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Two remarkable nematodes from the African reedfish *Erpetoichthys calabaricus* (Polypteriformes: Polypteridae)

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Summary

A helminthological examination of two specimens of *Erpetoichthys calabaricus* (Polypteriformes: Polypteridae), imported into the Czech Republic as an aquarium fish from Nigeria, revealed the presence of two nematode species in the hosts' intestine: *Batrachocamallanus siluranae* Jackson et Tinsley, 1995 and *Gendria polypteri* Vassiliadès et Chevalier, 1973. Representatives of *Batrachocamallanus* Jackson et Tinsley, 1995 (Spirurida: Camallanidae) have so far only been described in aquatic clawed toads (*Xenopus* spp.) from Africa. The discovery of a member of the genus in the freshwater polypterid fish may indicate an accidental infection acquired by *E. calabaricus* while feeding on infected copepods, probable intermediate hosts of the parasite. Considering the subadult stage of the presented nematode specimen, *E. calabaricus* may well serve as a paradefinitive host of *B. siluranae*. The finding of *G. polypteri* (Ascaridida: Quimperiidae) in *E. calabaricus* represents new host and geographical records.

Key words: Polypteridae; *Erpetoichthys*; nematode; *Batrachocamallanus*; *Gendria*, Nigeria

Introduction

The family Polypteridae (bichirs), confined to the freshwaters of tropical Africa, contains at least nine species of *Polypterus* Lacepède, 1803 and only one species of *Erpetoichthys* Smith, 1865 (Nelson, 1994). Bichirs are popular aquarium fishes and, among them, *E. calabaricus* (reedfish or snake fish) is imported in particularly large numbers from its natural habitats in Nigeria. While species of *Polypterus* are known to harbour five nematode species of four families (see Kabré and Petter, 1997; Khalil and Polling, 1997), the nematode fauna of *E. calabaricus* has not been studied yet. In this study the first records of two nematode species in this host are presented.

Materials and Methods

Fish hosts (n = 2) of *Erpetoichthys calabaricus* Smith, 1865 were obtained from a pet store in the Czech Republic where they had been imported directly from Nigeria. Once brought to the laboratory, they were immediately subjected to parasitological dissection, and nematode infections were found. Seven nematodes were removed from the intestine of the fish, fixed in hot 4 % formaldehyde and cleared in glycerine for light microscopy examination. After morphometric analysis, the specimens were remounted in glycerine jelly (Moravec, 1998). A light microscope equipped with DIC and a digital image analysis system (Micro Image 4) was used for the morphological study and for measuring the specimens. Drawings were made, using an Olympus microscope drawing attachment. Measurements are in millimetres unless otherwise stated. Voucher specimens have been deposited in the helminthological collection of the Institute of Parasitology, Academy of Sciences of the Czech Republic (ASCR), České Budějovice (Cat. Nos.: N-828, N-829).

Results

In this survey, two nematode species were recorded from *E. calabaricus*. The reedfish is a new host for both nematode species, and data on their morphometry are presented below.

Family Camallanidae Railliet et Henry, 1915
Batrachocamallanus siluranae Jackson et Tinsley, 1995
(Figs. 1, 2)
Description (1 female specimen): Small, yellowish nematode. Cuticle thick, with marked transverse striations; striae 5 µm high at level of posterior end of muscular oesophagus. Mouth circular, provided with 6 labial papillae (2 lateral, 4 submedian). Amphids lateral. Orange-brown buccal capsule barrel-shaped with well-developed basal ring; its

