

# *Myxobolus insignis* sp. n. (Myxozoa, Myxosporea, Myxobolidae), a parasite of the Amazonian teleost fish *Semaprochilodus insignis* (Osteichthyes, Prochilodontidae)

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A new myxosporean species is described from the fish *Semaprochilodus insignis* captured from the Amazon River, near Manaus. *Myxobolus insignis* sp. n. was located in the gills of the host forming plasmodia inside the secondary gill lamellae. The spores had a thick wall (1.5-2 µm) all around their body, and the valves were symmetrical and smooth. The spores were a little longer than wide, with rounded extremities, in frontal view, and oval in lateral view. They were 14.5 (14-15) µm long by 11.3 (11-12) µm wide and 7.8 (7-8) µm thick. Some spores showed the presence of a triangular thickening of the internal face of the wall near the posterior end of the polar capsules. This thickening could occur in one of the sides of the spore or in both sides. The polar capsules were large and equal in size surpassing the mid-length of the spore. They were oval with the posterior extremity rounded, and converging anteriorly with tapered ends. They were 7.6 (7-8) µm long by 4.2 (3-5) µm wide, and the polar filament formed 6 coils slightly obliquely to the axis of the polar capsule. An intercapsular appendix was present. There was no mucous envelope or distinct iodophilous vacuole.

Key words: Myxozoa - Myxosporea - *Myxobolus insignis* sp. n. - *Semaprochilodus insignis* - Brazil

*Myxobolus* spp. are the most common Myxosporea parasitizing fish. Landsberg and Lom (1991) listed 444 valid species, and Eiras et al. (in press) provided a synopsis of the species giving the full characterisation of 744 nominal species, including nearly all the species described so far in fish and amphibians. It is surprising that from such a high number of species only 21 were described for South America – 2 from Argentina, 1 from Guiana, and 18 from Brazil. This is surprising because the fish diversity in Brazilian waters is very high, comprising about 8000 species representing nearly 24% of all the known fish species (Cellere et al. 2002). It is likely that the small number of *Myxobolus* species known so far for this region (as well as of other Myxosporea species) does not mean a scarcity of parasites in this part of the world, but a lack of research on Myxosporea (Cellere et al. 2002).

In this paper we describe *Myxobolus insignis* sp. n. (Myxozoa, Myxosporea, Myxobolidae) from the “jaraqui”, *Semaprochilodus insignis* Jardine & Schomburgk, 1841 (Osteichthyes, Prochilodontidae), a freshwater fish from the Amazon River, Brazil. This fish species, jointly with *S. taeniurus*, is most important for a large part of the Central Amazon human population once they represent its main food resource.

## MATERIALS AND METHODS

Three specimens of *S. insignis* (total length: 22.3-24.5 cm) were net-fished from the Amazon river, at Manaus,

and transported to the laboratory. The specimens were thoroughly dissected under a compound microscope and all the organs were inspected for the presence of parasites. Measurements were made from fresh spores (30 specimens), and spores were observed under Nomarski differential interference-contrast. For detecting the presence of an iodophilous vacuole fresh spores were treated with Lugol's iodine solution. Spores were also stained with India ink for revealing any mucous envelope (Lom & Vávra 1961).

## RESULTS

Two specimens of *S. insignis* exhibited the gills infected by *Myxobolus*. The parasites formed whitish, rounded or slightly irregular plasmodia (about 0.02-0.08 mm in diameter) located intra-lamellarly within the secondary gill lamellae. Most of the plasmodia were located at the base of the lamellae, but could be present also more or less far from the base.

