Vol. 120: 251–254, 2016
doi: 10.3354/dao03033

DISEASES OF AQUATIC ORGANISMS
Dis Aquat Org

Published August 9

NOTE

# Larvae of *Contracaecum* sp. (Nematoda: Anisakidae) in the threatened freshwater fish *Sandelia capensis* (Anabantidae) in South Africa

**František Moravec[1,*], Candice Jansen van Rensburg[2], Liesl L. Van As[2]**

[1]Institute of Parasitology, Biology Centre of the Czech Academy of Sciences, 370 05 České Budějovice, Czech Republic
[2]Department of Zoology and Entomology, University of the Free State, Bloemfontein 9300, South Africa

ABSTRACT: Third-stage larvae of the nematode genus *Contracaecum* Railliet et Henry, 1912 (*Contracaecum* sp.) were, for the first time, recorded from the abdominal cavity of the threatened endemic freshwater fish *Sandelia capensis* (Cuvier) in South Africa. The larval morphology indicated that they belong to a species of which the adults are parasitic in fish-eating birds. Although the nematode seems to be a common parasite of *S. capensis* in the locality under study (prevalence 23%), the low intensity of infection recorded (1 to 4) and the generally known low pathogenicity of *Contracaecum* larvae in fish indicate that this parasite probably does not represent a danger to the local population of this threatened fish species.

KEY WORDS: Parasitic nematode · Third-stage larva · Paratenic host · Endangered fish species · Africa



## INTRODUCTION

Adult nematodes of the genus *Contracaecum* Railliet et Henry, 1912 are parasitic in the digestive tract of fish-eating birds and marine mammals, whereas their free or encapsulated third-stage larvae are found in the internal organs of fishes serving as paratenic hosts. In Africa, larvae of *Contracaecum* have frequently been reported as parasites of many (~70) species of freshwater fishes belonging to different families and orders (e.g. Khalil & Polling 1997 and subsequent authors; see Moravec & Van As 2015b) and the rate of infection is often very high in some fish hosts. For example, Tavakol et al. (2015) recorded *Contracaecum* spp. larvae from 9 fish species in the northern regions of South Africa, where prevalence was up to 100% and mean intensity up to 282 nematodes in *Clarias gariepinus* (Burchell) from several localities. *Contracaecum* larvae have not yet been found in African anabantid fishes.

Representatives of the perciform fish family Anabantidae (labyrinth fishes) occur in Africa and southern and south-eastern Asia, including the Philippines and Malay Archipelago. In Africa, the family includes 3 genera (*Ctenopoma* Peters, *Microctenopoma* Norris and *Sandelia* Castelnau) of which 2 species, *Ctenopoma multispine* Peters and *Microctenopoma intermedium* (Pellegrin) occur in Botswana, whilst *Sandelia capensis* (Cuvier) are found at the tip of the African continent and *S. bainsii* Castelnau only in 4 river systems in the Eastern Cape (Skelton 2001). According to FishBase (Froese & Pauly 2016), the Cape kurper *S. capensis* is a subtropical freshwater fish (maximum body length 20 cm) naturally distributed in the southern and south-western Cape coastal rivers from the Coega River (Algoa Bay) to the Cape Flats and north to Verlorenvlei. Since many populations have declined and are threatened by habitat destruction and predation from introduced bass, this fish is now on The

*Corresponding author: moravec@paru.cas.cz

IUCN Red List of Threatened Species (Froese & Pauly 2016).

Five species of trichodinid ectoparasites (3 species of *Trichodina* Ehrenberg, 1838 and 2 species of *Tripartiella* Lom, 1959) from *C. multispine* and *M. intermedium*, and the nematode *Camallanus* (*Zeylanema*) *ctenopomae* Vassiliadès et Petter, 1972 from *Ctenopoma* sp. were previously reported by Basson & Van As (2002) and Moravec & Van As (2015a), respectively, in the Okavango River, Botswana. However, none of the African species of *Sandelia* was previously studied for the presence of parasites. Therefore, a sample of the threatened endemic fish *S. capensis* collected in South Africa in 1998 was parasitologically examined. Digeneans (metacercariae) recovered were already reported by Jansen van Rensburg et al. (1998); the nematodes of the same material are treated in this paper.