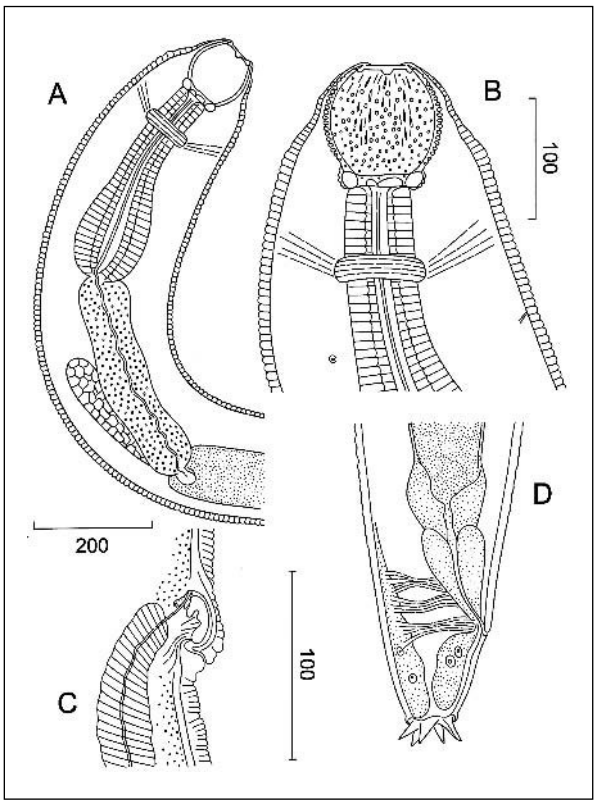

Fig. 1. *Batrachocamallanus siluranae* Jackson et Tinsley, 1995; female. A – anterior part of body; B – cephalic end, buccal capsule covered with sclerotised granules; C – region of vulva; D – posterior end, lateral view. Scale bars in µm

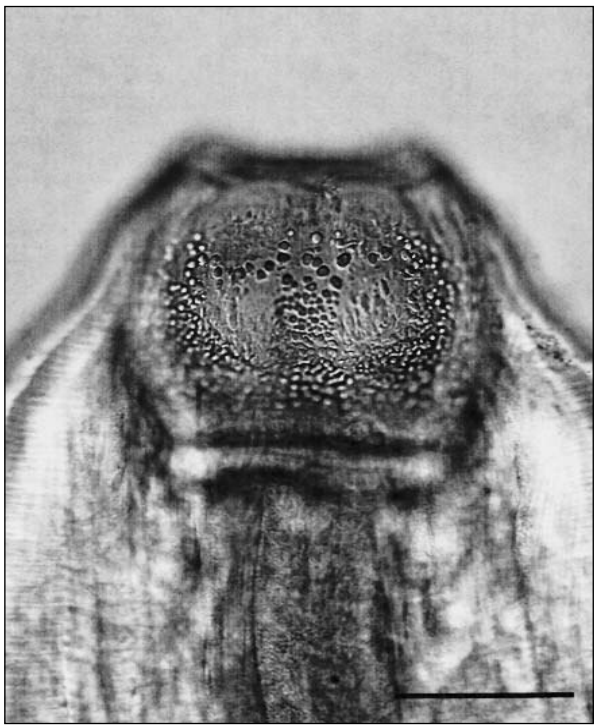

Fig. 2. Photomicrograph of buccal capsule of *Batrachocamallanus siluranae* Jackson et Tinsley, 1995; female. Scale bar = 50 µm

inner surface smooth, outer surface covered with sclerotised granules different in size (Figs. 1B, 2). Base of capsule with 3 small, anteriorly elevated obtuse sclerotised elevations (teeth-like protrusions). Oesophagus divided; anterior muscular region claviform, about same length as glandular region, maximum width 0.108; posterior glandular region almost cylindrical, maximum width 0.088. Nerve ring and excretory pore 0.180 and 0.247, respectively, from anterior extremity. Deirids somewhat posterior to nerve ring, 0.258 from anterior end. Vulva pre-equatorial, situated 1.540 from posterior end of body (at 44 % of body length). Vulval lips elevated; anterior lip provided with prominent rugose cuticular process directed posteriorly, 0.049 in length; posterior lip a small lobe-like cuticular protuberance. Tail conical, terminating in crown of 5 mucrons; length of mucrons 0.015 – 0.017 (Fig. 1D). For other morphometric data see Table 1.

