



The Discovery of the Mediterranean *Echinorhynchus abissicola* Dollfus, 1931 (Acanthocephala: Echinorhynchidae) From a New Host in the Persian Gulf

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Abstract

The obscure *Echinorhynchus abissicola* Dollfus, 1931 was briefly described from the deep-sea fish *Pachycara obesa* Zugmayer (Zoarcidae), a synonym of *Pachycara bulbiceps* (Garman) in the Mediterranean. Other observers rarely copied the description and 3 figures of a proboscis and 2 hooks but no taxonomic information was provided since. We have identified the same species from the leather jacket filefish *Aluterus monoceros* (Linn.) (Monacanthidae) in the Persian Gulf off the coast of Iran. Leather jackets are usually found worldwide in subtropical oceans at depths of 50 m. The lessepsian distribution of fish and their parasites across the Suez Canal in the Mediterranean and the Red Sea/Persian Gulf may account for the finding of *E. abissicola* in *A. monoceros* in the Persian Gulf. We made a few new taxonomic observations not previously reported in the description of 1931.

Keywords: *Echinorhynchus abissicola*; Alcohol; Hydrochloric Carmine

Introduction

Dollfus [1] described *Echinorhynchus abissicola* from two female specimens measuring 40-50 mm in length received from the Munich Museum marked "Aus Darm des *Pachycara obesa* (a synonym of *Pachycara bulbiceps* (Garman) said Zugmayer. 4,785 m. Tief. A, v. Monaco." These parasites were not found or fixed at the death of the host, but discovered several years later during dissection. These specimens, not surprisingly were in a poor state of preservation. The specimens were whole mounted in preparations toto which flattened them before they were returned back to alcohol. Dollfus was able to color the specimens using hydrochloric carmine and was able to recognize the receptacle, proboscis, and lemnisci but was unable to see the nerve ganglion and the retinacula and the genital tract. He found many eggs but could not distinguish the envelopes. He assigned his specimens to the genus *Echinorhynchus*.

The description by Dollfus [1] was repeated verbatim by Petrochenko [2] and Golvan [3] who also copied the 3 figures of

the proboscis and two hooks in the original description. Other observers have acknowledged the species by name, e.g., Amin [4,5] and Wayland [6] but no taxonomic treatment was ever published since 1931. We have accidentally come across two female specimens in a collection of one leather jacket filefish *Aluterus monoceros* (Linn.) (Monacanthidae) in the Persian Gulf off the coast of Iran. The senior author's identification of the acanthocephalan prompted the search for additional material that will form the core of subsequent publications.

Materials and Methods

Collections

Originally, the intestine of one leather jacket from the Persian Gulf was found infected with 2 worms on 15 April 2023. These worms were later identified by OMA after processing and whole mounting for microscopic examination. New collections included 19 leather jackets (Fig. 1) of which 5 were found infected with many acanthocephalans (Fig. 2) but these will not be included in this presentation.

Methods for Microscopical Studies

Two female worms were punctured with a fine needle and subsequently stained in Mayer's acid carmine, destained in 4% hydrochloric acid in 70% ethanol, dehydrated in ascending concentrations of ethanol (24 hr each), and cleared in 100% xylene then in 50% Canada balsam and 50% xylene (24 hr each). Whole worms were then mounted in Canada balsam. Measurements for diagnostic verification were made in micrometers, unless otherwise noted. Specimens are kept in the senior author's collection.

