

Metazoan parasites of the channel catfish (*Ictalurus punctatus*) from three dams in Nuevo Leon, Mexico

Metazoarios parásitos del bagre de canal (*Ictalurus punctatus*) de tres presas en Nuevo León, México

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ABSTRACT

The freshwater channel catfish (*Ictalurus punctatus*, Rafinesque, 1818) is one of the world-wide highlight species in aquaculture. Despite the growing presence of this fish in the farming industry, its parasitic fauna is rarely studied in Mexico. This survey was designed to provide insight into the occurrence and abundance of parasitic fauna of *I. punctatus* and to contribute to the national inventory of parasites of this fish. This study was performed at the following three dams in the state of Nuevo Leon, Mexico: Cerro Prieto, Rodrigo Gomez, and El Cuchillo-Solidaridad. Seven helminths and 1 copepod species were recorded from the 24 *I. punctatus* collected. This record consists of a total of 4,687 parasites, of which 108 were endoparasites and 4,579 ectoparasites. Our findings demonstrate a great diversity of helminth parasites, including *Ligictaluridus floridanus*, and *Corallobothrium fimbriatum*, and new locality records for *Megalogonia ictaluri*, *Centrocestus formosanus*, *Diplostomum (Austrodiplostomum) compactum*, *Spiroxys* sp., the copepod *Ergasilus cerastes*, and a new host and distribution record was reported for *Spinitectus tabascoensis*, originally described from *I. furcatus* from Tabasco, southern Mexico.

Key words: Copepod, helminth parasites, *Ictalurus*.

RESUMEN

El bagre de canal (*Ictalurus punctatus*) es una de las especies que destacan a nivel mundial en la acuicultura. Aunque la presencia de esta especie es cada vez mayor en la industria pesquera, su fauna parasitaria en México ha recibido escasa atención. Esta investigación tiene como objetivos obtener información sobre la prevalencia y abundancia de la fauna parasitaria de *I. punctatus* y contribuir al inventario nacional de los parásitos de este hospedero. El estudio se realizó en tres presas del estado de Nuevo León: Cerro Prieto, Rodrigo Gómez y El Cuchillo-Solidaridad. Fueron registradas siete especies de helmintos y una especie de copépodo de 24 *I. punctatus*. Los resultados obtenidos consisten en un total de 4,687 parásitos, de los cuales 108 fueron endoparásitos y 4,579 ectoparásitos. Los resultados demuestran una gran diversidad de helmintos parásitos, incluyendo a *Ligictaluridus floridanus*, *Corallobothrium fimbriatum* y un nuevo registro de localidad para *Megalogonia ictaluri*, *Centrocestus formosanus*, *Diplostomum (Austrodiplostomum) compactum*, *Spiroxys* sp. y el copepodo *Ergasilus cerastes*, así como un nuevo registro de hospedero y localidad para *Spinitectus tabascoensis*, originalmente descrito en *Ictalurus furcatus* en Tabasco al sur de México.

Palabras clave: Copépodos, helmintos parásitos, *Ictalurus*.

INTRODUCTION

Channel catfish (*Ictalurus punctatus* Rafinesque, 1818) are native to the flowing waters in the temperate environments of North America, including southern Canada and northern Mexico (FAO, 2012). In northern Mexico, channel catfish are found in the Nuevo Leon and Tamaulipas states. Freshwater channel catfish is one of the most common species cultured in Mexican aquaculture. Its production has increased, and it accounts for 60.6% of the national production from fisheries. The channel catfish was translocate in 1976 to the most central and southernmost states of the country (CONAPESCA, 2010). Despite its growing presence in the farming industry, information concerning helminth parasites associated with this species in Mexico is scarce (Galaviz-Silva *et al.*, 1990; Pérez-Ponce de León & Choudhury, 2002; Salgado-Maldonado, 2006; Rosas-Valdez & Pérez-Ponce de León, 2008). The present work aimed to characterize the prevalence and abundance of the parasitic fauna of wild channel catfish collected at three different reservoirs in Nuevo Leon, Mexico.

