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First Record of Six Myxosporean Species (Myxozoa: Myxosporea) in Iraq from Gills of the Mugilid Fish *Planiliza abu* (Heckel, 1843)

Kefah N. Abdul-Ameer & Fatima K. Atwan

Department of Biology, College of Education for Pure Science, University of Baghdad, Iraq

***Corresponding author e-mail:** kefahnaser59@yahoo.com

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Abstract: Sampling of *Planiliza abu* specimens were done from July 2015 until the end of March 2016, a total of 118 specimens were collected weekly from Tigris River near Al-Graiat region in Baghdad province. The examination of gills of these fishes showed the occurrence of six myxosporean species which were documented for the first time in Iraq. These included: *Myxobilatus baicalensis* (Dogiel, 1957), *Myxobolus bizerti* Bahri & Marques, 1996, *M. branchialis* (Markevich, 1932), *M. chuatsi* (Dogiel &Akhmerov in Akhmerov, 1960), *M. dermatobius* (Ishii, 1916) and *M. niei* Shul'man, 1962. The description and measurements of these parasites were given as well as their illustrations.

Keywords: Myxozoa, *Myxobilatus*, *Myxobolus*, *Planiliza abu*, Tigris River, Baghdad.

Introduction

Metazoan parasites which belong to the phylum Myxozoa, are an abundant and diverse group of parasites infecting fishes, amphibians and reptiles as well as human beings eating fishes (Boreham *et al.*, 1998; Singh & Kaur, 2012). The genus *Myxobolus* Bütschli, 1882 is the largest genus among myxozoans, with more than 850 nominal species and considered as most prevalent genus worldwide (Eiras *et al*., 2005, 2014). Spores of this genus are microscopic, multicellular, spore-forming metazoan parasites and exist as pseudocysts within tissues (histozic) or between tissues (coelozoic). These pseudocysts can be exist in various host tissues (fins, scales, kidney, muscles, gut, gall-bladder, brain, and cartilage) in a manner of white to pale yellow pock on the affected parts of the body and enable be seen in naked eyes (Kaur & Singh, 2008-2009; Gupta & Kaur, 2017).

In Iraq, Herzog (1969) who began his first study on fish parasites detected 20 parasite species from 16 different species of fishes sampled from different sites in Iraq. These parasites included two myxozoan parasites namely *Myxobolus muelleri* and *M. oviformis*. After that, several surveys were carried out on fish parasites from different Iraqi inland waters as well as some fish ponds and farms, and hence more species of myxozoan parasites were detected, among which some were reported as new records of *Myxobolus* species in Iraq (Abdul-Ameer, 1989; Abdullah, 1997; Adday *et al*., 1999; Asmar *et al*., 2003; Al-Nasiri, 2008; Al-Jawda & Asmar, 2013, 2114; Al-Salmany, 2015; Atwan, 2016; Rasheed, 2016; Hammood,

2017; Bdair, 2018). So, more surveys on fish parasites are needed to recognize more species and increasing information on the parasitic fauna of freshwater fishes of Iraq.

The present investigation deals with the record of an additional six myxosporeans species which occurred here for the first time in Iraq, parasitizing the mugilid fish *P. abu* from the Tigris River near Al-Graiat location at Baghdad city.

Materials and Methods

Samplings of *P. abu* specimens were done during the period from July 2015 until the end of March 2016. A total of 118 specimens of *P. abu* were collected weekly from three locations along Tigris River near Al-Graiat region in Baghdad province. Sampled fishes were transported alive to the laboratory, classified according to Coad (2010) and updating the scientific name with Froese & Pauly (2019) and examined for myxozoan parasites. External examination of fins and skin were carried out. Skin and gill smears, in addition to internal organ smears (intestine, gallbladder, kidneys and liver) were macroscopically examined for vegetative structures (plasmodia) of these parasites. Vegetative structures, when found, were carefully removed, placed on a slide with a drop of distilled water, ruptured, care was taken to isolate some of the fresh spores and microscopically examined, then drawn and measured in a live state. Some of the spores were placed into glycerol-gelatin on a slide under a coverslip. For permanent specimens, the spores were fixed in absolute methanol for 2-8 minutes and then stained with Giemsa solution for about 25- 30 minutes, then washed in water and desiccated (Saha & Bandyopadhyay, 2017). Spores were described and measured according to the guidelines of Lom & Arthur (1989). Scientific names of parasites were used according to Eiras *et al*. (2005, 2014). Drawings were made with the aid of a camera Lucida. All dimensions are given in micrometre (µm) as: minimum- maximum (mean) values. The information on the previous account records of myxozoans of fishes of Iraq were reviewed with the index-catalogue of parasites and disease agents of fishes of Iraq (Mhaisen, 2019) by a correspondence via his e-mail. The ecological terms calculated according to Bush *et al.* (1997)

Results

The results revealed the presence of six myxosporean species from *P. abu* which belonged to two genera; one species of the genus *Myxobilatus* and five species of the genus *Myxobolus*. The following is a brief account on their description and measurements (in µm, based on five specimens for each parasite species).

