

# Myxosporean Parasites from Mesopotamian Part of Iran

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**Abstract:** A survey on myxosporean parasites of freshwater fishes from Mesopotamian part of Iran (south western part of the country, Khuzestan Province) was carried out. Some 280 individuals belonging to 14 different species were examined during a period extending from 1994 to 1997. In this study we investigated the prevalence of myxosporean parasites, morphology of the spores, plasmodial development, the infective sites, and characteristics of the cyst location using the histological approach. The collected parasites were as follows: *Myxobolus persicus*, *M. karuni*, *M. bulbocordis*, *M. nodulointestinalis*, *M. iranicus*, *M. mesopotamiae*, *M. shadgani*, *M. sharpeyi*, *M. molnari* and *M. mokayeri*. *Barbus sharpeyi* and *B. grypus*, economically important fishes, were infected by six and four myxosporean parasites respectively. All of the studied cases of infection were observed in the natural waters.

**KEY WORDS:** Mesopotamian, Myxosporean, *Myxobolus*, *Barbus*, Iran

## Introduction

The Iranian freshwater resources are situated in three separated faunal regions: the northern part belongs to the Palaearctic region, the southwestern part of the country lies in the Mesopotamian region, while the Indian region influences the water resources in the eastern part of Iran.

The Central Asian fauna, including the northern and eastern parts of the Iranian territory, belongs also to the Palaearctic region. The myxosporidae fauna in this region of the former USSR has been comprehensively studied by Shulman (1984). With regard to the Iranian freshwater fishes, Mokhayer (1981) is the only researcher, who has observed *Myxobolus lobatus* in *Barbus brachycephalus*, however Masoumian and Pazooki (1998) have recently reported occurrence of ten different myxosporean parasites in eight fish species from northern part of Iran (the Caspian Sea's basin). Although Ebrahimzadeh and

Kaylani (1976), Ebrahimzadeh and Nabawi (1975), Moghainemi and Abbasi (1992) have encountered *Myxobolus spp.* infecting the gills and the inner organs of the fishes in Karun River and Hoor-Elazim, we have still little knowledge of the myxosporidian parasites from the Mesopotamian faunal region. During the recent years Masoumian *et al.* (1994; 1996 a,b), Molnar *et al.* (1996) and Baska and Masoumian (1996) have managed to study several new *Myxobolus* species isolated from barbs in Karun River, Hoor-Elazim Marsh and Shadgan Marsh in Southwest Iran.

Herzog (1969) was the first one, who reported *Myxobolus muelleri* and *Myxobolus oveformis* in the Iraqi fresh water. Zohair (1976) managed to isolate *Unicauda lumae* from the liver of *Barbus grypus*. Subsequently, Al-Salim (1986), Nazar *et al.* (1987) and Rashid *et al.* (1989) reported the occurrence of *Myxobolus pfeifferi* in different barboid species.

The purpose of this study was to survey on myxosporean parasites of the Mesopotamian part of Iran, and to identify different parasites of the commercially important fishes in this region, among which members of the subfamily Barbinae have economical importance, as they have recently been selected for culture.

## Materials and Methods

The methodology of our study was based on the guideline for preparation of species proposed by Lom and Arthur (1989) as well as comments on specificity of myxosporidian parasites (Molnar, 1994).

In this study some 280 fish specimens belonging to 14 different species were examined (Table 1). They were collected during a period of time extending from 1994 to 1997 at nine allocated stations (Table 2). Immediately after seining the fishes, the air and water surface temperature were recorded. The fishes were then transported alive to the laboratory where they were weighted and measured before being killed by transsection of the spinal cord. The samples were then examined for myxosporidian parasites under stereo- and light microscope.

**Table 1:** Fish species examined during the study

Species	Number	Length (cm)	Weight (g)
<b>Family Cyprinidae</b>			
<i>Acanthobrama marmid</i>	3	10-12	30-32
<i>Aspius vorax</i>	11	14-30	30-219
<i>Barbus grypus</i>	50	17-42	40-600
<i>Barbus luteus</i>	59	15-30	44-300
<i>Barbus rajanorum</i>	18	14-31	30-350
<i>Barbus sharpeyi</i>	83	11-31	11-372
<i>Barbus xanthopterus</i>	3	16-18	40-50
<i>Capoeta trutta</i>	8	10-35	13-400
<i>Carassius auratus</i>	15	12-24	30-168
<i>Calcalburnus mossulensis</i>	1	20	80
<i>Chondrostoma regium</i>	1	17	60
<i>Ctenopharyngodon idella</i>	5	11-29	20-180
<i>Cyprinion macrostomum</i>	21	12-29	20-180
<b>Family Clupeidae</b>			
<i>Hilsa ilisha</i>	1	28	184
<b>Total</b>	<b>280</b>		

