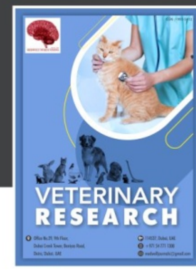
VETERINARY RESEARCH
MEDWELL PUBLICATIONS SINCE 2000



Ultrastructural Data on the Spore of *Myxobolus dermatobius* Ishii, 1915 *(Myxosporea: Myxobolidae)* Infecting Eye of Nile-Tilapia (*Oreochromis niloticus*) in Egypt

Nosseur M. El-Sayed
Department of Parasitology, Faculty of Veterinary Medicine, Zagazig University, Zagazig, Egypt

Key words: *Myxobolus*, ultrastructure, *Oreochromus niloticus*, *Myxospora, Tilapia nilotica*

Corresponding Author:
Nosseur M. El-Sayed
Department of Parasitology, Faculty of Veterinary Medicine, Zagazig University, Zagazig, Egypt

Page No.: 1-7
Volume: 13, Issue 1, 2020
ISSN: 1993-5412
Veterinary Research

Abstract: A total of 1000 cultured Nile-tilapia (*Oreochromis niloticus*) were collected from different governmental and private fish farms and examined for detection of myxosporean parasites infection. The infected fish showed slight unilateral exophthalmia with whitish cyst in the eye. Numerous white cyst like plasmodia of *Myxobolus dermatobius* were recovered from the eye of the examined fish with low prevalence rate (1%). Small intact cyst was isolated, fixed in 3% glutaraldehyde in 0.1 M sodium cacodylate (pH 7.4) and prepared for electron microscopy examination. Ultrathin sections of *Myxobolus dermatobius* spore revealed pair of capsulogenic cells at the apical pole of the developing spore.

INTRODUCTION

Fishes consider as one of the most important sources of animal protein all over the world. Egypt is a country with numerous lakes, seas and long river having the most diversified fauna of fresh and marine water fishes. Fish eye is considered a very important organ, it is adapted for the vision in air as well as waters either in wild and cultured fish which do display some differences to the mammalian eyes[1]. The awareness of and experience with parasites that affect fish health, growth and survival are increased with increasing the interest in fish culture and production. Therefore, the contribution to the knowledge of fish parasites is a prerequisite for early and correct diagnosis of the disease agent that can lead to preventive measure which is the best way to reduce outbreaks of disease[2, 3].

Myxosporidea are frequently described in fresh water, brackish and marine fishes and have a great importance in ichtyopathology. Myxosporean parasites are the most important fish pathogens and more than 2,300 species have been reported from marine and fresh water fish in several geographical areas[4-7]. Myxosporea infecting Egyptian fish is a group of parasites which is considered as the major cause of myxosporidiosis and harm of the fish[8-11]. Myxobolus Butschli, 1882, is one of the largest genus of myxosporean groups. Landsberg and Lom[12] gave a list of 444 Myxobolus species followed by Eiras *et al*.[13, 14] who listed approximately 744 and 856 species of Myxobolus parasitizing fish from all over the worldm respectively. The species of Myxobolus infect a diverse set of specific tissues that can include specifically the tegument, eyes, gills, glands, gonads, kidneys, muscle, digestive tract and nervous system[15, 6]. Myxobolus dermatobia recovered from *Oreochromis niloticus* causes petechial to focal haemorrhages in orbit, exophthalmia and unilateral eye opacity, especially in advanced cases[16] while *Myxobolus dematobia* isolated from *Tilapia zilli* at Giza province causes unilateral eye opacity[17].

The ultrastructural morphology of myxosporean species have been widely studied[12, 15], however, few species have been ultrastructurally described in Egypt. So, the present paper give ultrastructural data of *Myxobolus dermatobius*, infecting Nile tilapia, Oreochromis niloticus by using transmission electron microscope.

MATERIALS AND METHODS

A thousand of live or recently dead Nile-tilapia; *Oreochromis niloticus* were collected from different governmental and private fish farms in Sharkia Governorate, Egypt. The collected fish were transported to the laboratory and dissected. The different organs were examined macroscopically and microscopically for detection of any visible myxosporean cysts.