***Myxobilatus baicalensis* (Dogiel in Dogiel & Bogolepova, 1957) Shulman, 1966**

This parasite was isolated from gills of *P. abu* with a prevalence of 3.4 %. The following is an account on its description and measurements as shown in Fig. (1).

The vegetative structures were not distinctive. Elongated spores, with tapering anterior and posterior poles. Shell valves often with a smooth surface, which extend posteriorly into caudal appendages which fuse together to form a single caudal process. Length of spore 22.0-26.0 (24.0), width 8.8-10.8 (9.8), thickness 5-7 (6), distance from the anterior pole of spore to the end of its cavity 8-13 (10.5). Polar capsules pyriform, length 4.0-8.0 (6.0). Caudal process longer than the distance from the pole of spore to the end of its cavity, length 12.0-16.0 (14.0).

***Myxobolus bizerti* Bahri & Marques, 1996**

This parasite was isolated from gills of *P. abu* with a prevalence of 24.6 %. The following is an account on its description and measurements as shown in Fig. (2).

The vegetative structures formed elongated whitish cysts, length 0.4-0.6 (0.5) and width 0.21-0.22 (0.215) mm. Spores mostly spherical, measured 13.9-14.3 (14.1) in diameter. Intercapsular processes indistinct. Polar capsules pyriform, equal in size, converge at their anterior points and exceeded the mid-length of the spores with their posterior ends. Length of polar capsules 6.2-6.6 (6.4) and width 5.2-5.6 (5.4).

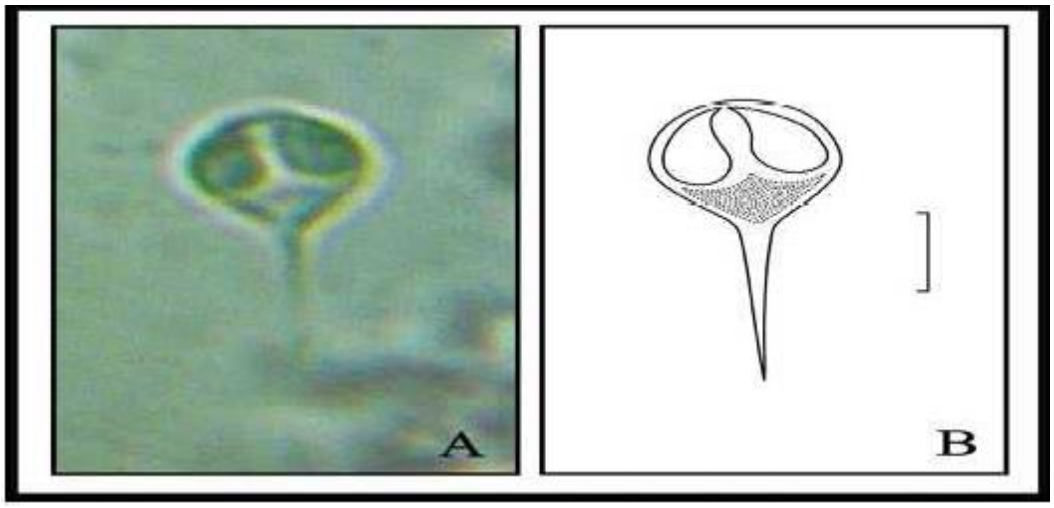

Fig. (1): *Myxobilatus baicalensis*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 8 µm).

