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Detection of parasites and their risk in some important consumed fish species from Nile River Egypt.

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Abstract

Many parasitic fish-borne zoonoses have primarily affected humans, especially in low and middle-income countries. The present work aims to investigate the infection by helminth parasites in Nile-Perch *Lates niloticus* (Linnaeus, 1758) collected from Nasser Lake in Aswan governorate, Egypt. Out of 25 fish samples (15 males & 10 females), seven (28%) had nematode infections. The mean intensity and parasitic abundance were 202±345 and 56.56 respectively. The infestation index (IX) was 15.84. The infection in males was higher (33.33%) than (20%) in females. The nematodes were found in the abdominal cavity or externally connected to the stomach and duodenum in a tightly capsulated spiral shape. Using the light microscope, the nematodes were identified and described based on their posterior end and cephalic area. It was discovered that they belong to the third-stage larvae *Contracaecum* Railliet & Henry, 1912 (Family Anisakidae). In conclusion, many parasite illnesses in fish have zoonotic significance, delaying the fish's reproductive maturity and increasing fish mortality so we must give great importance to these parasites, study them in detail and study their life cycle to demonstrate their role in affecting aquatic organisms, especially those of great economic importance such as fish, and try to find modern ways to combat and eliminate them to achieve a healthy environment free of diseases.

Key Words: *Lates niloticus*- Lake Nasser- Nematodes- Fish borne diseases- infection- Light Microscopy.

1. Introduction: Fish are regarded as an important source of food for humans, which is necessary for them to construct their bodies because they are a vital supply of animal protein that is required to maintain human safety and health (Maulu et al. 2021). Given the profits it produces, fish wealth is regarded as an economic source for many emerging nations. In the fish diet, many nutrients are directly involved in metabolic processes and are actively supplied to the body by fish meals. Omega-3 polyunsaturated fatty acids, such as docosahexaenoic acid and eicosapentaenoic acid, and premium protein with all the essential amino acids are added to it. A vast array of micronutrients, including vitamins (including fat-soluble vitamins and numerous members of the vitamin B complex), and minerals are also included. Additionally, they have strong preventive benefits against the development of several illnesses, including cardiovascular disease, cancer, retinopathy, diabetes, arthritis, and inflammatory and other acute and chronic conditions (Lynch, 2016). Recent developments in aquaculture technologies are also covered, demonstrating how they can meet the rising demand for fish products worldwide while maintaining sustainable production (Bidwe et al. 2025).

Lake Nasser is a sizable reservoir. It is located in northern Sudan and southern Egypt. It is one of the world's largest artificial lakes, formed by the building of the Aswan High Dam (Goher et al. 2021). The area of Lake Nasser is approximately 5248 km2, its breadth is 8.9 to 18.0 km at 160 and 180 m above mean sea level, and its mean depth is 21.5 to 25.5 m (maximum 90 m). Latitudes 22° 00′–23°58′ N and longitudes 31° 19′–33° 19′ E are its coordinates. Lake Nasser's performance is exceptional due to its location in an arid environment (Abdel Mola, 2012). In Lake Nasser, tilapias make up the majority of fish sold as fresh fish, with *Lates niloticus* accounting for 25.07% of the total fish population (Goher et al. 2021).

The Nile perch is a freshwater tropical carnivorous fish of considerable commercial and recreational significance in Africa. It lives in a range of habitats, such as rivers, lakes, and irrigation channels, and is commonly referred to as Samoos or Ishr-bayad in Egypt (Aloo et al. 2017). In many African lakes, notably Lake Nasser, where it is commercially fished, *Lates niloticus* has been introduced. *L. niloticus* is regarded as a suitable fish for aquaculture development because of its high edible white meat without bone, which is rich in protein and vitamins, particularly omega-3, which is essential for human health (Asnake, 2018). It can reach lengths of over 2 m and weights of up to 200 kg, making it the largest apex fish predator in the ecosystems of Lake Nasser and the Nile River (Grubich, 2014). Many parasites use fish as their main or intermediate hosts, and there is a chance that these parasites could spread to humans through zoonotic transmission (Abd-Elrahman et al. 2023).

Approximately 650 nematode species parasitize fish as intermediate hosts, and many more parasitize fish as adults (Sorour and Hamouda, 2019). The rise of parasitic illnesses among Lake Nasser's fish in recent years has resulted in a sharp decline in fish yields, low marketability, and consumer rejection of the fish due to their fear of the macroscopic parasites. Additionally, many parasite illnesses in fish have zoonotic significance, delaying the fish's reproductive

maturity and increasing fish mortality, which results in significant financial losses (Hamouda et al. 2018). Protozoa, trematodes, cestodes, nematodes, and acanthocephala are among the numerous endoparasites that can harm fish (Abd-elrahman et al. 2023).

