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ORIGINAL ARTICLE /ARTÍCULO ORIGINAL

PARASITIC NEMATODES IN THE MAYAN CICHLID *MAYAHEROS UROPHTHALMUS* SOLD IN CIUDAD DEL CARMEN, CAMPECHE: POTENTIAL IMPLICATIONS FOR PUBLIC HEALTH

NEMATODOS PARÁSITOS EN LA MOJARRA CASTARRICA *MAYAHEROS UROPHTHALMUS* COMERCIALIZADA EN CIUDAD DEL CARMEN, CAMPECHE: POSIBLES IMPLICACIONES PARA LA SALUD PÚBLICA

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Running head: Nematodes of the Mayan cichlid sold in Ciudad del Carmen

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ABSTRACT

The Mayan cichlid, *Mayaheros urophthalmus* (Günther, 1862), is a euryhaline fish used for local consumption in southeastern Mexico. This study characterized larval anisakid nematodes in fish sold at a market in Ciudad del Carmen, Campeche, and assessed their potential relevance to food safety. Fifteen fish obtained from market vendors were transported on ice and examined for external and internal parasites. Nematodes were cleared in glycerin and identified morphologically. *Contracaecum* sp. occurred in 3 of 15 fish (prevalence = 20.0%), *Anisakis* sp. morphotype I in 5 of 15 (33.3%), and *Anisakis* sp. morphotype II, tentatively assigned to the *A. simplex sensu lato* complex, in 2 of 15 (13.3%). At least one anisakid larval morphotype occurred in 8 of 15 fish, yielding an overall larval prevalence of 53.3%. Free nematode eggs were observed in 4 of 15 fish (occurrence = 26.7%) and were reported separately because they could not be assigned to a taxon. Larvae were recovered from the mesenteries and peritoneum, where they were generally encapsulated, and from the external surface or wall of the stomach and intestine. Because the edible musculature was not examined separately and species-level identification was not confirmed molecularly, consumer exposure and the probability of human infection cannot be estimated. The findings document anisakid larvae in fish sold for consumption and support molecular identification, systematic examination of edible muscle, prompt evisceration, and parasitological surveillance of local fishery products.

Keywords: anisakids – food safety – marked fish – Mayan cichlid – zoonotic potential

RESUMEN

La mojarra castarrica, *Mayaheros urophthalmus* (Günther, 1862), es un pez eurihalino utilizado para el consumo local en el sureste de México. El objetivo fue caracterizar larvas de nematodos anisákidos en peces comercializados en un mercado de Ciudad del Carmen, Campeche, y evaluar su relevancia potencial para la inocuidad alimentaria. Se obtuvieron 15 peces de vendedores del mercado, se transportaron con hielo y se examinaron para detectar parásitos externos e internos. Los nematodos se aclararon en glicerina y se identificaron morfológicamente. *Contracaecum* sp. se encontró en 3 de 15 peces (prevalencia = 20,0%); Anisakis sp. morfotipo I, en 5 de 15 (33,3%) y *Anisakis* sp. morfotipo II, asignado tentativamente al complejo *A. simplex* sensu lato, en 2 de 15 (13,3%). Al menos un morfotipo larvario de anisákido se encontró en 8 de 15 peces, con una prevalencia larvaria global de 53,3%. Se observaron huevos libres de nematodos en 4 de 15 peces (ocurrencia = 26,7%), los cuales se informaron por separado porque no pudieron asignarse a un taxón. Las larvas se recuperaron de los mesenterios y el peritoneo, donde generalmente estaban encapsuladas, así como de la superficie externa o pared del estómago y del intestino. Dado que la musculatura comestible no se examinó por separado y la identificación a nivel de especie no se confirmó mediante análisis moleculares, no es posible estimar la exposición del consumidor ni la probabilidad de infección humana. Los hallazgos documentan larvas de anisákidos en peces destinados al consumo y respaldan la identificación molecular, el examen sistemático del músculo comestible, la evisceración oportuna y la vigilancia parasitológica de los productos pesqueros locales.

Palabras clave: anisákidos – inocuidad alimentaria – mojarra castarrica – peces de mercado – potencial zoonótico

INTRODUCTION

As in many aquatic ecosystems, fish are exposed to parasitic infections that may have both ecological and sanitary implications (Rodríguez-Santiago *et al*., 2014; Lafferty & Mordecai, 2016; Poulin, 2019; Rodríguez-Santiago *et al*., 2019; Hasik *et al*., 2025). Parasites in fishery products have become an increasing concern for public health in several regions worldwide (Garrido-Olvera *et al*., 2022; Rodríguez-Santiago *et al*., 2022). In the southern Gulf of Mexico, this issue has gained relevance due to the risks associated with the consumption of contaminated fish and the growing incidence of zoonotic diseases (Rodríguez-Santiago *et al*., 2026).