Small intact cysts with minimum surrounding tissue were isolated and fixed in 3% glutaraldehyde in 0.1 M sodium cacodylate (pH 7.4)for at least 24 h, washed in the same buffer and post-fixed with 2% OSO_4 in the same buffer. The specimens were dehydrated in series of graded ethanol, transferred to propylene oxide and finally, embedded in araldite. Ultrathin sections were stained with uranyle acetate and lead citrate and examined with a Philips (208) electron microscope at 80-100 kV[18].

RESULTS AND DISCUSSION

The prevalence of infection with *Myxobolus dermatobius* among the examined fish was 1% (10 out of 1000). Several species of Myxobolus were isolated from *Oreochromis niloticus* in Egypt; *Myxobolus nilei* from eyes, skin, gills, kidney, spleen and pancreas[19], *M. heterosporus* from eye, muscle and kidney[20], *M. spheroidalis* and *M. ocularis* from eye[21], *M. heterosporus* from eye and gills[22], *Myxobolus* sp. from the inner wall of cornea, the base of the gill arch and roof of the mouth[23], *M. cornealis* from the eye[24], *M. dermatobia*[16] and *M. heterosporus*[25] from eye and cornea. *Myxobolus dermatobia* was isolated from eye of *Tilapia zilli* at Giza province[17]. The parasite was found in the form of whitish cyst in the eye of tilapia causing slight unilateral slight exophthalmia. The spores of *Myxobolus dermatobius* (Syn. *Myxobolus dermatobia*) were recovered from their original plasmodia found in the infected eye of Nile tilapia, *Oreochromis niloticus* (Fig. 1). Similar lesion of exophthalmia was noticed by Abdel-Aal[16] and Mohamed *et al.*[17].

Most of the Egyptian *Myxobolus* species have been described based on light microscopy descriptions and diagrammatic drawings even fewer have been described using ultrastructural observations. The ultrastructural characteristics of *Myxobolus dermatobius* revealed that each spore develops from five cells; a pair of capsulogenic cells, two peripherally arranged valvogenic cells and one sporoplasm cell. Capsulogenic cells are found at the apical pole of the developing spore and together with the sporoplasm, forms a central core that is ensheathed by valvogenic cells. These cells give rise to the two shell valves surrounding each spore and the sutural ridge joining the valves. The differentiation of the capsulogenic cells starts with appearance of a club-shaped structure “capsular primordium” (Fig. 2-4).

Fig. 1: Eye of Nile-tilapia *Oreochromis niloticus*; showing white plasmodia (arrows) of *Myxobolus dermatobius* infection

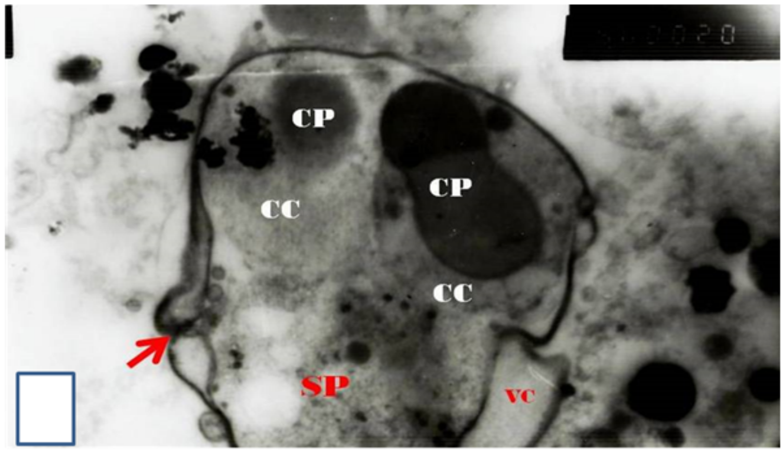


Fig. 2: *Myxobolus dermatobius* premature spore showing two Capsulogenic Cells (CC) containing Capsular Primordium (CP); Sporoplasm (Sp); Valvogenic Cell (VC) and suture valve (arrow). X5000

