

Parasites of *Auchenipterus osteomystax* (Osteichthyes, Auchenipteridae) from two different environments, Rosana's reservoir and upper Paraná river floodplain, Brazil

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ABSTRACT. Surumanha, *Auchenipterus osteomystax* Miranda-Ribeiro, 1918 is an insectivorous species that inhabits benthopelagic freshwater environments. In order to know the parasitic fauna and aspects of the host-parasite relationship in surumanhas from Rosana's hydroelectric reservoir and the upper Paraná river floodplain, 36 specimens from the reservoir and 41 specimens from the floodplain were collected, using gill nets. The parasitic fauna of the hosts from the different environments presented low similarity; among ten parasite species present in *A. osteomystax*, only two were observed in both environments. It was observed significant difference in the prevalence of the metacercariae of Strigeidae in relation to the sex of the hosts from the floodplain, indicating that males are more parasitized. *Clinostomum complanatum* was the only species that presented significant negative correlation with the relative condition factor (kn) of the host, indicating possible pathogenicity.

Key words: parasites, *Auchenipterus osteomystax*, Rosana's reservoir, upper Paraná river floodplain, Paraná, Brazil.

RESUMO. Parasitos de *Auchenipterus osteomystax* (Osteichthyes-Auchenipteridae) de dois diferentes ambientes, reservatório de Rosana e planície de inundação do alto rio Paraná, Brasil. A surumanha, *Auchenipterus osteomystax* Miranda-Ribeiro, 1918 é uma espécie insetívora que habita ambientes bentopelágicos de água doce. Com o objetivo de conhecer a fauna parasitária e os aspectos da relação parasito-hospedeiro em surumanhas do reservatório da Usina Hidrelétrica de Rosana e da Planície de Inundação do alto rio Paraná, 36 espécimes do reservatório e 41 espécimes da planície de inundação foram coletados utilizando-se redes de espera. A fauna parasitária deste hospedeiro nos dois ambientes apresentou baixa similaridade, das dez espécies de parasitos encontradas em *A. osteomystax*, somente duas foram observadas nos dois ambientes. Foi observada diferença significativa na prevalência de parasitismo da metacercária de Strigeidae em relação do sexo do hospedeiro na planície de inundação, onde os machos foram mais parasitados. *Clinostomum complanatum* foi a única espécie que apresentou correlação negativa significativa com o fator de condição relativo (kn) do hospedeiro, indicando uma possível patogenicidade.

Palavras-chave: parasitos, *Auchenipterus osteomystax*, reservatório de Rosana, planície de inundação do alto rio Paraná, Paraná, Brasil.

Introduction

Because of the increasing number of reservoirs and the consequent changes in flooding of the main water courses in Paraná Basin, new environments were formed due to differentiations in physical, chemical and biological local characteristics (AGOSTINHO et al., 1997). Impacts provoked by natural flooding oscillations or by anthropic influence lead to changes in the

population dynamics of the autochthonous fauna. According to Pavanelli et al. (1997), this phenomenon can be observed, mainly, in the ichthyofauna of a specific region, being reflected directly on the structure and composition of parasites communities. Studies in the upper Paraná river floodplain suggest that the modifications in the biological conditions of the hosts lead to considerable changes in the composition of

parasitic fauna. Dogiel (1961) pointed out that another factor that influences on the parasitic fauna is the feeding habit of the host. According to Hahn et al. (2004) in general, insectivores include small individuals that are an important food source for most piscivorous.

Surumanha, *Auchenipterus osteomystax*, belongs to Order Siluriformes and Family Auchenipteridae. It inhabits benthopelagic freshwater environments and is also found in Amazon and Tocantins Basins. This is the second most numerically abundant species in the upper Paraná river floodplain, being abundant in several environments, but more common in lagoons. It is also abundant in some of the reservoirs of the Paraná basin as the Rosana's hydroelectric reservoir.

The main food resource of this species is adult ephemeropterans, which are captured at the surface. Therefore, *A. osteomystax* occupies intermediate trophic level in the alimentary chain

increasing the probability of the fish to become infected by adults or larvae.

This paper aims to provide information on the parasite infracommunities of *A. osteomystax* of the Paraná basin and deals with aspects that may influence infracommunity structures in this locality.

Material and methods

Part of the biological material used was collected in the Rosana's hydroelectric reservoir, situated in the low stretch of Paranapanema river (22°36' S and 52°49' W), during July and November, 2001 and March, June, August and December, 2002 (Figure 1).