Factors such as water quality conditions, inadequate control during fish handling, cleaning and preservation processes, as well as the traditional consumption of raw or undercooked seafood products, significantly contribute to the transmission of parasites that may affect human health (Garrido-Olvera *et al*., 2022; Rodríguez-Santiago *et al*., 2022). During recent decades, parasitism has been recognized as a fundamental ecological process, regulating host population abundance and density, stabilizing trophic networks, and contributing to the structuring of animal communities (Dunn *et al*., 2019; Hasik *et al*., 2025).

In Mexico, fishes, particularly freshwater species, constitute the most extensively studied host group regarding helminth parasites (Rodríguez-Santiago *et al*., 2022). The National Helminth Collection contains approximately 4,000 records from nearly 200 freshwater fish species, in which about 270 helminth species have been documented (Choudhury *et al*., 2020; Mendoza-Franco *et al*., 2018).

Aquatic ecosystems, particularly those characterized by complex trophic webs, facilitate the transmission of parasites with indirect life cycles and support diverse parasite assemblages. This pattern has been widely documented in fishes, which have received considerable attention in ecological parasitology (Poulin, 2017; Carlson *et al*., 2020). This attention is partly explained by the fact that fishes are often collected and examined in large numbers, thereby increasing the probability of detecting their parasite fauna compared with other vertebrate groups. The Mayan cichlid, *Mayaheros urophthalmus* (Günther, 1862), is considered a potential host for a wide variety of parasites because of its opportunistic feeding habits. Under natural conditions, its diet consists mainly of small crustaceans, insects, microalgae, and detritus. However, the species can also adapt to artificial diets developed through nutritional studies (Franco-López *et al*., 2021; Froese & Pauly, 2023; Rodríguez-Santiago *et al*., 2024).

Previous studies have identified a variety of parasites infecting fish and mollusks, including trematodes, cestodes, nematodes, and protozoans, some of which are of zoonotic importance because of their ability to infect humans through the consumption of raw or insufficiently cooked products (Rodríguez-Santiago & Rosales-Casián, 2011; Rodríguez-Santiago *et al*., 2016; Shamsi, 2019).

In this context, it is necessary to characterize the parasite species present in commercially important fish species and to assess the potential risks they pose to consumers. The Mayan cichlid, *Mayaheros urophthalmus* (Günther, 1862), is a fish species of high ecological, economic, and nutritional importance in coastal regions of Mexico, particularly in Ciudad del Carmen, Campeche. This species not only represents an essential resource for local food security but also supports fisheries and commercial activities of considerable regional importance (Fernández-Pérez, 2024).

Therefore, the present study aimed to characterize larval anisakid nematodes in *M. urophthalmus* sold at a fish market in Ciudad del Carmen, Campeche, Mexico, estimate their prevalence, document their infection sites, and assess their potential relevance to food safety within the limitations of morphological identification and the absence of a specific examination of edible musculature.

MATERIALS AND METHODS

Study Area

Laguna de Términos is located in southeastern Mexico and partially encompasses the municipalities of Carmen, Escárcega, Champotón, Calakmul, and Candelaria in the state of Campeche. The system covers an approximate area of 4,676.33 km² and has a perimeter of 800.44

km. In the southeastern portion of the basin, the terrain reaches an elevation of 262 m above sea level (asl), whereas the northern sector lies at sea level (CONAGUA, 2004).

The lagoon belongs to the Mamantel River watershed, which is part of the Grijalva–Usumacinta Hydrological Region (RH30) and the Administrative Region XII, Yucatán Peninsula. In addition, it partially includes five priority conservation regions: two hydrological regions (Laguna de Términos, Pantanos de Centla, and Southern Campeche), two terrestrial regions (Pantanos de Centla and Silvituc-Calakmul), and one marine region (Pantanos de Centla, Laguna de Términos) (RAMSAR, 2003).

The study was conducted at the Renovación Market, locally known as “El Chechén”, in Ciudad del Carmen, Campeche, Mexico (18°38′54.60″ N, 91°47′36.77″ W). Fifteen specimens of *M. urophthalmus* were donated by Pescadería Doña Mari, one of the fish stalls located in the market. According to information provided by the vendor, the fish originated from different geographic locations along the Palizada River. The specimens were transported on ice to the Environmental Parasitology Laboratory of the Institute of Marine Sciences and Limnology, El Carmen Station, National Autonomous University of Mexico. The market constituted the sampling site, and the precise capture locality of each fish was not independently verified (Fig. 1).

