J. Helminthol. Soc. Wash.
65(1), 1998 pp. 91–95

Research Note

Trematodes from Fishes of the Río Hondo River and Freshwater Lakes of Quintana Roo, Mexico

TOMÁŠ SCHOLZ[1] AND JOAQUÍN VARGAS-VÁZQUEZ

Centre for Investigation and Advanced Studies of the National Polytechnic Institute (CINVESTAV-IPN) Mérida, Carretera Antigua a Progreso Km 6, A.P. 73 "Cordemex," C.P. 97310 Mérida, Yucatán, México

ABSTRACT: Twenty-seven species of Digenea (9 adults and 19 metacercariae) were found in 44 fish (11 species) from the Río Hondo River and two freshwater lakes ("lagunas") in Quintana Roo, Mexico. *Cichlasoma meeki* and *Astyanax fasciatus* had the highest number of species (12 and 9, respectively), and there were no significant differences in the composition of digeneans reported from previous surveys of cenote fishes from the same area. Fauna of trematodes found appeared to be most similar to that of the Neotropical region.

KEY WORDS: Digenea, freshwater fish, Yucatan Peninsula, zoogeography, survey.

The Yucatan Peninsula is situated in the transitional area between Nearctic and Neotropical regions. It has only two rivers, the Río Champoton situated on its western boundary in the State of Campeche, and the Río Hondo, State of Quintana Roo, which forms the boundary between Mexico and Belize.

Although surveys of parasites of freshwater fish from cenotes have been carried out (Moravec et al., 1995a,b; Scholz et al., 1995a,b, 1996), there is no information on the parasites of fish in rivers and lakes ("lagunas").

In January and February 1995, fish from four localities in the State of Quintana Roo, Mexico, were examined for the presence of helminths: 1) Río Hondo river at the village of La Unión (17°55′N, 88°51′W; 26 January 1995), *Astyanax fasciatus* (Cuvier)—8 specimens examined (family Characidae), 1 *Cichlasoma meeki* (Brind) (Cichlidae); 2) Río Hondo river at the village of Ramonal (18°16′N, 88°38′W; 26 January 1995), 1 *Dorosoma* sp. (Clupeidae), 1 *A. fasciatus*, 2 *Arius felis* (L.) (Ariidae), 1 *Poecilia velifera* (Regan) (Poeciliidae), 4 *Cichlasoma aureum* (Günther); 7 *C. meeki* (Brind), 3 *C. octofasciatum* (Regan), 1 *C. synspilum* Hubbs; 3) Laguna Bacalar, a lake near the village of Bacalar (18°38′N; 88°25′W; 25 January 1995), 1 *A. felis*, 4 *Cichlasoma urophthalmus* (Günther), 1 *C. synspilum*; 4) Laguna Paiyegua, a lake near the village of Valle Hermoso (19°10′N; 88°30′W), 3 *Dorosoma* sp., 2 *A. fasciatus*, 1 *Rhamdia guatemalensis* (Günther) (Pimelodidae), 1 *C. meeki*, 1 *C. octofasciatum*, and 1 *C. urophthalmus*.

Voucher specimens were deposited in the helminthological collections of the Institute of Biology, National Autonomous University of Mexico (UNAM), Mexico City, Mexico (Nos. CNHE 2681, 2683, 2685-6, 2841, 2845-6), the Institute of Parasitology, České Budějovice, Czech Republic (Nos. D-311, 314–316, 321–327, 334, 335, 341, 345, and 349), and the U.S. National Parasite Collection, Beltville, Maryland (Nos. 85969–85971 and 86399).

Table 1 summarizes prevalence, intensity, site of infection, and localities of trematodes found. The present study, even though based on a fairly limited number of examined fish, revealed the presence of as many as 27 species (9 adult trematodes and 19 species of metacercariae). Of these species, only one, identifiable at least to generic level (*Pelaezia* sp.), has not been reported from Mexico (see Pérez-Ponce de León et al., 1996; Salgado-Maldonado et al., 1997). It is probable that metacercariae unidentifiable to the species level ("*Haplorchoides*" type and "?"Heterophyidae) belong to species hitherto not reported from Mexico as well. Nevertheless, much more data, including obtaining adult worms, are necessary for their precise identification.

