

**Description of *Myxobolus karuni* sp. n. and
Myxobolus persicus sp. n. (Myxosporea, Myxozoa)
from *Barbus grypus* of the River Karun, Iran**

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Abstract: Two new *Myxobolus* (Myxosporea, Myxozoa) species (*M. karuni* sp. n. and *M. persicus* sp. n.) are described from the gills of *Barbus grypus* collected from River Karun (Persian Gulf water system). The two species differ from each other in location and morphology. Until plasmodia of *M. karuni* start their development in the blood vessels of the primary gill filaments, and the cysts are located in the central parts of the filaments free from respiratory plates, plasmodia of *M. persicus* are formed under the respiratory epithelium of the secondary gill lamellae and their cysts grow around the capillaries. In *Barbus grypus* the two Myxosporea usually occurred in mixed infection, while in *Barbus sharpeyi* and *B. luteus* only *M. persicus* sp. n. was found.

Key words: *Myxosporea*, *Myxobolus*, new species, *Barbus* spp., gills, Iran.

INTRODUCTION

The territory of Iran consists of three different faunal regions. Of them, the Mesopotamian region is the most interesting from the zoogeographic point of view. The Mesopotamian region includes the drainage basin of the rivers Tigris and Euphrates. River Karun, a left-side tributary of River Tigris, is the most important river in Iranian territory with its 850 km length and with a fish fauna mostly composed of typical species endemic in Mesopotamia. Among these species, members of the subfamily Barbinae have economic importance, as recently several successful efforts have been made to culture them in fish ponds (Yazdipour et al. 1991, Jamily et al. 1993, Nikpai et al. in press).

The genus *Myxobolus* contains a large number of species. Landsberg and Lom (1991) recorded 444 species, the majority of which were described from Eurasia and North America. The Central Asian region, which comprises also the northern and

eastern territory of Iran, belongs to the Palaearctic. The myxosporean fauna of the latter region is well studied (Shulman 1984). At the same time, only scarce information is available on the myxosporean fauna of fishes in the Mesopotamian Fauna Region.

From Iranian fishes, Ebrahimi and Kailani (1976) and Moghainemi and Abasi (in press) reported the occurrence of some *Myxobolus* spp. infecting the gills of fishes in River Karun. Another report came from Mokhayer (1981) who also described *Myxobolus lobatus* from *Barbus brachycephalus*. The occurrence of *Myxobolus mulleri* and *M. oviformis* in the neighbouring Iraqi freshwaters was first reported by Herzog (1969). Subsequently Al-Salim (1986) and Rashid et al. (1989) described the occurrence of *Myxobolus pfeifferi* in different barboid fishes.

This paper describes two new *Myxobolus* species, *M. karuni* and *M. persicus* from the gills of *Barbus grypus*.

MATERIALS AND METHODS

The fishes involved in this study comprised 24 specimens of *Barbus grypus* (Heckel, 1843), 22-43 cm in length; 42 specimens of *Barbus sharpeyi* (Günther, 1874), 10-31 cm in length; and 14 *Barbus luteus* (Heckel, 1843), 12-24 cm in length. Fish were collected monthly in the period between June and November 1993 from seven different stations of River Karun in Khuzestan Province situated in Southwest Iran.

Immediately after collection, the fish were transported in live condition to the laboratory where they were weighed and measured before being killed by transection of the spinal cord. They were then examined for myxosporean parasites under stereo- and light microscope.

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). Permanent preparations were made by placing a portion of the spores into glycerol-gelatin and mounting them on a coverslip. The structure of the polar capsules and the iodophilous vacuole was studied under Nomarski interference microscopy.

For histological examination, infected organs were fixed in 10% buffered formalin, then embedded in paraffin wax, cut in 5 μm thick sections, and stained with haematoxylin and eosin.