The spores (Figs 1-3) had a valvular wall 1.5-2 µm thick all around their body, and the valves were symmetrical and smooth. The spores were a little longer than wide, with rounded extremities, in frontal view, and oval in lateral view. They were 14.5 (14-15) µm long by 11.3 (11-12) µm wide and 7.8 (7-8) µm thick. Some spores showed the presence of a triangular thickening of the internal face of the wall near the posterior end of the polar capsules. This thickening could occur in one of the sides of the spore or in both sides. The polar capsules were large and equal in size surpassing the mid-length of the spore. They were oval with the posterior extremity rounded and converging anteriorly with tapered ends. They were 7.6 (7-8) µm long by 4.2 (3-5) µm wide, and the polar filament formed 6 coils slightly obliquely to the axis of the polar capsule. A

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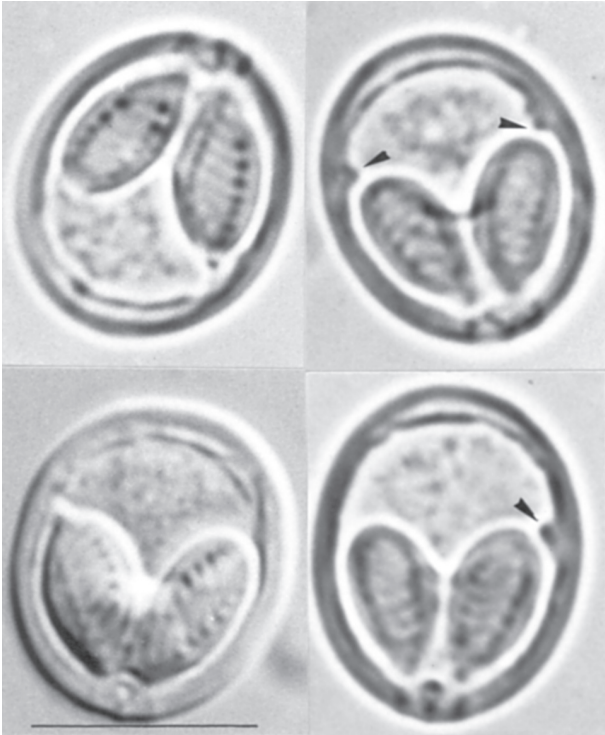


Fig. 1: *Myxobolus insignis* sp. n. spores from *Semaprochilodus insignis*. Note the triangular thickening of the internal face of the wall in some specimens (arrows). Bar = 10  $\mu$ m.

small intercapsular appendix was present. There was no mucous envelope or distinct iodophilous vacuole.

Host: teleost fish *Semaprochilodus insignis* Jardine & Schomburgk, 1841

Locality: Amazon River, near Manaus, Brazil

Site of infection: inside secondary gill lamellae

Prevalence: two out of three fish were infected

Etymology: the specific name derives from the name of the host species.

Specimens deposition: the syntypes are deposited at the "Collection of Myxozoa from the National Institute for the Amazonian Research" (Inpa), Manaus, AM, Brasil, under the reference INPA-002, in the Section of Animal Pathology from the Department of Zoology and Anthropology from the Faculty of Sciences of Porto, Portugal, and in the Museum of Natural History from the Faculty of Sciences of Porto, Portugal.

#### Taxonomic affinities

Comparing our species with other *Myxobolus* described for the South American fishes it can be seen that they are different from all of them. The most similar, concerning the morphometric characteristics, are *M. absonus* Cellere, Cordeiro & Adriano, 2002, *M. associatus* Nemeček, 1926, *M. galaxii* Szidat, 1953, *M. paranensis* Bonetto & Pignalberi, 1965 and *M. pygocentris* Penido, 1927. *M. absonus* despite some similarities in morphometric characters has unequally sized polar capsules. *M. associatus* has narrower spores and smaller polar cap-

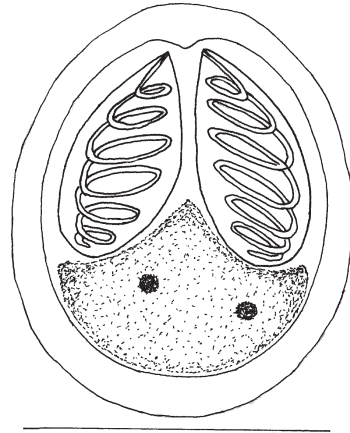


Fig. 2: schematic drawing of *Myxobolus insignis* sp. n. spore in frontal view from *Semaprochilodus insignis*. Bar = 10  $\mu$ m.