[1] Corresponding author. Present address. Institute of Parasitology, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic.

Table 1. Survey of trematodes found in freshwater fish from Quintana Roo, Mexico.

Species	Site	Host	Locality, prevalence, and intensity of infection
Family Haploporidae Nicoll, 1914			
Saccocoelioides sogandaresi Lumsden, 1963	Intestine	*P. velifera*	Ramonal (1 fish infected of 1 examined; 8 trematodes)
Family Angiodyctyidae Looss, 1902			
Cichlasotrema ujati Pineda and Andrade, 1989	Intestine	*C. synspilum*	Bacalar (1/1; 1)
Family Calodistomidae Poche, 1926			
Prosthenhystera obesa (Diesing, 1850)	Gallbladder	*A. fasciatus*	La Unión (1/8; 1)
Family Homalometridae Cable and Hunninen, 1942			
Crassicutis cichlasomae Manter, 1936	Intestine	*C. aureum*	Ramonal (1/4; 4)
		C. meeki	Ramonal (2/7; mean intensity 3 [range, 2–3]), Paiyegua (1/1; 7)
		C. synspilum	Ramonal (1/1; 13), Bacalar (1/1; 29)
		C. urophthalmus	Bacalar (4/4; 13 [1–22])
Family Macroderoididae McMullen, 1937			
Magnivitellinum simplex Kloss, 1966	Intestine	*A. felis*	Ramonal (1/1; 1)
Family Acanthostomidae Poche, 1926			
Pelaezia (?) sp.	Intestine	*A. felis*	Bacalar (1/1; 12)
Family Cryptogonimidae Ward, 1917			
Oligogonotylus manteri Watson, 1976	Intestine	*C. octofasciatum*	Ramonal (1/3; 2)
		C. synspilum	Bacalar (1/1; 6)
		C. urophthalmus	Bacalar (3/4; 17 [8–31])
Family Derogenidae Lühe, 1910			
Genarchella astyanactis (Watson, 1976)	Stomach	*A. fasciatus*	La Unión (6/8; 2 [1–2])
Genarchella isabellae (Lamothe-Argumedo, 1977)	Stomach	*C. aureum*	Ramonal (1/4; 4)
		C. meeki	Ramonal (3/7; 14 [1–32])
		C. octofasciatum	Ramonal (2/3; 4 [1–6])
		C. urophthalmus	Bacalar (3/4; 5 [2–7])
METACERCARIAE			
Family Echinostomatidae Poche, 1926			
Echinochasmus leopoldinae Scholz, Ditrich, and Vargas-Vázquez, 1996	Gills	*C. synspilum*	Ramonal (1/1; 70)
Echinochasmus macrocaudatus Ditrich, Scholz, and Vargas-Vázquez, 1996	Gills	*A. fasciatus*	La Unión (1/8; 22)
Family Acanthostomidae Poche, 1926			
Pelaezia loossi (Pérez Vigueras, 1955)	Muscles, including muscles of gill arches	*C. meeki*	Ramonal (1/7; 1)
		C. octofasciatum	Ramonal (2/3; 1)
		C. synspilum	Bacalar (1/1; 1); Ramonal (1/1; 3)
		C. urophthalmus	Bacalar (1/4; 1)
Stunkardiella minima (Stunkard, 1938)	Scales	*P. velifera*	Ramonal (1/1; 265)
Atrophecaecum (?) *astorquii* (Watson, 1976)	Fins and scales, rarely muscles and eyes	*Dorosoma* sp.	Paiyegua (3/3; 79 [56–105])

Table 1. Continued.