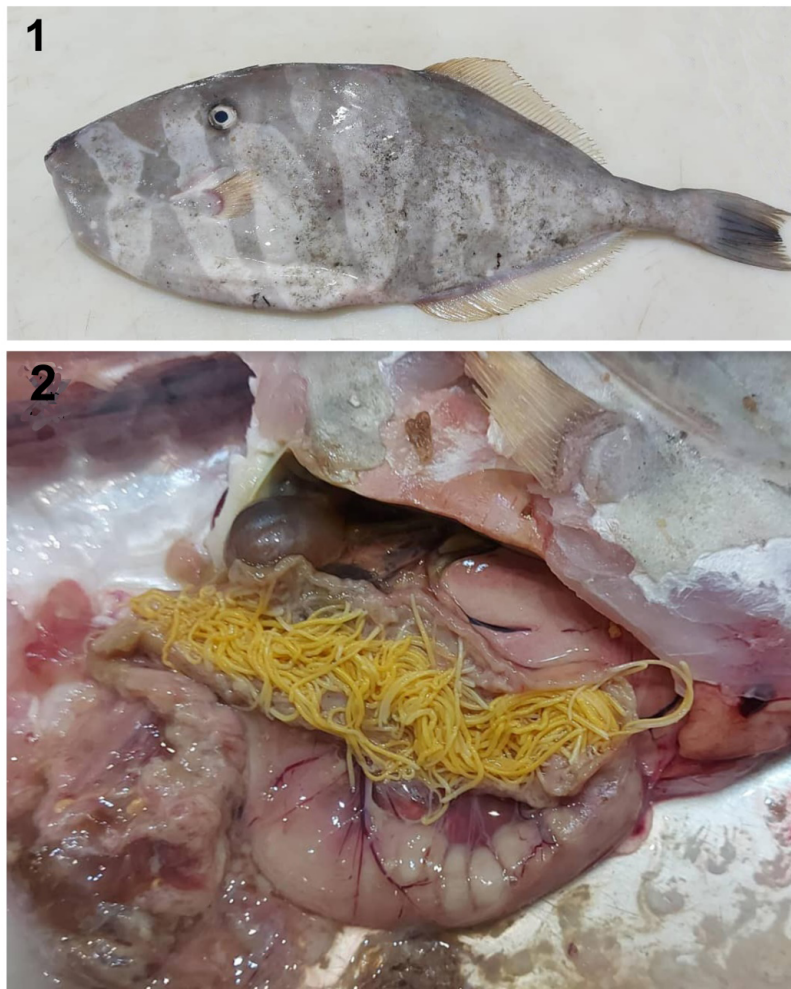
Optical Microscopy

Images created for this presentation were acquired using a Zeiss Axioskop Transmitted Nomarski DIC Phase Contrast Microscope Trinocular (Munich, Germany) and a Canon T3i EOS 600D DSLR Camera (Melville, New York).

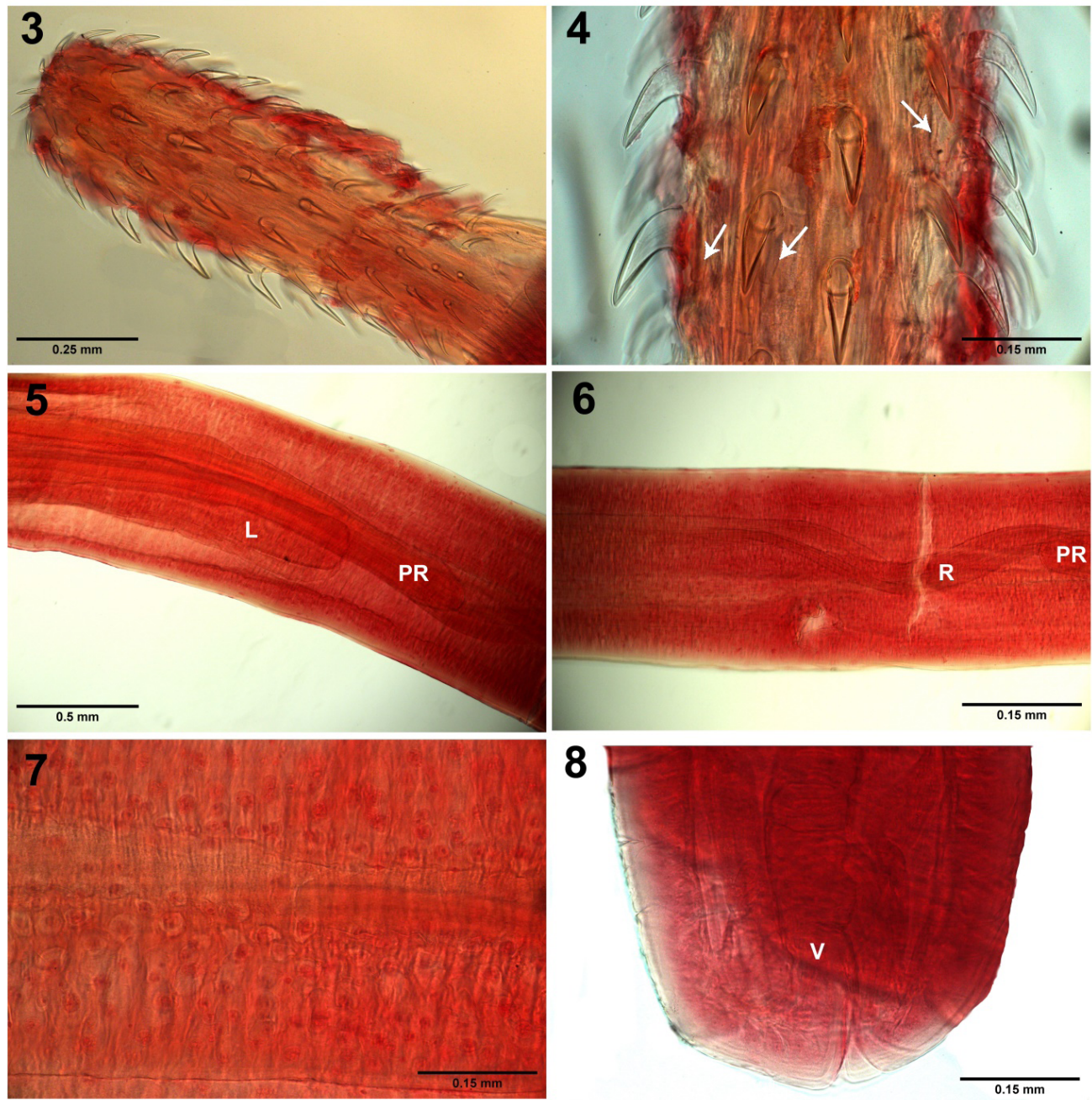
Images from the microscope were transferred from the laptop to a USB and stored for subsequent processing on a computer. Measurements are in micrometers unless otherwise noted; the range is followed by the mean values between parentheses when appropriate.

