

**ORIGINAL ARTICLE / ARTÍCULO ORIGINAL****LERNAEOSIS IN *CNESTERODON DECEMMACULATUS* (CYPRINODONTIFORMES, POECILIDAE) AND OBSERVATIONS ON THE LETHAL EFFECT IN SMALL SIZED SPECIES OF HOSTS****LERNEOSIS EN *CNESTERODON DECEMMACULATUS* (CYPRINODONTIFORMES, POECILIDAE) Y OBSERVACIONES SOBRE EL EFECTO LETAL SOBRE ESPECIES HOSPEDADORAS DE PEQUEÑA TALLA**

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**ABSTRACT**

*Lernaea cyprinacea* is one of the best known species of the genus, with a wide global distribution, that causes lesions on the skin of fresh water fish fostering secondary infections. The aim of the present study was to record the presence of *L. cyprinacea* on *Cnesterodon decemmaculatus* and to study the lethal effect of this copepod on a host species of small size. The specimens were parasitized by post-metamorphic stages of females. The ulcerous lesions rapidly became contaminated with dense *Saprolegnia* sp. mycelia and they were associated with *Epistylis* sp., a ciliated peritrichid. Histological examination showed invasion of the visceral mass which exerted mechanical compression on the muscle, kidney, spleen and gonad. Fibrous encapsulation and inflammatory infiltrate were observed as a response. The intense visceral invasion provoked in *C. decemmaculatus* in the reproductive stages makes the fish potentially susceptible to lethal consequences, with consequent damage at the population level.

**Keywords:** *Lernaea cyprinacea* – *Cnesterodon decemmaculatus* – Fish pathology**RESUMEN**

*Lernaea cyprinacea* es una de las especies mejor conocidas del género, con una distribución mundial, que causa lesiones en la piel de los peces de agua dulce promoviendo infecciones secundarias. El objetivo del presente estudio fue registrar a *L. cyprinacea* en *Cnesterodon decemmaculatus* y estudiar el efecto letal de éste copépodo en una especie de hospedador de pequeña talla. Los especímenes estuvieron parasitados por hembras post-metamórficas. Las lesiones ulcerativas rápidamente se contaminaron con densos micelios de *Saprolegnia* sp. asociados con el ciliado peritrichido *Epistylis* sp. El examen histológico mostró invasión de la masa visceral el cual ejerció compresión mecánica sobre el músculo, el riñón, el bazo y las gónadas. Se observó una respuesta de encapsulación fibrosa e infiltrado inflamatorio. La intensa invasión visceral de *C. decemmaculatus* en estados reproductivos torna al pez potencialmente susceptible a consecuencias letales con el perjuicio consecutivo a nivel poblacional.

**Palabras clave:** *Lernaea cyprinacea* - *Cnesterodon decemmaculatus* - Patología de peces

## INTRODUCTION

*Cnesterodon decemmaculatus*, Jenyns, 1842, is one of the small species of the Argentine ichthyofauna. They live in shallow pools and streams from the south of Brazil to Río Negro (Lucinda, 2005). Until now it was not known as a host to *Lernaea cyprinacea* Linnaeus, 1758 (Copepoda, Cyclopoida), a species introduced accidentally in South America via the Cyprinids (Piasecki *et al.*, 2004). Records of anchor worms in Argentina are occasional (Paggi, 1972, 1976; Ortubay *et al.*, 1994; Roux *et al.*, 2000; Vanotti and Tanzola, 2005, Mancini *et al.*, 2006, 2008; Plaul *et al.*, 2010). *Lernaea cyprinacea* is one of the best known species in the genus, with the widest global distribution, that causes skin lesions on fresh water fish. Cases have been reported of secondary infections in unsuitable water conditions (Carnevia & Speranza, 2003; Mancini *et al.*, 2008, Bednarska *et al.*, 2009). Among the lesions caused by different species of *Lernaea* the following are mentioned: disruption of the dermis and epidermis, hyperplasia, acute and chronic inflammation, granuloma formation, fibrotic encapsulation, ulceration and necrosis, and the following cell types of the immune response are observed: neutrophils, lymphocytes and eosinophilic granule cells (ECGs). Fish mortality appears to be related to the size of the fish (Sharif & Roberts, 1989; Paperna, 1996; Mancini *et al.*, 2008).

