



ORIGINAL ARTICLE

A new record of *Myxobolus brachysporus* and *M. israelensis* in the tilapia (*Oreochromis niloticus*) collected from the Nile River, Egypt



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Abstract The present study was carried out as part of an ongoing general survey for myxosporean parasites infecting tilapias in the River Nile, Egypt. In the present study, 77 Nile tilapia (*Oreochromis niloticus*) were collected from boat landing sites at Beni-Suef governorate, Egypt and examined for the myxosporean infection. The infection was encountered as a huge number of free spores in the kidney and the spleen. The infection showed a prevalence of 51.9% (40/77) for *Myxobolus brachysporus* while it was 25.9% (20/77) for *Myxobolus israelensis*. Mature spores of *M. brachysporus* were ellipsoidal and measured $8.6 \times 13.2 \mu\text{m}$. The polar capsules were subcircular with 5–6 filament turns and measured $4.7 \times 3.6 \mu\text{m}$. Spores of *M. israelensis* were ellipsoidal in the frontal view and fusiform in the lateral view. Spore measurements were $13.4 \mu\text{m}$ long and $8.7 \mu\text{m}$ wide. The polar capsules were elongated with 6–7 filament coils and measured $8.6 \times 3.1 \mu\text{m}$. The findings presented here proved that tilapia fishes in the Nile River are still suffering from infections with *Myxobolus* species. Therefore, further studies should be carried out to survey the *Myxobolus* infection among tilapias under culture conditions to clarify the pathological impacts of this parasite in tilapias aquaculture.

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1. Introduction

It is quite certain that fishes represent the foremost necessary sources of animal protein all over the world. Since the beginning, fishing is considered one of the most important activities that is practiced by ancient Egyptians (Abdel-Ghaffar et al., 2008). Tilapia are essentially freshwater fish commonly found in rivers, streams, lakes, ponds and less frequently inhabiting brackish and even marine water. The overall production of

tilapia culture in Egypt throughout 2007 was calculable by 265,862 Ton that represents about 41.8% of the whole national fish culture production (GAFRD, 2010). Myxosporeans are an abundant and diverse group of economically important microscopic parasites, which cause disease in a large variety of commercially important fishes including tilapias (Lom and Dykova, 2006). Myxosporean parasites are known to be responsible for several forms of damage, including post-mortem myoliquefaction of the host (Pampoulie et al., 1999), damage of ovaries (Gbankoto et al., 2001; Mansour et al., 2013) and reduction of the capacity of respiration (Molnár and Székely, 1999). Among the myxosporeans, species of the genus *Myxobolus* are, so far, the foremost unremarkably found in fish, with about 856 known species throughout the world (Eiras et al., 2014). Of them, about 12 species were described from tilapias spp. in natural and cultural habitats. In the present study, we described two *Myxobolus* species from the Nile tilapia *Oreochromis niloticus* collected from the Nile River at Beni-Suef governorate which were delineated for the first time from Egypt.

2. Materials and methods

During the present investigation, 77 tilapia fish (*Oreochromis niloticus*) live or freshly caught were collected from boat landing sites at the Beni-Suef governorate (29°3'50"N, 31°5'20"E), throughout a period from October 2012 to October 2013. Fish were collected from both sexes and with lengths ranging from 15 to 20 cm and weighs about 150–200 g. Skins and gills scraps were performed from all fishes and examined for myxosporean infection. Also, eyes of the fish were examined for the presence of any myxosporean spores within both the cornea and lens. Further, the fish were dissected then impression smears from different organs including liver, spleen, kidneys, gall bladder were made. Stomach and intestinal scraps were also made.

All samples were freshly examined using a regular light microscope as well as a dissecting microscope. Fresh spores were examined and photographed using differential interference contrast Zeiss Axiovert 135 microscope equipped with a camera. The morphometric measurements of spores followed the guidelines devised by Lom and Arthur (1989) for species descriptions of Myxosporea. Data are represented as: mean \pm SD followed by (Range).