**Table 2:** The location of the allocated stations in Khuzestan province

Stations	Ave. air T	Ave. water T
I Hoor-Elazim Marsh	30.5	36.7
II Karun River, Gargar branch	25.9	35.0
III Karun River, Ahwaz-Dezful (Alhayi)	26.5	41.0
IV Karun River, Ahwaz-Abadan (Km 51)	28.0	40.0
V Karun River, Abadan-Mahshahr (Abushanak)	38.0	49.0
VI Karun River, Shushtar	28.0	34.0
VII Karun River, Ahwaz	25.5	36.0
VIII Karun River, Hejazi fish farm	28.0	35.0
IX Shadgan Marsh	28.0	35.6

Spores were obtained from mature cysts in each organ sample. On the average 30 spores were measured using the parameters recommended by Lom and Arthur (1989). For the histological examination, infected organ was fixed in 10% buffered

formalin, and then embedded in paraffin, cut in 5- $\mu$ m thick sections and stained with Haematoxylin-Eosin.

## Results

In the current study ten myxosporean parasites species of Iranian freshwater fishes were identified. These species belong to family Myxobolidae and genus *Myxobolus*. Table 3 contains the list of the identified parasites and their classification according to Lom and Noble (1984).

**Table 3:** Myxosporidian parasites of freshwater fishes in Mesopotamian part of Iran (classified according to Lom & Noble, 1984)

Phylum: Myxozoa Grasse 1960

Class: Myxosporia Butschli 1881

Suborder: Platysporina Kudo 1919

Family: Myxobolidae: Thelohan 1892

Genus: *Mexobolus* Butschli 1882

*Myxobolus persicus* Masoumian, Baska , Molnar 1994

*Myxobolus karuni* Masoumian, Baska , Molnar 1994

*Myxobolus bulbocordis* Masoumian, Baska , Molnar 1996

*Myxobolus nodulointestinalis* Masoumian, Baska , Molnar 1996

*Myxobolus iranicus* Molnar, Masoumian, Abbasi 1996

*Myxobolus mesopotamiae* Molnar, Masoumian, Abbasi 1996

*Myxobolus shadgani* Molnar, Masoumian, Abbasi 1996

*Myxobolus sharpeyi* Molnar, Masoumian, Abbasi 1996

*Myxobolus molnari* Baska, Masoumian 1996

*Myxobolus mokhayeri* Baska Masoumian 1996

Table 4 indicates the prevalence of infection in the most important fish species in the studied area. *Barbus sharpeyi*, an economically important fish, infected by six myxosporidian parasites, seemed to be the most infected fish in our study, *Barbus luteus* infected by 5 and *Barbus grypus* infected by 4 parasites species are the next. The infection rate at different stations was not the same (Table 5). Karun-Alhayi (82%) and Hoor-Elazim (76%) stations were the most infected areas followed by four other stations, i.e. Karun-Ahwaz (65%), Karun-Gargar (64%), Ahwaz-Abadan (61%) and Shadgan Marsh (51%).



Table 4: Prevalence of infection in different fish species

Parasite	Infected Organs	No. of infected fish	prevalence %
<b><i>Barbus sharpeyi</i></b>			
<i>Myxobolus persicus</i>	Gills, secondary filaments	18	22
<i>M. karuni</i>	Gills, primary filaments	14	17
<i>M. sharpeyi</i>	Gills cartilage	18	22
<i>M. nodulointestinalis</i>	Intestine	8	10
<i>M. bulbocordis</i>	Heart	9	10
<i>M. iranicus</i>	Spleen	5	6
<b><i>Barbus luteus</i></b>			
<i>M. persicus</i>	Gills, secondary filaments	12	20
<i>M. karuni</i>	Gills, primary filaments	10	17
<i>M. nodulointestinalis</i>	Intestine	9	15
<i>M. mesopotamiae</i>	Pectoral, dorsal fins	8	14
<i>M. iranicus</i>	Spleen	10	16
<b><i>Barbus grypus</i></b>			
<i>M. persicus</i>	Gills, secondary filaments	26	52
<i>M. karuni</i>	Gills, primary filaments	26	52
<i>M. mesopotamiae</i>	Pectoral, dorsal fins	10	20
<i>M. iranicus</i>	Spleen	3	6
<b><i>Barbus rajanorum</i></b>			
<i>M. shadgani</i>	Gills, primary filaments	4	22
<i>M. mesopotamiae</i>	Pectoral, dorsal fins	3	10
<b><i>Capoeta trutta</i></b>			
<i>M. molnari</i>	Gills, primary filaments	2	25
<i>M. mokhayeri</i>	Fins, between rays	1	13