Family Quimperiidae Gendre, 1928

Gendria polypteri Vassiliadès et Chevalier, 1973

(Fig. 3)

Description (2 male, 4 female specimens): Small-sized, whitish to yellowish nematodes. Cuticle with very fine

Table 1. Comparative measurements (in mm) of females *Batrachocamallanus siluranae* from *Xenopus* spp. and *Erpetoichthys calabaricus*

Characters	*Xenopus* spp.[1]	*Erpetoichthys calabaricus*[2]
Body length	1.130 – 5.000	3.497
Body width	0.093 – 0.326	0.174
Buccal capsule length	0.083 – 0.152	0.110
Buccal capsule width	0.076 – 0.144	0.097
Muscular oesophagus length	0.197 – 0.356	0.347
Glandular oesophagus length	0.157 – 0.356	0.338
Vulva*	43 – 60	55.96
Tail length	0.028 – 0.078	0.060
Mucron no.	5 – 8	5

* Distance from anterior end as a percentage of body length; [1] Overall range of measurements of specimens from three *Xenopus* species taken in Cameroon, Ghana, Nigeria, and Zaire according to Jackson and Tinsley (1995); [2] Measurements of one female from *E. calabaricus* from Nigeria

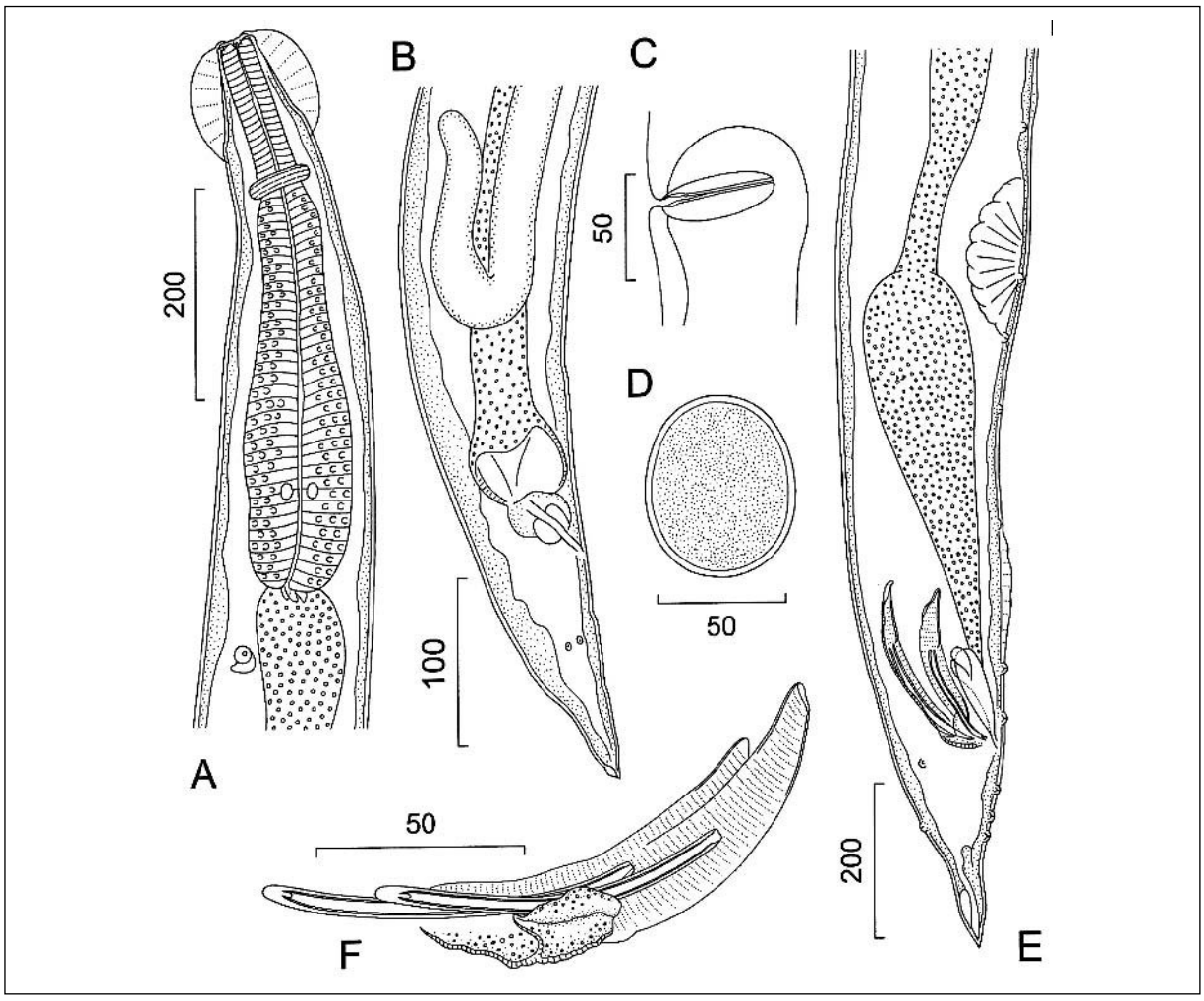

Fig. 3. *Gendria polypteri* Vassiliadès et Chevalier, 1973. A – anterior part of female, lateral view; B – posterior end of female, lateroventral view; C – region of vulva; D – egg; E – posterior end of male, lateral view; F – spicules. Scale bars in µm