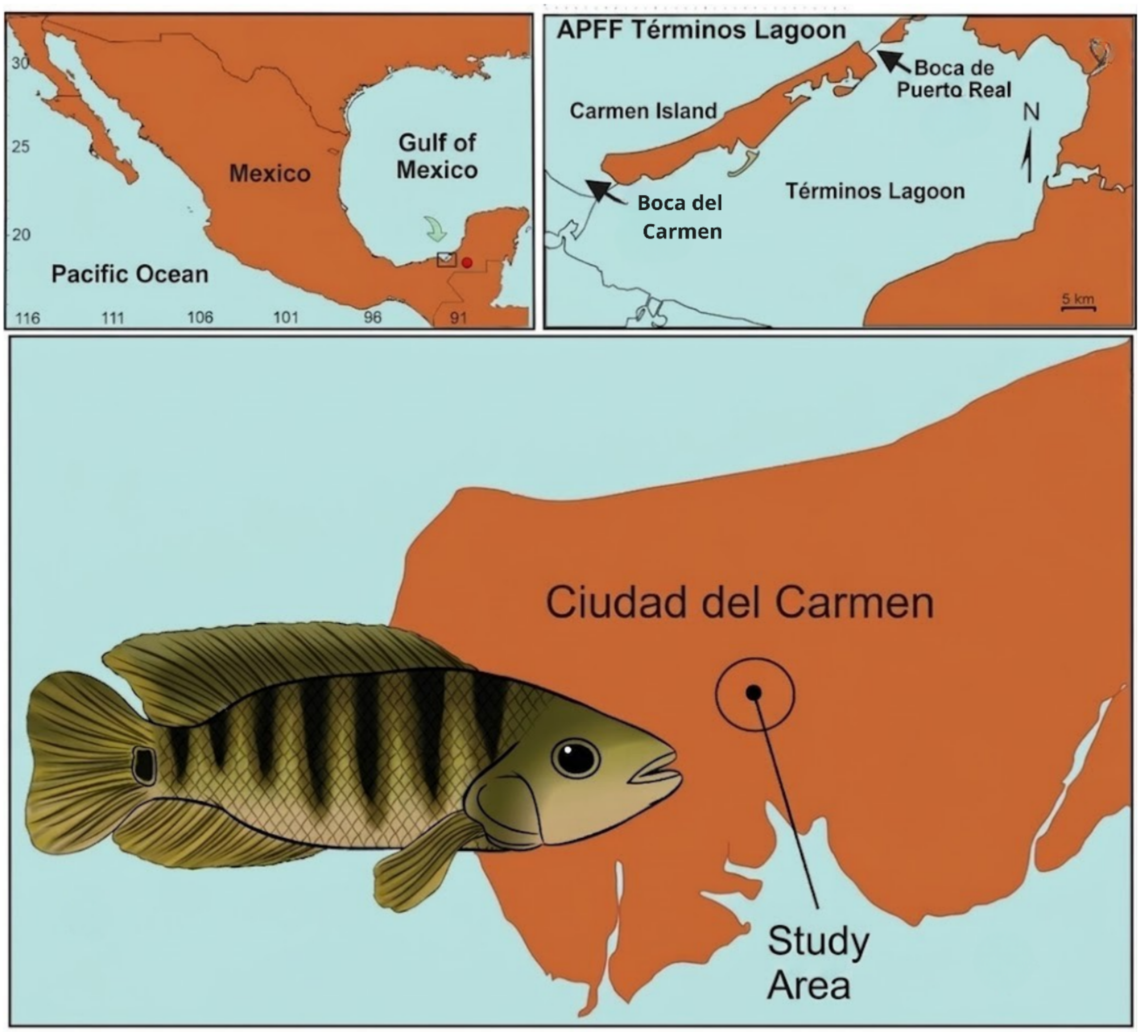

Figure 1. Location of the study area. (a) Geographic location of Mexico. (b) Extent of the Laguna de Términos Flora and Fauna Protection Area, Campeche. (c) The circle indicates the study site corresponding to the "Chechén" market in Ciudad del Carmen, Campeche.

Fish collection

A total of 15 fresh specimens of the Mayan cichlid, *M. urophthalmus*, were obtained considering their commercial importance in the region. Sampling was conducted in collaboration with local fishermen and seafood vendors, who provided specimens purchased from a stall at the Renovación Market, locally known as "El Chechén", for laboratory examination (Fig. 2).

