

# Ecological aspects of the *Procamallanus (Spirocamallanus) pinto* parasite of *Corydoras paleatus* (Jenyns, 1842) (Siluriformes: Callichthyidae) in reservoirs of the State of Paraná, Brazil

Kennya Fernanda Ito\*, Sara Tatiana Moreira, Ricardo Massato Takemoto and Gilberto Cezar Pavanelli

Laboratório de Ictioparasitologia, Nupélia, Universidade Estadual de Maringá, Av. Colombo, 5790, 87020-900, Maringá, Paraná, Brasil. \*Author for correspondence. e-mail: kyfernanda@hotmail.com

**ABSTRACT.** One hundred and twenty-four specimens of *Corydoras paleatus* (Jenyns, 1842) collected from July 2001 to December 2002 in five reservoirs in Paraná state were analyzed. One hundred and ninety-eight *Procamallanus (Spirocamallanus) pinto* (Kohn; Fernandes, 1988) were collected, representing a prevalence of 78.23% and a mean intensity of infection of 2.04 parasites by fish. The values of prevalence and mean intensity of infection for *P. (S.) pinto* were submitted to statistical tests for the analysis of the host's relation. Data showed that the standard length and host's sex do not influence the parasitism level. Moreover, no significant difference of parasitism among the five analyzed reservoirs was found and the parasitism does not have seasonality.

**Key words:** *Corydoras paleatus*, endoparasites, reservoirs, Paraná.

**RESUMO.** Aspectos ecológicos de *Procamallanus (Spirocamallanus) pinto* parasita de *Corydoras paleatus* (Jenyns, 1842) (Siluriformes: Callichthyidae) em reservatórios do Estado do Paraná, Brasil. O presente trabalho objetivou realizar um estudo ecológico em 124 espécimes de *Corydoras paleatus* (Jenyns, 1842), coletados entre julho de 2001 a dezembro de 2002, em cinco reservatórios no Estado do Paraná. Foram coletados 198 *Procamallanus (Spirocamallanus) pinto* (Kohn; Fernandes, 1988), representando uma prevalência de 78,23% e uma intensidade média de 2,04 parasitos por peixe. Os valores de prevalência e intensidade média de infecção para *P. (S.) pinto* foram submetidos a testes estatísticos para a análise de sua relação com o hospedeiro, os quais demonstraram que o comprimento padrão e sexo do hospedeiro não interferem no nível de parasitismo. Também foi verificado que não há diferença significativa de parasitismo entre os cinco reservatórios analisados e que não possuem uma sazonalidade.

**Palavras-chave:** *Corydoras paleatus*, endoparasitos, reservatórios, Paraná.

## Introduction

The population growth and the technological development need a great demand of electric energy. The option of water sources for its production resulted in the construction of innumerable reservoirs, changing the regime of important water courses in Paraná (Thomaz *et al.*, 1997). According to Dogiel (1961), all available information on the formation of fish parasite fauna in the new reservoirs indicates the occurrence of extensive and gradual changes, which take place within a period of ten or more years. Thus, it indicates the great importance of studies in this area. Considering that *Corydoras paleatus* (Jenyns, 1842) is a fish found in the reservoirs of Paraná state, studying its parasitic fauna is necessary since this fish has a great potential for commercial fish culture.

Also called "limpa-fundo", *Corydoras paleatus* (Siluriformes: Callichthyidae) is found in South America, in low Paraná River and in the coastal rivers of Uruguay and Brazil. The body presents two rows of overlapping bony plates on each side. The swim bladder is in the bony case. The mouth is small and ventral and one or two pairs of well-developed barbels are present. The dorsal and pectoral fins are also present within the strong spine and the adipose fin is with the spine at the anterior border. Their main food is crustaceans, worms, insects and vegetables (Burgess, 1989).

## Material and methods

One hundred and twenty-four specimens of *C. paleatus* collected from July 2001 to December 2002 in five reservoirs of Paraná state (Irai, Segredo,

Governador Parigot de Souza, Passaúna and Curucaca) were analyzed. The reservoirs possess different ages and distinct uses, such as production of electric energy and water supply.

The fish was captured with gill nets of various mesh sizes. The helminth was fixed, prepared and mounted according to specific techniques for each group (Eiras *et al.*, 2000).