MATERIAL AND METHODS

The state of Nuevo Leon is located in northeast Mexico. It has three principal dams that are used primarily for water capture and storage, commercial sport fishing and ecotourism. Rodrigo Gomez (known as "La Boca", 25°24' N, 99°14' W) and El Cuchillo-Solidaridad (25°38' N, 99°14' W) are located in the municipalities of Santiago and China, respectively. Both dams were constructed on the main stream of the San Juan River in the Grand River hydrological region. The Cerro Prieto reservoir (Linares municipality) has two tributaries, the Hualahuises and Pablillo rivers, which serve as the main sources of inflow into the reservoir, and the reservoir is located in the San Fernando-Soto La Marina hydrological region (Fig. 1). The climate of the reservoirs is arid to semi-arid, and it contains vegetation and wildlife that include Taumalipan scrub and chaparral desert ecosystems (INEGI, 2012).

Freshwater channel catfish (9 from Cerro Prieto, 8 from Rodrigo Gomez, and 7 from El Cuchillo-Solidaridad) were obtained from local fishermen from November 2009 to February 2010 and transported on ice (Guidelli *et al.*, 2011; Kritsky *et al.*, 2011). At the laboratory, the external surfaces (skin and fins) were examined for ectoparasites. Then, the gills were excised, and the soft tissue and mucosa were scraped off with forceps to detect copepods and monogeneans using a stereo dissecting microscope. The internal organs, including the heart, liver, intestines, and stomach, were separated and examined for metazoan parasites under a stereo dissecting microscope and compound microscope according to standard parasitological techniques (Vidal-Martínez *et al.*, 2002). Live parasites were killed by immersion in hot fixatives (4% formalin). Unflattened monogeneans were mounted unstained in Gray and Wess medium to study the sclerotized structures; other flattened specimens were stained with Gomori's trichrome and

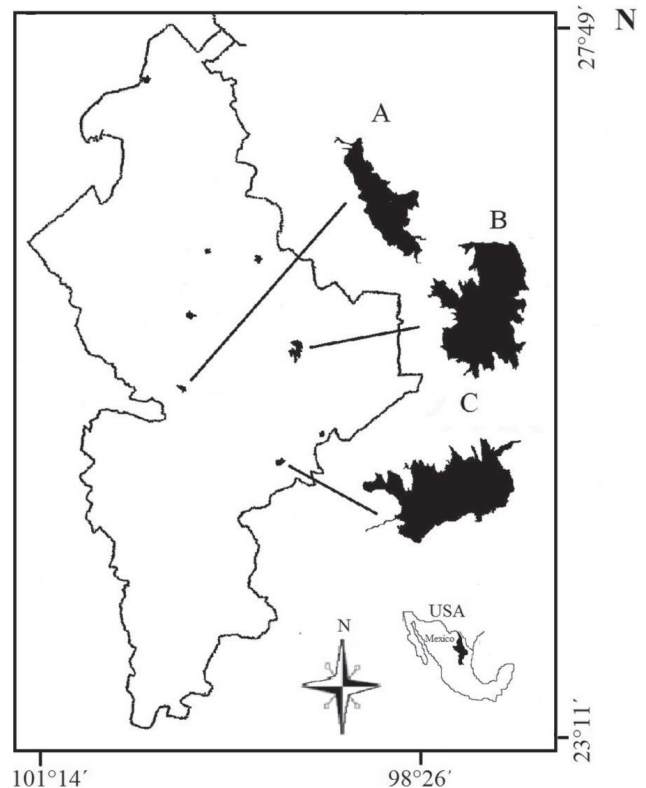


Figure 1. Map of Nuevo Leon state, showing sampling sites. A) Rodrigo Gómez. B) El Cuchillo-Solidaridad. C) Cerro Prieto dams.