## MATERIALS AND METHODS

In April 1998, 47 specimens of *Sandelia capensis* (average body length 75 mm) from the small stream Tierhoek (34° 26′ 30″ S, 20° 22′ 56″ E) in the De Hoop Nature Reserve were examined for the presence of parasites; this stream is a part of the Sout River, which once reached Die Mond (river mouth) but the estuary has been blocked for more than 100 yr.

The nematode specimens collected from the viscera of the abdominal cavity of *S. capensis* were fixed in 10% formalin or 70% ethanol. For light microscopy examination, these were cleared in glycerine. Specimens used for scanning electron microscopy (SEM) were postfixed in 1% osmium tetroxide, dehydrated through a graded acetone series, critical-point-dried and sputter-coated with gold; they were examined using a JEOL JSM-7401F scanning electron microscope at an accelerating voltage of 4 kV (GB low mode). All measurements are in µm unless otherwise indicated. Voucher specimens were deposited in the Helminthological Collection of the Institute of Parasitology, Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic (Cat. No. N–468).

## RESULTS AND DISCUSSION

The only nematode species found in *Sandelia capensis* was the third-stage larvae of *Contracaecum* sp. (prevalence: 23%, intensity: 1 to 4 nematodes per fish).

The bodies of the 10 fixed larvae (Figs. 1 & 2) are whitish, 28.68 to 36.29 mm long and 1.27 to 1.51 mm wide. Transverse striations of cuticle are more distinct on body ends (Figs. 1B–D & 2A–D). The cephalic end is rounded, bearing a small ventral cuticular tooth 12 to 15 µm long and 4 submedian cephalic papillae surrounding the small transverse oval oral aperture; the bases of lips are weakly developed (Figs. 1B,C & 2A–C). The excretory pore is situated below the ventral cephalic tooth. A somewhat elevated region of cephalic papillae is surrounded by several low, circular cuticular lamellae interrupted by lateral lines (Figs. 1C & 2A–C). The oesophagus is narrow, 3.13 to 3.59 mm long and 122 to 150 µm wide. The ventriculus is small, rounded, 122–136 × 150–218 µm in size; the posterior ventricular appendix is short, 558 to 775 µm long and 122 to 177 µm wide. The nerve ring is located 340 to 394 µm from the anterior extremity. The intestine is brownish. The intestinal caecum is