Another part of the material was collected in the upper Paraná river floodplain (22°50'-22°70' S and 53°15'-53°40' W), specifically in Patos, Guaraná and Garças Lagoons, Baía and Ivinheima rivers and Pau Véio Glade, during March, June and September, 2004 and March, 2005 (Figure 1).

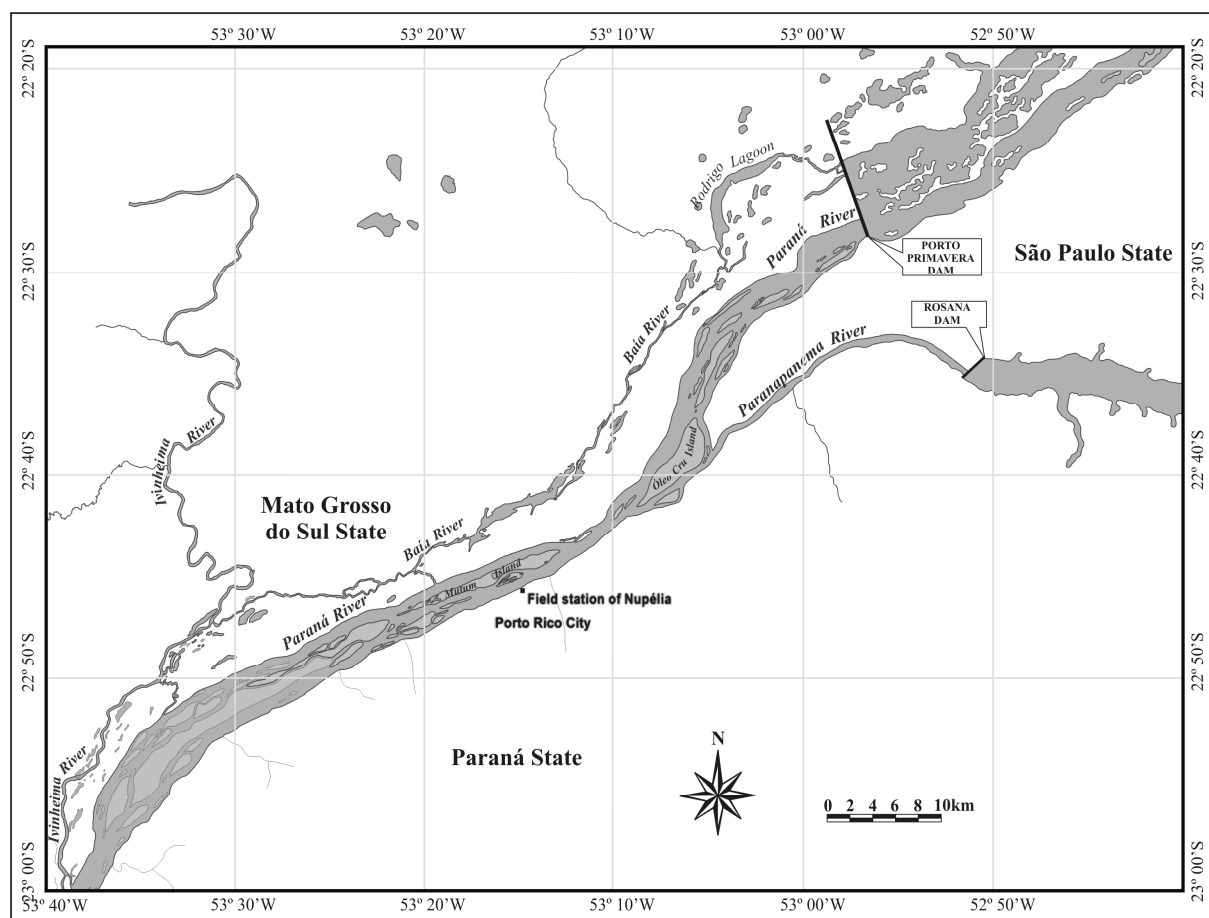


Figure 1. Upper Paraná river floodplain and Rosana's hydroelectric reservoir.

The parasites were collected, fixated, prepared and mounted according to Eiras et al. (2006).

The identification of parasites was made using optic microscope and specialized bibliography (YAMAGUTI, 1963a and b; 1971; THARCHER, 1993; MORAVE, 1998; REGO et al., 1999).