The objective of the present study is to record the presence of *L. cyprinacea* in *C. decemmaculatus* and to study the lethal effect of this copepod on a small sized host species. They have not experimented with live animals, not affected population parameters of the host or provoked impacts on the environment and human health or animal.

## MATERIALS AND METHOD

One hundred and eighteen adults of *Cnesterodon decemmaculatus* (62 females and 56 males) from an urban lake in Bahía Blanca, Argentina (38°41'S; 62°15'W) were examined during March and April 2012. They were between 23-34 mm (Mean= 28; Standard deviation= 3.02) in size and had a total weight between 0.227-0.277 g (Mean= 0.250; Standard deviation= 0.018). A hand net was used to catch the fish which were then kept in an aerated aquarium at 18-20°C and fed with fish food. The external areas of the body examined were: skin, eyes and fins. The parasitized fish were fixed in 10% formalin, transverse sections in series (5 µm thick) were made of the whole body and stained with hematoxylin and eosin (HE) and Masson trichrome.

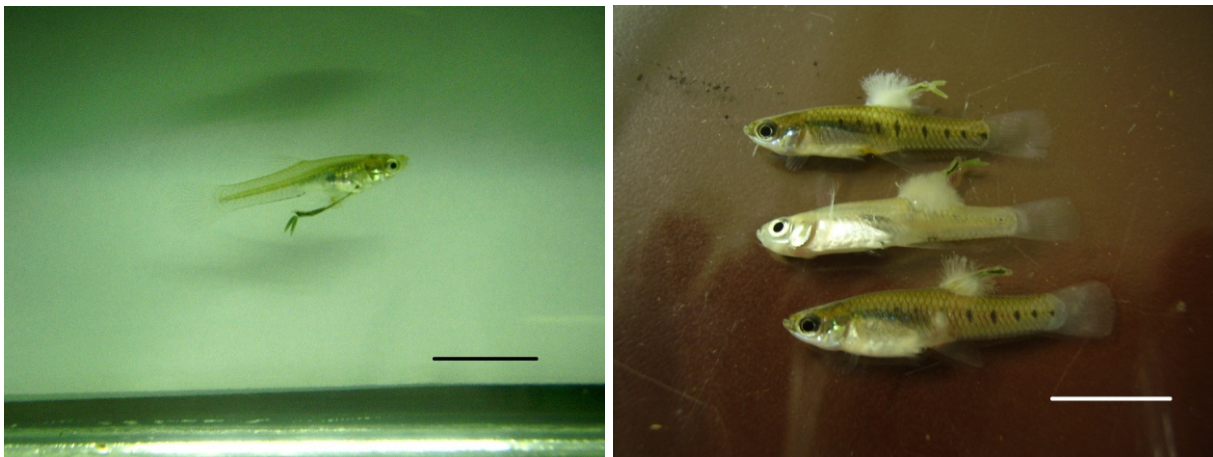
## RESULTS

The specimens were parasitized by post-metamorphic stages of females of *L. cyprinacea*. They were identified by morphological features such as the structure of antennae, maxillae, maxillipeds and thoracopods. The site of anchorage of the copepods varied between dorsal (8/19), anal (9/19) and left pectoral fins (2/19) (Figures 1a and 1b). The prevalence of infection was 19.1% and the mean intensity 1. Ulcerative lesions were rapidly contaminated with dense mycelia of *Saprolegnia* sp. that invaded the external integument and the scale sack. Dense colonies of *Epistylis* sp (ciliated peritrichids) and *Gomphonema* spp (diatoms) were fixed to the external segment of the neck of *L. cyprinacea*.