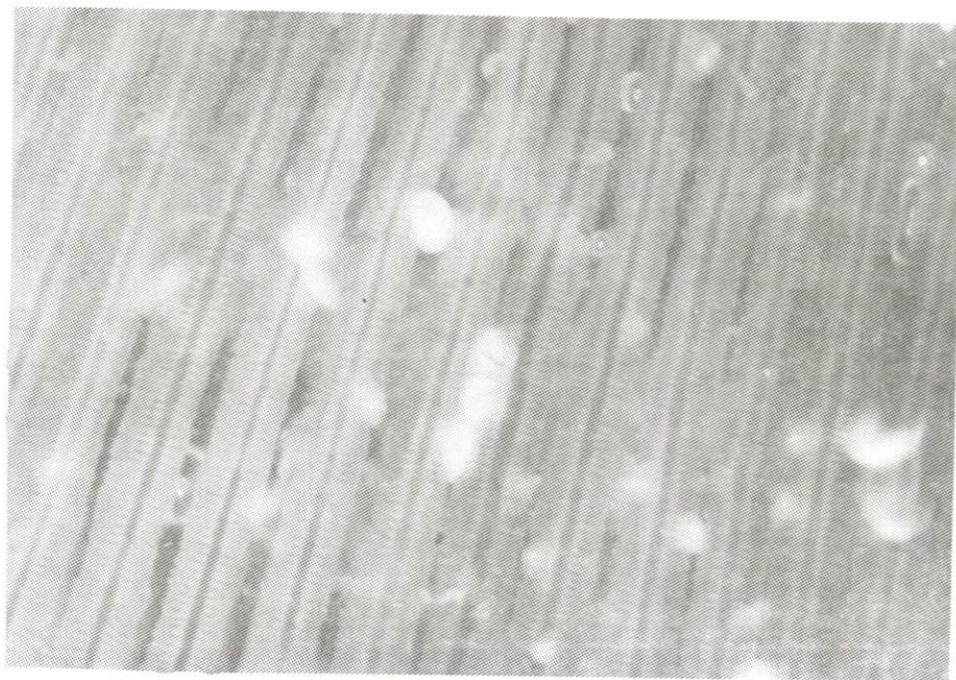
Table 5: Prevalence of infection in each station

	No. of the examined fish	No. of the infected fish	prevalence (%)
I	43	33	76
II	28	18	64
III	28	23	82
IV	23	14	61
V	21	5	24
VI	19	8	42
VII	35	23	65
VIII	9	2	22
IX	84	43	51

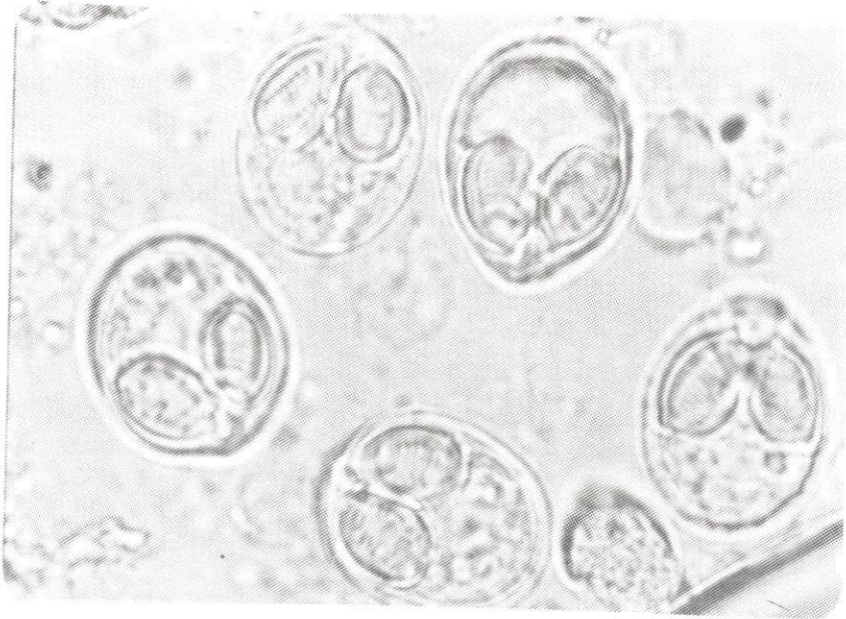
The list of infected fishes by different myxosporidian parasites has been summarised in Table 6. *Barbus grypus* with 90% infection among the examined fishes is the most infected one. Prevalence of infection on other important fishes; *Barbus luteus*, *B. sharpeyi*, *Capoeta trutta* and *B. rajanorum* are 86%, 54%, 63%, 18% respectively. (Fig. 1, 2, 3, 4).