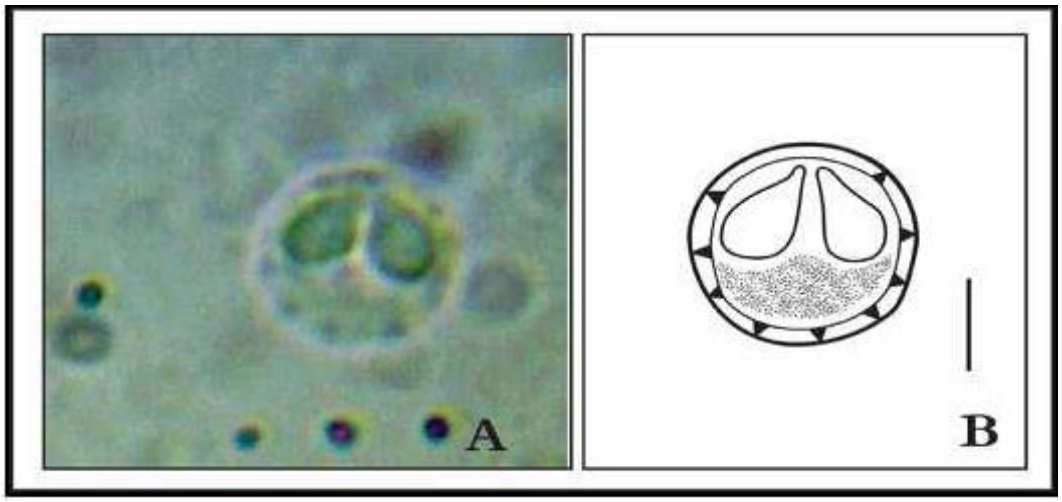

Fig. (2): *Myxobolus bizerti*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 6.3 µm).

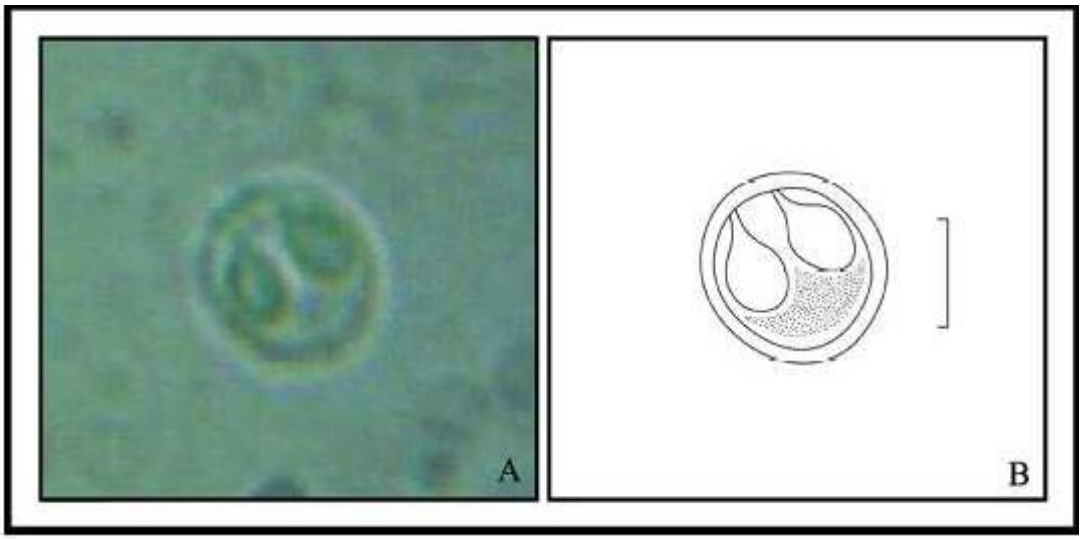

Fig. (3): *Myxobolus branchialis*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 4.2 µm).

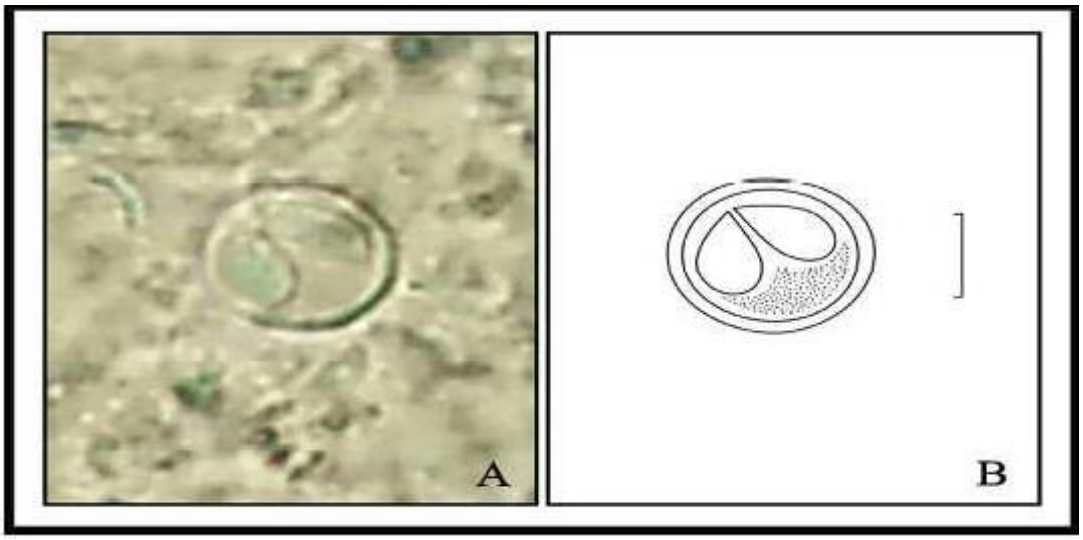

Fig. (4): *Myxobolus chuatsi*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 2.7 µm).

