



Original Article

**Morphological Re-description of *Camallanus polypteri*
(Nematoda: Camallanidae) Infecting the African Sharptooth
Catfish *Clarias gariepinus* (Clariidae)**

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Abstract

Fish represents one of the major sources of animal proteins, and different species of fish are susceptible to infections with parasites which cause severe tissue damage and cell destruction of the infected organ. Therefore, in 2019, this parasitological study was conducted to assess the helminth parasites infecting the African sharptooth catfish *Clarias gariepinus* that were collected from Lake Manzala, Egypt. Only nematode parasite was reported as a prevalent infection from the fish stomach with an infection rate of 7.5%. Depending on the seasonal prevalence, the extent of the infection was analyzed. It was indicated that parasite infection was only reported as 15% in the winter season. Morphological and morphometric analyses of the present parasite species revealed that it possesses all the characteristics of the *Camallanus* genus, whereas it is closely related to *Camallanus polypteri* described previously. It is characterized by the presence of a buccal capsule with longitudinal internal ridges, some of which are very short and ranged from 8-14 in males and 8-9 in females. The esophagus consisted of muscular and glandular portions, the middle position of the excretory pore to the muscular esophagus, the anterior location of deirids to the nerve ring, posterior end of males with two unequal spicules and caudal papillae; nonetheless, it is smooth and straight in females. In addition, some morphology and measurement differences for the different body parts were identified with other *Camallanus* species. Therefore, the present study can provide a full morphologically re-description of *Camallanus polypteri* with a new geographical location in the Egyptian freshwater.

Keywords: Camallanidae, *Camallanus* spp., Freshwater fish, Morphology

Re-description Morphologique de *Camallanus polypteri* (Nematoda: Camallanidae) Infectant le Poisson-chat à Dents Pointues d'Afrique *Clarias gariepinus* (Clariidae)

Résumé: Le poisson représente l'une des principales sources de protéines animales, et différentes espèces de poissons sont sensibles aux infections parasitaires qui causent de graves lésions tissulaires et la destruction cellulaire de l'organe infecté. Par conséquent, en 2019, cette étude parasitologique a été menée pour évaluer les parasites helminthes infectant le poisson-chat africain à dents pointues *Clarias gariepinus* qui ont été collectés dans le lac Manzala, en Égypte. Seul le parasite nématode a été signalé comme une infection répandue de l'estomac du poisson avec un taux d'infection de 7.5%. En fonction de la prévalence saisonnière, l'étendue de l'infection a été analysée. Il a été indiqué que l'infection parasitaire n'était rapportée qu'à 15% pendant la saison d'hiver. Les analyses morphologiques et morphométriques de l'espèce parasitaire actuelle ont révélé qu'il possède toutes les caractéristiques du genre *Camallanus*, alors qu'il est étroitement lié à *Camallanus polypteri* décrit précédemment. Elle se caractérise par la présence d'une capsule buccale avec des crêtes internes

longitudinales, dont certaines sont très courtes et varient de 8 à 14 chez les mâles et de 8 à 9 chez les femelles. L'œsophage se composait de parties musculaires et glandulaires, la position médiane du pore excréteur à l'œsophage musculaire, l'emplacement antérieur des déirides à l'anneau nerveux, l'extrémité postérieure des mâles avec deux spicules inégaux et papilles caudales; néanmoins, il est lisse et droit chez les femelles. De plus, certaines différences de morphologie et de mesure pour les différentes parties du corps ont été identifiées avec d'autres espèces de *Camallanus*. Par conséquent, la présente étude peut fournir une re-description morphologique complète de *Camallanus polypteri* avec une nouvelle situation géographique dans l'eau douce égyptienne.