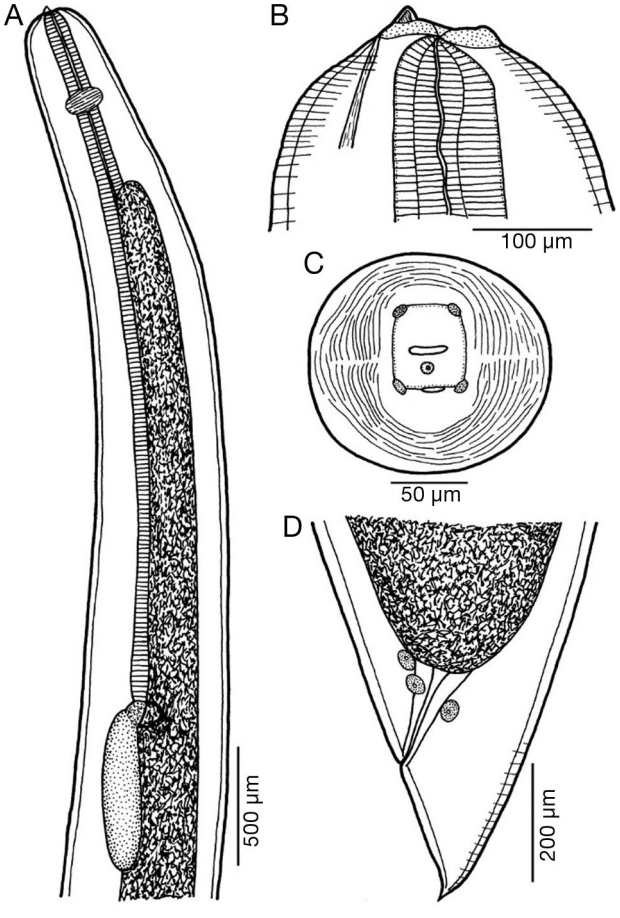


Fig. 1. *Contracaecum* sp. third-stage larva from *Sandelia capensis*. (A) Anterior end of body, lateral view; (B,C) cephalic end, lateral and apical views, respectively; (D) tail, lateral view

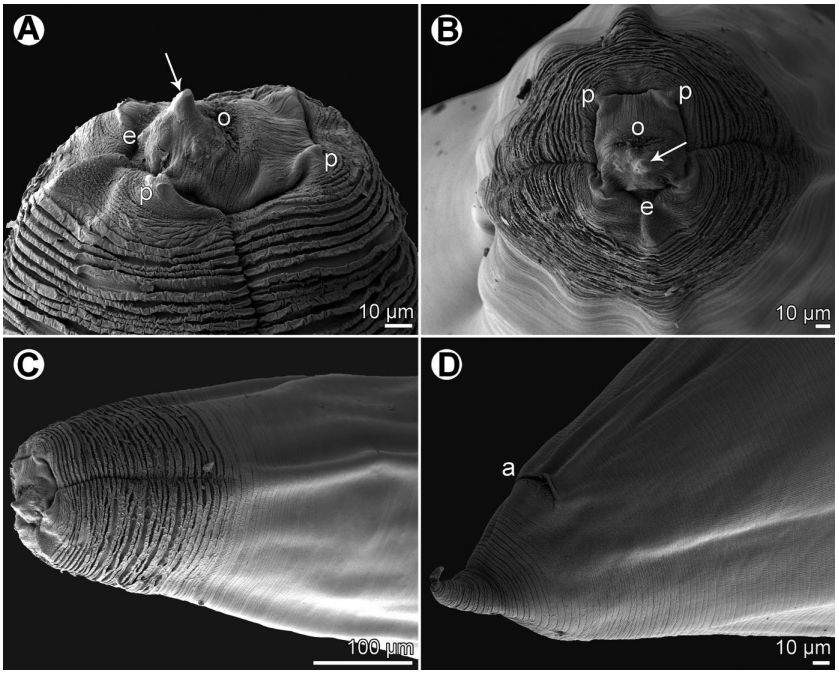


Fig. 2. *Contracaecum* sp. third-stage larva from *Sandelia capensis*, scanning electron micrographs. (A,B) Cephalic end, sublateral and apical views, respectively (arrow indicates ventral boring tooth); (C) anterior end of body, lateral view; (D) caudal end, sublateral view. a: anus; e: excretory pore; o: oral aperture; p: submedian cephalic papilla

very long, extending anteriorly almost to the nerve ring; its length is 2.36 to 2.94 mm, maximum width 245 to 299 µm (Fig. 1A). The length ratio of the caecum and ventricular appendix is 1:0.2–0.3. The genital primordium is indistinct. The rectum is a short hyaline tube; 3 small unicellular rectal glands are present. The tail is conical, 122 to 258 µm long, ending in a sharp cuticular spike (Figs. 1D & 2D).