Species	Site	Host	Locality, prevalence, and intensity of infection
		C. aureum	Ramonal (1/4; 11)
		C. meeki	La Unión (1/1; 1); Ramonal (6/7; 52 [3–27]); Paiyegua (1/1; 316)
		C. octofasciatum	Ramonal (1/3; 73)
		C. synspilum	Ramonal (2/2; 278 [2–756])
Family Heterophyidae Odhner, 1914			
Ascocotyle (Ascocotyle) tenuicollis Price, 1935	Heart	*A. fasciatus*	La Unión (5/8; 8 [7–10]); Ramonal (1/1; 16); Paiyegua (1/2; 3)
		C. urophthalmus	Bacalar (1/4; 1)
Ascocotyle (Ascocotyle) nunezae Scholz, Vargas-Vázquez, Vidal-Martínez, and Aguirre-Macedo, 1997	Gills	*C. aureum*	Ramonal (2/4; 34 [1–67])
		C. meeki	La Unión (1/1; 3); Ramonal (4/7; 23 [2–70]); Paiyegua (1/1; 15)
Ascocotyle (Phagicola) diminuta (Stunkard and Haviland, 1924)	Gills	*P. velifera*	Ramonal (1/1; 482)
Ascocotyle (Phagicola) nana Ransom, 1920	Mesentery, intestinal wall, liver, spleen, muscles	*A. fasciatus*	La Unión (4/8; 13 [1–20])
		P. velifera	Ramonal (1/1; 242)
		C. aureum	Ramonal (1/4; 12)
		C. meeki	Ramonal (4/7; 4 [1–6])
		C. octofasciatum	Ramonal (1/3; 15)
Family Cryptogonimidae Ward, 1917			
Oligogonotylus manteri Watson, 1976	Intestinal wall, gills, fins	*C. meeki*	Ramonal (2/7; 13 [2–23])
		C. octofasciatum	Ramonal (1/3; 86)
		C. synspilum	Bacalar (1/1; hundreds)
		C. urophthalmus	Bacalar (4/4; thousands); Paiyegua (1/1; thousands)
Cryptogonimidae gen. sp.	Eye (humor body), fins, gills, muscles of fins	*A. fasciatus*	La Unión (6/8; 8 [1–18])
		Dorosoma sp.	Ramonal (1/1; 72)
		C. meeki	Ramonal (1/7; 1)
Family Clinostomidae Lühe, 1901			
Clinostomum complanatum (Rudolphi, 1814)	Muscles	*P. velifera*	Ramonal (1/1; 1)
Family Diplostomidae Poirier, 1886			
Diplostomum (Austrodiplostomum) compactum (Lutz, 1928)	Eye (humor body)	*A. felis*	Ramonal (2/2; 12)
		C. meeki	Ramonal (2/7; 11 [1–21])
Posthodiplostomum minimum (MacCallum, 1921)	Muscles	*C. meeki*	Ramonal (2/7; 2)
		C. synspilum	Ramonal (1/1; 5)
Family Proterodiplostomidae Dubois, 1936			
Crocodilicola pseudostoma (Wilemoes-Suhm, 1870)	Mesentery and muscles	*R. guatemalensis*	Paiyegua (1/1; 4)
		C. aureum	Ramonal (1/4; 1)
Proterodiplostomidae gen. sp.	Muscles, rarely gills, swimbladder, or liver	*A. fasciatus*	Paiyegua (2/2; 6 [5–7])
		A. felis	Ramonal (1/2; 4)
		P. velifera	Ramonal (1/1; 4)
		C. aureum	Ramonal (1/4; 2)
		C. synspilum	Ramonal (1/1; 5)

Table 1. Continued.

Species	Site	Host	Locality, prevalence, and intensity of infection
Family Strigeidae Railliet, 1919			
Apharyngostrigea sp.	Mesentery	*A. fasciatus*	La Unión (1/8; 1)
		C. meeki	La Unión (1/1; 1); Ramonal (1/3; 1)
Trematoda gen. sp. 1 ("*Haplorchoides*" type)	Gills, fins, muscles	*C. aureum*	Ramonal (1/4; 5)
		C. meeki	Ramonal (4/7; 6 [1–19])
Trematoda gen. sp. 2 (? Heterophyidae)	Gills, fins, exceptionally eyes	*A. fasciatus*	La Unión (6/8; 47 [2–94])

The specimen identified as *Magnivitellinum simplex* found in *Arius felis* corresponded in its morphology to the species *M. simplex,* a trematode hitherto found only in the characid *Astyanax fasciatus* (Kloss, 1966; Jiménez-Guzmán, 1973; Scholz et al., 1995a). The finding of this trematode in the piscivorous catfish may be accidental because of predation of *A. fasciatus* by this fish host.