The relative condition factor (Kn) was calculated according to LeCren (1951). Analysis of data used: index of qualitative similarity of Sorenson, to compare data from Rosana's reservoir and the upper Paraná river floodplain (STONE; PENCE, 1978); the χ^2 test with Yate's correction, to determine possible associations between pairs of species (ZAR, 1996); dispersion index and statistic d , to verify the pattern of dispersion of parasite species in the sample of hosts (LUDWIG; REYNOLDS, 1988); Pearson's correlation coefficient 'r', to determine the correlation between the standard length class of the hosts and the prevalence of infection/infestation, with previous angular transformation of the prevalence data (ZAR, 1996); Spearman's rank correlation coefficient 'rs', to determine the possible correlations between the standard length of the host and the abundance of parasite species, and to verify correlations of abundance of parasites with relative condition factor (Kn) of the hosts (ZAR, 1996); Student's 't' test, to verify the existence of significant differences between the standard length of males and females (ZAR, 1996); Fisher's exact test 'F', with contingency table using 2x2, to determine the effect of the sex of the host on the prevalence of each species of parasite (ZAR, 1996); and Mann-Whitney 'U' test, to verify the influence of the host sex in the abundance of each species of parasite (ZAR, 1996). Statistical analysis were applied for parasite species with prevalence up to 5% and the results were considered significant when $p \leq 0.05$. Ecological terms followed Bush et al. (1997).

Results

Seventy-seven specimens of hosts, 36 from Rosana's reservoir and 41 from the upper Paraná river floodplain were analyzed. Most of the fish from the floodplain were parasitized by two parasite species, while in the reservoir most of the fish were not parasitized (Figure 2).

The parasite *Microrchis oligovitellum* presented the higher prevalence in fish from the reservoir, while *Demidospermus* sp. and *Creptotrema creptotrema* presented highest prevalence in hosts from the floodplain (Table 1).

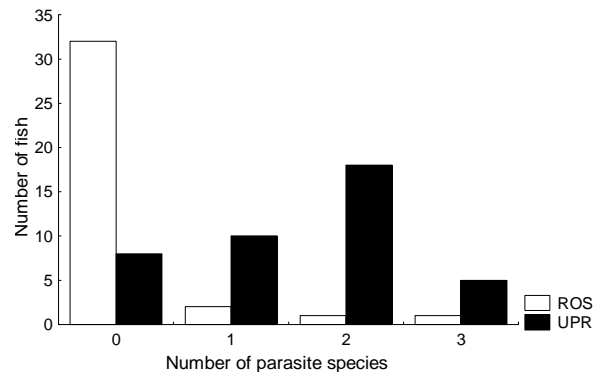


Figure 2. Parasitic richness of *Auchenipterus osteomystax* collected in Rosana's reservoir (ROS) in July and November, 2001 and March, June, August and December, 2002, and in the upper Paraná river floodplain (UPR), Brazil, in March, June and September, 2004 and March, 2005, Brazil.

Table 1. Values of Prevalence (P (%)), Mean Intensity (MI) and Abundance (Ab) of the parasitic fauna of *Auchenipterus osteomystax* collected in Rosana's reservoir (ROS) in July and November, 2001 and March, June, August and December, 2002, and in the upper Paraná river floodplain (UPR), in March, June and September, 2004 and March, 2005, Brazil.

| Parasite | Site of infection/infestation | ROS | | | UPR | | |
|---|-------------------------------|-------|-----|-----|-------|------|------|
| | | P (%) | MI | Ab | P (%) | MI | Ab |
| DIGENEA | | | | | | | |
| <i>Creptotrema creptotrema</i> | Intestine | 2.8 | 1.0 | 0.1 | 51.2 | 24.8 | 85.9 |
| <i>Microrchis oligovitellum</i> | Intestine | 11.1 | 1.5 | 0.2 | 4.9 | 2.0 | 0.1 |
| <i>Crocodylicola</i> sp. | Mesentery | --- | --- | --- | 4.9 | 1.0 | 0.1 |
| <i>Clinostomum complanatum</i> | Mesentery | --- | --- | --- | 7.3 | 1.0 | 0.1 |
| Metacercariae | | | | | | | |
| Strigidae gen. sp. | Mesentery | --- | --- | --- | 7.3 | 1.0 | 0.1 |
| NEMATODA | | | | | | | |
| <i>Procamallanus</i> (<i>Spirocamallanus</i>) sp. | Intestine | --- | --- | --- | 2.4 | 1.0 | 0.1 |
| <i>Johnstonmawsonia</i> sp. | Intestine | --- | --- | --- | 2.4 | 1.0 | 0.1 |
| <i>Rhabdochona acuminata</i> | Intestine | 5.6 | 9.5 | 0.5 | --- | --- | --- |
| MONOGENEA | | | | | | | |
| <i>Demidospermus</i> sp. | Gills | --- | --- | --- | 68.3 | 24.4 | 16.7 |
| COPEPODA | | | | | | | |
| Vaigamidae | Nasal cavities | --- | --- | --- | 2.4 | 1.0 | 0.1 |