mounted in synthetic resin (Entellan, Merk, Germany) to study the internal anatomy. Digeneans and cestodes were fixed by immersion into AFA (formalin-ethanol-acetic acid) for 24 h in either unflattened or flattened conditions. Subsequently, platyhelminths were stained in Van Cleave or Delafield's hematoxylin, dehydrated using a graded alcohol series, cleared in methyl salicylate, and mounted whole on slides. Nematodes were stored in 70% ethanol and examined after being cleared in lactophenol. Copepods were fixed in a 5% formalin solution, preserved in 70% ethanol and diaphanized with lactophenol. The copepods were identified according Roberts (1969), Amado and Rocha (2001), and Boxshall *et al.* (2002). Voucher specimens of each species have been deposited in the Colección de Parásitos de la Universidad Autónoma de Nuevo León (CP:UANL). Abundance was defined as the number of conspecific parasites living in (or on) any host, and prevalence was expressed as the percentage of channel catfish infected relative to the number examined in a sample, as defined in Bush *et al.* (1997).

RESULTS

In total, 8 species of parasites were obtained from channel catfish (3 larval and 5 adults), including 1 monogenean, 3 digeneans, 1 cestode, 2 nematodes, and 1 copepod. This record consists of a

total of 4,687 parasites, of which 108 were endoparasites, including *Megalogonia ictaluri* (Surber, 1928); *Centrocestus formosanus* (Nishigori, 1924); *Diplostomum (Austrodiplostomum) compactum* Lutz, 1928; *Corallobothrium fimbriatum* Essex, 1927; *Spinitectus tabascoensis* Essex, 1927; and *Spiroxys* sp. In this report, 4,579 ectoparasites were recorded, including *Ligictaluridus floridanus* Mueller, 1936; and the copepod *Ergasilus cerastes* Roberts, 1969 (Table 1).

DISCUSION

There are very few studies referring to *Ictalurus punctatus* parasites from Mexico, and this is the first study on *I. punctatus* parasite communities in Rodrigo Gómez, El Cuchillo-Solidaridad, and Cerro Prieto reservoirs. Although the present collection of channel catfish was small (only 7-9 specimens examined by locality), we observed that the monogenean *Ligictaluridus floridanus* was found in all three reservoirs and was the most prevalent (69%-100% for locality) and abundant (51.3-334.3, Table 1).

L. floridanus was previously reported on *I. punctatus* and *Cyprinus carpio* Linnaeus from three fish farms: Vicente Guerrero (Abasolo, Tamaulipas), Salinillas, (Anahuac, Nuevo Leon), and La Rosa (General Cepeda, Coahuila). However, the previously reported prevalence was lower than that reported in this study, which ranged from 14.9% to 38.3% (Galaviz-Silva et al., 1990). *L. floridanus* has also been reported on *Ictalurus furcatus* (Valenciennes) caught in Presa La Angostura, Chiapas (Pineda-López, 1985a).

The prevalence of Diplostomid metacercarie *Diplostomum (A.) compactum* in the three reservoirs was documented (14%-

89%). Previous reports have recorded this helminth on *Rhamdia guatemalensis* Günther from Oaxaca (Salgado-Maldonado, 2006); *I. furcatus* caught in Chiapas and Tabasco (Pineda-López, 1985b) and *I. punctatus* from Sonora (Hernández-Martínez, 1992). This is the first official report of this parasite in Nuevo Leon, Mexico.