Mots-clés: Camallanidae, *Camallanus* spp., Poissons d'eau douce, Morphologie

1. Introduction

Camallanidae Railliet and Henry (1915) is a single family from the Spirurida order within the Camallanoidea superfamily. Adult camallanid nematodes are common parasites that infect the digestive tract of marine, freshwater, or estuarine predaceous vertebrates (Bullard and Overstreet, 2002). Six genera of *Camallanus*, *Onchophora*, *Paracamallanus*, *Procamallanus*, *Spirocamallanus*, and *Spirocotyle* form this family. Species of the genus *Camallanus* are widespread across the globe (Akinsanya and Otubanjo, 2006; Kakar et al., 2013). Numerous species of this nematode group have been described from the stomach or intestine of frogs, tortoises, and most often from numerous species of fish (Kuzmin et al., 2009; Enyidi and Uwanna, 2019). Relatively few details are available on the morphology and systemic evaluation of *Camallanus* species.

The members of this genus are distinguished by an external circle of cephalic papillae around well-sclerotized buccal capsules consisting of four large and four rudimentary papillae. Six very small papillae form an inner circle (Rigby and Rigby, 2014; Svitin et al., 2019). The structure of the buccal capsule is of great importance for the identification and classification of Camallanidae (Yeh, 1960). Males are usually smaller than females and have a ventrally curved tail with caudal alae and pedunculate papillae, spicules are unequal, and gubernaculum is either present or absent (Moravec, 1994). Females are ovoviviparous with a heteroxenic life cycle, and copepods develop as

obligatory intermediate hosts (Sures et al., 1994; Moravec, 1998).

In light of the aforementioned issues, the present study aimed to detect morphological and morphometric characterization for a nematode parasite infecting the African sharptooth catfish *Clarias gariepinus* using light and scanning electron microscopy.

2. Material and Methods

A total of 80 specimens of the African sharptooth catfish *Clarias gariepinus* (F: Clariidae) were captured alive from Lake Manzala, Egypt, throughout the whole year of 2019. Fish specimens were transported to Parasitology Research Laboratory, Zoology Department, Faculty of Science, Cairo University, Egypt. All fish were dissected and microscopically examined to detect helminths. The recovered nematodes were fixed in 70% ethanol and subsequently clarified with lactophenol for identification and photographing using a Leica DM 2500 microscope (NIS ELEMENTS software, version 3.8). For scanning electron microscopy (SEM), worms were fixed with 3% buffered glutaraldehyde, post-fixed with aqueous OsO₄ for 4h, and dehydrated by ascending ethyl alcohol series. Thereafter, they were dried with liquid CO₂ using a critical point dryer "LEICA, EM CPD300", placed on an aluminum stub, covered with gold palladium, and then examined and photographed in a JEOL scanning electron microscope (JSM-6060LV). The measurements were carried out in millimeters presented as a range, followed by the arithmetic mean±SD in parentheses.

3. Results

In each of the six necropsied African sharptooth catfish *Clarias gariepinus* (F: Clariidae), among 80 specimens, adult specimens of *Camallanus polypteri* were found to spontaneously parasitize the stomach with an infection rate of 7.5%. The infection was reported to be only 15.0% (6 out of 40) in the winter season, without any records in other seasons.

3.1. Description

(Figures 1 and Figure 2) The recovered nematodes were small-sized and slender with a thin

cuticle transversely striated with striations. Lateral valves of the buccal capsule with smooth internal longitudinal ridges ranged from 8-14 in male and 8-9 in female worms. Some ridges were very short, confined to the anterior portion of the valves. The esophagus is divided into muscular and glandular portions, with the muscular esophagus being longer than the glandular one. The excretory pore is at the middle portion of the muscular esophagus. Deirids is very thin and slightly anterior to the nerve ring.