RESULTS

Eighteen specimens of *B. grypus* (75%) were infected by *Myxobolus* cysts on the gills. Two types of cysts were differentiated. Some of the cysts were located in the tissues of the primary filaments forming plasmodia in the blood vessels, others were developing in the secondary lamellae, so that the cysts grew around the capillary of the lamellae. Spores obtained from the two types of cysts differed in both shape and size (Fig 1).

Of the two other barboid fish species 7 specimens of *B. sharpeyi* (16%) and 2 specimens of *B. luteus* (14%) were infected by *Myxobolus* cysts. In these fishes all cysts developed in the secondary lamellae.

MYXOSPOREA Bütschli, 1881

Bivalvulida Schulman, 1859

Myxobolus Bütschli, 1882*Myxobolus karuni* sp. n.

Host: *Barbus grypus* (Heckel, 1843)

Locality: River Karun in Southwest Iran

Site of infection: Primary filaments of the gills

Description of the species: Spores (Figs 1A and 1B) relatively large, shortly oval in front view, lemon shaped in side view, with prominent sutural folds, straight sutural ridge, indistinct sutural line and long prominent intercapsular appendix. Spore valves symmetrical, smooth, relatively thin but enlarged at the anterior end. Spores 14.1 (13.0-14.9) μm long, 10.2 (9.7-10.4) μm wide and 7.2 (6.5-7.8) μm thick. Two polar capsules, elongated ellipsoidal in shape, equal in size, 6.2 (6.5-7.5) μm long, 3.4 (3.2-3.9) μm wide, tapering only at the discharging channels of the polar filaments (Fig. 1A). Polar capsules slightly longer than the half length of the spore. Polar filaments closely coiled with 10 to 11 turns situated perpendicular to the longitudinal axis of the capsule. A large but indistinct iodophilous vacuole was found in the sporoplasm, which, however, was consistently seen by Nomarski interference microscopy. No projections or membranaceous envelope were found.

Tissue sites: Development histozoic (Fig. 2A). Developing plasmodia were found inside the blood vessels of the primary filaments, so that a part of the cyst bulged into the lumen of the vessels (Fig. 2A) while the larger part of the plasmodia was embedded in the neighbouring filamental tissue of the gill filament. This latter part of the plasmodium was demarcated from the neighbouring tissues by a thin connective tissue layer.

Myxobolus persicus sp. n.

Type host: *Barbus grypus* (Heckel, 1843)

Other hosts: *Barbus sharpeyi* (Günther, 1874); *Barbus luteus* (Heckel, 1843)

Locality: River Karun in Southwest Iran

Site of infection: Secondary lamellae of the gills

Description of the species: Spores (Figs 1C and 1D) oval in front view, tapering anteriorly, lemon shaped in side view, with sutural folds, straight sutural ridge, indistinct sutural line and small intercapsular appendix. Spore valves symmetrical, smooth, relatively thin. Spores 10.0 (9.1-10.4) μm long, 7.3 (6.5-7.8) μm wide and 6.3 (5.2-6.5) μm thick. Two polar capsules, pyriform in shape, unequal (or occasionally equal) in length. The larger 5.1 (4.5-5.8) μm long, 2.7 (2.6-3.2) μm wide. The smaller 4.8 (4.5-5.1) μm long (Fig. 1D). The larger polar capsules slightly longer than the half length of the spore. The anterior ends of the polar filament are close to each other. Polar filaments coiled up with 6 to 7 turns in the smaller and 7 to 8 turns in the larger capsules situating perpendicular to the longitudinal axis of the capsule. The sporo-

plasm contained no iodophilous vacuole. No projections or membranaceous envelope were found.