Data were analyzed according to the statistical tests: Student's "t" test to verify if standard length of male and female hosts were similar; Pearson's "r" coefficient of correlation was used as an indicator to the relationship between the hosts' standard length and the prevalence of parasites, with previous transformation of the prevalence data ( $\text{arc sine } \sqrt{x}$ ) (Zar, 1996); Spearman's ranks coefficient correlation "rs" is to determine possible correlation between standard length of host and intensity of parasite infection and also to verify correlation between parasites abundance and hosts relative condition factor (Kn); Mann-Whitney's "U" test is to verify whether there is any influence of host's sex on the infection intensity of parasite (Siegel, 1975); Fisher's "F" test is to verify possible effects of host's sex on infection prevalence of parasite (Zar, 1996). The Kruskal-Wallis's test was used to verify the possible differences in the abundance of parasitism among the reservoirs and the seasons of the year (Zar, 1996). In order to perform the seasonal analysis, the hosts were collected from March 2002 to December 2002.

The statistical analysis was applied to the species of parasites with prevalence superior to 10% and the results were considered significant when  $p < 0.05$ . The ecological terms were considered by Bush *et al.* (1997).

## Results

A total of 124 specimens of *C. paleatus* were collected. From these, 97 were parasitized by nematode *Procamallanus (Spirocamallanus) pinto*, identified according to Moravec, (1998). 198 parasites in the total represented a prevalence of 78.23% and mean intensity of infection of 2.04. Moreover, 2 specimens of digenean *Allocreadiidae* were found, with a prevalence of 1.61% and mean intensity of infection of 1.

The standard length of the fish collected varied from 3.9 to 6.2 cm (mean = 5.01) in males and from 4.3 to 5.8 cm (5.0) in females. The Student test "t", verified no significant difference between standard length and the host sex ( $t=0.15$ ,  $p=0.88$ ).

Of the 56 male hosts analyzed, 37 were parasitized, presenting a prevalence of 66.07% and mean intensity of infection of 2.41. For the females ( $N=36$ ), 88.89% of prevalence, and mean intensity of 1.97 of infection. In both sexes, the prevalence and mean intensity of

infection were similar, ( $U=983$ ,  $p=0.84$ ), and test "F" of Fisher ( $F=1.53$ ,  $p=0.43$ ).

When correlating the standard length and the prevalence of infection, data showed that these parameters are not correlated ( $r=0.004$ ,  $p=0.99$ ).

No correlation was found between standard length and abundance of parasitism ( $r_s=0.10$ ,  $p=0.25$ ).

When comparing the five reservoirs, the Kruskal-Wallis test demonstrated no significant difference in the parasitism levels ( $H=6.4$ ,  $p=0.1$ ) (Table 1). Moreover, no correlation between the condition factor and the parasitism abundance was verified ( $r_s = -0.10$ ,  $p=0.25$ ).

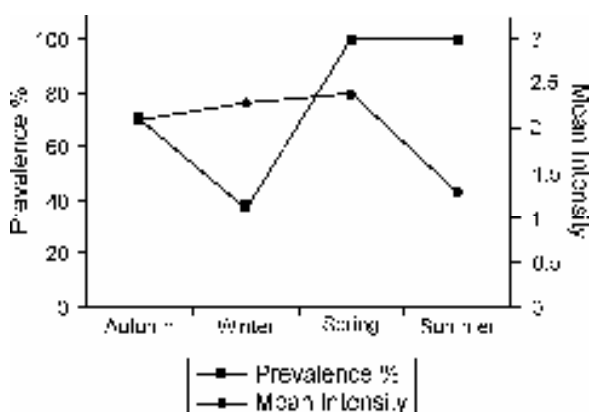
**Table 1.** Values of Prevalence (P%) and Mean Intensity of Infection (MII) of *Procamallanus (Spirocamallanus) pinto* in *Corydoras paleatus* collected between July 2001 and December 2002, in five reservoirs of the State of the Paraná. (Nef= number of examined fishes)

Reservoirs	Nef	P %	MI
Iraí	61	68.85	2.1
Segredo	27	85.19	2.26
Gov. Parigot de Souza	18	77.78	1.64
Passaúna	10	100	2
Curucaca	8	100	1.88

Comparing the prevalence of parasitism in the four seasons of the year (Table 2), all hosts in spring and summer were parasitized. There was no significant difference in the mean intensity (Figure 1).

**Table 2.** Seasonal variation of Prevalence (P%) and Mean Intensity of Infection (MI) for *Procamallanus (Spirocamallanus) pinto* in *Corydoras paleatus* collected between March 2002 and December 2002, (Nef= number of examined fishes)

Station of the year	Nef	P %	MI
Autumn	72	70.83	2.10
Winter	8	37.50	2.30
Spring	9	100	2.40
Summer	7	100	1.30



**Figure 1.** Values of prevalence and mean intensity of infection for *Procamallanus (Spirocamallanus) pinto* in *Corydoras paleatus* in the four seasons along the year, collected between March 2001 and December 2002.