Fish were captured using No. 6 trawl nets, with fishing operations lasting between 45 and 90 min. Subsequently, the specimens were transported on ice to the Environmental Parasitology Laboratory of the Institute of Marine Sciences and Limnology, "El Carmen" Station, National Autonomous University of Mexico (UNAM), where the parasitological examination was conducted.

Diagnosis of internal parasites

The dissection procedure for the collection of endoparasites began with an incision along the lateral line of each fish, followed by the immediate removal of the gills. Subsequently, an incision was made in the abdominal cavity, extending from the cloaca to the branchial region using straight-tipped scissors. The entire digestive tract, from the oral-branchial region to the rectum, was removed and placed in a Petri dish for examination (Keim, 1982; Aho *et al*., 2018) (Fig. 2).

The remaining internal organs, including the spleen, gallbladder, urinary bladder, stomach, intestines, kidneys, swim bladder, liver, mesenteries, adipose tissues, brain, and eyes, were also dissected and individually placed in Petri dishes containing 0.7% saline solution (Keim, 1982; Möller & Anders, 1986) (Fig. 2).

For parasite detection, the different organs were examined under a stereoscopic microscope. Each organ (except the eyes) was compressed between two glass slides using the compression technique to facilitate observation and determine the presence or absence of parasites (Fig. 2).

External Examination

Each specimen was subjected to a washing and sieving procedure using a 0.3 mm (300 µm) mesh to recover ectoparasites. This technique consisted of placing the fish on a sieve and carefully washing it with running water for approximately 2 minutes per specimen. The material retained on the sieve was subsequently examined for the presence of ectoparasites (Fig. 2).

Internal Examination

The dissection for endoparasite collection began with an incision along the lateral line of the fish, followed by the immediate removal of the gills. Subsequently, an incision was made in the abdominal cavity, extending from the cloaca to the branchial region using straight-point scissors. The entire digestive tract, from the oral-branchial region to the rectum, was removed and placed in a Petri dish for examination (Fig. 2).

The remaining internal structures, including the spleen, gallbladder, urinary bladder, stomach, intestines, kidneys, swim bladder, liver, mesenteries, adipose tissues, brain, and eyes, were also dissected and individually placed in Petri dishes containing 0.7% saline solution.

For analysis, the different organs were examined under a stereoscopic microscope. Each organ (except the eyes) was placed between two microscope slides using the compression technique to facilitate observation and determine the presence or absence of parasites. Internal parasites (endoparasites) were isolated and placed in Eppendorf vials containing 70% ethanol for initial preservation. Subsequently, nematode specimens were transferred to 50% glycerin for clarification, allowing detailed observation under a light microscope and subsequent taxonomic identification (Fig. 2).

Taxonomic Identification

For taxonomic identification, nematodes (Nematoda) were cleared using gradual glycerin solutions following the methodology proposed by Moravec *et al*. (1993). Specimens were then mounted on microscope slides with coverslips and examined under a light microscope for identification using specialized taxonomic keys. Finally, all records were incorporated into a parasitological database, and the specimens were deposited in the Parasitology Collection of the Environmental Parasitology Laboratory, Institute of Marine Sciences and Limnology, “El Carmen” Station, National Autonomous University of Mexico (UNAM), Mexico (Fig. 2).