M. ictaluri and *Spiroxys* sp. (larvae) have been reported on *I. punctatus* in Veracruz and Tamaulipas. *Centrocestus formosanus* was reported on *I. punctatus* in Hidalgo (Rosas-Valdez & Pérez Ponce de León, 2008), and Salgado-Maldonado et al. (1995, 2005) reported *C. formosanus* on several freshwater fish species from Oaxaca and Tabasco. However, this paper is the first to report the presence of *Megalogonia ictaluri*, *Spiroxys* sp., and *C. formosanus* (larvae) on *I. punctatus* in Nuevo Leon. In this work, the cestode *Corallobothrium fimbriatum* and the nematode *Spinitectus tabascoensis*, which have been widely recorded in Mexico (Moravec et al., 2009, 2010; Rosas-Valdez & Pérez Ponce de León, 2008; Salgado-Maldonado, 2006; Vidal-Martinez et al., 2002), were also found, but with a low to moderate prevalence (Table 1). *Spinitectus tabascoensis* was compared with the key species of *Spinitectus*, which parasitizes freshwater fish in Mexico (Moravec et al., 2010; Salgado-Maldonado, 2006), it was originally described from *I. furcatus* from Usumacinta River, Tabasco, southern Mexico (Moravec et al., 2002), and in the present report, it is considered as new host and distribution record for *I. punctatus* from Nuevo Leon, located at northeast of Mexico. Also, a new locality record was created for the *Ergasilus cerastes* observed in this study because only *E. versicolor* Wilson, 1911 and *E. davidi* Suárez-Morales & Santana-Piñeros, 2008 have been reported as part of the parasitic fauna of fish. The former was reported as

Table 1. Parasite list of *Ictalurus punctatus* from three reservoirs in Nuevo Leon, Mexico.

Parasite species	Structure were the parasite was found	CP:UANL	Prevalence (Abundance)		
			Cerro Prieto ¹ n = 9	Rodrigo Gómez ² n = 8	El Cuchillo-Solidaridad ³ n = 7
<i>Megalogonia ictaluri</i> (Surber, 1928)	Intestine	2016			14 (0.6)
<i>Centrocestus formosanus</i> (Nishigori, 1924)	Gills	2022			14 (0.7)
<i>Diplostomum (Austrodiplostomum) compactum</i> Lutz, 1928	Eyes	2011, 2012			
2013	89 (5.1)	75 (3.6)	14 (0.6)		
<i>Ligictaluridus floridanus</i> Mueller, 1936	Gills	2019, 2020			
2021	69 (51.3)	75 (217.8)	100 (334.3)		
<i>Corallobothrium fimbriatum</i> Essex, 1927	Intestine	2017, 2018	11 (0.4)		29 (0.3)
<i>Spinitectus tabascoensis</i> Essex, 1927	Intestine	2023	11 (0.6)		
<i>Spiroxys</i> sp.	Mesentery	2024			29 (1.3)
<i>Ergasilus cerastes</i> Roberts, 1969	Gills	2014, 2016	11 (1.2)	50 (3.0)	

n = number of fish examined. Prevalence is expressed in percent. CP:UANL- Colección de Parásitos de la Universidad Autónoma de Nuevo León. ¹November 2009, ²December 2009, and ³February 2010.

an ectoparasite of *Mugil cephalus* Linnaeus, which was collected in the Colorado River in Baja California (Valles-Ríos *et al.*, 2000), and of *I. punctatus* caught in Anahuac, Nuevo Leon, Mexico (Galaviz-Silva *et al.*, 1990). *E. davidi* has also been reported on the gills of yellow snapper *Lutjanus argentiventris* (Peters) and yellowfin snook *Centropomus robalito* Jordan and Gilbert, found in the Pacific coastal system of Chiapas, Mexico (Suárez-Morales & Santana-Piñeros, 2008). In the present study, the occurrence of *Ergasilus cerastes* was documented for the first time in Nuevo Leon, Mexico. The present study provides new data on species abundance and the prevalence of parasitic fauna on *Ictalurus punctatus* from Mexico, and it complements the checklist of previously reported parasites (Pérez-Ponce de León & Choudhury, 2002; Salgado-Maldonado, 2006; Rosas-Valdéz & Pérez-Ponce de León, 2008). Furthermore, these records contribute to the national inventory of parasites for this host. However, it is clear that further studies are necessary to develop a more accurate profile of the component community and the infracommunity parameters of the parasitic catfish fauna because catfish are an excellent host for this extraordinarily rich and diverse fauna.

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