## Discussion

According to Dogiel (1961), the fish parasitic fauna reservoir formation takes ten years or more to reach stability. That is the reason why studies in this area are important. One of the possible alterations that can occur is related to the alimentary habit, since this is one of the excellent factors that explains the composition of the endoparasites species, as the majority of them is transmitted by food (Pavanelli *et al.*, 1997).

According to Esch *et al.* (1988) the hosts' sex is a determinant and influential factor in the parasitism levels. For endoparasites, this difference can be explained by the differences in the diet, behavior and physiology, mainly during the reproduction, between males and females (Fernandez, 1985). However, in the present work, data showed that the females' prevalence was slightly higher than the males'. In any case, this difference was not significant. The females' susceptibility in some species can be related to reproductive stress, which probably does not occur in this case.

According to Dogiel (1961), there is a relation between the host's age and the level of parasitism. The older the age, the bigger the corporal size, and thus, this host has a bigger area to adapt to the parasitic community. Other factors can also explain this relation, such as changes in the habitat (Wootton, 1990), and alimentary diet (Nikolski, 1963) and in the proper immunity to the parasitism (Bauer, 1961).

A great number of studies describe positive correlation between the standard length of the host and parasitism levels (Takemoto and Pavanelli, 1994; Machado *et al.*, 1996). However, in the *C. paleatus* the parasitism level is not modified when it comes to its age. According to the applied tests that had correlated the length standard of this host to the prevalence and mean intensity of infection, these parameters are not associated.

This result could have occurred due to low amplitude of the size of the collected hosts and because the size of the parasite (males = 2.23-4.20 mm; females = 18.90-26.05 mm long) is relatively greater in relation to the size of the host (39-62 mm long), disabling the occurrence of high infestation.

In the comparative analysis of the parasitism level among the five reservoirs, values of similar prevalence and mean intensity were verified.

The analyzed reservoirs possess distinct characteristics, such as area, year of closing and topography. Oldest reservoirs present fish with higher level of parasitism, due to the environment being already stabilized and having great

probabilities of the organisms necessary for the cycle of the parasite to be present. The reservoir Governador Parigot de Souza, also called Capivari, is the oldest, closed in 1970, even though it was verified in a comparative analysis of the level of parasitism between the reservoirs that it shows levels of prevalence and mean intensity of infection similar to the other reservoirs. The reservoir Segredo was closed in 1992, and according to Dogiel (1961), it cannot be considered an old reservoir yet. The high value of mean intensity of infection found may be occurring, even though this is not an old reservoir, but because in this place, *P. (S.) pinto* finds favorable conditions to complete its life cycle and guarantees success in the infection.

According to Bauer (1961), the pathogenic activity of parasites necessarily affects host condition negatively. However, Moore (1987) suggests that even more pathogenic parasites can benefit from their hosts.

The results showed that *P. (S.) pinto* cannot cause damage to *C. paleatus*, because the weight difference between fish in the parasitic and non-parasitic state was not significant according to the relative condition factor. This could also have occurred due to low parasitism intensity.

In previous studies on the Upper Paraná river floodplain, Ranzani- Paiva *et al.* (2000) did not find significant differences in the relative condition factor between parasitized and unparasitized *Prochilodus lineatus* hosts.

In the comparative analysis between the parasitism prevalence and the annual seasons, data showed great values in spring and summer. This can be explained because in the summer, this host was probably in the reproduction period. In this period, the reproduction stress can favor the occurrence of parasitism (Suzuki and Agostinho, 1997).

No significant difference was verified for the mean intensity. But this also can be explained due to the great size of the nematode, that does not permit high intensity of parasitism.

## Conclusion

The results show no difference in the parasitism levels in different analyzed environments, since the values of prevalence and mean intensity were similar in the five reservoirs.

Moreover, there was no seasonal variation in the parasitism levels for the four seasons of the year.

Based on the analyzed parameters, according to the host's condition factor (Kn), nematoda *P. (S.) pinto* has a steady relation with *C. paleatus*.