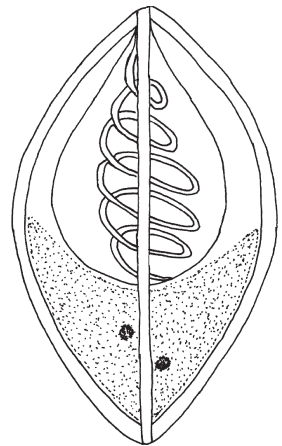


Fig. 3: schematic drawing of *Myxobolus insignis* sp. n. spore in lateral view from *Semaprochilodus insignis*. Bar = 10  $\mu$ m.

sules. *M. galaxii* has spores that are narrower, and infect all the organs of the hosts except the gills, exactly the contrary occurring with our specimens. *M. paranensis* has smaller spores and smaller polar capsules, and *M. pygocentris* has longer spores and longer polar capsules. Besides, the spores under examination have a very thick wall, a characteristic not reported for any of the South American *Myxobolus* species.

On the other hand, the spores from our material are ovoid with rounded extremities. This is clearly a different shape of a number of species that have the spores pyriform (*M. maculatus* Casal, Matos & Azevedo, 2002, *M. inaequus* Kent & Hoffman, 1984, *M. cunhai* Penido, 1927, *M. lutzi* Aragão, 1919, *M. paranensis*, *M. desaequalis* Azevedo, Corral & Matos, 2002, *M. braziliensis* Casal, Matos & Azevedo, 1996, *M. associatus*, *M. chondrophilus* Nemeček, 1926 and *M. inaequalis* Gurley, 1893), or the anterior end slightly pointed (*M. absonus* and *M. kudoi* Guimarães & Bergamim, 1938). The species which have a similar shape of the spores can not be identified as our species because they are quite different in spore size, in size and position of the polar capsules, in the number of coils of the polar filament, or do not have intercapsular appendix.

Our material was also compared with the characteristics of 744 species corresponding to nearly all the species described so far (Eiras et al. in press). Despite some similarities of some species, our specimens could not be identified as any of these species. *M. alievi* Gasi-magomedov (1970) described from *Rutilus rutilus caspicus*, and *M. lampiformis* Chen & Ma (1989) infecting *Aristichthys nobilis* have dimensions similar in some aspects, but have unequally sized polar capsules and do not have an intercapsular appendix. *M. angustus* Kudo (1934) from the host *Cliola vigilax* has spores with the same length, but they are not so wide (7-8 µm), the polar capsules are larger and thinner (8-9.5 and 2.5-3 µm, respectively), and do not have intercapsular appendix. *M. baueri* Chernova, 1970, infecting *Tinca tinca*, has similar spore dimensions, but the polar capsules are distinctly smaller (5.3-6 by 2.7-3.3 µm). *M. bibullatus* Grinham & Cone, 1990 infecting *Catostomus commersonii* has spores of identical dimensions and the polar capsules are a little smaller, but do not have intercapsular appendix. *M. enoblei* Lom & Cone (1996) parasitizing *Ictiobus bubalus* has spores not so wide (10.5-11.5 µm), and longer and larger polar capsules (7.9-8.5 µm and 4.5-5.5 µm, respectively). Finally, *M. spalli* Landsberg & Lom, 1991, has spores of the same length but much more thin, smaller polar capsules, and do not have intercapsular appendix. Furthermore, none of the above mentioned species has a spore wall as thick as observed in our specimens.

It is concluded that the present material represents a species not yet described, and the name *Myxobolus insignis* sp. n. is proposed.