**Table 6 :** List of fishes infected by different myxosporeans

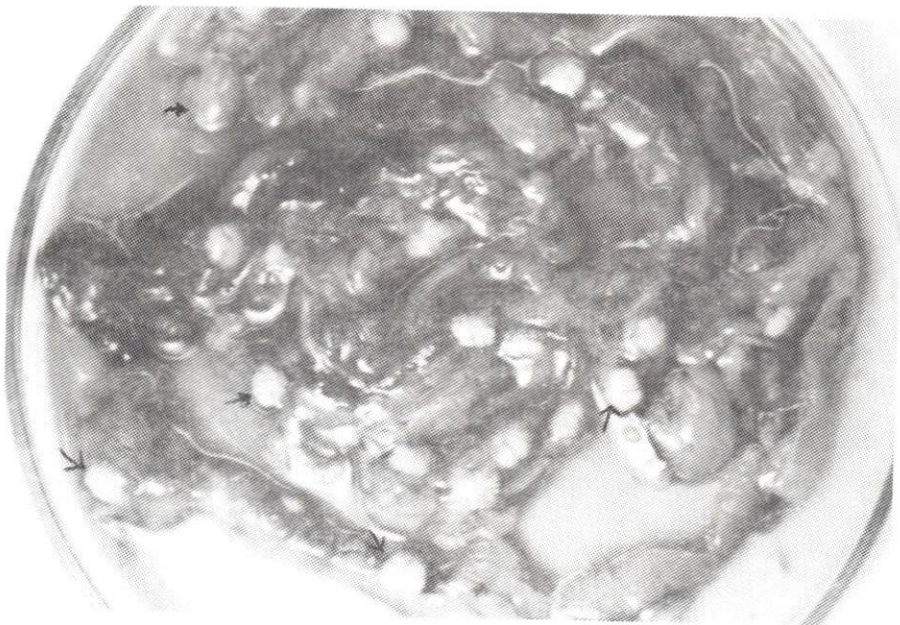
Fish species	No. of examined fish	No. of infected fish	Prevalence %
<i>Barbus grypus</i>	50	45	90
<i>B. luteus</i>	59	51	86
<i>B. rajanorum</i>	18	5	18
<i>B. sharpeyi</i>	83	45	54
<i>Capoeta trutta</i>	8	5	63



**Fig. 1:** Heavy infection by *Myxobolus karuni* and *M. persicus* on the gills of *Barbus grypus* (mag.  $\times 19$ )

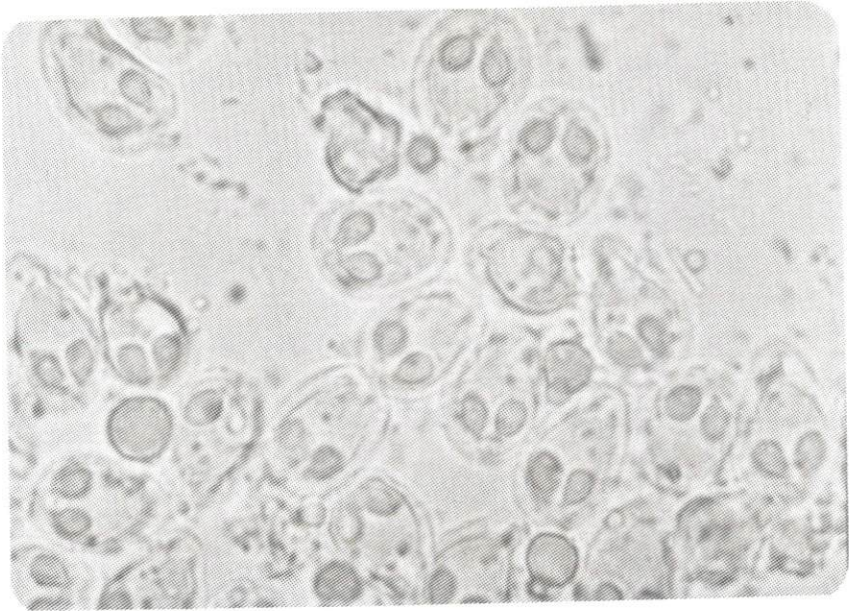


**Fig. 2:** Spores of *M. bulbocordis* from the heart of *Barbus sharpeyi* (mag.  $\times 1690$ )



**Fig. 3 :** Large, branched cysts (arrows) of *M. nodulointestinalis* on the intestinal wal of *Barbus grypus* (mag.  $\times 15$ )





**Fig. 4 :** Spores of *M. nodulointestinalis* from the intestine of *Barbus luteus*, (mag.  $\times 2340$ )

## Discussion

The class Myxosporidia is one of the most controversial groups of fish parasites. On one hand myxosporidian parasites are regarded as well known and common fish parasites and on the other hand there are still a lot of doubts about their species composition, specificity and their intra- and extrapiscine development.