## References

- BAUER, O.N. Parasitic diseases of cultured fishes and methods of their prevention and treatment. In: DOGIEL, V.A. et al. (Ed.). *Parasitology of fishes*. Translated by Z. Kabata. 1<sup>st</sup> ed. Edinburgh, London: Oliver and Boyd, 1961. Cap. 11, p. 265-298. Translation of Russian original title, published by Leningrad University Press, 1958.
- BURGESS, W.E. *An atlas of freshwater and marine catfishes: a preliminary survey of the Siluriformes*. Neptune City: T.F.H. Publications, 1989.
- BUSH, A.O. et al. Parasitology meets ecology on its own terms: Margolis et al. revisited. *J. Parasitol.*, Lawrence, v. 83, n. 4, p. 575-583, 1997.
- DOGIEL, V.A. Ecology of the parasites of freshwater fishes. In: Dogiel, V.A. et al. (Ed.). *Parasitology of fishes*. Translated by Z. Kabata. 1<sup>st</sup> ed. Edinburgh; London: Oliver and Boyd, 1961. Cap. 1, p. 1-47. Translation of Russian original title, published by Leningrad University Press, 1958.
- EIRAS, J.C. et al. *Métodos de estudio y técnicas laboratoriales en parasitología de peces*. Zaragoza: Editorial Acribia, 2000.
- ESCH, G.W. et al. Patterns in helminth communities in freshwater fish in Great Britain: Alternative strategies for colonization. *Parasitology*, Cambridge, v. 96, p. 519-532, 1988.
- FERNANDEZ, J. Estudio parasitológico de *Meluccius australis* (Hutton, 1872) (Pisces: Merlucciidae): Aspectos sistemáticos, estadísticos y zoogeográficos. *Bol. Soc. Biol. Concepcion*, Concepción, v. 56, p. 31-41, 1985.
- MACHADO, M.H. et al. Structure and diversity of endoparasitic infracommunities and the trophic level of *Pseudoplatystoma corruscans* and *Schizodon borelli* (Osteichthyes) of high Paraná River. *Mem. Inst. Oswaldo Cruz*, Rio de Janeiro, v. 97, n. 4, p. 441-444, 1996.
- MOORE, J. Some roles of parasitic helminths in trophic interactions. A view from North America. *Rev. Chil. Hist. Nat.*, Santiago, v. 60, p. 159-179, 1987.
- MORAVEC, F. *Nematodes of freshwater fishes of the neotropical region*. Czech Republic, České Budějovice: Academia, 1998.
- NIKOLSKI, G.U. *The ecology of fishes*. London: Academic Press, 1963.
- PAVANELLI, G.C. et al. Fauna helmintica de peixes do rio Paraná, região de Porto Rico, Paraná. In: VAZZOLER, A.E.A. de M. et al. (Ed.). *A planície de inundação do alto Rio Paraná: aspectos físicos, biológicos e socioeconômicos*. Maringá: Eduem, 1997. Cap. II-10, p. 307-329.
- RANZANI-PAIVA M.J.T. et al. Hematological characteristics and relative condition factor (Kn) associated with parasitism in *Schizodon borelli* (Osteichthyes, anostomidae) and *Prochilodus lineatus* (Osteichthyes, Prochilodontidae) from Paraná River, Porto Rico region, Paraná, Brazil. *Acta Scientiarum*, Maringá, v. 22, p. 515-521, 2000.
- SIEGEL, S. *Estatística não paramétrica (para as ciências do comportamento)*. São Paulo: McGraw-Hill do Brasil, 1975.
- SUZUKI, H.I.; AGOSTINHO, A.A. Reprodução de peixes do reservatório de Segredo. In: AGOSTINHO, A.A.; GOMES, L.C. (Ed.). *Reservatório de Segredo: bases ecológicas para o manejo*. Maringá: Eduem, 1997. Cap. 9, p. 163-182.
- TAKEMOTO, R.M.; PAVANELLI, G.C. Ecological aspects of Proteocephalidean cestodes parasites of *Paulicea luetkeni* (Steindachner) (Osteichthyes: Pimelodidae) from Paraná River, Brazil. *Rev. Unimar*, Maringá, v. 16, n. 3, p. 17-26, 1994.
- THOMAZ, S.M. et al. Limnologia do reservatório de Segredo: padrões de variação espacial e temporal. In: AGOSTINHO, A.A.; GOMES, L.C. (Ed.). *Reservatório de Segredo: bases ecológicas para o manejo*. Maringá: Eduem, 1997. cap. 2, p. 19-37.
- WOOTON, R.J. *Ecology of teleosts fishes*. London: Chapman and Hall, 1990.
- ZAR, J.H. *Biostatistical Analysis*. 2. Ed. New Jersey: Prentice-Hall, 1996.

Received on August 16, 2005.

Accepted on September 21, 2005.