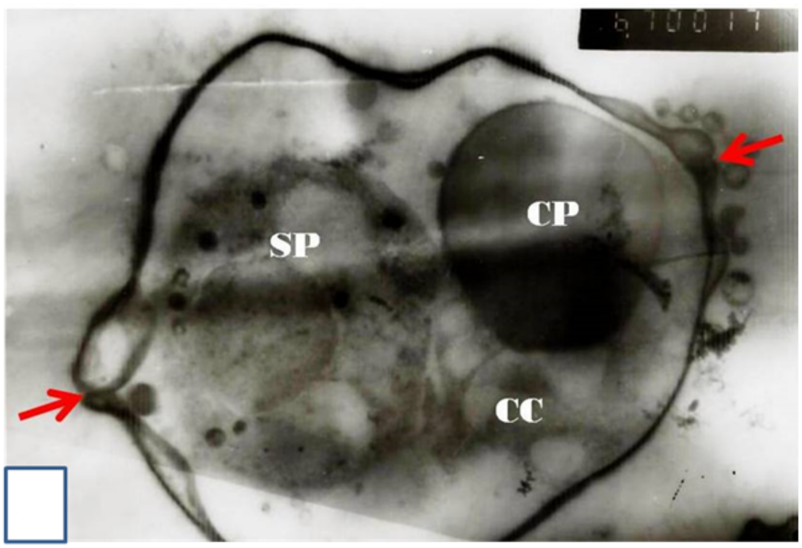


Fig. 3: *Myxobolus dermatobius* premature spore showing two Capsulogenic Cells (CC) containing Capsular Primordium (CP); Sporoplasm (Sp). X5000

This come in accordance to *M. dermatobia* described by Abdel-Aal[16] and *Myxobolus* sp.[26]. The capsulogenic cell of the present species showed capsular primordial as described in *M. stomum* and *Myxobolus* sp. by Ali *et al.*[27] and Abdel-Ghaffar *et al.*[26], respectively. The valvogenic cells gave rise to shell valve surrounding each spore and sutural ridge joining the valves were similar to *M. dermatobia* described by Abdel-Aal[16].

Sporoplasm fills nearly all the space beneath the polar capsules. It contains single mono-nucleated, small vesicles and sometimes exhibited dense matrices known as sporoplasmosomes. A small area of sporoplasm is occupied by a glycogen body (Fig. 4-5). Corresponding finding of nucleus was observed in *Myxobolous dermatobia* described by Abedel-Aal[16] while bi-nucleated sporoplasm was descibed in other species; *Myxobolus stomum*[27]; *Myxobolus braziliensis*[28] and *Myxobolus* sp.[29,30]. The sporoplasmosomes of the present species complied with a similar dense body found in *Myxobolus cotti* reported by EI-Matbouli *et al.*[31]; *M. dermatobia*[16]; *M. stomum*[27] and *Myxobolus* sp.[26]. The glycogen body noticed in the sporoplasm is essential in the myxosporean spore which could provide the energy necessary for further developmental stages in the life

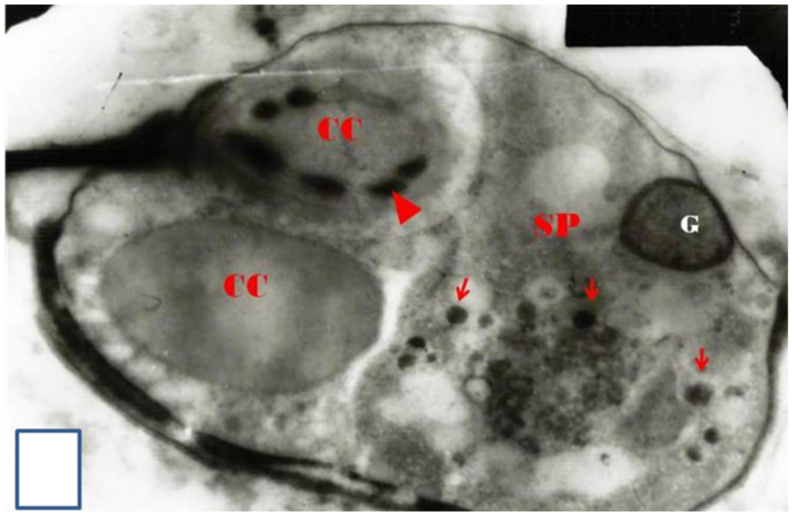


Fig. 4: *Myxobolus dermatobius* nearly mature spore containing two Capsulogenic Cells (CC), primordia of polar filaments (arrow head); Sporoplasm (Sp) with sporoplasmosomes (arrow) and Glycogen body (G). x5000