transverse striations. Body cylindrical, reaches greatest width at about its middle, tapers anteriorly to form bluntly rounded head. Head surrounded by distinct cephalic vesicle. Mouth in form shallow depression; 6 cephalic papillae and pair of amphids present. Three simple oesophageal teeth protrude into buccal cavity from anterior part of oesophagus; dorsal tooth longer than lateroventral pair. Muscular oesophagus undivided, claviform, expanded behind nerve ring; posterior region of oesophagus containing numerous secretory granules (Fig. 3A). Nerve ring encircling oesophagus approximately at border of its first and second quarters. Oesophagus opens into intestine through 3 prominent valves. Excretory pore and deirids located slightly posterior to level of oesophago-intestinal junction.

Male: Maximum width of cephalic vesicle 0.030. Posterior end of body slightly curved ventrally; tail conical, with sharply pointed tip. Pre-cloacal sucker well developed, 0.100 – 0.140 long. Caudal alae absent. Twelve paired and 1 unpaired caudal papillae: 7 pairs of subventral pre-cloacal papillae (1 pair anterior to sucker, 1 pair approximately in middle of sucker, remaining pairs posterior to sucker), 1 median unpaired papilla located on anterior cloacal lip and 5 pairs (3 subventral, 2 lateral) of post-cloacal papillae present. Spicules equal, weakly sclerotised, supported by slightly sclerotised wing-shaped sheath; proximal end of spicule blunt; distal end bifurcate, with membranous cover. Small gubernaculum present.

Female: Maximum width of cephalic vesicle 0.030 – 0.040. Posterior end of body conical, with sharply pointed tip. Pair of small papillae (phasmids) situated in middle of tail (Fig. 3B). Vulva post-equatorial, situated at 57.2 – 71.42 % of body length; vulval lips slightly elevated. Ovejector muscular, long, directed anteriorly. Uteri opposed, containing 1 – 2 fully-formed eggs. Eggs almost spherical, thin-walled, smooth, non-embryonated. Other morphometric data are presented in Table 2.

Table 2. Comparative measurements (in mm) of *Gendria polypteri* from two species of Polypteridae

Characters	*Polypterus senegalus senegalus*		*Erpetoichthys calabaricus*	
	Male (n = 1) [1]	Female (n = 1) [1]	Male (n = 2) [2]	Female (n = 4) [2]
Body length	4.200	5.900	2.780 – 2.920	2.500 – 3.670
Body width (maximum)	0.300	0.500	0.150 – 0.170	0.172 – 0.220
Cephalic vesicle length	0.380	0.435	0.112 – 0.140	0.110 – 0.180
Cephalic vesicle width (maximum)	0.050	0.067	0.030 – 0.034	0.030 – 0.040
Nerve ring – anterior extremity	0.200	0.250	0.040 – 0.140	0.053 – 0.062
Oesophagus – entire length	0.760	0.890	0.530 – 0.550	0.490 – 0.630
Oesophagus anterior region length	0.200	0.250	0.140 – 0.150	0.150 – 0.190
Oesophagus anterior region width	0.070	0.110	0.030 – 0.035	0.030 – 0.040
Oesophagus posterior region length	0.560	0.640	0.390 – 0.400	0.340 – 0.440
Oesophagus posterior region width	0.235	0.350	0.080 – 0.090	0.090 – 0.120
Distance pre-cloacal sucker – tail	0.480	–	0.440 – 0.460	–
Spicule length	0.145	–	0.120 – 0.150	–
Spicule proximal part width	0.020	–	0.010 – 0.015	–
Gubernaculum length	0.040	–	0.042 – 0.050	–
Tail length	0.150	0.220	0.140 – 0.160	0.130 – 0.150
Distance vulva – anterior extremity	–	4.150	–	1.530 – 2.510
Egg dimensions	–	0.065 x 0.050	–	0.070 – 0.080 x 0.060

