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Myxidium elmatboulii n. sp. and *Ceratomyxa ghaffari* n. sp. (Myxozoa: Myxosporea) Parasitic in the Gallbladder of the Red Sea Houndfish *Tylosurus choram* (Rüppell, 1837) (Teleostei: Belonidae) from the Red Sea, Egypt

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Summary. Two new myxosporean species, *Myxidium elmatboulii* n. sp. and *Ceratomyxa ghaffari* n. sp., are described from the gallbladder of the Red Sea houndfish *Tylosurus choram* (Ruppell, 1837) from the Gulf of Suez, Red Sea, Egypt. Diagnostic features of *Myxidium elmatboulii* n. sp.: plasmodia disporous, spherical in shape. Spores s-shaped with smooth surface and measures 20.7 (19.0-23.0) × 10.6 (9.0-12.0) × 10.4 (8.5-12.0) µm. Polar capsules pyriform with 9-10 polar filaments, measuring 9.10 (8.0-10.0)× 3.8 (3.5-4.0) µm. Spores of *Ceratomyxa ghaffari* n. sp. slightly crescent-shaped, measuring 7.6 (6.0-9.0) × 29.9 (25.0-33.0) µm. Polar capsules typically rounded, 3.3 (3.0-4.0) µm in diameter with 5 filament turns.

Key words: *Ceratomyxa elmatboulii* n. sp., Egypt, houndfish, *Myxidium elmatboulii* n. sp., Myxosporean, Myxozoa, Red Sea.

INTRODUCTION

Myxosporea constitute a major group of fish parasites and their impact on wild and cultured fishes is significant (Kent *et al*. 2001) and are thus of both economic and ecological importance. Yet, little is known about the myxosporeans of the Red Sea fishes. Research on the parasites of the Red Sea fauna has been sporadic and inadequate considering the high fish biodiversity in the area. Few studies have been carried out on parasites of the Red Sea fishes as those of Paperna and Overstreet (1981), Ali *et al*. (2001, 2003) and Diamant *et al*. (2004). In view of the recognized pathogenicity inflicted by many fish parasites on commercial fish, it is desirable to obtain data as complete as possible on the protistan parasites of fish from this region. During a recent survey on the protistan parasites from selected Red Sea fish, two myxosporean parasites were recorded. *Myxidium elmatboulii* n. sp. and *Ceratomyxa ghaffari* n. sp. are described as new species from the gallbladder of the Red Sea houndfish *Tylosurus choram* (Ruppell, 1837).

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MATERIALS AND METHODS

Fresh caught fishes were purchased from fishermen at Gulf of Suez during visits between November 2000 and February 2002. Visits were carried out every two months and about 15 fish were examined during each visit. A total of 108 *Tylosurus choram* fish were examined; the fish range from 28-40 cm in total length. Fish were necropsied and all organs and body fluids were examined for myxosporean infection. Fresh spores were measured and photographed using Zeiss Axiovert 135 microscope with Contax Camera. Descriptions and measurements of spores followed the guidelines of Lom and Arthur (1989). Measurements were based on 30 fresh spores and data were presented as: mean ± SD (range). All measurements in µm. Drawings were made with the aid of a camera Lucida. For permanent preparation, air-dried smears were stained with Giemsa after fixation in acetone-free absolute methanol.

RESULTS AND DISCUSSION

Myxidium elmatboulii n. sp. (Figs 1-4, 7a)

Vegetative stages: The bile contained floating plasmodia of *Myxidium* mixed with *Ceratomyxa* forms (Fig. 2). Plasmodia were spherical and contained two tightly packed spores (Fig. 1). The diameter of the plasmodia was 27 ± 1.4 (25-30).

Spores: Spores typical of the genus *Myxidium*. Mature spores were smooth, sigmoid or s-shaped in the frontal view with prominent acuminated tips (Figs 3, 4, 7a). Sutural line was thin and slightly curved. Polar capsules pyriform; equal in size and tapering anteriorly to form prominent necks opening at the end of the spore tips. Polar filament with 9-10 coils was perpendicular to the longitudinal axis of the polar capsule. Single binucleated sporoplasm was filling the entire extracapsular spore cavity. Spore dimensions: 20.7 ± 1.2 (19.0-23.0) in length × 10.6 ± 0.9 (9.0-12.0) in width × 10.4 ± 0.8 (8.5-12.0) in thickness. Polar capsules: 9.10 ± 0.6 (8.0-10.0) × 3.8 ± 0.2 (3.5-4.0).