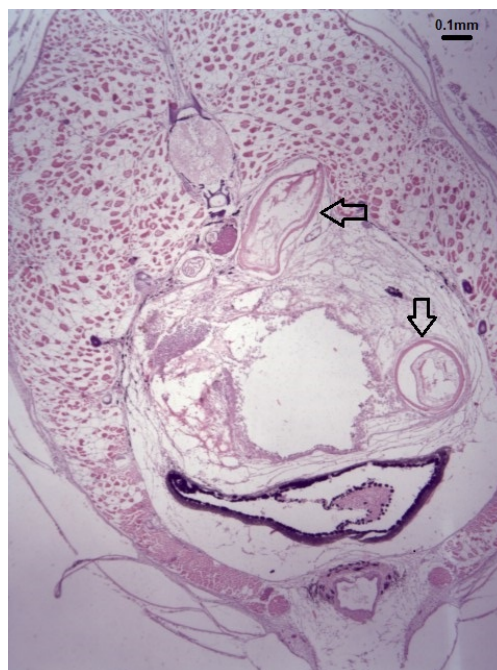
The histological examination showed that the whole visceral mass of the fish was invaded. Figures 2 illustrate the anchor apparatus

(arrows) of the parasite invading internal organs and exerting mechanical compression on the muscle and kidney. The fish developed a strong fibrotic response around the horns of the anchor. Figure 3 shows infiltrated inflammatory tissue around the parasite, severe compressive atrophy in the spleen. No

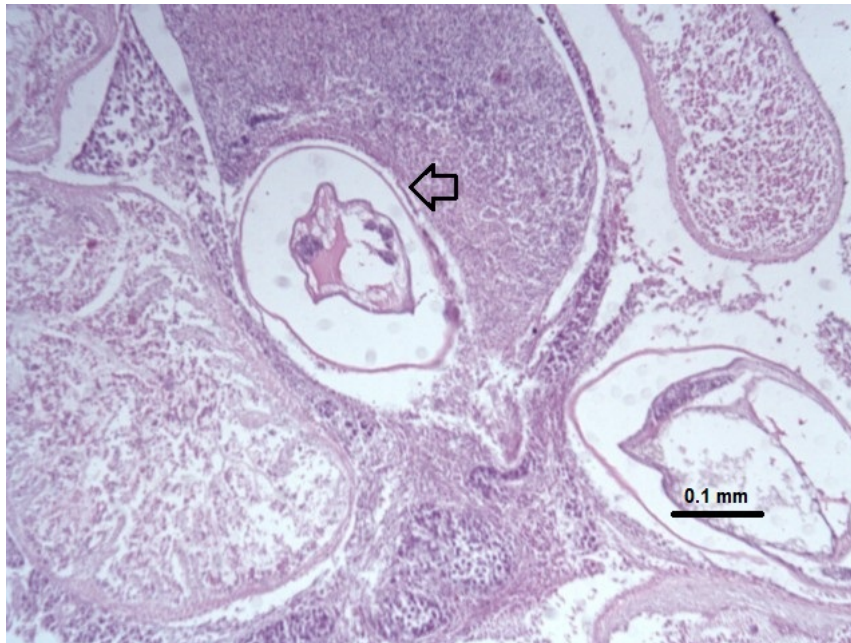
congestion or hemorrhagic areas in the visceral mass were observed. All the parasitized fish became emaciated and died at the end of three weeks. In contrast, there was 100% survival in another fish group without parasites maintained in the same conditions.



**Figure 1.** *Lernaea cyprinacea* (*in situ*) parasitising *Cnesterodon decemmaculatus*. a) Ventral location of anchorage; b) Dorsal fin affected, observed the heavy colonization by micelia of *Saprolegnia* sp., *Epystilis* sp. and *Gomphonema* sp. (Scale-bar= 10mm)



**Figure 2.** Transverse section of *Cnesterodon decemmaculatus* showing two sections (arrows) of the anchorage apparatus (horns) exerting mechanical compression on the muscle and kidney and a strong fibrosis around the visceral mass (Scale-bar= 0.1mm)



**Figure 3.** Transverse section of *Cnesterodon decemmaculatus* showing severe compressive atrophy in the spleen (arrow) (Scale-bar=0.1mm)