3. Results

The infection was encountered as a huge number of free spores in the kidney and the spleen. The infection showed a prevalence of 51.9% (40/77) for *Myxobolus brachysporus* whereas it was 25.9 (20/77) for *Myxobolus israelensis*. The recorded species are described as follows:

3.1. *Myxobolus brachysporus* Baker, 1963

The spores were ellipsoidal in shape and characterized by their width that greatly exceeded the length (Figs. 1, panels 1–3 and 2). They measured 8.6 ± 0.4 (7.8–9.2) long \times 13.2 ± 0.6 (12.1–14.2) wide. The polar capsules were subcircular, mostly equal in size and measured 4.7 ± 0.3 (4.2–5.1) long \times 3.6 ± 0.3 (3.2–4.2) wide. The polar filament spired in 5–6 turns perpendicular or slightly oblique to the longitudinal axis of the capsule. The sporoplasm filled up the rest of the spore cavity (Figs. 1, panels 1–3 and 2).

3.2. *Myxobolus israelensis* Landsberg, 1985

The spores were ellipsoidal with rounded anterior and posterior ends in the frontal view and fusiform in the lateral view (Figs. 1, panels 4–6, 3). The spores measured 13.4 ± 0.9

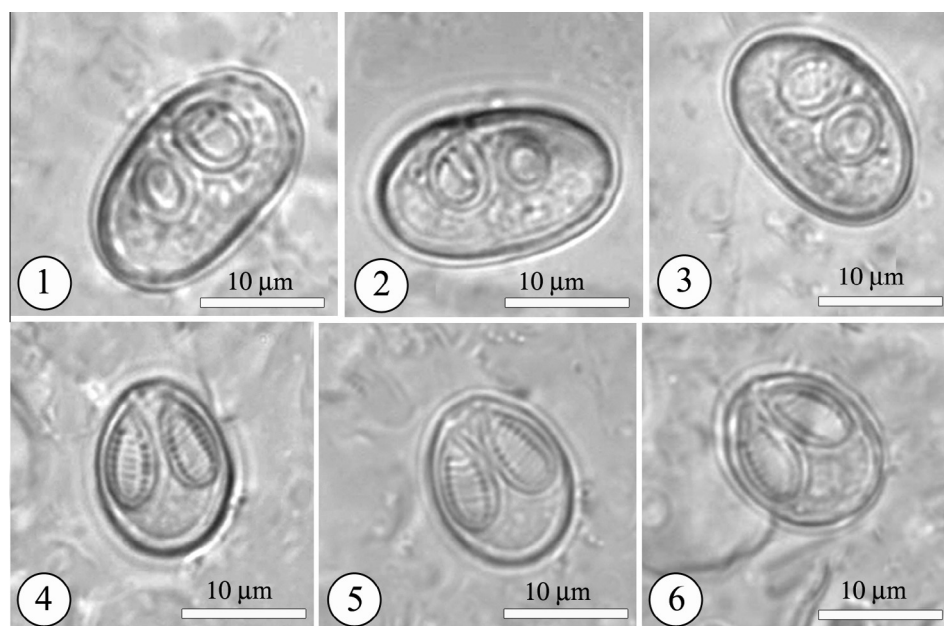


Figure 1 Light micrographs of fresh mature spores of *Myxobolus brachysporus* (panels 1–3) and *Myxobolus israelensis* (panels 4–6) infecting the kidney and the spleen of Nile tilapia *Oreochromis niloticus* from the River Nile.

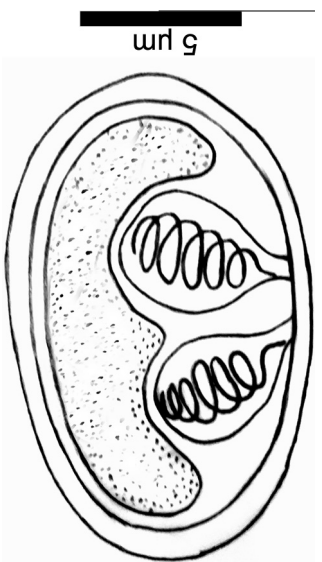


Figure 2 Line draw of fresh mature spore of *Myxobolus brachysporus* infecting the kidney and the spleen of the Nile tilapia *Oreochromis niloticus* from the River Nile.