Among the large number of myxosporidian genera the *Myxobolus* and *Myxosoma* are the best known and the most prevalent ones. The first members of this group have been already identified at the end of the nineteenth century and the beginning of the twentieth century.

Landsberg and Lom (1991) listed 444 *Myxobolus* species but only few of them had definitive morphological characters, on the basis of which they could be differentiated from the other species.

The number of *Myxobolus* parasites of barboids is relatively high; Donec and Shulman (1984) recorded 37 species infecting different barbus and capoeta species of the Palaearctic region.

In Iran, the occurrence of *Myxobolus lobatus* in the Ponto-Caspian region (Mokhayer, 1981) and ten other *Myxobolus* species (Masoumian and Pazooki,



1998) have been so far reported. Myxosporidian parasites of the fishes in the central part of the Mesopotamian region of Iran have not been comprehensively studied yet. In this part of the country Ebrahimzadeh and Kaylani (1976), Ebrahimzadeh and Nabawi (1975), and Moghainemi and Abbasi (1992) have identified some unidentified *Myxobolus* spp. in different fishes of Karun River.

In our study we observed ten different myxosporidian parasites that also have been described by Masoumian *et al.* (1994; 1996a,b), Molnar *et al.* (1996), and Baska and Masoumain (1996). The results of this study confirmed that the myxosporidian parasites of fishes in different faunal regions of Iran differ significantly from each other. The survey on *Myxobolus* species of southwestern Iranian freshwater fishes shows that these Mesopotamian fishes are infected by other *Myxobolus* spp. than those infected the fishes of the Palaearctic and Indian faunal regions. This findings correlate with the data obtained by Gussev *et al.* (1993a,b), who found similar differences between the Monogenea fauna infecting the barbels in the Mesopotamian and Palaearctic regions. In the southwestern part of Iran, beside Karun River, there are other rivers and reservoirs that have fish endemic to parasitic infection observed in the Mesopotamian Region. Ichthyological studies (Coad , 1978) have shown that fishes inhabiting the water basin of Tigris and Euphrates rivers do not live in the other regions, therefore, myxosporean parasites infecting them might be some new and undescribed species. According to Coad (1978), fishes in different faunal regions differ significantly from each other and there are several fish species in each region. Therefore from the pathological point of view, transferring fishes inside the country's boarder is hazardous. Zoologically the Mesopotamian region is one of the most interesting regions. This region includes the drainage basin of the Tigris and Euphrates rivers (Berg , 1940), and freshwater resources of the southwestern part of Iran (Khuzestan province) are parts of the Mesopotamian Great Faunal Region. On the other hand its ichthyofauna includes at least 52 fish species (Coad, personal communication). Karun River, with 850 km length, and other reservoirs situated in this region, have fish species endemic to diseases occurring in the Mesopotamian region.

The prevalence and distribution of myxosporean parasites in Khuzestan province was considerably high. Infections caused by myxosporidian parasites in the examined fishes were observed in all sampling stations indicating that these parasites are distributed in all water bodies of the region. In some cases the

parasites had infected some of the important species of the region with very high intensity, e.g. *Myxobolus persicus* and *M. karuni* on the gills of *Barbus grypus*, *M. iranicus* in the spleen of *Barbus luteus*, *M. bulbocordis*, in the heart and *M. nodulointestinalis* in the intestine of *Barbus sharpeyi*. It means that under certain conditions they might infect their hosts very extensively.

The pathological importance of *Myxobolus spp.* observed in this study can not be assessed properly because so far only natural cases of infections have been recorded. It can not be excluded that these species will cause economic losses in the near future. Two of the host fishes, *Barbus sharpeyi* and *B. grypus* examined in this study are potential pond cultured species which infected by six and four myxosporean parasites respectively. Their artificial propagation and culture have already started in Iran (Nikpay *et al.* , 1992 ; Yazdipour *et al.* , 1991 ; Jamili *et al.* , 1993).

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