Taxonomic affinities: The spore shape and/or measurements of the present species showed some similarities with other *myxidium* sp. As the present spores have smooth surfaces, species with ridged surfaces are excluded from the comparison. Of those species with smooth surface, only the following resemble *M. elmatboulii*: *Myxidium incurvatum* Thelohan, 1892 (from Lom and Dykova 1992); *M. sphaericum* Thelohan, 1895 (Moser *et al.* 1989); *M. giganteum* Dolfein, 1898 (Kpatch *et al.* 1996); *M. baurei* Kovaleva *et* Gaevskaya, 1982 (after Kalavati *et al.* 1996); *M. trachinorum* Canning *et al.* 1999 and *M. tuanfegensis* Gong *et al.* 2003 (Table 1). *M. incurvatum* is smaller than *M. elmatbouli* and there are only 5-7 turns to the polar filament. *Myxidium sphaericum* has spores of comparable length; however; its polar capsules are about half of the present species and have lower number of polar filament coils (5-8 *vs.* 9-10). Among the species infecting the African fishes, *M. giganteum* differs from the present species in having quite smaller polar capsules and less polar filament turns (6 *vs.* 9-10). *M. baueri* has more straight spores than the present species, quite smaller polar capsules and less number of filament coils (5*vs.* 9-10). Spores of *M. trachinorum* are smaller in all body measurements and possess prominent kink in the spore middle. The spore dimensions of *M. tuanfegensis* very close to the present species, however it appears distinctly different from our species in having quite smaller rounded polar capsules with a lower number of polar filaments (5-6 *vs.* 9-10).

Regarding the fish host, no myxosporean infection is mentioned in the literature to this fish species. The comparison of the present parasite revealed no *Myxidium* species recorded thus far is identical. Therefore, we propose to establish the present myxosporean as *Myxidium elmatboulii* n. sp.

Host: *Tylosurus choram* (Ruppell, 1837)

Locality: Gulf of Suez (Lat. 30° N and Long. 32.5° E)

Location in the host: Gall bladder

Prevalence: 18/108 (16.6%).

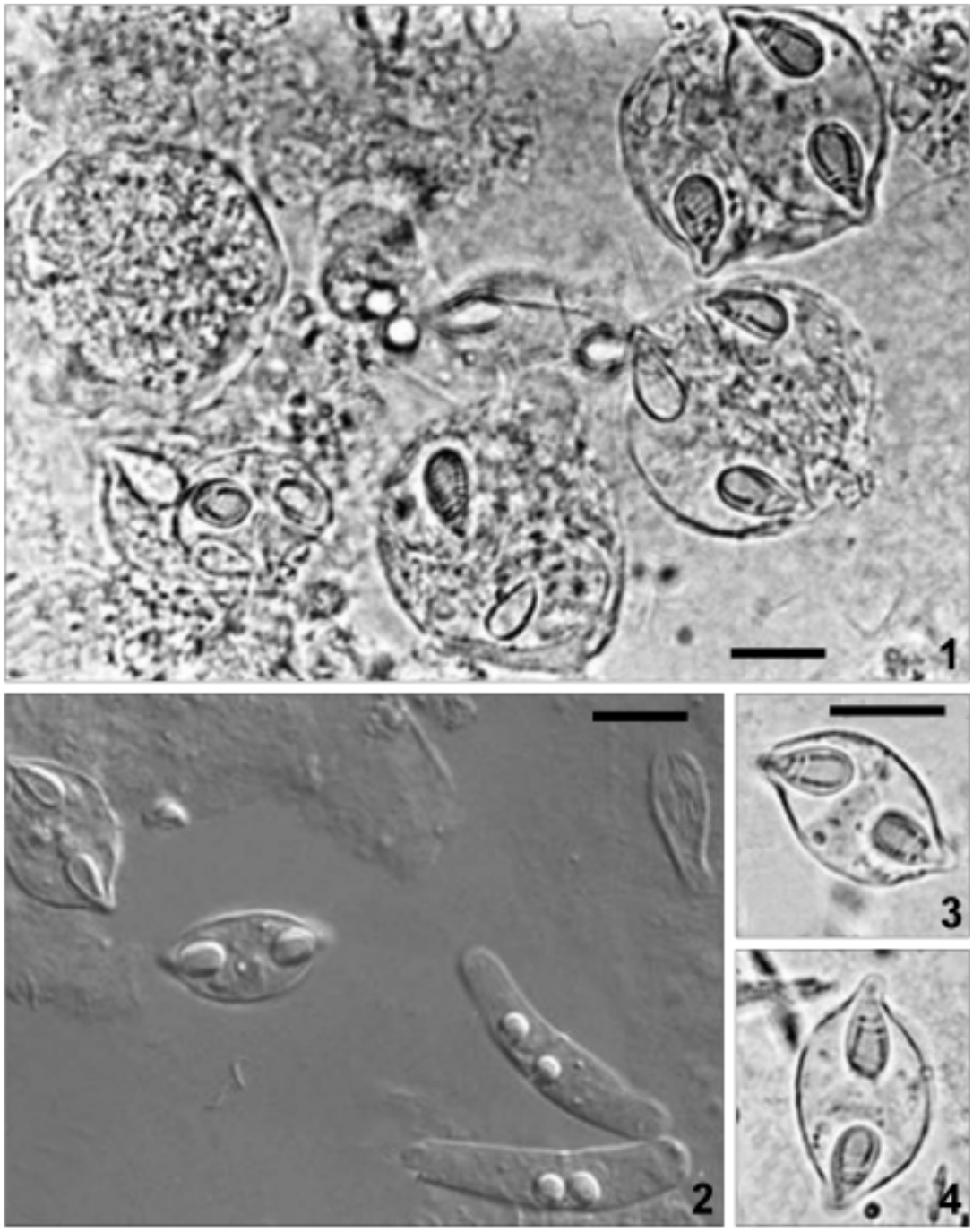
Type material: Syntypes on slid no. Myx.-15 is deposited at the Museum of Zoology Department, Faculty of Science, Beni-Suef University, Beni-Suef, Egypt.