[1] According to Vassiliadès and Chevalier (1973); [2] Present study

Discussion

In West African freshwater fishes four species of the Camallanidae are very common: *Camallanus polypteri* Kabré et Petter, 1997; *Paracamallanus cyathopharynx* (Baylis, 1923); *Procamallanus laeviconchus* (Wedl, 1862); and *Procamallanus spiralis* Baylis, 1923 [syn. *Spirocamallanus spiralis* (Baylis, 1923) Olsen 1952]. The general morphology, in particular the buccal capsule structure, of the present camallanid species most closely resembles that of *P. laeviconchus*. However, *P. laeviconchus* reaches much greater body size, i.e. female body length up to 15 mm (Baylis, 1923), and shows only 3 mucrons on the female tail.

Jackson and Tinsley (1995) erected *Batrachocamallanus* to include the procamallanines from African amphibians bearing a large number of mucrons on the female tail and having a relatively small body size. The genus contains four species: *B. xenopodis* (Baylis, 1929), *B. slomei* (Southwell et Kirshner, 1937), *B. occidentalis* Jackson et Tinsley, 1995 and *B. siluranae* Jackson et Tinsley, 1995. It should be emphasised that this group of nematode species principally differs from other procamallanines in the large number of mucrons (five or more) on the female tail. Adult females from other genera never exhibit more than three mucrons. All known species belonging to *Batrachocamallanus* occur only in African amphibians, and are specialists of aquatic clawed toads (*Xenopus* spp., Pipidae). According to Tinsley (1981), the colonisation of clawed toads by a *Procamallanus*-like lineage (= *Batrachocamallanus*) may have been favoured by the ecological similarity of these amphibians, which show a fully aquatic lifestyle, to the more usual fish hosts parasitised by the very numerous procamallanine species. It should be noted that the distinctive morphology of *Batrachocamallanus* species formed in amphibians suggests that any "host jump" from fish is not recent (Jackson and Tinsley, 1995). Our finding of a member of this genus in a freshwater fish, *Erpetoichthys calabaricus* (Polypteriformes: Polypteridae), may represent an accidental infection acquired by this fish while feeding on infected intermediate or definitive host (*Xenopus* sp.). Although the life cycle of *B. siluranae* is not known, the intermediate hosts of the species are probably copepods, as in other camallanids (see Moravec, 1998). Because reedfishes feed on worms, crustaceans and insects (Mills and Vevers, 1989), we believe that copepods were in this particular case the most likely source of nematode infection. This is supported by the absence of larvae in the uterus of the present nematode – a fact suggesting that the female is not fully mature. Like other camallanids, the uterus in gravid females of *Batrachocamallanus* spp. contains larvae. The general morphology and measurements of the present female nematode correspond to those of *B. siluranae*, as described by Jackson and Tinsley (1995). *B. siluranae* is well differentiated - and so is the specimen found by us - from other known *Batrachocamallanus* spp. by the presence of a projection of the body wall in association with the vulva and a smaller numbers of mucrons (five; versus more than five in other species). However, the female nematode from *E. calabaricus* differs from the *B. siluranae* females described by Jackson and Tinsley (1995) in the presence of distinct sclerotised granules on the outer surface of the buccal capsule (Figs. 1B, 2). The species identification of the present specimen is based only on one female and is

consequently provisional.

Gendria Baylis, 1930 includes six species parasitising freshwater fishes and amphibians. Three species occur in hosts with an African distribution, two of them are parasitic in fishes only: *G. tilapiae* Baylis, 1930 in *Tilapia galilaea* (Cichlidae) from Nigeria (Ivashkin and Khromo-va, 1970) and *G. polypteri* Vassiliadès et Chevalier, 1973 in *Polypterus senegalus senegalus* (Polypteridae) from Senegal. The morphology of specimens from *E. calabaricus* is more or less identical with that described for *G. polypteri* by Vassiliadès and Chevalier (1973). The present male specimens differ from the original description mainly in the distribution of pre-cloacal papillae; the sixth pair of papillae (counting from the cloaca) is situated approximately in the middle of the pre-cloacal sucker rather than on its anterior margin, as reported by Vassiliadès and Chevalier (1973). Furthermore, the nematodes in our collection are apparently younger (not fully mature), as documented by the lower values for the majority of characters in both sexes and a smaller number of fully-developed eggs (1 – 2) in the uteri of the females.