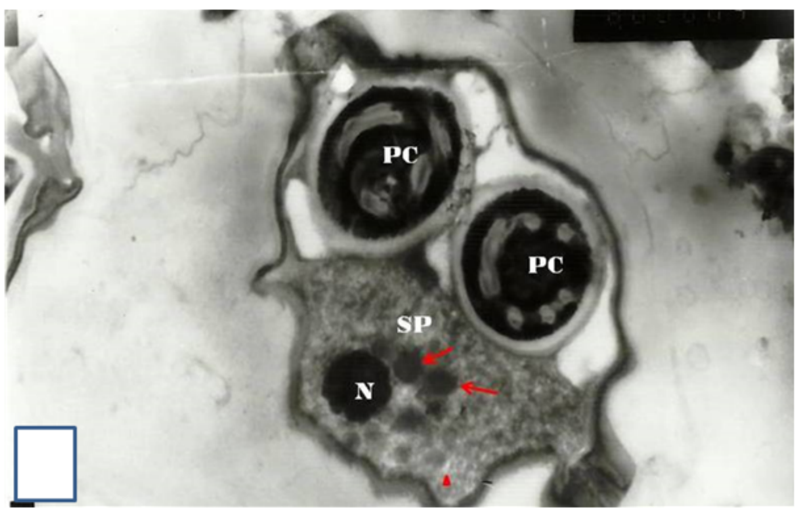


Fig. 5: Transverse section through *Myxobolus dermatobius* mature spore, showing Polar Capsules (PC); Sporoplasm (Sp) containing sporoplasmosomes (arrows); Nucleus (N) and small vesicles (arrow head). X5000

cycle. It was similar to that reported in *M. cotti*[31]; *Myxobolus* sp. (Abdel-Ghaffar *et al*., 1994) and *M. dermatobia*[16].

Two polar capsules are pyriform in shape, equal size, located side by side at the same level and occupy approximately half of the total spore length (Fig. 6). Each polar capsule has a homogenous core of medium electron-density containing polar filaments, surrounded by an electron-lucent layer and an outer layer of medium density (Fig. 7). Similar findings were reported in many species of *Myxobolus*; *M. cotti*[31], *M. dermatobia*[16], *M. stomum*[27], *Myxobolus* sp.[26] and *Myxobolus sciades*[32]. The number of polar filament coils is probably 4 turns in each capsule. The apical portion of each polar capsule has cap-like cover plugged the apex of each mature polar capsule (Fig. 8). These was identical to that of *Myxobolus dermatobia* described by Abdel-Aal[16]. The same number of polar filament coils was reported in *M. hetersporus* by El Mansy[25] while different numbers of polar filament turns were mentioned by Casal *et al.*[28], Ali *et al.*[27], Abdel-Ghaffar *et al.*[26], Azevedo *et al.*[32], Kaur and Singh[33] and Abdel-Baki *et al.*[34] in *M. maculatus* (14-15) *M. stomum* (5-6) *Myxobolus* sp. (5); *M. sclerii* (4-5), *M. sciades* (9-10) and *M. brachysporus* (6-7), respectively.

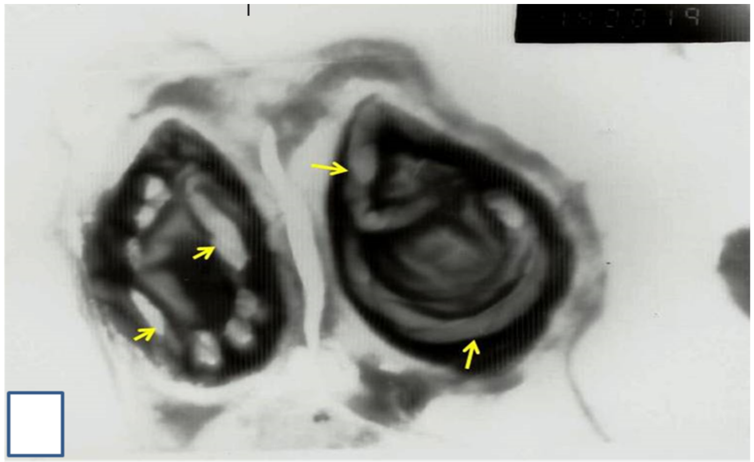


Fig. 6: Longitudinal section through anterior portion *Myxobolus dermatobius* mature spore showing two synchronously developed Polar Capsules (PC) with polar filament coils (arrows) x5000