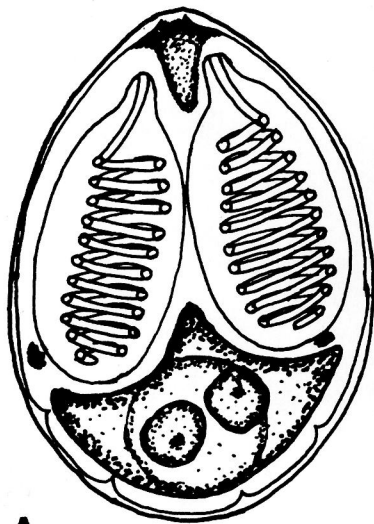
Tissue sites: Development histozoic (Fig 2B). Developing plasmodia and cysts were found in the secondary lamellae, so that they surrounded the capillary of the lamellae and were located on the membrana basalis of the secondary lamellae, covered by the respiratory epithelium (Fig. 2B).

DISCUSSION

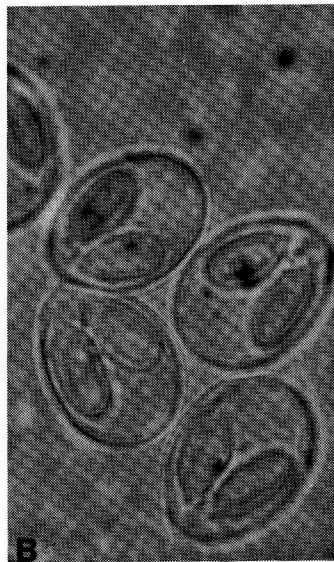
Only a few of the *Myxobolus* species listed by Landsberg and Lom (1991) show definitive morphological characteristics by which they can be unanimously distinguished from other species. The description of a new *Myxobolus* species should therefore contain, besides the morphological characteristics of the spores, the host specificity and tissue specificity of the given species as an aid to identification. As regards host specificity, some myxosporeans have been recorded from a large number of fish species and e.g. *Myxobolus cerebralis* has been found to infect almost all salmonids. At the same time, *Myxobolus drjagini* and *M. pavlovskii* develop only in the closely related *Hypophthalmichthys molitrix* and *H. nobilis*. According to Achmerow (1955), *Thelohanellus* spp. show an even stricter host specificity, and several *Thelohanellus* spp. infect only one fish species, the common carp. Therefore, it seems to be obvious that among the species described hitherto there are several synonyms; at the same time, it is also possible that a species known under a common name covers several undescribed species. It seems very unlikely e.g. that *M. exiguus*, a common parasite of the *Mugil* and *Liza* species living in brackish water, could infect freshwater cyprinids, although several papers have reported such infection. Tissue specificity is a neglected but very important point in the identification of a species. Different *Myxobolus* spp. have a strict affinity to a certain type of host tissue, and there are muscle, nerve, epithelium, cartilage and connective tissue specific species. For instance, *M. cyprini* develops exclusively in muscle cells (Molnár and Kovács-Gayer, 1985).

In view of the above points, in the description of the two species found by us we accepted the following considerations: (1) *Barbus* spp. inhabiting the water system of River Tigris do not live in other faunal regions; therefore, myxosporeans infecting them are also very likely to represent new, undescribed species. (2) The two species found are typical gill parasites, which means that they can be compared only with gill-dwelling parasites of the known species.

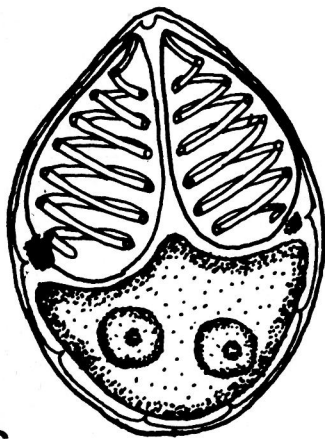
Both parasites found by us distinctly differ from the known species by their specific location. *M. karuni* obviously starts its development in the gill endothelium, while *M. persicus* forms plasmodia between endothelial and epithelial cells of the secondary lamellae. *M. karuni* has relatively large spores with elliptical polar capsules. This species distinctly differs from the known species by its polar filaments coiled up 10 to 11 times in the capsule, and by the elongated shape of the intercapsular appendix. The shape of *M. persicus* spores resembles that of *M. oviformis* Thelohan, 1892, *M. exiguus* Thelohan, 1895 and *M. lobatus* Dogiel, 1934, but only the last mentioned species