***Myxobolus branchialis* (Markevitsch, 1932) Landsberg & Lom, 1991**

This parasite was found on gills and eyes of *P. abu* with a prevalence of 0.9. The following is an account on its description and measurements as shown in Fig. (3).

Vegetative stage round and white, diameter 0.3-0.5 (0.4) mm. Spore of small size, almost rounded, its diameter 6.9-7.7 (7.3). Pyriform polar capsules, equal in size, widely separated, length 3.4-3.8 (3.6) and width 1.9-2.3 (2.1).

***Myxobolus chuatsi* (Dogiel & Akhmerov in Akhmerov, 1960) Landsberg & Lom, 1991**

This parasite was isolated from eyes and gills of *P. abu* with a prevalence of 33.9%. The following is an account on its description and measurements as shown in Fig. (4).

The vegetative structures were not distinctive. Spore of small size, rounded, its diameter 5.2-5.8 (5.5). Pyriform polar capsules equal in size, occupy over half of the spore cavity, converge at narrow anterior ends and separated at the posterior ends, length 2.8-3.4 (3.2) and width 1.6-2.0 (1.8).

***Myxobolus dermatobius* (Ishii, 1915) Landsberg & Lom, 1991**

This species was obtained from gills of *P. abu* with a prevalence of 18.6. The following is an account on its description and measurements as shown in Fig. (5).

The vegetative structures were not distinctive. Spore almost rounded, its diameter 9.1-9.5 (9.3). Pyriform polar capsules, equal in size and widely separated at the posterior ends, length 4.3-5.0 (4.6) and width 3.1-3.5 (3.3).

***Myxobolus niei* Shul'man, 1962**

This parasite was isolated from eyes of *P. abu* with a prevalence of 2.5%. The following is an account on its description and measurements as shown in Fig. (6).

The vegetative structures were not distinctive. Spores of this parasite were found scattered in the smears taken from the vitreous body of the eyes. Small-sized spore, rounded, slightly tapering anteriorly and its length is slightly greater than its width. Length of spore 9.5-9.9 (9.7) and width 9.2-9.6 (9.4). Intercapsular processes readily seen. Polar capsules pyriform, unequal in size, placed posteriorly from the tip of spore, length of larger capsule 4.9-5.5 (5.2), width 2.7-3.3 (3.0), length of smaller capsule 4.0-4.4 (4.2)and width 2.3-2.7 (2.5).

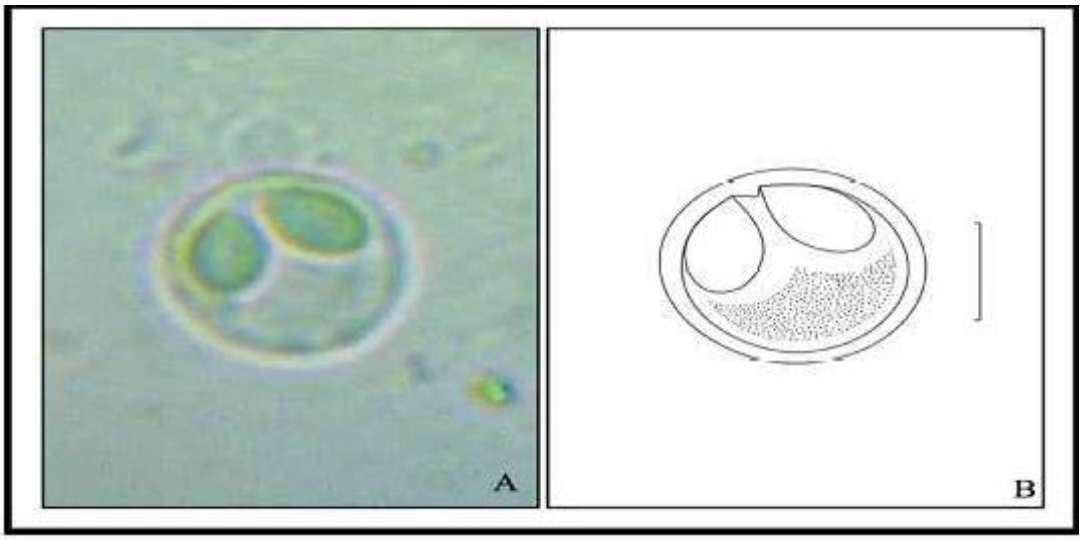

Fig. (5): *Myxobolus dermatobius*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 4.3 µm).