The parasitic fauna of the hosts from the two environments presented low similarity (index of Sorenson = 36.36%). Among 10 parasite species found in *A. osteomystax* only *M. oligovitellum* and *C. creptotrema* were common to the two environments.

The χ^2 test indicated that between the parasites *Microrchis oligovitellum* and *Rabdochona acuminata*, present in hosts from Rosana's reservoir, positive and significant association ($\chi^2 = 8.752$ and $0.005 > p > 0.001$) was observed. For the other three possible associations between endoparasites, in hosts from the floodplain, the results were not significant.

Creptotrema creptotrema and *Demidospermus* sp. were overdispersed (ID = 53.01 and $d = 56.23$; ID = 62.76 and $d = 61.97$, respectively) in the sample of hosts from the floodplain, such as *M. oligovitellum* and *R. acuminata* (ID = 1.89 and $d = 3.18$; ID =

9.26 and $d = 17.15$, respectively) in the sample of hosts from Rosana's reservoir.

There was no significant correlation between the prevalence of fish parasitized by any species of parasite and its standard length class, as well as between the standard length of *A. osteomystax* and the abundance (Figures 3 and 4), in the floodplain and in the reservoir.

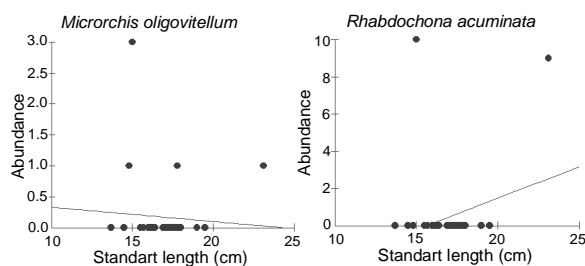


Figure 3. Abundance of *Microrchis oligovittellum* and *Rabdochona acuminata* X standard length of *Auchenipterus osteomystax* collected in Rosana's reservoir in July and November, 2001 and March, June, August and December, 2002, Brazil.

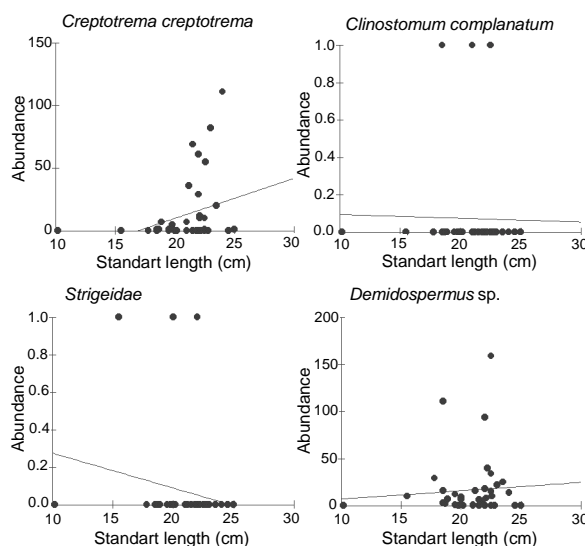


Figure 4. Abundance of *Creptotrema creptotrema*, *Clinostomum complanatum*, Strigeidae and *Demidospermus* sp. X standard length of *Auchenipterus osteomystax* collected in the upper Paraná river floodplain, in March, June and September, 2004 and March, 2005, Brazil.

The analyze of the parasitic abundance in males and females were not significant for any species of parasite in the two environments, even so females from the two environments present measures significantly higher than males (reservoir: $t = 2.108$; $p = 0.0429$; floodplain: $t = 2.613$; $p = 0.0127$). In the reservoir, on average, males present 16.5cm and females 17.7 cm, whereas in the floodplain males present 19.5 cm and females 21.6 cm. Significant positive difference was only observed in the

prevalence of Strigeidae regarding the sex of the hosts from the floodplain ($F = 0.0597$, $p = 0.0341$).