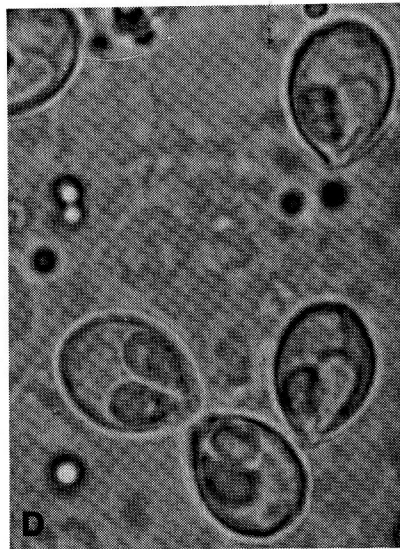
A



B



C



D

Fig. 1.

A) Schematic illustration of a spore of *Myxobolus karuni* n. sp. (scale bar = 10 μ m). - B) Excysted spores of *Myxobolus karuni* sp. n. from the gill of *Barbus grypus*. x 1710. - C) Schematic illustration of a spore of *Myxobolus persicus* sp. n. (scale bar = 10 μ m). - D) Excysted spores of *Myxobolus persicus* sp. n. from the gill of *Barbus grypus*. x 1960.

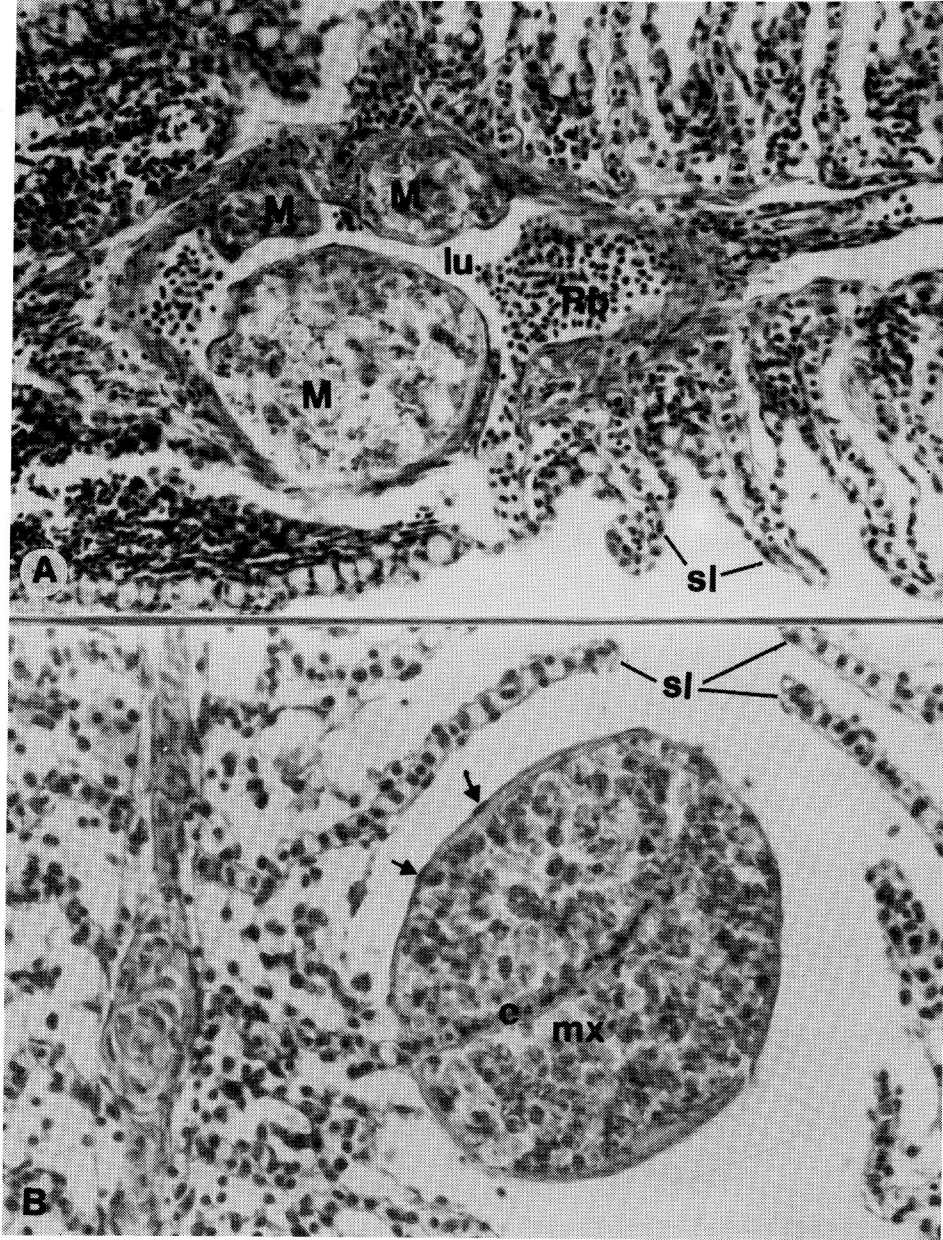


Fig. 2.

A) Histological section of the gill of *Barbus grypus* infected by cysts of *Myxobolus karuni* sp. n. Developing plasmodia inside the lumen of the blood vessels in a gill filament. H & E x 210. Abbreviations: secondary lamellae (sl); lumen of the blood vessels (lu); red blood cells (Rb); plasmodia (M). – B) Histological section of the gill of *Barbus grypus* infected by cysts of *Myxobolus persicus* sp. n. Mature plasmodium containing spores in a secondary lamella. The plasmodium is formed between the membrana basialis and the lamellar epithelium. The plasmodia are covered by a single layer of the gill epithelium. H & E x 210. Abbreviations: secondary lamellae (sl); capillary (c); *Myxobolus* cysts (mx); epithelium covering the plasmodium (arrows).

infects barboid fishes. *M. persicus*, however, differs from *M. lobatus* in the size and shape of the intercapsular appendix.

