First record of *Myxobolus insignis* Eiras, Malta, Varella, Pavanelli, 2005 (Myxozoa: Myxobolidae) in Iraq from gills of the common carp *Cyprinus carpio*

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Abstract. The Myxozoan parasite, *Myxobolus insignis* Eiras, Malta, Varella, Pavanelli, 2005 is recorded in the present study from gills of the common carp *Cyprinus carpio* for the first time in Iraq. The fishes were caught from the Al-Ataifiya location on the Tigris River at Baghdad city during the period from January to October 2020. The measurements and description of this external parasite in addition to its illustrations were given.

Keywords. Myxozoa, *Myxobolus insignis*, *Cyprinus carpio*, Tigris River, Baghdad.

1. Introduction
Myxozoans are highly specialized metazoan parasites of aquatic hosts with a very wide host range. This diverse group of organisms is characterized by multicellular spores with polar capsules containing extrudable polar filaments. Interest in this group has intensified along with the development of aquaculture since many species cause serious disease outbreaks in farmed fish species, in both freshwater and marine environments [1]. Different fish-parasitic myxosporean is characterized by varying degrees of host specificity, while most Myxosporeans species are tissue-specific parasites, includes an intracelluar stage and form spore within the cell [2]. *Myxobolus* species develop in large plasmodia which on the surface or in organs such as gills, fins, skin, eyes, heart, muscles, gall-bladder, kidneys, spleen, liver, a wall of the intestine, urinary bladder, testis and Ovaries [2,3]. The presence of myxosporea was related to epithelial hyperplasia, the fusion of lamellae, hyperplasia of mucous cells, inflammation and other pathological changes [4]. The prevalence and intensities of myxosporeans infestations were affected by the host’s size, sex, organs and seasons [5]. Among the Myxozoan, species of the genus *Myxobolus* Bütschli, 1882 infects fishes with 856 nominal species throughout the world [6, 7]. The first study on fish parasites in Iraq described three myxozoan parasites, namely *Myxobolus muelleri*, *M. multiplicatus* (reported as *Myxosoma multiplicata*), and *M. oviformis* [8]. Hence, many studies were performed that showed a record of 97 *Myxobolus* species [9]. For this, it is important to conduct more studies on fish parasites to registration more species and increase information on the parasitic fauna of freshwater fishes of Iraq.
2. Materials and Methods

Between January to October 2020, 40 specimens of the common carp *Cyprinus carpio* were collected weekly from Tigris River near Al-Ataifiya region north of Baghdad city (33°21'37.4"N 44°21'49.2"E). Fish were classified according to an account on freshwater fishes of Iraq [10]. Fresh smears the external parts (gills and surface of the body) and all internal organs (intestine, gallbladder, kidneys and liver) of fishes were examined macroscopically for visible plasmodia. Smears were made from the external and internal organs of the fish and examined with a microscope for spores. Fresh spores were photographed by a digital camera and draw with the aid of a Camera Lucida. For further examination, some spores were put into glycerol-gelatin to get permanent slides, while some other spores were fixed in absolute methanol for 2-8 minutes, and then staining them with Giemsa solution for about 25-30 minutes in accordance [11]. Spores were described and measured according to the guidelines [12]. The scientific name of the parasite was used in accordance [7]. All measurements are given here in μm as: minimum-maximum (mean) values. The information on the previous records of myxozoans of fishes of Iraq was obtained from the index-catalogue of parasites and disease agents of fishes of Iraq [13].

3. Results and Discussion

3.1. Myxobolus insignis  Eiras, Malta, Varella & Pavanelli, 2005

Two out of 40 of common carp *Cyprinus carpio* Linnaeus, 1758 were infected with this parasite which was found on the gills of the infected fishes. The following is the description and measurements (in μm based on five specimens) of this parasite. Plasmodia of *M. insignis* appeared as small, white, irregular cysts which occurred in different size at the base of the secondary lamellae of gills. Spore Description (Figure 1). The spores are subspherical in frontal view with slightly tapering anterior end, its length is greater than the width, length 13.8-14.6 (14.2), width 11.6-12.2 (11.9), thickness 7. Polar capsules large, oval, equal in size, extend beyond the mid-length of the spore and converge at their anterior points, length 7.2-7.8 (7.5) and width 3.8-4.4 (4.2). There is a small intercapsular process at the frontal tip of the spore.