Acanthostomide trematodes found in *A. felis* were characterized by the presence of two intestinal caeca, opening posteriorly into the excretory system. On the basis of this feature, they fit well into the diagnosis of the genus *Pelaezia* (Lamothe-Argumedo and Ponciano-Rodríguez, 1986), which currently accommodates two species, *P. unami* (Pelaez and Cruz, 1953) and *P. loossi* (Pérez Vigueraz, 1955). Both species, however, differ from the present material by the number of circumoral spines (30 and 23, vs. 27).

Metacercariae of two proterodiplostomatid trematodes were found. They correspond to those designated as Proterodiplostomidae gen. sp. 1 and 2 by Scholz et al. (1995b). It is evident that the larvae found by these authors in *Rhamdia guatemalensis* belong to the species *Crocodilicola pseudostoma.* The larvae can be differentiated one from another on the basis of body size and shape and size of the ventral sucker, which is more than 2 times smaller in Proterodiplostomidae gen. sp. (Proterodiplostomidae gen. sp. 2 in Scholz et al., 1995b) (diameter, 66–69 μm) than in *C. pseudostoma* (157–171 μm).

Fish harboring the highest number of trematode species were *Cichlasoma meeki* (12 species, including 10 metacercariae) and *Astyanax fasciatus* (2 adults and 7 metacercariae). In cenote fish, the highest number of trematode species (12) was also found in *C. meeki*; *C. octofasciatum, C. synspilum, C. urophthalmus,* and *A. fasciatus* harbored 10 trematodes (Scholz et al., 1995a, b).

Regarding the zoogeographical distribution, it is evident that most trematodes that could be identified to the species level belong to the Neotropical fauna. These include species limited to southeastern Mexico (*C. ujati, G. isabellae, E. leopoldinae, E. macrocaudatus, S. minima, A. nunezae*), to southeastern Mexico and Central America (*C. cichlasomae, O. manteri, G. astyanactis, A. ?astorquii*), southeastern Mexico and South America (*Magnivitellinum simplex, Pelaezia loossi, D. compactum*), southeastern Mexico and U.S.A. (*S. sogandaresi*), or Gulf of Mexico and South America (*A. tenuicollis, A. diminuta, A. nana*).

Comparison of the present data with results of a survey of helminth parasites of cenote fish (Scholz et al., 1995a, b) demonstrated that there are only minor differences in composition of trematode fauna; the number of species found is almost identical (Table 2). However, the number of fish examined from Río Hondo and internal lakes of Quintana Roo was rather limited, and this comparison should be considered prelimi-

Table 2. Number of trematode species found in fish from different freshwater bodies of the Yucatan Peninsula.

	Cenotes*	Rivers†	Lakes‡
Adult trematodes	10	8	5
Metacercariae	21	19	7
Total§	29	26	11

* Scholz et al. (1995a, b).

† Río Hondo, two localities (La Unión, Ramonal); present study.

‡ Laguna Bacalar and Laguna Paiyegua; present study.

§ *Stunkardiella minima* and *Oligogonotylus manteri* were found both as adults and as metacercariae.

nary. On the other hand, the high number of species found during the present study suggests that trematodes represent the dominant component of helminth fauna of freshwater fish of the Peninsula, similar to observations of Scholz et al. (1995a, b) and Salgado-Maldonado et al. (1997).

The authors are indebted to Raúl Simá-Alvarez, Clara Vivas-Rodríguez, and Edgar Mendoza-Franco (CINVESTAV-IPN, Mérida, México) for help in collecting and examining fish, and to Eva Matějovská (formerly Faculty of Biology, University of South Bohemia, České Budějovice) for help in evaluation of the material. Thanks are also due to Martina Borovková (Institute of Parasitology, České Budějovice) for help in staining and mounting voucher specimens. This study was supported in part by the grant PO99 of the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Mexico.

