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EDITORIAL

ON DIVERSITY OF THE MONOGENOIDEAN FAUNA IN A MEGADIVERSE COUNTRY, BRAZIL

SOBRE LA DIVERSIDAD DE LA FAUNA MONOGENOIDEA EN UN PAÍS MEGADIVERSO, BRASIL

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Abstract

Monogenoidea represents a class of hermaphroditic Platyhelminthes ecto-parasitic of mainly fishes. They inhabit the gills, skin, nasal fossae, ureters and some intestinal ducts. Brazil is known as a country with rich fauna, flora and mineral resources, with more than 4000 species of freshwater fishes, representing approximately 31% of the world freshwater fish species. Abou 365 species of Monogenoidea described from Brazil is listed. The International Symposium on Monogenea (ISM) represents the most traditional event for researchers worldwide that study this group of parasites. During the Sixth ISM, in South Africa, Brazil had being elected the next venue (ISM 7). This is the first time in American continent that will enable the participation of researchers and students of the whole continent.

Keywords: ectoparasites - fishes - International Symposium on Monogenea - Monogenoidea.

Resumen

Monogenoidea representa una clase de hermafroditas, en su mayoría ectoparásitos, Platyhelminthes que parasitan principalmente peces, que habitan en las branquias, piel, fosas nasales, los uréteres y pocos en los conductos intestinales. Brasil es conocido como un país con una rica fauna, flora y recursos minerales, representando el liderazgo de especies de peces de agua dulce, con más de 4000 especies, que representan aproximadamente el 31% de las especies de peces de agua dulce del mundo. Una lista de 365 especies de Monogenoidea ha sido descrita de Brasil. El Simposio Internacional sobre Monogenea (ISM) representa el evento más tradicional para los investigadores de todo el mundo que estudian este grupo de parásitos. Durante la Sexta ISM, en África del Sur, Brasil tuvo el privilegio de ser elegida la próxima sede (ISM 7). Esta es la primera vez en el continente americano, y permitirá la participación de investigadores y estudiantes de todo el continente.

Palabras clave: ectoparásitos - peces - Simposio Internacional sobre Monogenea - Monogenoidea.

The first author to recognize Monogenoidea as a distinct taxon was van Beneden (1858), which divided Trematoda into two groups: the monogénèses and the digénèses. Carus (1863) used the name of the group in latinized form, Monogenea. Bychowsky (1937) raised the taxon from order to class and amended the name of the group to Monogenoidea. During the IV International congress of Parasitology, in Poland in 1978, a round table discussed the problems on nomenclature and decided to adopt the name Monogenea, since the ending *oidea* is in disagreement with the code, which reserves this ending to superfamily. Boeger & Kritsky (1993) argued that the name Monogenoidea follows the priority principle, considering that this name was the first proposed for the group at class level. These authors also argued that the ending "oidea" to superfamily is a recommendation by the International Code of Zoological Nomenclature, and also, the code did not pertain to taxa above family groups.

Monogenoidea represents a class of hermaphroditic, mostly ectoparasites Platyhelminthes parasitizing mainly fishes, inhabiting the gills, skin, nasal fossae, ureters and few in the intestinal ducts. In amphibians and aquatic reptiles they may be found in the mouth, cloaca, or urinary bladder. This group has been found in a diversity of groups as mammals (*Hippopotamus*) and cephalopods (Boeger & Vianna, 2006).

Infections with parasites are common in cultures fishes and some groups cause veterinary problems. Parasites have assumed a central role among the limiting factors of productivity, particularly those with direct life cycle, such as Monogenoidea. This group has been recognized as responsible for economic losses for fish farming activities. The presence of Monogenoidea in a variety of fish species has been responsible for mortalities or a reduction in the health of the stocks (Antonelli *et al*., 2010).

It is not possible to argue that Monogenoidea are the most important group of parasites, but the simplicity of the life cycle make them excellent models to understand the host-parasite relationship. It had been demonstrated that some species of Monogenoidea are adequate as experimental studies models, besides they are important pathogenic agents. This parasitic group have intrinsic interest and the adaptations developed by them to the parasitism, diversity of attachment organs, general morphology and plasticity of the life cycle attracted high number of parasitologists dedicated to study them (Poulin, 2002).

In the Monogenoidea, the haptor allows the attachment on hosts and generally is composed by hooks, suckers or clamps. As monogenoideans are mostly soft-bodied and hence highly plastic in body shape, their hard sclerotized structures, including copulatory organs and haptoral sclerites, are taxonomically most important and often used to distinguish between species. The morphology of these attachment organs has been extensively studied in various ecological and evolutionary contexts due its influence in the specificity, specialization, and the reproductive isolation (Vignon *et al*., 2011).