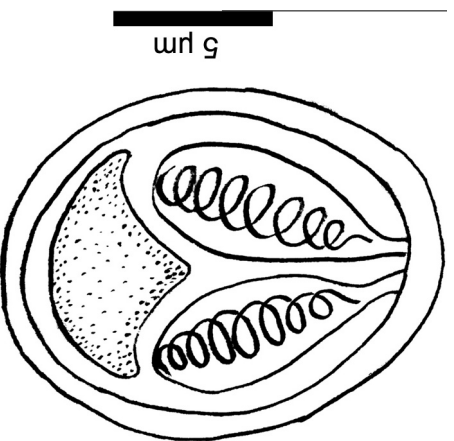


Figure 3 Line draw of fresh mature spore of *Myxobolus israelensis* infecting the kidney and the spleen of the Nile tilapia *Oreochromis niloticus* from the River Nile.

(12.1–15.7) long \times 8.7 \pm 0.58 (7.8–9.9) wide. The polar capsules were elongated, tapering at two short discharge canals. They surpassed two thirds of the spore cavity. They measured 8.6 ± 0.7 (7.4–9.9) long \times 3.1 \pm 0.4 (2.6–4.2) wide. The polar filament coiled in 6–7 turns arranged obliquely along the inner wall of the capsule (Figs. 1, panels 4–6, 3). The sporoplasm occupied the posterior third of the spore lacking the iodophilous vacuole.

4. Discussion

4.1. *Myxobolus brachysporus* Baker, 1963

Spores of the present *Myxobolus* species are wider than long as those of *M. artus* Akhmerov, 1960 from the muscles of *Cyprinus carpio* in East Asia (see Shulman, 1966); *M. brachysporus* Baker, 1963 from *Oreochromis esculentus* and *O. variabilis* and *Haplochromis* sp. in Uganda (see Rocha et al., 1992) and *M. jahnricei* Landsberg and Lom, 1991 from the gills of *Ictiobus bubalus* in U.S.A. (see Fomena and Bouix, 1987) (Table 1).

Table 1 Comparative descriptions of the present *Myxobolus brachysporus*, and *M. israelensis* with morphologically similar species (measurements in μm).

Parasite	Host	Spore		Polar capsule		References
		Length	Width	Length	Width	
<i>M. artus</i> Akhmerov, 1960	<i>Cyprinus carpio</i>	6.5–8.5	9–12	4–6	2.3–5	Shulman (1966)
<i>M. brachysporus</i> Baker, 1963	<i>Oreochromis esculentus</i> and <i>Haplochromis</i> sp.	7.3 (7–7.5)	12.5 (12–13.5)	3.1 (2.5–3.8)	2.3 (2.3–2.5)	Rocha et al. (1992)
<i>M. jahnricei</i> Landsberg and Lom, 1991	<i>Ictiobus bubalus</i>	12.4	15.5	7	4.4	Fomena and Bouix (1987)
<i>M. brachysporus</i> (present study)	<i>Oreochromis niloticus</i>	8.6 \pm 0.4 (7.8–9.2)	13.7 \pm 0.6 (12.1–14.2)	4.7 \pm 0.3 (4.2–5.14)	3.6 \pm 0.3 (3.2–4.2)	Present study
<i>M. microcystus</i> Price and Mellen, 1980	<i>Micropterus salmoides</i>	12.5 (11–14)	7.5 (7–10)	6.5 (5–7)	2.5 (2–4)	Price et al. (1980)
<i>M. agolus</i> Landsberg, 1985	<i>Oreochromis aureus</i>	10.7 (9.8–11.6)	8.4 (7.5–9.2)	6.9 (6.1–7.4)	3.4 (3.1–3.8)	Landsberg (1985)
<i>M. israelensis</i> Landsberg, 1985	<i>O. niloticus</i> and <i>O. niloticus vulcani</i>	3.5 (3.2–4)	12.5 (11.4–13.9)	8.8 (8–9.9)	7.7 (7–8.2)	Landsberg, (1985)
	<i>Oreochromis aureus</i>					
	<i>O. niloticus</i> , <i>Sarotherodon galilaeus</i> and <i>O. niloticus vulcani</i>					
<i>M. magurii</i> Sarkar, 1993	<i>Clarias magur</i>	14.13 (13–15)	7.75 (6.5–8)	7.53 (7–8)	2.34 (2–3)	Kaur and Singh (2012)
<i>M. cognati</i> Cone et al., 1996	<i>Cottus cognatus</i>	13.3 (12–14)	10 (9.5–10.5)	6.6 (5.5–7.5)	3	Cone et al. (1996)
<i>M. enoblei</i> Lom and Cone, 1996	<i>Ictiobus bubalus</i>	14.4 (13.5–15)	11 (10.5–11.5)	8.3 (7.9–8.5)	4.8 (4.5–5)	Lom and Cone (1996)
<i>M. israelensis</i> (present study)	<i>Oreochromis niloticus</i>	13.4 \pm 0.9 (12.1–15.7)	8.7 \pm 0.5 (7.8–9.9)	8.6 \pm 0.7 (7.4–9.9)	3.1 \pm 0.4 (2.6–4.2)	Present study