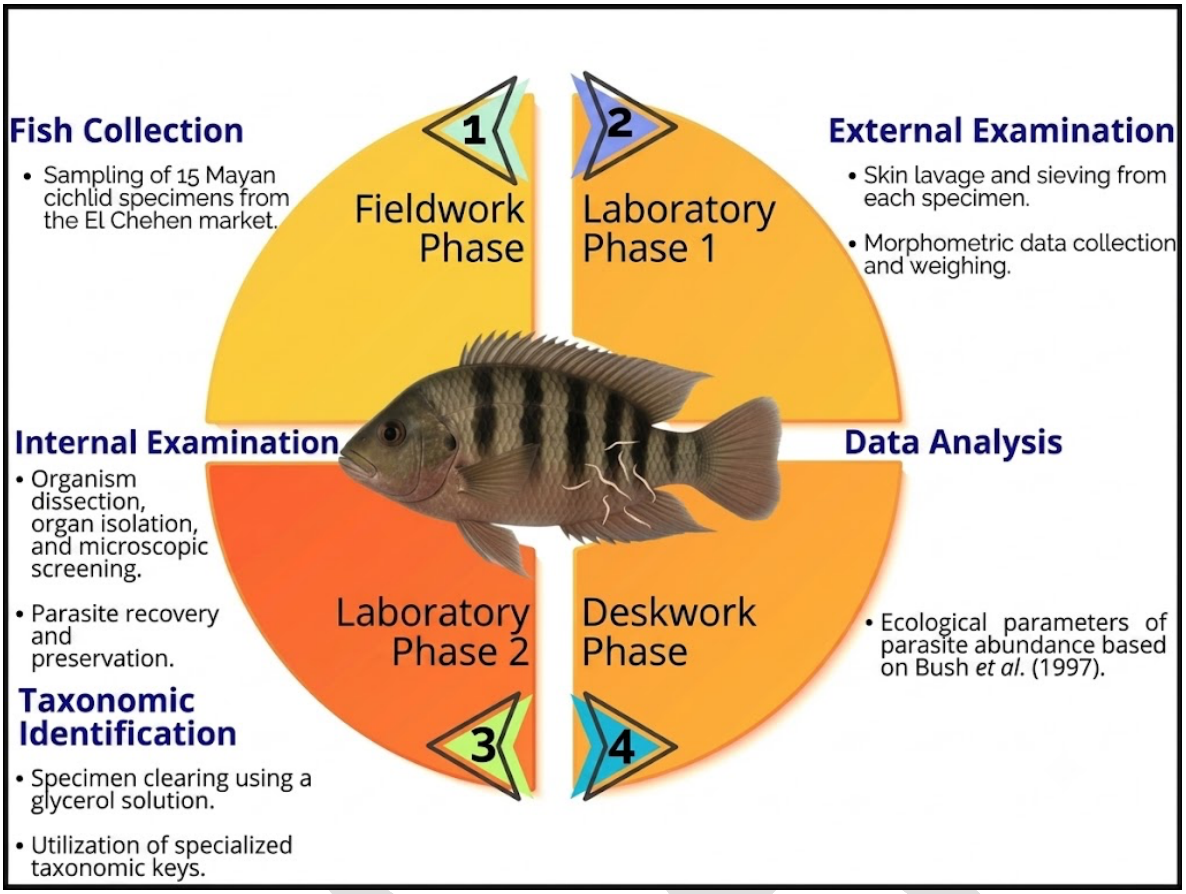

Figure 2. Methodological scheme of the parasitological analysis performed on *Mayaheros urophthalmus.*

Preparation of Parasitological Illustrations

The illustrations of the identified parasites were produced using a combination of traditional drawing and digital editing techniques. Initially, a hand-drawn sketch was created based on the morphological characteristics observed in the specimens and on previously published taxonomic descriptions. The sketch was then photographed using a mobile phone camera, and the digital image was imported into the software Ibis Paint X.

Once imported, multiple digital layers were used to trace the outlines and morphological details of each organism, allowing for a more accurate representation of diagnostic structures. Finally, digital colors were applied to reproduce the staining observed in the microscopic preparations, resulting in digital illustrations that were used to complement the identification and documentation of the parasites recorded in this study.

Data analysis

Prevalence was calculated as the number of fish infected with a given larval morphotype divided by the 15 fish examined and multiplied by 100, following Bush *et al.* (1997). Overall larval prevalence was calculated from the number of fish harboring at least one anisakid larval morphotype. Free nematode eggs were reported separately as occurrence because they were not assigned to a parasite taxon. Percentages describing the distribution of larvae among positive fish were treated as descriptive proportions and not as prevalence. Mean abundance and mean intensity were not calculated because the taxon-specific raw counts could not be verified consistently from the available records.

Ethical considerations

The study used fish that had already been captured and offered for sale for human consumption. The research team did not capture, maintain, experimentally manipulate, or euthanize live vertebrates specifically for this investigation.

RESULTS

Larval anisakids were detected in 8 of the 15 examined fish, corresponding to an overall larval prevalence of 53.3%. Three larval morphotypes were recognized: *Contracaecum* sp., *Anisakis* sp. morphotype I, and *Anisakis* sp. morphotype II, tentatively assigned to the *A. simplex* sensu lato complex (Figure 3). Free nematode eggs were observed in four fish and were analyzed separately (Table 1).

The larvae were located in the mesenteries and peritoneum, where they were generally encapsulated, and on or within the external surface or wall of the stomach and intestine. No conclusion can be made regarding infection of edible muscle because the musculature was not examined separately.

Table 1. Prevalence of anisakid larval morphotypes and occurrence of free nematode eggs in 15 market-sold *Mayaheros urophthalmus*.