Literature Cited

Jiménez-Guzmán, F. 1973. Tremátodos digéneos de peces dulceacuícolas de Nuevo León, México I. Dos nuevas especies y un registro nuevo en el carácido *Astyanax fasciatus mexicanus* (Filippi). Cuadernos del Instituto de Investigaciones Científicos, Universidad Autónoma de Nuevo León, México, 17:1–19.

Kloss, G. R. 1966. Helmintos parásitos de espécies simpátricas de *Astyanax* (Pisces, Characidae). I. Papéis avulsos do Departamento de Zoología, Secretaría de Agricultura, São Paulo, Brasil, 18(17): 189–219.

Lamothe-Argumedo, R., and G. Ponciano-Rodríguez. 1986. Revisión de la subfamilia Acanthostominae Nicoll, 1914. Anales del Instituto de Biología, Universidad National Autónoma de México, Seria Zoología, 56:301–322.

Moravec, F., C. Vivas-Rodríguez, T. Scholz, J. Vargas-Vázquez, E. Mendoza-Franco, and D. González-Solís. 1995a. Nematodes of fishes from cenotes (sinkholes) in the Yucatán, Mexico. Adults. Folia Parasitologica 42:115–129.

———, ———, ———, ———, ———, **J. J. Schmitter-Soto, and** ———. 1995b. Nematodes of fishes from cenotes (sinkholes) in the Yucatán, Mexico. Larvae. Folia Parasitologica 42:199–210.

Pérez-Ponce de León, G., L. García-Prieto, D. Osorio-Sarabia, and V. León-Regagnon. 1996. Listados faunísticos de Mexico. VI. Helmintos parásitos de peces de aguas continentales de México. Universidad National Autónoma de México, Instituto de Biología. 100 pp.

Salgado-Maldonado, G., R. Pineda-López, V. M. Vidal-Martínez, and C. R. Kennedy. 1997. A checklist of metazoan parasites of cichlid fish from Mexico. Journal of the Helminthological Society of Washington 64:195–207.

Scholz, T., J. Vargas-Vázquez, F. Moravec, C. Vivas-Rodríguez, and E. Mendoza-Franco. 1995a. Cenotes (sinkholes) of the Yucatan Peninsula, Mexico, as a habitat of adult trematodes of fish. Folia Parasitologica 42:37–47.

———, ———, ———, ———, **and** ———. 1995b. Metacercariae of trematodes of fishes from cenotes (=sinkholes) of the Yucatan Peninsula, Mexico. Folia Parasitologica 42:173–192.

———, ———, ———, ———, **and** ———. 1996. Cestoda and Acanthocephala of fish from cenotes (sinkholes) of the Peninsula of Yucatan, Mexico. Folia Parasitologica 43:141–152.

J. Helminthol. Soc. Wash.
65(1), 1998 pp. 95–98

Research Note

Effect of *Echinostoma caproni* Infection on Survival, Growth, and Fecundity of Juvenile *Biomphalaria glabrata*

KATHARINE A. SCHMIDT,[1] BERNARD FRIED,[1,3] AND M. A. HASEEB[2]

[1] Department of Biology, Lafayette College, Easton, Pennsylvania 18042 and
[2] Department of Microbiology and Immunology, State University of New York, Health Science Center, Brooklyn, New York 11203

ABSTRACT: The effect of *Echinostoma caproni* infection on survival, growth, and fecundity of juvenile *Biomphalaria glabrata* was studied. Of 40 juvenile snails (4 ± 0.2 mm in shell diameter) exposed to 5 miracidia each, 24 were alive at 6-wk postexposure (PE) and 16 of these were infected with *E. caproni* larvae. Of 40 size-matched control snails maintained identically to the experimental snails except for mira-

[3] Corresponding author
(e-mail: friedb@lafvax.lafayette.edu).