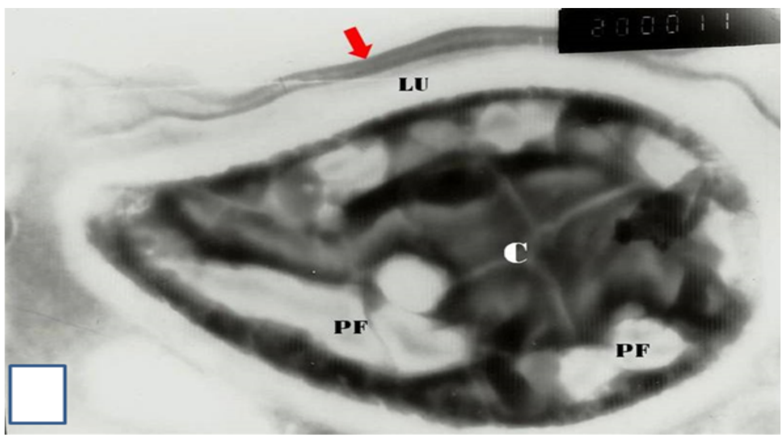


Fig. 7: Longitudinal section through *Myxobolus dermatobius* well developed polar capsule showing an electron-dense outer layer (arrow); a central translucent layer (LU) and inner dense core (C) with polar filament coils (PF). X7600

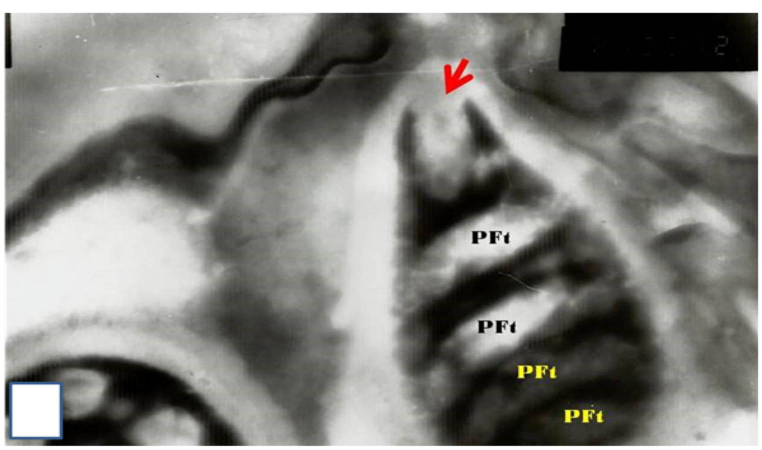


Fig. 8: Longitudinal section through *Myxobolus dermatobius* well developed polar capsule showing four turn of Polar Filament (PFt) and apical cap (arrow). X14000

CONCLUSION

Single sporoplasm containing a nucleus and sporoplasmosomes fills nearly all the space beneath the polar capsules. The later were pyriform in shape, each one had homogenous dense core and 4 turns of polar filaments. Ultrastructural characteristics of the present spore were described and discussed in detail.