Taxon or finding	Positive fish	Positive fish (n)	Prevalence or occurrence (%)
Contracaecum sp.	M2, M7, M10	3	20.0
Anisakis sp. morphotype I	M1, M2, M3, M4, M7	5	33.3
Anisakis sp. morphotype II, cf. *A. simplex* s.l.	M5, M9	2	13.3
Any anisakid larval morphotype	M1, M2, M3, M4, M5, M7, M9, M10	8	53.3
Free nematode eggs*	M3, M7, M8, M9	4	26.7

Occurrence is reported instead of taxon-specific prevalence because the eggs were not identified to genus or species.

Contracaecum sp. was recorded in three fish, with M7 accounting for 51.6% of the larvae assigned to this morphotype, M2 for 38.7%, and M10 for 9.7%. *Anisakis* sp. morphotype I occurred in five fish; the proportional distribution was 26.3% in M3, 21.1% in M1 and M2, and 15.8% in M4 and M7. Morphotype II occurred in M9 and M5, which accounted for 71.4% and 28.6%, respectively. These percentages describe the proportional distribution of each morphotype among positive fish and are not prevalence values.

Free nematode eggs were detected in M3, M7, M8, and M9, corresponding to an occurrence of 26.7%. They were not pooled with the larval morphotypes because their taxonomic identity and association with adult nematodes could not be established.

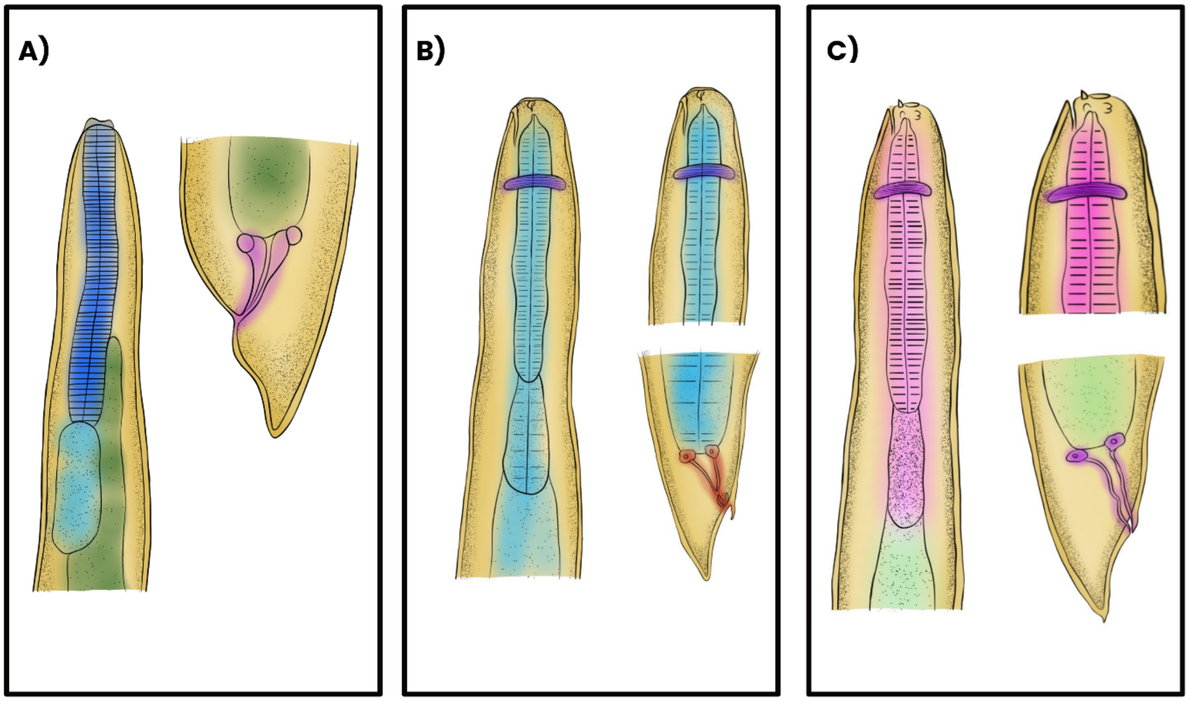

Figure 3. Illustrations of the internal structures of the three parasite species identified in the present study. (A) *Contracaecum* sp., (B) *Anisakis* sp., and (C) *Anisakis simplex*.

DISCUSSION

Three larval nematode taxa were identified in *M. urophthalmus*: *Contracaecum* sp., *Anisakis* sp. morphotype I, and *Anisakis* sp. morphotype II, the latter tentatively assigned to the *Anisakis simplex* sensu lato complex. Nematode larvae were detected in eight of the 15 fish examined, corresponding to an overall prevalence of 53.3%. Among the identified taxa, *Anisakis* sp. morphotype I showed the highest prevalence (33.3%), followed by *Contracaecum* sp. (20.0%) and *Anisakis* sp. morphotype II (13.3%). These findings indicate that more than half of the Mayan cichlids marketed in Ciudad del Carmen harbored trophically transmitted anisakid larvae and support the participation of *M. urophthalmus* as an intermediate or paratenic host in aquatic food webs of southeastern Mexico (Rodríguez-Santiago *et al*., 2024).

