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Studies of parasites that infect the nervous system of Amazonian fish: why are these studies neglected?

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Abstract

It is noticed that parasites that infect the Nervous System in Amazonian fish, manifest an action that directly interferes with peripheral vision loss and indirectly are manipulative and alter the behavior of these hosts, thus facilitating being predated so that the parasitic cycle ends in the bird, somehow preserving the maintenance and the parasite/host relationship in the environment. It is observed that this parasitic mechanism is little studied in the Amazon region, even though it is the region with the greatest diversity of freshwater fish, such infections were observed in only nine species of fish. We recently found new species of fish that live in the central Amazon region that were infected with the parasite *Austrodiplostomum* sp. Studies of parasites of fish from natural environments such as *Austrodiplostomum* sp. they are considered as "Neglected Parasite Group", besides being an intriguing, complex and mysterious transmission system, it is a very incipient study, when compared with other environmental parasites.

Keywords: Parasitic diseases, Environmental parasites, Neglected parasite group.

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Editorial

The central nervous systems of animals are well protected, and access to them is both regulated and highly selective. That control, however, sometimes lapses. Some microorganisms can take advantage of low immunity episodes in potential host organisms, while in other cases the microorganisms themselves can induce alterations that allow accessing their nervous systems [1].

Some fish parasites take advantage of that latter strategy of host interaction, including parasites of the genus *Austrodiplostomum sp.*, which are capable of infecting several different fish species [2].

Austrodiplostomum sp. parasites have complex and unusual life cycles, requiring three hosts before attaining their adult phase. Among those hosts are snails (first intermediate host), some fish species (second intermediate host), and piscivorous birds (definitive host), with adult parasites being found in their intestines. Infected fish species will have parasites in their cranial cavity, eyes, and muscle tissues. The presence of those parasites directly causes the loss of peripheral vision, and the hosts are thus indirectly manipulated so that the parasites' lifecycles can be completed in birds-constituting a complex parasite/host relationship in the natural environment [3-6].

Despite the wide distributions of those parasites and the growing numbers of reports of ocular infections in Brazilian fish species, their potential impacts on wild fish populations are still unknown and/or have been neglected by researchers. In the Amazon region, where the greatest diversity of freshwater fish on our planet is found, ocular parasite infections have been observed in only 9% of the fish species. We recently encountered five new fish species in the central Amazon region infected by *Austrodiplostomum sp. parasites: Caquetaia spectabilis, Satanoperca acuticeps, Curimatella sp., Crenicichla marmorata, and Acaronia nassa.* The parasites were free and active in the vitreous humor of those fish; they were also free and active in their brains. Those findings are important in terms of understanding the degrees of the interaction of those parasites with fish nervous systems and will aid in evaluating, from evolutive and ecological points of view, the modulation of the behaviors of infected fish, as well as how those modifications facilitate predation by piscivorous birds [6].

This pioneering study in the central Amazon region has suggested several hypotheses: that seasonal changes can influence the prevalence and intensity of *Austrodiplostomum* sp. infestations in fish species; that the larvae of *Austrodiplostomum* sp. encountered parasitizing the new fish taxa all belong to the same species; and that the high densities of *Austrodiplostomum* sp. larvae in the eyes and cranial cavities of the fish species identified in the present study induce distinct behavioral alterations at each infection site.

More detailed analyses of the *Austrodiplostomum* sp. larvae may encounter, could identify new species for Brazil and (principally) for the Amazon region. However, with few exceptions, the importance given to fish parasitology in natural environments has considerably diminished in recent decades, together with financial support and attention directed toward that taxonomic group.

Fish parasites encountered in natural environments, such as *Austrodiplostomum* sp., are considered to constitute a group of "Neglected Parasites" because (1) fish parasites are not currently viewed as being of significant economic importance; (2) there is little funding available for that area of research, especially when commercial applications are not immediately apparent; and, (3) research focuses have changed and there is a lack of qualified professionals investigating neglected parasites that could train

new generations of fish parasitologists. Parasitic infections of the nervous systems of fish in natural environments nonetheless involve intriguing, complex, and somewhat mysterious transmission systems that are only beginning to be understood as compared to other parasite-host systems known to occur in pisciculture.

References

1. Mehlhorn H, editors. Host Manipulation by Parasites and Viruses. Springer, 2015.
2. Niewiadomska K, Moczoń T. The nervous system of *Diplostomum pseudospataceum* Niewiadomska, 1984 (Trematoda, Diplostomidae). Parasitol Res. 1990;76,635-37.
3. Yamada HF, Moreira LH de A, Ceschini TL, et al. New occurrences of metacercariae of *Austrodiplostomum compactum* (Lutz, 1928) (Platyhelminthes: Digenea) eye flukes of fish from the Paraná Basin Rev Bras Parasitol. Vet. 2008;17(3):163-6.
4. Sato MDCB, Pavanelli GC. Digenea of *Pimelodus maculatus* (Osteichthyes, Pimelodidae) from the basins of the São Francisco and Paraná rivers, Brazil. Parasitol Latinoam. 2004;59(3-4):123-31.
5. Corrêa LL, Souza GTR, Takemoto RM, et al. Behavioral changes caused by *Austrodiplostomum* spp. in *Hoplias malabaricus* from the São Francisco River, Brazil. Parasitol Res. 2014;113(2):499-503.
6. Lima MJS, Veiga RP, Sousa LF de. Metacercariae of *Austrodiplostomum* spp. (Digenea: Diplostomidae) infecting the eyes and brains of fish in Brazilian Amazon. Arq Inst Biol. 2019;86:1-7.

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