Etymology: The parasite is named for Prof. Mansour El-Matbouli in recognition of his valuable contribution to myxozoan research.

Ceratomyxa ghaffari n. sp. (Figs 5-6, 7b)

Vegetative stages: The vegetative forms of this parasite were not observed. Free spores, mostly mature ones, were densely floating in the bile. The infection was mixed with *Myxidium* forms (Fig. 2).

Spores: Spores typical of genus *Ceratomyxa*. Mature spores were slightly crescent-shaped, the anterior margin was arched and the posterior margin was nearly straight or with very slight concavity. Valves were equal,



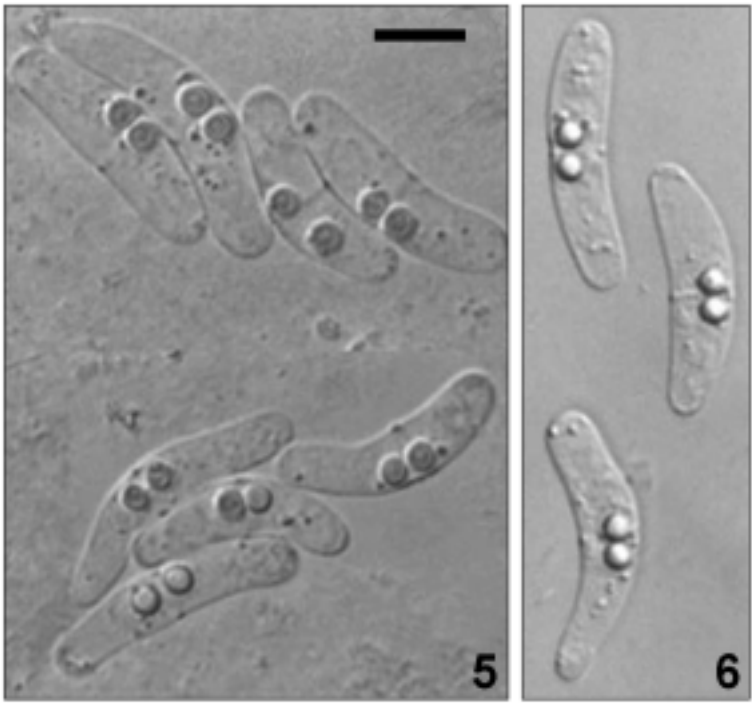
Figs 1-4. *Myxidium elmatboulii* n. sp. from the gallbladder of *Tylosurus choram*. **1** - disporic plasmodia; **2** - fresh spores of *Myxidium elmatboulii* and *Ceratomyxa ghaffari* (DIC); **3, 4** - spores of *Myxidium elmatboulii* in sutural and frontal views, respectively. Scale bars: 10 µm.