REFERENCES

01. Lee, W.R., 2002. Ophthalmic Histopathology. 2nd Edn., Springer, London, UK.,.
02. Abdel-Ghaffar, F., K. Morsy, H. Mehlhorn, A.R. Bashtar, M.A. Shazly, A.H. Saad and R. Abdel-Gaber, 2012. First report of *Kudoa* species (Myxozoa: Kudoidae) infecting the spotted coral grouper *Plectropomus maculates* from the Red Sea. A light and ultrastructural study. Parasitol. Res., 111: 1579-1585.
03. Morsy, K., F. Abdel-Ghaffar, A.R. Bashtar, H. Mehlhorn, S. Al Quraishy and R. Abdel-Gaber, 2012. Morphology and small subunit ribosomal DNA sequence of *Henneguya suprabranchiae* (Myxozoa), a parasite of the catfish *Clarias gariepinus* (Clariidae) from the River Nile, Egypt. Parasitol. Res., 111: 1423-1435.
04. Adriano, E.A., S. Arana and N.S. Cordeiro, 2006. *Myxobolus cuneus* n. sp. (Myxosporea) infecting the connective tissue of *Piaractus mesopotamicus* (Pisces: Characidae) in Brazil: histopathology and ultrastructure. Parasite, 13: 137-142.
05. Adriano, E.A., S. Arana, A.L. Alves, M.R.M.D. Silva, P.S. Ceccarelli, F. Henrique-Silva and A.A.M. Maia, 2009. *Myxobolus cordeiroi* n. sp., a parasite of *Zungaro jahu* (Siluriformes: Pimelodiade) from Brazilian Pantanal: morphology, phylogeny and histopathology. Vet. Parasitol., 162: 221-229.
06. Feist, S.W. and M. Longshaw, 2006. Phylum Myxozoa. In: Fish Diseases and Disorders: Protozoan and Metazoan Infections, Woo, P.T.K. (Ed.)., CAB International, Oxfordshire, English, pp: 230-296.
07. Azevedo, C., G. Casal, P. Matos, I. Ferreira and E. Matos, 2009. Light and electron microscopy of the spore of *Myxobolus heckelii* n. sp. (Myxozoa), parasite from the Brazilian fish *Centromochlus heckelii* (Teleostei, Auchenipteridae). J. Eukaryotic Microbiol., 56: 589-593.
08. El-Mansy, A. and A.R. Bashtar, 2002. Histopathological and ultrastructural studies of *Henneguya suprabranchiae* Landsberg, 1987 (Myxosporea: Myxobolidae) parasitizing the suprabranchial organ of the freshwater catfish *Clarias gariepinus* Burchell, 1822 in Egypt. Parasitol. Res., 88: 617-626.
09. Adriano, E.A., S. Arana and N.S. Cordeiro, 2005. Histology, ultrastructure and prevalence of *Henneguya piaractus* (Myxosporea) infecting the gills of *Piaractus mesopotamicus* (Characidae) cultivated in Brazil. Dis. Aquat. Org., 64: 229-235.
10. Morsy, K.S., 2010. Studies on myxosporidian and microsporidian parasites infecting some economic fishes from the Red Sea in Egypt. Ph.D. Thesis, Zoology Department, Cairo University, Giza, Egypt.
11. Abdel-Ghaffar, F., A.R. Bashtar, H. Mehlhorn, A.R. Khaled and K. Morsy, 2011. Microsporidian parasites: A danger facing marine fishes of the Red Sea. Parasitol. Res., 108: 219-225.
12. Landsberg, J.H. and J. Lom, 1991. Taxonomy of the genera of the *Myxobolus/Myxosoma* group (Myxobolidae: Myxosporea), current listing of species and revision of synonyms. Syst. Parasitol., 18: 165-186.
13. Eiras, J.C., K. Molnar and Y.S. Lu, 2005. Synopsis of the species of *Myxobolus* Butschli, 1982 (Myxozoa: Myxosporea: Myxobolidae). Syst. Parasitol., 61: 1-46.
14. Eiras, J.C., J. Zhang and K. Molnar, 2014. Synopsis of the species of *Myxobolus* Butschli, 1882 (Myxozoa: Myxosporea, Myxobolidae) described between 2005 and 2013. Syst. Parasitol., 88: 11-36.
15. Lom, J. and I. Dykova, 1992. Myxosporidia (Phylum Myxozoa). 7. Protozoan parasites of fishes. Dev. Aquat. Fish Sci., 26: 159-235.
16. Abdel-Aal, A.M.I., 2002. Studies on tissue parasites in fish. Ph.D. Thesis, University of Tanta, Tanta, Egypt.
17. Mohamed, M.A., E. El Dien and E.E. Elsayed, 2004. Tissue protozoa (*Myxobolus dermatobia*) from the eye in Tilapia zilli in Egypt. Proceedings of the 1st International Conference on Veterinary Research Division, February 15-17, 2004, At National Research Center, Egypt, pp: 307-319.
18. Vita, P., L. Corral, E. Matos and C. Azevedo, 2003. Ultrastructural aspects of the myxosporean *Henneguya astyanax* n. sp. (Myxozoa: Myxobolidae), a parasite of the Amazonian teleost *Astyanax keithi* (Characidae). Dis. Aquat. Org., 53: 55-60.
19. Faisal, M. and S.I. Shalaby, 1987. *Myxosoma tilapiae* as a new species (Myxosoma: Myxosporea) in wild *Oreochromis niloticus* in lower Egypt. Egypt. J. Vet. Sci., 24: 73-86.
20. Abed, G.P., 1987. Studies on myxosporidia of some Nile fishes in Assuit province. M.Sc. Thesis, Assuit University, Asyut, Egypt.
21. El-Wafa, S.A.D.A., 1988. Protozoa-parasites of some fresh water fish in Behera governorate, Egypt. M.Sc. Thesis, Alexandria University, Alexandria, Egypt.