Results

Our specimens were comparable to those incompletely described by Dollfus collected from the deep-sea fish *Pachycara bulbiceps* (Garman) in the Mediterranean but provided considerably more information. We describe below females from a new host, the leather jacket filefish *Aluterus monoceros* (Linn.) (Monacanthidae) (Fig. 1) in the Persian Gulf off the coast of Iran from which many specimens were collected (Fig. 2).



Figures 1 & 2: The host fish and the parasites. 1. An individual leather jacket filefish *Aluterus monoceros* from the Persian Gulf off the Iranian coast. 2. A collection of specimens of *Echinorhynchus abissicola* acanthocephalans from the intestine of one infected fish. Five infected fish yielded 3 petri dishes full of acanthocephalans.



Figures 3-8: Specimens of *Echinorhynchus abissicola* acanthocephalans from the intestine of leather jacket filefish *Aluterus monoceros* from the Persian Gulf off the Iranian coast. **3.** The organization of hooks on the proboscis of one specimen. **4.** A higher magnification of a part of the same proboscis in Fig. 3 shows the larger ventral hooks (left) compared to the smaller dorsal hooks (right) and the truncated roots (arrows), shorter than the blades. **5.** An anterior segment of the trunk showing the posterior part of the proboscis receptacle (PR) overlapping the shorter lemniscus (L). **6.** A more anterior part of the trunk showing part of the proboscis receptacle (PR) and the prominent retractor muscles (R) extending through it posteriorly. **7.** Part of the trunk showing the fragmented hypodermal nuclei. **8.** The posterior part of a female trunk shows the terminal gonopore and vagina (V).

A brief Description of the Persian Gulf Females (Figs. 3-8)

With characters of the genus *Echinorhynchus* Zoega in Müller, 1776. Measurements in Table 1. Main longitudinal lacunar canals lateral. Lemniscal and hypodermal nuclei fragmented (Fig. 7). Trunk long, cylindrical with parallel sides (Fig. 5). Proboscis cylindrical joined basally with receptacle, with 12-13 rows of 10 hooks each, smallest anteriorly and basally (Fig. 3). Hooks dorso-ventrally differentiated with the ventral hooks being relatively longer and more robust than dorsal hooks (Fig. 4) and with simple shorter truncated roots directed posteriorly (Fig. 4, arrows). Proboscis receptacle

more than twice the length of the proboscis, double-walled, with undecided position of the cephalic ganglion and retinacula. Lemnisci shorter than receptacle (Fig. 5). Retractor muscles emerge from receptacle and extend into body cavity posteriorly (Fig. 6). Body wall covered with fragmented hypodermal nuclei (Fig. 7). Gonopore terminal and vagina relatively short with reduced sphincter (Fig. 8).