In spite of this similarity, spores of the present species are quite smaller in size to those of *M. jahnricei*. Moreover, spores of *M. jahnricei* and *M. artus* possess considerably more variable polar capsule sizes with different angles of orientation compared to those of the present species. All of them differ in the host and in the site of infection in contrast to the present species. Only *M. brachysporus* shows the same size, shape and host of the present species and therefore, the present species can be identified as *M. brachysporus*.

4.2. *Myxobolus israelensis* Landsberg, 1985

On the basis of a morphological and dimensional comparison of the spores, several species of *Myxobolus* are found to resemble the present form: *M. microcystus* Price and Mellen, 1980 from *Micropterus salmoides* in U.S.A. (see Price et al., 1980); *M. agolus* Landsberg, 1985 infecting *Oreochromis aureus*, *O. niloticus* and *O. niloticus vulcani* (see Landsberg, 1985); *M. israelensis* Landsberg, 1985 infecting also *Oreochromis aureus*, *O. niloticus* and *O. niloticus vulcani* in Israel in addition to *Sarotherodon galilaeus* (see Landsberg, 1985); *M. magurii* Sankar, 1993 from the catfish *Clarias magur* in India (see Kaur and Singh, 2012), *M. cognati* Cone et al., 1996 from *Cottus cognatus* in Canada (see Cone et al., 1996) and *M. enoblei* Lom and Cone, 1996 from the bigmouth buffalo *Ictiobus bubalus* in U.S.A. (see Lom and Cone, 1996) (Table 1).

M. cognati differs from the present species in having spores with sutural folds at their posterior end, in addition to the different number of polar filament turns (8 to 11 vs. 7). The present form shows an ellipsoidal shape in contrast to *M. magurii* which produces spores of larger size and banana-shaped polar capsules. Spores of *M. microcystus* differ in having narrower extremity and quite smaller polar capsules. Spores of the present species differs from those of *M. enoblei* in their smaller size, while are considered larger than those of *M. agolus*, in addition to the different polar filament turns shown by both species (7 vs. 10–11). Also, the present species differs from the formerly discussed species in the host species (except for *M. agolus*). Conversely, spores of the present species show high relativity to those of *M. israelensis* in shape and size in addition to the host species and, therefore, it can be distinguished as *M. israelensis*.

5. Conclusion

The present study documented that tilapia fishes in the Nile River are still suffering from infections with *Myxobolus* species. Therefore, further investigations should be carried out on the *Myxobolus* infections among tilapias under culture conditions which are important for clarification of the pathological impacts of this parasite in tilapias aquaculture.

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