## DISCUSSION

*Lernaea cyprinacea* is a cosmopolitan species and one of the freshwater fish ectoparasites with lower host specificity. To the present, it has been recorded in 16 fish species in Argentina (Mancini *et al.*, 2008; Plaul *et al.*, 2010). This is the first record of *L. cyprinacea* in *C. decemmaculatus*. All parasitic females were ripped, coincident with the season of previous records in the literature (end of summer). In respect to the site of location on the host, the following points of insertion were reported in the literature: the base of the dorsal and pectoral fins and the middle part of the body (in *Odontesthes bonariensis* (Valenciennes, 1835)), the caudal peduncle (in *Rhamdia quelen* (Quoy & Gaimard, 1824)) or without any preferred site in *Oligosarcus jenynsii* (Günther, 1864) (Mancini *et al.*, 2008). In the present study the invaded zones were the base of the dorsal, anal and left pectoral fins. Only one copepod was found per

fish, which appears to be the maximum permitted number considering the body mass ratio between parasite and host.

El-Mansy (2009) showed that specimens of *Carassius auratus* Linnaeus, 1758 infected by *Lernaea* were stressed, exhausted, lost scales and stopped feeding. They showed oedema in the anchorage point, hemorrhage, fibrotic reaction around the parasite, leukocyte infiltration, necrosis and ulcerative areas especially on the base of the fins. There are numerous reports of the presence of eosinophilic granular cells (EGCs), but it is still not clear what role they play in the inflammatory processes (Sharif & Roberts, 1989; Silva-Souza *et al.*, 2000; Wojciech *et al.*, 2004). In the present study, mononuclear infiltrates predominated around the parasite. Essa *et al.* (2003) demonstrated the deleterious effect of increased cortisol levels in the grass carp, *Ctenopharyngodon idella* Steindachner, 1866 parasitized by *L. cyprinacea*.

Sometimes infected fish were noted scratching on the walls of the tank (Sharif & Roberts, 1989). In the hosts studied in captivity a progressive loss of condition and positive response to feeding was observed. After three weeks 100% lethality was recorded compared to another group kept without parasites.

Considering the parasitic prevalence (P) and intensities (I) documented for Argentine fish, the estimates in this study can be classified as moderated (P=19%; I= 1) compared to 53.6% in *O. bonariensis*; 80.9% in *O. jenynsii* and 100% in *Cyprinus carpio*, among others. Paperna (1996) indicated that lernaecosis in fish smaller than 40 mm is lethal. The heavy invasion in the visceral mass of *C. decemmaculatus* makes the fish potentially susceptible of suffering lethal consequences in the reproductive stage, with consequent negative effect at population level, considering that the standard length recorded for this species varies between 38 mm (Ringuelet *et al.*, 1967), and 35 mm (males) and 45 mm (females) (Lucinda, 2003).

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#### BIBLIOGRAPHIC REFERENCES

- Bednarska, M, Bednarski, M, Soltisyak, Z & Polechonski, R. 2009. *Invasion of Lernaea cyprinacea in rainbow trout (Onchorhynchus mykiss)*. Acta Scientiarum Polonorum., Medicina Veterinaria, vol. 8, pp.27-32.
- Carnevia, D & Speranza, G. 2003. *First report of L. cyprinacea L., 1758 in Uruguay introduced by goldfish C. auratus (L., 1758) and affecting axolotl Ambystoma mexicanum*. Bulletin of the European Association of Fish Pathologists, vol. 23, pp.255-256.
- El-Mansy A. 2009. *On the occurrence of adult females of Lernaea species (Crustacea: Copepoda) parasitic on gold fish Carassius auratus (Linnaeus) in some commercial aquaria in Egypt*. Egypt Journal of Aquatic Biology and Fisheries, vol. 13, pp. 7-36.
- Essa, M, Abd El-Galil, M, Mousa, W & Ibrahim S. 2003. *Verification of the deleterious effects of Lernaecosis on the health of grass carp (Ctenopharyngodon idella)*. Egypt Journal of Aquatic Biology and Fisheries, vol. 7, pp. 241-261.
- Lucinda, 2003. *Poeciliidae (Livebearers)*. p. 555-581. In R.E. Reis, S.O. Kullander and C.J. Ferraris, Jr. (eds.) *Checklist of the Freshwater Fishes of South and Central America*. Porto Alegre: EDIPUCRS, Brazil.
- Lucinda P. 2005. *Systemmatics of genus Cnesterodon Garma, 1895 (Cyprinodontiformes: Poeciliidae: Poeciliinae)*. Neotropical Ichthyology, vol. 3: pp.259-270.
- Mancini, M, Rodríguez, C, Prosperi, C, Salinas, V & Bucco, C. 2006. *Main diseases of pejerrey (Odontesthes bonariensis) in central Argentina*. Pesquisa Veterinaria Brasileira, vol. 26, pp. 205-210.
- Mancini, M, Rodríguez, C, Ortiz, M, Salinas, V & Tanzola, R. 2008. *Lernaecosis en peces silvestres y cultivados del Centro de Argentina*. Biología Acuática, vol. 24, pp. 33-41.
- Ortubay, S, Semenas, L, Ubeda, C, Quagliotto, A & Viozzi, G. 1994. *Catálogo de peces dulceacuícolas de la Patagonia Argentina y sus parásitos metazoos*. Dirección de Pesca, Subsecretaría de Recursos Naturales. Río Negro, 108 pp.
- Paggi, J. 1972. *Contribución al conocimiento de los Lernaeidae (Crustacea,*