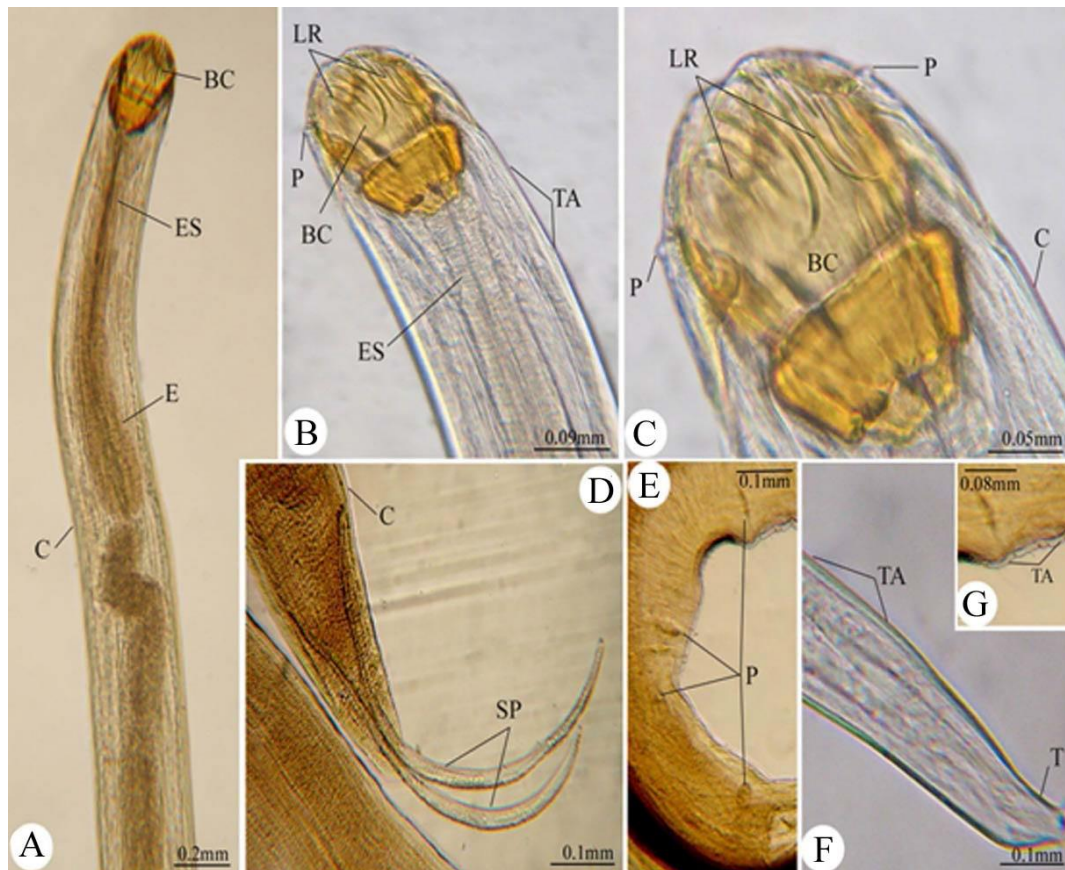


Figure 1. Photomicrographs of *Camallanus polypteri* that infect *Clarias gariepinus*. **A, B and C.** Anterior portion of the adult worm demonstrating buccal capsule (BC) provided with longitudinal ridges (LR) and cephalic papillae (P), followed by esophagus separated into muscular (ES) and glandular esophagus (E), high magnifications in **B and C** Note the presence of cuticle (C). **D, E, F and G** High magnifications for: **D** Posterior end of male worm provided with two unequal spicules (SP) and number of caudal papillae (P), **E** Caudal papillae (P), **F** Tail of female worm, **G** Cuticle showing transverse annulations (TA)

