 250 μm); *b*) Metabasal armature on internal tentacle surface (scale bar = 10 μm); *c*) Metabasal armature on external tentacle surface (scale bar = 10 μm); *d*) Metabasal armature on bothridial tentacle surface (scale bar = 10 μm).

of India (Southwell, 1929). Only members of the order Trypanorhynchidea were encountered including several cosmopolitan species, while the Tetraphyllidea,

which are presumed to be more localized in distribution, were not found. The diverse and abundant elasmobranch fauna of the gulf of Guinea accounts for

the preponderance of the trypanorhynch for which they serve as final hosts. The absence of plerocercoids of the Pseudophyllidea is in agreement with the known distribution of the order which occurs mainly in the boreal and arctic regions in relation to the distribution of their final hosts.

Taking into account the report of *Dasyrhynchus talismani* by Baudin-Laurencin (1971), 4 out of 10 trypanorhynchid cestodes known from teleost fishes fo the gulf of Guinea belong to the family Otobothriidae. Results from the gulf of Mexico show a similar predominance of this family in the teleost fishes. Otobothriids are apparently dominant trypanorhynchids of tropical and subtropical waters, which is noteworthy in view of the propensity of this group to penetrate and inhabit fish flesh.

Most of the cestodes had a narrow host range, infesting only one or two second intermediate hosts. Within this category are *Grillotia perelica, Nybelinia* sp., *Otobothrium dipsacum, Otobothrium* sp., *Poecilancistrum caryophyllum* and *Pterobothrium* sp. Of these *Grillotia perelica, Otobothrium dipsacum* and *Poecilancistrum caryophyllum* infest several different intermediate hosts in other geographical regions (Cruz-Reyes, 1973; Overstreet, 1977; 1978; Schramm, 1991). *Otobothrium cysticum* on the other hand is characterized by a lack of host specificity in the gulf of Guinea, occurring in 8 of 19 fish species infested with trypanorhynch cestodes. This assures the maintenance of its population in the locality within the final hosts. Apparently this cestode either uses one very predominant first intermediate host or a wide range of such hosts to gain such effective access to the food chain. It would seem that trypanorhynch cestodes potentially are able to infest a wide range of teleosts as second intermediate hosts. Their success in this regard, however, depends on the presence of the first intermediate hosts within the particular localities. Such a dependency in the occurrence of cosmopolitan parasite species on the first intermediate hosts has been demonstrated recently for the anisakid nematode *Contracaecum osculatum* in the high Antarctic food web (Klöser *et al.*, 1992).

Callitetrarhynchus gracilis is a widely distributed trypanorhynch with a continually increasing host range. As reported during this study, the plerocercoids also occur in two distinct size forms at the North East Brazilian coast (Palm, 1992) – the small form in two clupeids (*Harengula clupeola, Opisthonema oglinum*) and a carangid (*Caranx chrysos*), the large form in two carangids (*Oligoplites palometa, Selene vomer*) and the scombrid *Scomberomorus maculatus*. Mattis (1986) proposed a four-stage life cycle for *Poecilancistrum caryophyllum*, requiring two fish intermediate hosts to complete its life cycle. As typical for trypanorhynchid cestodes, this species develops a procercoid or primary metacestode out of an oncosphere in a copepod. The author assumed a secondary metacestode lacking a developed scolex in the viscera of a copepod-eating teleost. The fully developed plerocercoid or terminal

metacestode infests sciaenids. Similarly Nakajima and Egusa (1972) have indicated the possibility of a four-host life cycle for *Callitetrarhynchus nipponica* although the first intermediate host was not found. *Callitetrarhynchus gracilis* has two very distinct growth potentials in its various hosts. Although the small scolices are fully developed, they might not be a scolex variation but an obligatory stage to complete the development of the species. It would seem that *Callitetrarhynchus* might require at least two obligatory teleost fish intermediate hosts. Unless experimental infestation studies have been carried out, we propose a four-host cycle for *C. gracilis* involving small pelagic Carangidae and Clupeidae harbouring the secondary metacestode which develops into the terminal metacestode stage in larger predatory fish, mostly Carangidae and Scombridae.

Pathogenic effects of larval cestodes on free-living host fish species are difficult to demonstrate. Although Hoffmann *et al.* (1986) are of the opinion that such influences may be diverse and include growth disturbances and lowering of the condition factor, direct pathogenic effects have been established in only a few cases (Radhakrishnan *et al.*, 1983; Richards and Arme, 1981; Rosen and Dick, 1984). Adjei *et al.* (1986) attribute increased mortality of *Saurida tumbil* to the pressure on the ventral aorta exerted by the blastocyst of *Callitetrarhynchus gracilis*. Bussieras and Aldrin (1965) showed an increased mortality of young *Thyrsites atun* due to heavy infestation of the ventral aorta with plerocercoids of *Dasyrhynchus talismani*. Results from this study indicate that the swim bladder infestation of *Caranx senegallus* by *Grillotia perelica* must lead to altered weight and malfunction of the organ. It has been demonstrated that the swimming speed in fish may be greatly reduced by helminth infestation of the swim bladder or the musculature (Sprengel and Lüchtenberg, 1991). It can be expected that *Caranx senegallus* heavily infested with *Grillotia perelica* fall easier prey as a result of reduced swimming speed. This would greatly improve the chances of the parasite which is dependent on just one second intermediate host in this locality to reach the final host. The musculature infestation of *Stromateus fiatola* by *Otobothrium* sp. and *Pseudotolithus senegalensis* by *Poecilancistrum caryophyllum* may have similar effects.

Due to the low prevalence and intensity of occurrence as shown in this study, metacestode infestations do not present marketing problems for most commercially important fish species in the gulf of Guinea. *Stromateus fiatola*, which is not a particularly valued species, may be excluded from human consumption due to high infestation with *Otobothrium* sp. The importance of *Poecilancistrum caryophyllum* in sciaenid fish of the gulf of Guinea might require further evaluation considering the very high infestation rates recorded by Overstreet (1977) in the gulf of Mexico.

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