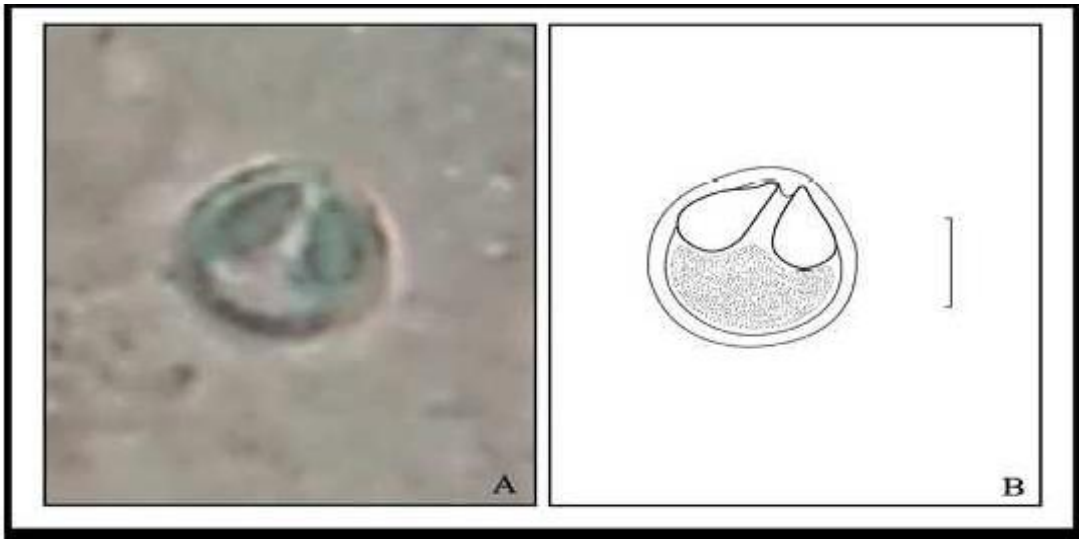

Fig. (6): *Myxobolus niei*: A-Photomicrograph (400 x), B-Diagrammatic drawing (Scale bar = 4.7 µm).

Discussion

The measurements of the present parasites: *M. baicalensis*, *M. branchialis*, *M. chuatsi*, *M. dermatobius* and *M. niei* are in agreement with those of the same of these parasites reported by Bykhovskaya-Pavlovskaya *et al*. (1962), while the measurements of *M. bizerti* are in agreement with those reported by Bahri & Marques (1996).

Depending on to the index-catalogue of parasites and disease agents of fishes of Iraq (Mhaisen, 2019), the current records of *M. baicalensis*, *M. bizerti*, *M. branchialis*, *M. chuatsi*, *M. dermatobius* and *M. niei* appear as their first records in Iraq as no previous records were known for any of these parasites from fishes of Iraq.

So far in Iraq, surveys of fish parasites of *P. abu* from different water bodies, revealed the presence many species belonging to the genus *Myxobolus* beside the species of the present article. The followings are these parasite species which are chronologically arranged with their only first records in *P. abu* in Iraq in parentheses (in order to economize space and literature): *M. pfeifferi* (Khamees, 1983), *M. dogieli* and *M. nemachili* (Abdul-Ameer, 1989), *M. sphaericus* (Abdullah, 1990), *M. oviformis* (Balasem *et al.*, 1993),

Myxobolus sandrae (Abdullah, 1997), *M. dispar* (Asmar *et al.*, 1999), *M. muelleri* (Al-Nasiri, 2000), *M. karelicus* (Al-Nasiri, 2008), *M. bramae*, *M. cyprinicola*, *M. drjagini*, *M. macrocapsularis*, *M. mesopotamiae*, *M. musculi* and *M. parvus* (Al-Jawda & Asmar, 2013), *M. rotundus* (Atwan, 2016) and both *M. amurensis* and *M. episquamalis* (Hammood, 2017) in addition to unspecified *Myxobolus* sp. (Al-Dosary, 1999). In connection with the occurrence of *Myxobilatus* species from *L. abu*, *M. baicalensis* of the present article is the only so far known *Myxobilatus* species from this fish in Iraq.

Conclusions

With the present record of six myxosporean species, number of *Myxobolus* species from *P. abu* of Iraq so far reaches 25 species, in addition to unspecified *Myxobolus* sp.

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