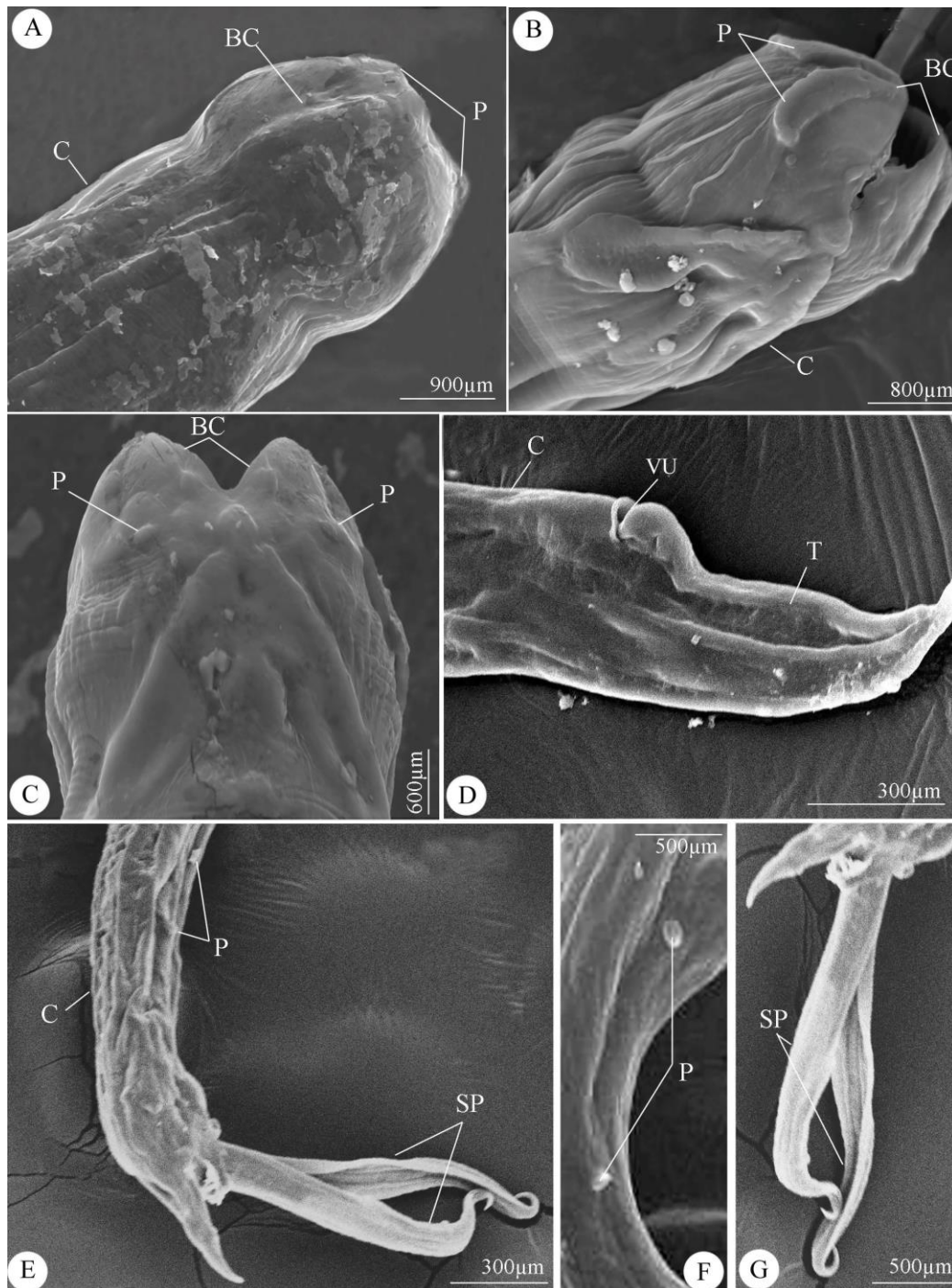


Figure 2. Scanning electron micrographs of *Camallanus polypteri* infecting *Clarias gariepinus* showing: **A, B and C** The anterior portion with buccal capsule (BC), papillae (P), and body covered by cuticle (C), **D, E, F and G** The posterior portion of: **D** Female worm with vulva opening (VU). **E, F, and G** Male worm with papillae (P) and two unequal spicules (SP) with high magnifications in **F and G**

3.2. Body of the Male Worm

It was 2.87-3.1 (2.91±0.1) mm long and 0.090-0.15 (0.098±0.01) mm wide. The length and width of the buccal capsule were 0.041-0.052 (0.48±0.01) and 0.048-0.069 (0.051±0.01) mm, respectively. The muscular esophagus was 0.25-0.39 (0.31±0.1) mm long, and the glandular esophagus was 0.20-0.34 (0.29±0.1) mm long. The posterior part of the body is provided with caudal papillae and two unequal spicules: the left one is 0.07-0.12 (0.09±0.1) mm, while the right spicule is 0.08-0.16 (0.12±0.1) mm long. The tail is bifid and measured as 0.057-0.069 (0.061±0.01) mm long.