In conclusion we consider that polypterid fishes are known to host five nematode species: these are *Camallanus polypteri* Kabré et Petter, 1997 from the Nile bichir (*P. bichir* Lacepède, 1803); *Amplicaecum* sp. (larva, type I) and *Procamallanus spiralis* Baylis, 1923 from the saddled bichir (*P. endlicheri* Heckel, 1847); and *Amplicaecum* sp. (larva, type I), *Gendria polypteri* Vassiliadès et Chevalier, 1973 and *Rhabdochona congolensis* Campana-Rouget, 1961 from the gray bichir (*P. senegalus* Cuvier, 1829) (Campana-Rouget, 1961; Khalil, 1969; Vassiliadès and Chevalier, 1973; Shotter and Medaiyedu, 1977; Kabré and Petter, 1997). The present finding of *G. polypteri* in *Erpetoichthys calabaricus*, the only species of the genus, represents a new host record as well as the first record of this parasite from Nigeria. With regard to the finding of *Batrachocamallanus siluranae*, a known parasite of clawed toads, in *E. calabaricus* it is possible that this reedfish may serve as a paradefinitive host (see Moravec, 1998) of this nematode species, which is unable to attain gravidity in fishes.

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References

BAYLIS, H. A. (1923): Report on a collection of parasitic nematodes, mainly from Egypt. Part III. Camallanidae. *Parasitology*, 15: 24 – 38

CAMPANA-ROUGET, Y. (1961): Nématodes de poisons. Exploration Hydrobiologique des Lacs Kivu, Edouard et Albert (1952 – 54). Résultats scientifiques. *Publ. IRSNB*, 3: 1 – 61

IVASHKIN, V. M., KHROMOVA, P. A. (1976): *Fundamentals of nematodology XXVII. Cucullanata and Gnathostomata causing diseases in animals and man.* Nauka, Moscow [In Russian]

JACKSON, J. A., TINSLEY, R. C. (1995): Representatives of *Batrachocamallanus* n. g. (Nematoda: Procamallaninae) from *Xenopus* spp. (Anura: Pipidae): geographical distribution, host range and evolutionary relationships. *Syst. Parasitol.*, 31: 159 – 188

KABRÉ, G. B., PETTER, A. J. (1997): *Camallanus polypteri* n. sp. (Nematoda: Camallanidae) in freshwater fishes from Burkina Faso. *Onderstepoort J. Vet. Res.*, 64: 33 – 37

KHALIL, L. F. (1969): Studies on the helminth parasites of freshwater fishes of the Sudan. *J. Zool.*, 158: 143 – 170

KHALIL, L. F., POLLING, L. (1997): *Check list of the helminth parasites of African freshwater fishes.* University of the North, Pietersburg

MILLS, D., VEVERS, G. (1989): *The Tetra encyclopedia of freshwater tropical aquarium fishes.* Tetra Press, New Jersey

MORAVEC, F. (1998): *Nematodes of freshwater fishes of the Neotropical region.* Academia, Prague

NELSON, J. S. (1994): *Fishes of the world.* 3rd Ed. John Wiley and Sons, Inc., New York

SHOTTER, R. A., MEDAIYEDU, J. A. (1977): The parasites of *Polypterus endlicheri* Heckel (Pisces: Polypteridae) from the River Galma at Zaria, Nigeria, with a note on its food. *Bulletin de l'IFAN.*, ser. 39, A: 177 – 189

TINSLEY, R. C. (1981): Interactions between *Xenopus* species (Anura: Pipidae). *Mon. Zool. Ital.*, (N.S.) Suppl., 15: 133 – 150

VASSILIADÈS, G., CHEVALIER, J. L. (1973): Un nouveau *Gendria* (Nematoda: Seuratoidea) chez un polyptere (poisson) du Senegal. *Bulletin de l'IFAN.*, ser. 35, A: 92 – 98

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