Mayaheros urophthalmus is widely distributed in freshwater and brackish environments of southeastern Mexico, where it contributes to artisanal fisheries and local consumption. Its opportunistic and predominantly omnivorous diet includes small crustaceans, insects, detritus, and other aquatic organisms that may participate as intermediate hosts in helminth life cycles. Consequently, its feeding ecology may facilitate exposure to infective nematode larvae in the fluvial, lagoon, mangrove, and estuarine environments characteristic of the region (Franco-López *et al*., 2021; Rodríguez-Santiago *et al*., 2024).

The occurrence of *Contracaecum* sp. agrees with previous records in freshwater and estuarine fishes. Bullard *et al.* (2004) reported larval *Contracaecum* sp. in *M. urophthalmus* from Florida, confirming that this fish can participate in the transmission cycle of the nematode under different environmental conditions. In the present study, *Contracaecum* sp. showed a prevalence of 20.0%, a value within the range reported for juvenile gray snapper, *Lutjanus griseus*, from Mecoacán Lagoon, Tabasco. Rodríguez-Santiago *et al.* (2022) recorded prevalences ranging from 3.3 to 23.3% for two *Contracaecum* morphotypes, depending on the morphotype and sampling season. These comparable values indicate that exposure to *Contracaecum* larvae occurs in different coastal lagoon systems of the southern Gulf of Mexico, although prevalence may vary according to host species, season, diet, and the local availability of infected prey.

The occurrence of *Contracaecum* larvae in fishes from Campeche and Tabasco may reflect trophic transmission within the complex aquatic food webs of southeastern Mexico. Species of this genus have indirect life cycles in which aquatic invertebrates and fishes may act as intermediate or paratenic hosts, whereas piscivorous birds generally serve as definitive hosts (Buchmann & Mehrdana, 2019). Ecological connectivity among rivers, coastal lagoons, mangroves, and estuarine environments may facilitate contact among the hosts involved in these transmission cycles. However, neither intermediate and definitive hosts nor environmental stages of the parasite were evaluated in the present study. Therefore, this interpretation should be regarded as a plausible ecological explanation rather than a demonstrated causal relationship.

The detection of *Anisakis* morphotypes is particularly relevant because members of this genus are mainly associated with marine food webs. Their life cycles involve aquatic invertebrates as intermediate hosts, fishes and cephalopods as intermediate or paratenic hosts, and marine mammals as definitive hosts (Mattiucci *et al*., 2018; Buchmann & Mehrdana, 2019). The occurrence of *Anisakis* larvae in *M. urophthalmus* may therefore reflect ecological connectivity among freshwater, estuarine, and marine environments in the southern Gulf of Mexico, possibly through the consumption of infected crustaceans or small fishes. Nevertheless, although vendors indicated that the examined fish originated from different areas of the Palizada River, the precise capture locations could not be verified. Consequently, the specific environment in which the infections were acquired remains unknown.

Anisakis sp. morphotype I showed a prevalence of 33.3%, whereas morphotype II, tentatively assigned to the *A. simplex* sensu lato complex, showed a prevalence of 13.3%. These records provide preliminary evidence that *M. urophthalmus* is exposed to anisakid transmission cycles in southeastern Mexico. However, species belonging to the *A. simplex* complex cannot be reliably differentiated solely through larval morphology because closely related taxa share several diagnostic characteristics. Molecular analyses are therefore required before these larvae can be conclusively assigned to *A. simplex* (Mattiucci *et al*., 2018).

The anisakid larvae were recovered from the mesenteries and peritoneum, where they were generally encapsulated, as well as from the surface or wall of the stomach and intestine. These infection sites agree with the visceral distribution of anisakid larvae documented in other commercially important fishes. Rodríguez-Santiago *et al.* (2016) recorded anisakids in the mesentery, coelomic cavity, stomach wall, intestine, and other visceral organs of *Caulolatilus princeps* and *Sebastes miniatus*.

The visceral and encapsulated locations observed in *M. urophthalmus* are therefore consistent with larval migration and establishment following the ingestion of infected prey.