![Image](image_url)

Figure 1. Myxobolus insignis: A- Photomicrograph (400 x) B- Diagrammatic drawing (Scale bar = 7.5 μm)

The descriptions and measurements of the present *M. insignis* are in agreement with those of the holotype of these parasites from secondary gill lamellae of *Semaprochilodus insignis* in Amazon River, near Manaus, Brazil [14]. Depending on the index-catalogue of parasites and disease agents of
fishes of Iraq [13], the current record of M. insignis represents its first record in Iraq, as no previous record was given for this parasite from fishes of Iraq. Previously, 14 species belonging to the genus *Myxobolus* were reported from different fish species collected from Tigris river at Al-Ataifiya location, including only *M. squamae* from *C. carpio* [15]. Although 97 *Myxobolus* species were registered recently from fishes of the different water bodies in Iraq [9], only 16 species belonging to the genus *Myxobolus* so far, reported from *C. carpio*. The following is a chronologically arranged list of these species with the mention of only the first record from *C. carpio* in Iraq:

- *M. pfeifferi* [16]
- *M. cyprinicola* and *M. parvus* [17]
- *M. muelleri* and *M. oviformis* [18]
- *M. dispar* [19]
- *M. punctatus* [20]
- *M. dogieli* [21]
- *M. intrachondrealis* [22]
- *M. musculi* [23]
- *M. squamae* [24]
- *M. drjagini*, *M. gigi*, *M. koi*, *M. poljanski* and *M. sphaericus* [25], besides one unidentified species [26]. With the present record of a new species *M. insignis*, the number of *Myxobolus* species from fishes of Iraq so far reaches 98 species, among which 17 species were reported from *C. carpio*.

4. Conclusion

The Myxozoan parasite, *Myxobolus insignis* Eiras, Malta, Varella, Pavanelli, 2005 for the first time in Iraq. It is the 17th species from this genus recorded from the gills of *Cyprinus carpio* Linnaeus, 1758.

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6. References

[1] Feist SW and Longshaw M 2006 *Phylum Myxozoa* In: Woo, T.K.P. (ed.) Fish diseases and disorders, Vol. 1: Protozoan and Metazoan infections, 2nd Edition. CAB International, Wallingford: 130-279.

[2] Molner K 1994 Comments on the host, organ and tissue specificity of fish myxosporeans and on the type of their intrapiscine development *Parasit. Hung*. 27 05.

[3] Fomena A and Bouix G 1997 Myxosporea (Protozoa: Myxozoa) of freshwater fishes in Africa: keys to genera and species *Syst. Parasitol*. 37 161.

[4] Teixeira RJ, Eiras JC, Spadacci-Morena DD, José Guilherme Xavier JG and Lallo MA 2018 Infecção das brânquias de tilápia do Nilo (Oreochromis niloticus) por Myxosporea. *Pesq. Vet. Bras*. 38 1085.

[5] Georges F, Timoléon T, Elysée N and Joseph T 2017 Structure and population dynamics of Myxosporeans (Myxozoa: Myxospora), parasites of Barbus callipterus Boulenger, 1907(Cyprinidae) in the Soudano-guinean zone of Cameroon. *Int. J. Multidiscipl. Curr. Res*. 5 1416.

[6] Eiras JC, Molnár K and Lu YS 2005 Synopsis of the species of Myxobolus Bütschli, 1882 (Myxospora: Myxospora), parasites of Barbus callipterus Boulenger, 1907(Cyprinidae) in the Soudano-guinean zone of Cameroon. *Arch. Fischereiwiss*. 20 132.

[7] Herzog PH 1969 Untersuchungen über die parasiten der süßwasserfische des Irak. *Biol. Appl. Environ. Res*. 4 127.