The pathological effect of the two species found by us is unknown. From the sparse occurrence of cysts in the gills it seems possible that in natural waters neither of these parasites can be considered pathogenic. We must not forget, however, that the pond culture of *B. grypus* and *B. sharpeyi* on experimental level has been started (Yazdipour et al. 1991, Jamily et al. 1993, Nikpai et al. in press), and in these systems an increase is expected in the level of infection and in pathogenicity.

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Masoumian M., Baska F. és Molnár K.: Két új *Myxobolus*-faj, *M. karuni* sp. n. és *M. persicus* sp. n. a Karun folyóból (Irán, Tigris mellékág) származó *Barbus grypus*-ból

A szerzők a Karun folyóból (Irán; Perzsa-öböl vízrendszer) gyűjtött *Barbus grypus* kopoltyújáról két új *Myxobolus* fajt írnak le *M. karuni* sp. n. ill. *M. persicus* sp. n. néven. A két faj egymástól morfológiailag és a kopoltyún való elhelyezkedésében egyaránt különbözik. Amíg a *M. karuni* sp. n. fejlődését a kopoltyú elsődleges lemezeinek légzőredőktől mentes részében, a kopoltyúerekben kezdi meg, és cisztáit a lemezek középső részén alakítja ki, a *M. persicus* sp. n. plasmodiumai (cisztái) a másodlagos lemezekben fejlődnek ki oly módon, hogy a plasmodiumok fejlődése a lemezek membrana basalis és fedőhám-sejtjei között kezdődik, és a ciszták a légzőredők kapillárisait körülveve találhatók meg. *Barbus grypus*-ban a két faj általában együttesen fordult elő, *Barbus sharpeyi*-ből és *B. luteus*-ból csak a *M. persicus* fajt mutattuk ki.

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