Differences in anisakid prevalence among fish species may be associated with host diet, trophic position, mobility, and the availability of infected prey. Marine predatory fishes commonly consume crustaceans, cephalopods, and small fishes that may accumulate anisakid larvae, whereas *M. urophthalmus* has a more generalist and opportunistic diet. Environmental conditions, including temperature, salinity, habitat connectivity, and the distribution of intermediate and definitive hosts, may also influence parasite transmission (Mattiucci *et al*., 2018; Rahmati *et al*., 2020; Sures & Nachev, 2022; Sures *et al.*, 2023). The extensive fluvial, lagoon, and estuarine systems of southeastern Mexico are characterized by marked salinity gradients and seasonal variation in precipitation and freshwater discharge. However, because these environmental variables were not measured, their influence on the observed prevalence cannot be determined from the present data.

From a public health perspective, the detection of *Anisakis* and *Contracaecum* larvae indicates potential zoonotic relevance because species belonging to these genera have been associated with gastrointestinal or allergic manifestations in humans following exposure to infected fish products (Audicana & Kennedy, 2008; Shamsi & Suthar, 2016; Buchmann & Mehrdana, 2019). Larvae and allergens associated with the *A. simplex* complex may cause abdominal symptoms, urticaria, and, in sensitized individuals, anaphylactic reactions (Daschner & Pascual, 2005; Hernández-González *et al*., 2023). The detection of anisakid larvae in fish marketed in Ciudad del Carmen therefore highlights the importance of parasitological surveillance of fishery products intended for local consumption.

Nevertheless, the observed prevalence should not be interpreted as an equivalent probability of human infection. All larvae were recovered from visceral tissues, and the edible musculature was not examined separately. Consequently, the present results do not demonstrate the occurrence of infective larvae in the portions of the fish normally consumed by humans. In some fish species, anisakid larvae may migrate from the viscera to the musculature after host death, although the extent of this process depends on the parasite and host species, storage temperature, and time elapsed before evisceration (Rodríguez-Santiago *et al*., 2016; Shamsi & Barton, 2023). Prompt evisceration, adequate refrigeration, prevention of cross-contamination, and thorough cooking are therefore appropriate measures for reducing potential exposure to viable larvae. However, some anisakid allergens may remain active after thermal or freezing treatments, particularly in previously sensitized individuals (Audicana & Kennedy, 2008; Hernández-González *et al*., 2023).

The present study expands the limited information available on the parasite fauna of *M. urophthalmus* in southeastern Mexico. A previous investigation conducted on Isla del Carmen documented ectoparasitic crustaceans in this host and emphasized the scarcity of parasitological information for the species in the region (Rodríguez-Santiago *et al*., 2024). The present findings complement those records by documenting larval anisakid nematodes in Mayan cichlids marketed in Ciudad del Carmen.

The small sample size of 15 fish limits the precision and regional representativeness of the prevalence estimates. Moreover, the lack of verified capture locations prevents the association of infections with particular environmental conditions or aquatic systems. Future studies should include larger and seasonally replicated samples from documented capture localities, separate examination of viscera and edible musculature, and molecular identification of the recovered larvae. Incorporating host diet and environmental variables would also improve understanding of the spatial and temporal dynamics of anisakid transmission and its potential implications for food safety in the southern Gulf of Mexico.

The present study documents the occurrence of three larval nematode taxa, *Contracaecum* sp., *Anisakis* sp. morphotype I, and *Anisakis* sp. morphotype II, the latter tentatively assigned to the *Anisakis simplex* sensu lato complex in the Mayan cichlid, *M. urophthalmus*, marketed in Ciudad del Carmen, Campeche. Larval nematodes were detected in eight of the 15 fish examined, corresponding to an overall prevalence of 53.3%. These findings support the participation of *M. urophthalmus* as an intermediate or paratenic host in the trophic transmission of anisakid nematodes within aquatic food webs of southeastern Mexico.

The occurrence of *Anisakis* and *Contracaecum* larvae indicates potential zoonotic relevance and highlights the importance of parasitological surveillance of fishery products intended for local consumption. However, because all larvae were recovered from visceral tissues, the edible musculature was not examined separately, and identification was based exclusively on morphological characteristics. The present study does not demonstrate the occurrence of infective larvae in edible tissues or allow a direct estimation of the risk to consumers.

Overall, these findings expand current knowledge of the parasite fauna of *M. urophthalmus* and provide preliminary information on anisakid transmission in the southern Gulf of Mexico. Future studies should include larger and seasonally replicated samples from verified capture localities, separate examination of viscera and edible musculature, and molecular identification of the recovered larvae. These approaches will help clarify spatial and temporal patterns of infection and strengthen parasitological monitoring and food-safety strategies for fishery products commercialized in southeastern Mexico.

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