[8] Coad BW 2010 *Freshwater fishes of Iraq* Pensoft Publ. Sofia: 274 pp. + 16 pls. www.briancoad.com.
[11] Saha M and Bandyopadhyay PK 2017 Parasitological and histological analysis of a new species of the genus Thalohanellus and description of a myxozoan parasite (Myxosporea: Bivalvulida) from cultured ornamental goldfish, *Carassius auratus* L. *Aquac. Rep.* 8 8.

[12] Lom J and Arthur JR 1989 A guideline for the preparation of species descriptions in *Myxosporea* J. *Fish Dis.* 12 151.

[13] Mhaisen FT 2020 *Index-catalogue of parasites and disease agents of fishes of Iraq* (Unpublished: mhaisenft@yahoo.co.uk).

[14] Eiras JC, Malta JCO, Varella AMB and Pavanelli GC 2005 *Myxobolus insignis* sp. n. (Myxozoa, Myxosporea, Myxobolidae), a parasite of the Amazonian teleost fish *Semaiprochilodus insignis* (Osteichthyes, Prochilodontidae) *Mem. Inst. Oswaldo. Cruz Rio de Janeiro* 100 245.

[15] Abbas IA 2019 *The parasitic fauna of some species of fishes from Tigris river at Al-Autaifia region, Baghdad province, Iraq*. MSc. Thesis, Coll. Educ. Pure Sci. Ibn Al-Haitham, Univ. Baghdad: 140 pp. (In Arabic).

[16] Ali NM., Salih NE and Abdul-Ameer KN 1987 Parasitic fauna of some freshwater fishes from Tigris river, Baghdad, Iraq I: Protozoa J. *Biol. Sci. Res.* 18 11.

[17] Abdullah SMA 1997 *First record of five species of Myxobolus of some fishes from Dokan Lake*. Zanco, Spec. Issue (1). Proc. 3rd Sci. Conf. Univ. Salahaddin, Erbil: 3-4 June 1997: 14-21. (In Arabic).

[18] Al-Zubaidy AB 1998 *Studies on the parasitic fauna of carps in Al-Furat fish farm, Babylon province, Iraq*. PhD. Thesis, Coll. Sci., Univ. Babylon: 141 pp. (In Arabic).

[19] Mohammad-Ali NR, Balasem AN, Mhaisen FT, Salih AM and Waheed IK 1999 Observations on the parasitic fauna in Al-Zaafaraniya fish farm, south of Baghdad. *Veterinary* 9 79.

[20] Al-Daraji SAM, Salim YAK, Jori MM and Nasir AM 1999 Endoparasites of some cultured fishes from Basrah *Basrah J. Sci.*, B, 17 81.

[21] Al-Rubae IA, Mohammad-Ali NR, Balasem AN and Al-Jawda JM 2003 Study on fish diseases in Diyala river *Iraqi J. Agric.* 8 40. (In Arabic).

[22] Bannai MAA, Al-Daraji SAM, Jarallah HM and Hussain NA 2005 *Three new parasites recorded from the common carp, Cyprinus carpio L.*, 1758, captured from southern part of *Al-Hammer marshes* 1st Sci. Conf. Rehabilit. South. Iraq Marshes. Basrah: 11-12 April 2005. (Abstract).

[23] Al-Jawda JM and Asmar KR 2013 *Myxosporeans* (phylum Myxozoa) parasitic on some fishes from Tigris river at north, mid and south of Baghdad province, *Iraq* *Basrah J. Agric. Sci.* 26 106.

[24] Atwan FK 2016 *Parasitic infections in some fishes from Tigris river, Al-Graiat location in Baghdad province, Iraq*. MSC. Thesis, Coll. Educ. (Ibn Al-Haitham), Univ. Baghdad: 136 pp. (In Arabic).

[25] Mansoor NT 2019 *Morphological and histopathological investigation of myxozoan parasites in some fish species in Tigris river/ Baghdad city*. PhD. Thesis, Coll. Sci., Univ. Tikrit: 160 pp.

[26] Abdullah SMA 2004 Comparison between the parasitic infections of fishes caught in two of each of small natural habitats and fish farms in Erbil city *Zanco* 16 43 (In Arabic).