- Copepoda*) de Argentina. *Lernaea argentinensis* sp. nov. y *Taurocheros salminisii* Brian 1924, parásitos de peces del río Paraná. Acta Zoológica Lilloana, vol.29, pp. 35-46.
- Paggi, J. 1976. Una nueva especie de *Copepodo* *Lerneido*, *Taurocheros tarangophilus* sp. nov., parásita de *Hoplias malabaricus* (Bloch, 1974) hallada en el río Paraná. Physis, vol. 35, pp. 113-119.
- Paperna, I. 1996. Parasites, infections and diseases of fishes in Africa. An Update. CIFA Technical Paper 31. FAO. Rome. 220 pp.
- Piasecki, W, Goodwin, A, Eiras, J & Nowak, B. 2004. Importance of *Copepoda* in freshwater Aquaculture. Zoological Studies, vol. 43, pp. 193-205.
- Paul, S, García Romero, N & Barbeito, C. 2010. Distribution of the exotic parasite, *Lernaea cyprinacea* (copepoda, *Lernaeidae*) in Argentina. Bulletin of the European Association of Fish Pathologists, vol. 30, pp. 65-73.
- Ringuelet, RA, Aramburu, RH & Aramburu, AA de. 1967. Los peces argentinos de agua dulce. Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, La Plata, Argentina, 602 pp.
- Roux, J, Tocalino, P, González, A, Sánchez, S & Bechara, J. 2000. Parásitos externos de peces de importancia comercial y/o deportiva del río Paraná Superior (tramo Ituzaingo – Ita Ibate, Corrientes, Argentina). Comunicaciones Científicas y Tecnológicas. Universidad Nacional del Nordeste, Corrientes, 3 pp.
- Silva-Souza, A, Almeida, S & Machado P. 2000. Effect of the infestation by *Lernaea cyprinacea* Linnaeus, 1758 (*Copepoda*, *Lernaeidae*) on the leucocytes of *Schizodon intermedium* Garavello & Britski, 1990 (*Osteichthyes*, *Anostomidae*). Revista Brasileira de Biología, vol. 60, pp. 217-220.
- Sharif, M & Roberts, R. 1989. The experimental histopathology of *Lernaea polymorpha* Yu, 1938 infection in naïve *Aristichthys nobilis* (Richardson) and a comparison with lesion in naturally infected clinically resistant fish. Journal of Fish Diseases, vol. 12, pp.405-414.
- Vanotti, M & Tanzola R. 2005. Relación entre la carga parasitaria total y algunos parámetros hematológicos de *Rhamdia sapo* Val. (Pisces) en condiciones naturales. Biología Acuática, vol. 22, pp. 249-258.
- Wojciech, P, Goodwin, A & Eiras, J. 2004. Importance of *Copepoda* in fresh water Aquaculture. Zoological Studies, vol. 43, pp. 193-205.

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