These larvae from *S. capensis* are characterized by the presence of a conspicuously long intestinal caecum reaching anteriorly nearly to the nerve ring and a markedly short ventricular appendix. Larvae with this morphology were designated as *Contracaecum* Type 2 by Moravec et al. (1993); these may belong to the morphological group of several species of this genus parasitizing mainly fish-eating birds as adults. In Africa, similar larvae of *Contracaecum* sp. were reported by Barson & Avenant-Oldewage (2006) from the catfish *Clarias gariepinus* (Burchell) in South Africa, and by Moravec & Van As (2015b) from 6 fish species of the families Alestidae, Cichlidae and Clariidae in Botswana. As visible from SEM micrographs of the cephalic end (Fig. 2A–C), the larvae from *S. capensis* differ slightly from those reported by the latter authors in that the cuticular lamellae surrounding the elevated cephalic region are interrupted by very narrow lateral lines instead of fairly wide smooth lateral fields.

However, the species identification of *Contracaecum* larvae from fishes based on morphological features is practically impossible. The life cycles of many *Contracaecum* species have not yet been studied and, consequently, the systematics of *Contracaecum* larvae from fishes is so far little known. The species of *Contracaecum* are described from adults found in definitive hosts (e.g. fish-eating birds), so it is impossible to assign congeneric larvae from naturally infected fishes to any species without carrying out feeding experiments or using molecular methods (Moravec 2013).

Barson & Marshall (2004) recorded 4 adult species of *Contracaecum* — *C. carlislei* Ortlepp, 1938, *C. microcephalum* (Rudolphi, 1819), *C. rudolphii* Hartwich, 1964 and *C. tricuspis* (Gedoelst, 1916) — from piscivorous birds in Zimbabwe, mentioning that all of them were previously reported from South Africa. Of these, the third-stage larvae of *C. rudolphii* obtained from experimentally infected fish (common carp) attained the maximum body length (<5 mm) after 18 mo post-infection (Moravec 2009), whereas the larvae from African fishes reported by Moravec & Van As (2015b) and those of the present material from *S. capensis* were approximately 4 to 7 times longer and their morphology was different; this indicates that the above-mentioned larvae from African fishes did not belong to *C. rudolphii*, a common parasite mainly of cormorants.

Although some authors (e.g. Tavakol et al. 2015) still consider copepods and fishes to be the first and second intermediate hosts, respectively, of *Contracaecum* spp., the available data show that the third-stage larvae of these nematodes develop already inside eggs in the external environment (water) and are already infective for the definitive host (Thomas 1937, Køie & Fagerholm 1993, 1995, Dziekońska-Rynko & Rokicki 2007, Moravec 2009). However, a variety of invertebrate (copepods, larvae of aquatic insects) and vertebrate (fish, less often amphibians and reptiles) paratenic hosts usually participate in the transmission of *Contracaecum* species to the definitive host (Moravec 2009).

The recorded prevalence (23%) of *Contracaecum* sp. larvae in *S. capensis* indicates that these parasites commonly occur in this host species in the locality under study. However, neither encapsulated nor free *Contracaecum* larvae are known to severely affect fish (even multiple infection has no apparent impact of the body condition). Therefore, in view of a low intensity of infection recorded in *S. capensis*, this parasite does not seem to endanger the local population of this threatened fish species. The Cape kurper *S. capensis* represents a new host record for *Contracaecum* sp. larvae.

*Acknowledgements.* The authors thank staff at De Hoop Nature Reserve and Cape Nature South Africa, for assistance during fieldwork. Thanks are also due to the staff of the Laboratory of Electron Microscopy, Institute of Parasitology, Biology Centre of the AS CR, České Budějovice for their technical assistance, and to Blanka Škoríková of the same Institute for help with illustrations. This study was partly supported by the Czech Science Foundation (grant no. P505/12/G112) and the Institute of Parasitology, BC AS CR (institutional support RVO:60077344).

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*Editorial responsibility: Stephen Feist, Weymouth, UK*

*Submitted: April 11, 2016; Accepted: June 15, 2016*
*Proofs received from author(s): August 4, 2016*