3.3. Body of the Female Worm

It is measured as 4.99-6.1 (5.2±0.1) mm long and 0.097-0.14 (0.12±0.01) mm wide. Buccal capsule is 0.060-0.069 (0.062±0.01) mm long and 0.068-0.079 (0.071±0.01) mm wide. Muscular esophagus is 0.32-0.69 (0.39±0.1) mm long, and glandular esophagus is 0.30-0.39 (0.34±0.1) mm long. The vulva is equatorial or slightly post-equatorial, with a prominent anterior lip. The tail is long and measured as 0.01-0.09 (0.03±0.1) mm long. Table (1) displays the maximum and minimum values, as well as the mean values of the different body parts of this species, compared to previously described *Camallanus* species.

Table 1 Comparative measurements of the present *Camallanus polypteri* and those described from previously recorded host species

Parameters Related species	Host fish	Dimensions								
		Body		Buccal capsule		Esophagus		Spicules length		Tail Length
		Length	Width	Length	Width	Muscular	Glandular	Right	Left	
<i>Camallanus cotti</i>	<i>Poecilia reticulata</i>	M: 3.901 (3.44-4.24)	M: 0.195 (0.171-0.220)	M: 0.093 (0.083-0.100)	M: 0.091 (0.076-0.102)	M: 0.356 (0.332-0.377)	M: 0.470 (0.441-0.490)	0.143 (0.132-0.152)	0.106 (0.100-0.110)	M: 0.114 (0.108-0.127) F: 1.33 (1.08-1.53)
		F: 8.44 (7.42-9.23)	F: 0.332 (0.293-0.366)	F: 0.167 (0.132-0.147)	F: 0.141 (0.122-0.157)	F: 0.535 (0.519-0.588)	F: 0.672 (0.588-0.752)			
<i>Camallanus polypteri</i>	<i>Clarias gariepinus</i>	M: 2.98 (2.20-3.75)	M: 0.087 (0.080-1.00)	M: 0.049 (0.045-0.052)	M: 0.053 (0.050-0.060)	M: 0.340 (0.30-0.37)	M: 0.278 (0.25-0.30)	0.074 (0.065-0.080)	0.043 (0.032-0.048)	M: 0.067 (0.050-0.090) F: 0.0132 (0.011-0.014)
		F: 5.92 (5.10-6.87)	F: 0.37 (0.10-0.16)	F: 0.064 (0.062-0.068)	F: 0.075 (0.070-0.080)	F: 0.452 (0.44-0.78)	F: 0.385 (0.31-0.44)			
<i>Camallanus maculatus</i>	<i>Xiphophorus maculatus</i>	M: 3.5±0.3 (2.7-4.1)	M: 0.16±0.03 (0.080-0.20)	M: 0.079±0.004 (0.070-0.084)	M: 0.08±0.009 (0.07-0.09)	M: 0.34±0.049 (0.25-0.40)	M: 0.45±0.05 (0.39-0.56)	0.148±0.023 (0.107-0.204)	0.099±0.011 (0.08-0.124)	M: 0.115±0.008 (0.092-0.120) F: 0.90±0.180 (0.70-1.3)
		F: 7.1±0.1 (4.4-9.02)	F: 0.29±0.073 (0.16-0.45)	F: 0.13±0.043 (0.11-0.32)	F: 0.137±0.043 (0.116-0.324)	F: 0.52±0.06 (0.44-0.65)	F: 0.61±0.054 (0.49-0.68)			
<i>Camallanus boomker</i>	<i>Channa orientalis</i>	M: 2.1 (1.74-1.95)	M: 0.1 (0.07-0.09)	M: 0.042 (0.032-0.039)	M: 0.065 (0.061-0.063)	M: 0.28 (0.23-0.26)	M: 0.33 (0.25-0.29)	0.32 (0.26-0.29)	0.016 (0.013-0.015)	M: 0.13 (0.09-0.11) F: 0.11 (0.05-0.09)
		F: 2.23 (1.95-2.1)	F: 0.14 (0.1-0.13)	F: 0.06 (0.03-0.05)	F: 0.0554 (0.05-0.053)	F: 0.22 (0.19-0.22)	F: 0.28 (0.21-0.25)			
<i>Camallanus polypteri</i> (The present study)	<i>C. gariepinus</i>	M: 2.91±0.1 (2.87-3.1)	M: 0.098±0.01 (0.090-0.15)	M: 0.48±0.01 (0.041-0.052)	M: 0.051±0.01 (0.048-0.069)	M: 0.31±0.1 (0.25-0.39)	M: 0.29±0.1 (0.20-0.34)	0.12±0.1 (0.08-0.16)	0.09±0.1 (0.07-0.12)	M: 0.061±0.01 (0.057-0.069) F: 0.03±0.1 (0.01-0.09)
		F: 5.2±0.1 (4.99-6.1)	F: 0.12±0.01 (0.097-0.14)	F: 0.062±0.01 (0.060-0.069)	F: 0.071±0.01 (0.068-0.079)	F: 0.39±0.1 (0.32-0.69)	F: 0.34±0.1 (0.30-0.39)			