Table 1. Comparative descriptive measurements (µm) of *Myxidium elmatboulii* n. sp. with morphologically similar species.

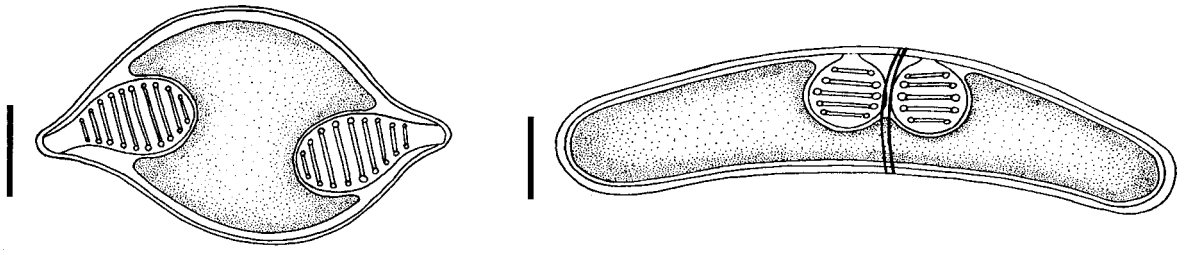
Species	Host	Site of infection	Locality	Spore		Polar capsule	
				length	width	length	width
M. incurvatum Thelohan, 1892 (from Lom and Dykova 1992)	*Syngnatus acus*	Gallbladder	Mediterranean coast, France	8.0-20.0	4.0-8.2	3.0-5.5	2.4-2.7
M. sphaericum Thelohan, 1895 (Moser *et al.* 1989)	*Trachinotus blochi*	Gallbladder	Heron Island, Australia	17.5 (15.0-20.0)	7.5 (6.0-8.0)	4.5 (4.0-6.0)	3.7 (3.0-5.0)
M. giganteum Dolfein, 1898 (Kpatch *et al.* 1996)	*Raja miraletus*	Gallbladder	Coast of Senegal	19.9 ± 0.2 (19.0-20.0)	9.5 ± 0.8 (8.0-10.0)	4.7 ± 0.6 (4.0-5.4)	2.9 ± 0.2 (2.0-3.0)
M. baueri Kovaleva *et* Gaevskaya, 1982 (Kalavati *et al*. 1996)	*Patagonatothen sima*	Gallbladder	Falkland Islands, Southwest Atlantic	22.4 ± 1.9 (19.0-24.0)	9.9 ± 1.0 (9.0-11.0)	5.2 ± 0.2 (4.5-5.5)	3.7 ± 0.2 (3.0-4.0)
M. trachinorum Canning *et al*., 1999	*Echiichthys vipera*	Gallbladder	South coast of UK at Plymouth and Weymouth	17.2	8.8	6.5	3.7
M. tuanfengensis Gong *et al*., 2003	*Letobotia taeniops*	Liver, intestine	China	19.5 ± 0.8 (18-20)	9.7 ± 0.6 (9.1-10.4)	6.8 ± 0.5 (5.7-7.8) (diameter)	
M. elmatbouli n. sp.	*Tylosurus choram*	Gallbladder	Gulf of Suez, Red Sea	20.7 ± 1.2 (19.0-23.0)	10.6 ± 0.9 (9.0-12.0)	9.1 ± 0.6 (8.0-10.0)	3.8 ± 0.2 (3.5-4.0)

Table 2. Comparative descriptive measurements (µm) of *Ceratomyxa ghaffari* n. sp. with morphologically similar species.