Taxonomic summary Type host: Snubnose eelpout, *Pachycara obesa* Zugmayer (synonym of *Pachycara bulbiceps* (Garman) (Zoarcidae). Other hosts: leather jacket filefish, *Aluterus monoceros* (Linn.) (Monacanthidae).

Host	<i>Aluterus monoceros</i> (Linn.)	<i>Pachycara bulbiceps</i> (Garman)
Locality	Persian Gulf	Mediterranean
Source	This paper	Dollfus, 1931
Sample size	2	2
Trunk L X W (mm)	11.00-24.00 X 0.50-0.75	45-46 X 0.8
Proboscis L X W (mm)	0.95-1.04 X 0.31-0.32	0.85-0.95 X 0.30
Hook rows	12-13	13
Hooks per row	10	11 (Fig. 1 with some rows of 10)
Hook L X W (µm)	75-115 X 15-45 dorsally	Emerging part of hooks 70
	78-120 X 20-50 ventrally	
Hook roots	Truncated, shorter than hooks	Truncated, shorter than hooks
Receptacle L X W (mm)	2.12-2.70 X 0.27-0.29	1.50-1.75 X 0.50
Cephalic ganglion	Indistinct	Unrecognizable
Retinacula	Indistinct	Unrecognizable
Retractor muscles	Prominent	Not mentioned
Lemnisci L X W (mm)	1.66-2.37 X 0.12-0.20	Shorter than receptacle
Hypodermal nuclei	Prominent	No large (giant) nuclei
Gonopore	Terminal	Unrecognizable like genital tract

Table 1: Comparative measurements of *Echinorhynchus abissicola* females from the Mediterranean and from the Persian Gulf.

Hook number	Length of hook blades		Width of hook blades	
	Dorsal hooks	Ventral hooks	Dorsal hooks	Ventral hooks
1	75	87	17	22
2	92	100	20	25
3	107	107	30	32
4	112	115	37	45
5	115	120	45	50
6	112	117	32	35
7	107	107	25	25
8	97	102	17	20
9	90	90	16	20
10	78	78	15	20

Table 2: Differences in size of dorsal vs. ventral proboscis hook blades of one female *Echinorhynchus abissicola* from *Aluterus monoceros* collected in the Persian Gulf.

Type locality: The Mediterranean at Monaco at depth of 4,785 m.

Other locality: The Persian Gulf off the Iranian coast.

Site of infection: Intestine.

Specimens: In first author's collection.

Remarks

While the differences between the two sets of females from the Mediterranean and the Persian Gulf appear unremarkable (Table 1), our additions to the original description are significant enough to warrant a special note. For instance, we observed the sexual differentiation in hook sizes being more robust and longer ventrally than dorsally (Table 2, Fig. 4). Dollfus (1931) only measured the emerging parts of the hooks at 70 μm . The cephalic ganglion and the retinacula remain unrecognizable. We noted prominent elements of the retractor muscles (Fig. 6) and the hypodermal nuclei (Fig. 7). We also marked the terminal position of the gonopore and noted the short vagina (Fig. 8). The lessepsian distribution of fish and their parasites across the Suez Canal in the Mediterranean and the Red Sea/Persian Gulf may account for the finding of *E. abissicola* in *A. monocerus* in the Persian Gulf. There are at least 63 Lessepsian fish species that are known to have penetrated the Suez Canal either way since its opening in 1869 [7,8]. If this was the case, then we would not have known if *E. abissicola* was originally a Mediterranean parasite that spread into the Red Sea and the Persian Gulf or was it the other way around. This Lessepsian migration has been more often documented from the Red Sea to the Mediterranean which may have been the direction of the movement of parasites [9].

Compliance with Ethical Standards

- **Conflict of interest:** The authors declare conflicts of interest none.
- **Ethical approval:** The authors declare that they have observed all applicable ethical standards.
- **Author's contributions:** Amin did the research, identified the acanthocephalan parasite, wrote the manuscript, and created the optical microscopy images. Milad helped with fish dissection, administrative tasks, and shipping. Eslahi obtained and dissected fish and managed the parasite collection.
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