The well-established morphology of the group provides the language for species description and diagnosis. However, molecular data have tended to supplement morphology through a diversity of taxonomic and evolutionary scales. Increasingly, molecular markers are being incorporated in revisions and description of new species, often with molecular based phylogeny, demonstrating the uniqueness of a new taxon and/or its relationship among the established taxa (Littlewood, 2008).

In the last decade of the 20 century, a great progress was done in the studies of phylogeny of most group of helminths, specially the Neodermata (Littlewood *et al*., 1999 a,b, Brooks, 2000, Littlewood & Bray, 2001). The application of cladistics methods (Brooks, 1989, Brooks & Mc Lennan, 1993), the intense search for new adequate characters for phylogeny, as data on ultrastructure, spermiogenesis, life cycle (Justine, 1991, 1993, Littlewood & Bray, 2001) and the wide use of molecular data on phylogenetic studies has resulted in a

considerable increase of understanding the phylogenetic relationships within the helminth groups, including Monogenoidea (Scholz, 2001).

According to Whittington (1998), there are 25 000 known fish species in the world. Considering that Monogenoidea are the more specific parasites to their hosts and each fish species host a different species of Monogenoidea, is would be possible to predict that there are 25 000 monogenoidean species in the world. However, numerous studies made by Kritsky, Boeger and collaborators indicated that a single host species can harbor about five species of Monogenoidea, reaching 25 different species in *Pygocentrus nattereri* Kner, 1860 (Boeger & Kritsky, 1988, Kritsky *et al.* 1988, 1992, 1996, 1997, 1998; Mizelle & Price, 1965, Kohn & Pinto-Paiva, 2000) in the Amazonian Region, and, considering this fact, the number of 25 000 is underestimated.

Brazil is known as a country with rich fauna, flora and mineral resources, representing the leader of freshwater fishes species, with more than 4000 species, representing approximately 31% of the world freshwater fish species (Levêque *et al*., 2008) distributed among 39 different families (Buckup *et al*., 2007). Despite the importance of the group as parasites of fishes, until 1965 only two species had been described in Brazil: *Fredericianella ovicola* Brandes, 1894 and *Capsala laevis* (Verril, 1874). In 1965, Mizelle and Price obtained in Steinhart Aquarium specimens of *P. nattereri* provenient from Amazonas and described eight new species of Dactylogyridae. From 1966 to 1969, nineteen species of Dactylogyridae form Amazonian Region were described. The first member of the family Microcotylidae was reported in 1970 and the presence of the genus *Polystoma* were reported for the first time in 1978 from amphibians collected in Para and Rio de Janeiro states (Kohn *et al*., 1978). The first species of Gyrodactylidae in South America was described by Szidat (1973) parasite of *Corydoras paleatus* (Jenyns, 1842), in Argentina. From 1973 to 1989, only one species, *Oogyrodactylus farlowellae* Harris, 1983, an oviparous gyrodactylid, was described from an amazonian fish held in an aquarium in England. Oviparous gyrodactylids are restricted to South American freshwater catfishes mainly in the relatively recent Loricariidae (Siluriformes), while viviparous gyrodactylids, on the other hand, represent one of the most diverse and widespread taxons of Monogenoidea (Boeger *et al*., 2003).

Kohn & Santos (1989) presented a list of 93 species of Monogenoidea described from Brazil. In 1998, Kohn & Cohen updated the list, enlarging the records to South America and reported 252 species from Brazil, the majority of them (193) from Amazonian region. Cohen & Kohn (2008) referred that more 65 species were described from Brazil and 26 new geographical records were reported. From 2008 to now, 48 new species were described and 11 known species were referred from Brazilian hosts. The growth rate on number of species is related to the increasement of research on Monogenoidea in Brazil.

The International Symposium on Monogenea represents the most traditional event for researchers worldwide that study this group of parasites. The idea of these meetings was initiated by R. Ergens and M. Gelnar from the Czech Republic. The first International Symposium on Monogenea (ISM) was held on Ceske Budejovice, Czech Republic in 1988. This inaugural meeting was convened for all specialists on monogenoideans to meet and discuss current research on the class Platyhelminthes. Five years later, the second took place in Montpellier, France and the tradition continued in august of 1997 when the Third ISM returned to Czech Republic and was convened in Brno. The Fourth International Symposium on Monogenea was held in Australia in 2001. Four years later, The 5th International Symposium on Monogenea was held in China on 2005 and the 6th International Symposium on Monogenea in Cape Town, South Africa in 2009.

During the Sixth ISM, in South Africa, Brazil had the privilege of being elected the next venue

(ISM 7). This is the first time in American continent and will enable the participation of researchers and students of the whole continent.

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