Spores	Host	Site of infection	Locality	Spore		Polar capsule	
				length	thickness	length	width
C. inaequalis Doflein, 1898 (Lubat *et al.* 1989)	*Symphodus mediterraneus* and *S. tinca*	Gallbladder coast, Italy	Mediterranean	5.5 (5.0-6.0)	25.0 (23.5-31.0)	2.5 (diameter)	
C. elegans Jameson, 1929 (Jurakhno 1993)	*Scorpaena porcus*	Gallbladder	Black Sea	6.7- 8.0	26.0-31.5	2.4-2.5	2.2-2.4
C. sprenti Moser *et al.*, 1989	*Chaeodon rainfordi*, *C. trifascaiatus*, *C. aureofasciatus*, *Choerodon venustus*	Gallbladder Australia	Heron Island,	5.7 (4.0-8.0)	16.3 (14.0-23.0)	2.4 (2.0-3.0)	-
C. dissimilaris Narasimhamurti *et al.*, 1990	*Nemipterus mesoprion*	Gallbladder	Bay of Bengal, India	10.4 (9.2-11.8)	41.6 (36.4-45.8)	4.8 (3-5.2) 3.5 (2.4-3.8)	large small
C. peculiaria Jurakhno, 1991	*Spicara flexuosa*	Gallbladder	Black Sea	6.5-8.5	21.0-29.3	2.4-2.7	1.9-2.4
C. aspera Aseeva, 2003	*Limanda aspera*, *L. herzensteini*	Gallbladder	Japan Sea	8.0-10	34-42.5	4.0-4.5 (diameter)	
C. ghaffari n. sp. (Present paper)	*Tylosurus choram*	Gallbladder	Gulf of Suez, Red Sea	7.6 ± 1.1 (6.0-9.0)	29.9 ± 3.6 (25.0-33.0)	3.3 ± 0.4 (3.0-4.0) (diameter)	



Figs 5, 6. Fresh spores of *Ceratomyxa ghaffari* n. sp. from the gallbladder of *Tylosurus choram* (DIC). Scale bar: 10 µm.



Figs 7a, b. 7a - line diagrams. Spore of *Myxidium elmatboulii* n. sp. in frontal view. **7b -** sutural view of *Ceratomyxa ghaffari* sp. n spore. Scale bars: 5 µm.

cylindrical, thin and smooth with rounded ends. Straight sutural line was clearly seen between the two valves. Polar capsules were spherical and equal size. Polar filament with 5 coils was perpendicular to the longitudinal axis of the capsule. Single binucleated sporoplasm was filling the entire extracapsular spore cavity. Spore Dimensions: 7.6 ± 1.1 (6.0-9.0) in length x 29.9 ± 3.6 (25.0-33.0) in thickness. Polar capsules 3.3 ± 0.4 (3.0-4.0) in diameter.

Taxonomic affinities: *C. ghaffari* is superficially similar to *Ceratomyxa inaequalis* Dolfein, 1898 (Lubat *et al.* 1989); *C. elegans* Jameson, 1929 (Jurakhno 1993); *C. sprenti* Moser, Kent *et* Dennis 1989; *C. dissimilaris* Narasimhaurti, Calavati, Anuradha *et* Dorothy, 1990; *C. peculiaria* Jurakhno, 1991 and *C. aspera* Aseeva, 2003 (Table 2).

Comparatively, *C. inaequalis* can be distinguished from the present species by having unequal valves and

unequal polar capsules. In addition, *C. inaequalis* has shorter spores with smaller polar capsule. Similarly, *C. elegans* differs in having quite smaller polar capsules with lower number of filament coils (3-4 *vs*. 5). C*eratomyxa sprenti* can be separated from the present species by its quite thinner spores, which are nearly half of the present species. The asymmetrical spore valves with bent ends, unequal polar capsule and polar filament can distinguish *C. dissimilaris*. Moreover, *C. dissimilaris* has quite thicker spores. Similarly, *C. peculiaria* can be differentiated by its smaller spore dimensions; lower number of filament coils (3 *vs*. 5) and its pyriform polar capsules compared to typically rounded ones characterizing the present species. *C. aspera* appears distinctly different from the present species in having quite thicker spores with asymmetrical spore valves.

The above comparison revealed that the present species is distinctive in its feature from other recorded species. In addition, no myxosporean infections have been recorded in the present fish host. Therefore, the present species is considered new and the name proposed is: *Ceratomyxa ghaffari* n. sp.

Host: *Tylosurus choram* (Ruppell, 1837)

Locality: Gulf of Suez (Lat. 30° N and Long. 32.5° E)

Location in the host: Gall bladder

Prevalence: 15/108 (13.8%).

Type material: Syntypes on slide no. Myx.-16 is deposited at the Museum of Zoology Department, Faculty of Science, Beni-Suef University, Beni-Suef, Egypt.

Etymology: The parasite is named for Prof. Fathy Abdel-Ghaffar, Professor of Parasitology, Cairo University, Egypt.

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