4. Discussion

In the present study, African sharptooth catfish *C. gariepinus* was found to be naturally infected with *C. polypteri* inhabiting the stomach of the examined fish with an infection rate of 7.5%. Moreover, during the winter season, the infection was recorded at only 15.0%. These results coincide with data obtained by Adeyemi and Toluhi (2014) who claimed that *Synodontis resupinatus* inhabiting Lower Niger River, Kogi State, Nigeria, was infected with *Camallanus* sp. with an infection rate of 17.7%. Nonetheless, it was lower than the data obtained by Ranibala et al. (2013) who reported high infection rates of *Anabas testudineus* with *C. anabantis* in the summer (88.7%), medium in autumn (66.8), and spring (42.5%), and lower in winter (23.2%).

The morphology of the present *C. polypteri* specimens recovered from *C. gariepinus* has all the diagnostic generic characteristics of the genus *Camallanus*. They have tridents attached to the buccal capsule reaching to the level of the nerve ring, caudal alae joining anteriorly, and the larger spicule as the left one (usually the longer spicule is on the right side in camallanids). These results were similar to earlier explanations of *C. polypteri* infecting the same host as those provided by Moravec, 1973, Gupta and Verma (1978), Kabré and Petter, 1997, and Moravec et al., 2003, with little variation in the measurements of different body parts. Nevertheless, it is different from other species of the genus *Camallanus*, such as *C. longicaudatus* Moravec (1973), *C. kirandensis* Amin (1978), *C. ancylodirus* Baker (1979), and *C. tholukodensis* Lakshmi et al. (1990) in the measurements of the total length, buccal capsule length and width, number of longitudinal ridges, length of the muscular and glandular esophagus, number of genital papillae, and spicules length. Furthermore, it differs from *C. magathi* Sprehn (1932), *C. parvus* Caballero (1939), *C. mazabukae* Kung (1948), *C. unispiculus* Khera (1954), *C. johni* Yeh (1960), and *C. unispiculus* Khera (1954) in having two unequal spicules instead of one for other species. Therefore, the present study is

considered a re-description of *C. polypteri* from *C. gariepinus* with a new geographical location in Egyptian freshwater.

Authors' Contribution

Study concept and design: R. A. G.

Acquisition of data: S. M and R. A. G.

Analysis and interpretation of data: S. M and R. A. G.

Drafting of the manuscript: R. A. G.

Critical revision of the manuscript for important intellectual content: R. A. G. and S. M.

Statistical analysis: R. A. G. and S. M.

Administrative, technical, and material support: S. M and R. A. G.

Ethics

We hereby declare all ethical standards have been respected in preparation of the submitted article.

Conflict of Interest

The authors declare that they do not have any conflict of interest regarding the publication of the current article.

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