#### REFERENCES

- Aragão M 1919 *Myxobolus lutzi* n. sp. *Rev Soc Brasil Ciênc* 3: 325.
- Azevedo C, Corral L, Matos E 2002 *Myxobolus desaequalis* n. sp. (Myxozoa, Myxosporea), parasite of the Amazonian freshwater fish, *Apteronotus albifrons* (Teleostei, Apterontidae). *J Eukaryot Microbiol* 4: 485-488.
- Bonetto A, Pignalberi C 1965 *Myxobolus paranensis* (Protozoa, Myxosporidea), una nueva especie parasita del "Dorado" (*Salminus maxillosus*). *Physis* 25: 23-26.
- Casal G, Matos E, Azevedo C 2002 Ultrastructural data on the spore of *Myxobolus maculatus* n. sp. (phylum Myxozoa), parasite from the Amazonian fish *Metynnis maculatus* (Teleostei). *Dis Aquat Org* 51: 107-111.
- Cellere EF, Cordeiro NS, Adriano EA 2002 *Myxobolus absonus* sp. n. (Myxozoa: Myxosporea) parasitizing *Pimelodus maculatus* (Siluriformes, Pimelodidae), a South American freshwater fish. *Mem Inst Oswaldo Cruz* 97: 79-80.
- Chen QL, Ma CL 1998 *Myxozoa, Myxosporea. Fauna Sinica*, Science Press, Beijing, 292-528.
- Chernova TN 1970 New species of mucous sporozoans (Myxosporidia) of fish in some reservoirs of western Georgia. *Vestnik Zoologii* 2: 60-64.
- Eiras JC, Molnár K, Lu YS (in press) Synopsis of the species of the genus *Myxobolus* Butschli, 1882 (Myxozoa: Myxosporea: Myxobolidae). *Syst Parasitol*
- Gasimagomedov AA 1970 New species of myxosporea in the fishes of the Caspian Sea. *Sbornik nauchnykh soobshchenii Kafedry fiziologii cheloveka i zhivomykh of the Dagestan Republic. Makkachkala* 4: 72-76.
- Grinham T, Cone DK 1990 A review of species of *Myxobolus* (Myxosporea) parasitizing catostomid fishes, with a redescription of *Myxobolus bibullatus* (Kudo, 1934) n. comb. and description of *Myxobolus lamellus* n. sp. from *Catostomus commersoni* in Nova Scotia. *Can J Zool* 68: 2290-2298.
- Guimarães JRA, Bergamim F 1938 Sobre um novo myxosporideo parasito de peixe de água doce, *Myxobolus kudoi* sp. n. *Rev Ind Animal* 1: 65-67.
- Gurley MD 1893 On the classification of the myxosporidia, a group of protozoa parasites infecting fishes. *Bull US Fish Commission* 11: 407-420.
- Kent ML, Hoffman GL 1984. Two new species of Myxozoa, *Myxobolus inaequus* sp. n. and *Heneguya theca* sp. n. from the brain of a South American knife fish, *Eigemannia virescens* (V.). *J Protozool* 31: 91-94.
- Kudo R 1934 Studies on some protozoan parasites of fishes of Illinois. *Ill Biol Monographs* 13: 7-44.
- Landsberg JH, Lom J 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.
- Lom J, Cone D 1996 Myxosporeans infecting the gills of bigmouth buffalo (*Ictiobus bubalus*) in Illinois, USA. *Folia Parasitol* 43: 37-42.
- Lom J, Vávra J 1961 Mucous envelopes of spores of the subphylum Cnidospora (Doflein, 1901). *Vestnik Ceskoslov Spolec Zool* 27: 4-6.
- Nemeczek A 1926. Beitrage zur Kenntnis der Myxosporidienfauna Brasiliens. *Archiv Protistenk* 54: 137-149.
- Penido JCN 1927 Quelques nouvelles myxosporidies parasites des poissons d'eau douce du Brésil. *Compt Rendus Soc Brésil Sciences Naturel* 97: 850-852.
- Szidat L 1893 Einige neue Arten der Familie Myxobolidae Thélohan (Protozoa, Klass Sporozoa) aus Susswasserfischen Argentinien. *Gewasser und Abwasser* 5: 7-16.