Significant negative correlation was observed between the abundance of *Clinostomum complanatum* and the relative condition factor (K_n) of hosts from the floodplain ($r_s = -0.3385$, $p = 0.0433$).

Discussion

With the flooding of Sete Quedas Falls (Guaíra, Estado do Paraná) for the formation of Itaipu's reservoir in 1982, fishes from the Lower and Middle Paraná river, including *A. osteomystax* (= *A. nuchalis*), had access to the upper Paraná river Surumanha had access and colonized the region where today is Rosana's reservoir, situated in Paranapanema river, closed in 1986 (JÚLIO JUNIOR et al., 2005).

Assuming that *A. osteomystax* kept the present parasitic fauna in the Lower and Middle Paraná river, through the low qualitative similarity it is possible to suppose that parasites present in *A. osteomystax* are more adapted to the upper Paraná river floodplain. This system is considered an environment that suffered less impact than the reservoirs, and the presence of higher parasite species richness, show that their life cycles find all necessary hosts, contrasting with the parasites present in hosts from Rosana's reservoir.

Probably, when *A. osteomystax* reached where today is the Rosana's reservoir, the monogeneans, that are specific, may had been lost because of the impacts and the new environmental conditions. Certainly the intermediate hosts of *M. oligovittellum* and *C. creptotrema* are found in the two environments.

On the other hand, for larvae, the snail used as intermediate host in the floodplain may not be found in the reservoir, therefore the presence of the larvae in this environment was not observed.

Microrchis oligovittellum and *Rhabdochona acuminata*, observed in hosts from Rosana's reservoir, presented positive association, indicating that both can occur together in the intestine of host without competition. Possibly this can be explained by the fact that the two species present low mean intensity, therefore, bigger space to coexist. In relation to the parasite species present in fishes from the floodplain, competition was not observed in any association, but it was noticed that the mean intensity of *C. creptotrema* is high and generally this species occurs alone in the host.

The species *C. creptotrema* and *Demidospermus* sp., in the sample of hosts from the floodplain, and *M. oligovittellum* and *R. acuminata*, in the sample of hosts from the reservoir, were aggregated, where many

hosts had few parasites and few hosts had many parasites, a commonly observed pattern in parasites of freshwater fish (MACHADO et al., 2000; GUIDELLI et al., 2003). Individual differences in susceptibilities to infection could have caused the aggregated distribution (GUIDELLI et al., 2003).

The relation between the length or age of the host and the abundance and prevalence of parasites is based on the process of temporal accumulation and the increase of the dimensions of the sites of infection in function of the growth (LUQUE et al., 1996) in case of a positive relation, and development of an immune reaction in case of a negative response. The lack of this relation in *A. osteomystax* can indicate homogeneous alimentary habits during the ontogenetic development and the lack of an immune reaction.

In the present study it was observed that the prevalence of the metacercariae of the Strigeidae Family was influenced by the sex of the host, males being more parasitized. Fernandez (1985) explains that for *Merluccius australis* Hutton, 1872 this fact can be related to the physiological differences between males and females, mainly during reproduction. According to Zaman e Seng (1989) the masculine hormones can help parasites increasing and survival, whereas the feminine hormones can damage parasitic infections. This justifies the results obtained for *A. osteomystax*, however more studies are necessary.

According to LeCren (1951), the relative condition factor is a quantitative pointer of the welfare degree of the fish, reflecting recent alimentary conditions. As expected and observed weight are considered, reproductive or gonadal formation events are minimized, since the relation between the two is equal to one in normal conditions and any alteration that occurs in this relation will provoke variations in this calculation. These variations can be provoked by influence of the environment, lack of food or parasitism.

The abundance of parasitism of *Clinostomum complanatum* in hosts from the floodplain affects negatively the relative condition factor of its hosts, indicating that parasites cause damages in the host's organism, then this can facilitate the predation, facilitating the life cycle of the parasite. For other parasite species present in fishes from the two environments, it is possible to assume that parasites are not pathogenic to the hosts and present significant degree of adaptation.

Tharcker (1981) observed that, in general, larvae of digeneans are the most pathogenic endoparasites, since they often perforate some tissues and organs to reach their site of infection.

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