22. Mazen, N.A.M., 1994. Effect of the protozoan parasite, *Myxosoma heterospora* on the eye of the fish Tilapia Nilotica. Assiut Vet. Med. J., 31: 120-120.
23. Ghaffar, F.A., G. El-Shahawi and S. Naas, 1995. Myxosporidia infecting some Nile fishes in Egypt. Parasitol. Res., 81: 163-166.
24. Hegazy, A.M., 1999. Light and electron microscopic studies on Myxozoan infecting some Egyptian fishes in Bahr Shebin Canal. M.Sc. Thesis, Menoufia University, Al Minufiyah, Egypt.
25. El-Mansy, A., 2005. Revision of *Myxobolus heterosporus* Baker, 1963 (syn. *Myxosoma heterospora*) (Myxozoa: Myxosporea) in African records. Dis. Aquat. Org., 63: 205-214.
26. Abdel-Ghaffar, F., A.A. Abdel-Baki and M.E. Garhy, 2005. Ultrastructural characteristics of the sporogenesis of genus Myxobolus infecting some Nile fishes in Egypt. Parasitol. Res., 95: 167-171.
27. Ali, M.A., A.S. Abdel-Baki, T. Sakran, R. Entzeroth and F. Abdel-Ghaffar, 2003. Light and electron microscopic studies of *Myxobolus stomum* n. sp. (Myxosporea: Myxobolidae) infecting the blackspotted grunt *Plectorhynicus gaterinus* (Forsskal, 1775) in the Red Sea, Egypt. Parasitol. Res., 91: 390-397.
28. Casal, G., E. Matos and C. Azevedo, 1996. Ultrastructural data on the life cycle stages of *Myxobolus braziliensis* n. sp., parasite of an Amazonian fish. Eur. J. Protistol., 32: 123-127.
29. Desser, S.S. and W.B. Paterson, 1978. Ultrastructural and cytochemical observations on sporogenesis of *Myxobolus* sp. (Myxosporida: Myxobolidae) from the common shiner *Notropis cornutus*. J. Protozoology, 25: 314-326.
30. Abdel-Ghaffar, F., A. Abdel-Aziz, G. El-Shahawi and S. Naas, 1994. Light and electron microscopic studies on *Myxobolus* sp. infecting *Oreochromis niloticus* and *Oreochromis aureus* in the river Nile, Egypt. J Union Arab Biol., 2: 241-261.
31. El-Matbouli, M., T. Fischer-Scherl and R.W. Hoffmann, 1990. Light and electron microscopic studies on *Myxobolus cotti* El-Matbouli and Hoffmann, 1987 infecting the central nervous system of the bullhead (*Cottus gobio*). Parasitol. Res., 76: 219-227.
32. Azevedo, C., G. Casal, I. Mendonca, E. Carvalho, P. Matos and E. Matos, 2010. Light and electron microscopy of *Myxobolus sciades* n. sp. (Myxozoa), a parasite of the gills of the Brazilian fish *Sciades herzbergii* (Block, 1794) (Teleostei: Ariidae). Mem. Inst. Oswaldo Cruz., 105: 203-207.
33. Kaur, H. and R. Singh, 2010. A new myxosporean species *Myxobolus sclerii* sp. nov. and one known species *M. stomum* Ali et al. 2003 from two Indian major carp fishes. J. Parasit. Dis., 34: 33-39.
34. Abdel-Baki, A.A.S., E. Zayed, T. Sakran and S. Al-Quraishy, 2015. A new record of *Myxobolus brachysporus* and *M. israelensis* in the tilapia (*Oreochromis niloticus*) collected from the Nile River, Egypt. Saudi J. Biol. Sci., 22: 539-542.