Because of their increased metabolic activity, pathogenicity, and immunological activation, parasites generate costs to their hosts. According to numerous research, parasite infection raises the infected hosts' basal metabolic rate. Due to improved transportation networks, growing worldwide markets, and demographic shifts including population movements, the prevalence of fish-borne parasite zoonoses has decreased among populations in emerging nations (Chai et al. 2005). The importance of these zoonoses for public health, their connections to poverty, cultural customs, environmental degradation, and the absence of control measures are all becoming more widely known (World Health Organisation, 2004).
The Anisakiasis (Anisakidosis) infects humans through the larval stages of ascaridoid worms that are members of the Anisakidae and most likely Raphidascarididae families (Taha 2020). By eating seafood or raw fish that have larval stages contaminated in their flesh, viscera, or body cavities, humans, an unintended host in the life cycle, can contract an anisakid infection (Audicana and Kennedy 2008). Nematodes never reach adulthood within the human body before penetrating the alimentary canal and related organs, resulting in severe pathological effects such as allergic reactions, vomiting, nausea, and gastrointestinal diseases (Murrell and Fried, 2007). Approximately 20,000 instances of human anisakidosis have been documented worldwide over the last three decades (Hochberg et al. 2010).

2. The Theoretical Framework

The genus *Contracaecum* is a nematode parasite which is commercially and zoonotically significant. Larval stages of *Contracaecum* spp. infect a variety of fish and invertebrate species, while adult forms are found in the stomachs of marine mammals or piscivorous birds (Anderson 2000). In the Fayoum Governorate, Al-Bassel (2003) collected *Contracaecum* larvae from *Tilapia galilaea*. Also, Third-stage *Contracaecum* spp. larvae were detected in Lake Nasser by Younis et al. (2017) in four teleostean species, including *L. niloticus*, *Hydrocynus forskalii*, *T. galilaea*, and *Oreochromis niloticus*. However, Hamouda et al. (2018) discovered third-stage *Contracaecum* spp. larvae in *L. niloticus.*

Taha (2020) discovered the L3 anisakid nematode larvae from marine fish *Pagrus pagrus* collected from different markets in Cairo, these larvae included *Hysterothylacium* sp., *Raphidascaris* sp., *Contracaecum* sp. and *Terranova* sp. Thabit and Abdallah (2022) isolated the third-stage larva *Contracaecum* from *L. niloticus* from the Nile River in Assiut with a prevalence of 66.96%. Saad et al. (2018) introduced a new species, *Contracaecum quadripapillatum*, in Lake Nasser by describing third-stage *Contracaecum* larvae from *C. gariepinus* (known as *Clarias lazera*). In the El-Minia Governorate, Hefnawy et al. (2019) collected third-stage larvae of *Contracaecum* sp. from *Tilapia nilotica* and *C. gariepinus* (reported as *C. lazera*) From Cairo.

3. Materials and Methods

3.1. Study area: Twenty-five freshwater fishes of the genus (*Lates niloticus*) were collected in November 2024 from Lake Nasser in southern Egypt, Aswan. The lake is some 479 km (298 mi)

long and 16 km (9.9 mi) across at its widest point. It covers a total surface area of 5,250 km^2 (2,030 sq mi) and has a storage capacity of some 132 km^3 (32 cu mi) of water (Fig. 1).

3.2. Parasitological Study:

The specimens were transported to the Faculty of Education laboratory, Ain Shams University. The taxonomic study of Schultz (2003) served as a basis for fish identification (Fig. 2). Each specimen's sex, standard length (SL), and total weight (TW) were measured to the closest 0.1 cm and 0.1 gm. To check for extra-intestinal helminths, the fish were dissected immediately. Internal organs were removed from the body cavity and repeatedly cleaned with a 0.7% saline solution. These organs included the gonads, liver, spleen, kidney, heart, and alimentary canal. To facilitate the appearance of helminth parasites, the gut was meticulously divided longitudinally. The obtained nematodes were placed in a petri dish with physiological saline solution (0.7%) for one to two hours to relax before being examined under a light microscope. For 12 hours, the specimens were fixed with 7% formalin (Fig. 3). Lactophenol solution was added in intervals of two to three drops each hour to gradually replace the fixative. Two drops of lactophenol were used to clean the specimens. Once more, lactophenol solution was used for mounting. Drops of DPX were used to seal the coverslip's edges (Hassan, 2019).

The following parasitological parameters were calculated:

$$\text{Prevalence} = \frac{\text{No. of infected fish}}{\text{Total no. of examined fish}} \text{ x100}$$

$$\text{Abundance} = \frac{\text{No. of parasites}}{\text{Total no. of examined fish}}$$

$$\text{Mean intensity} = \frac{\text{No. of parasites}}{\text{Total no. of infected fish}}$$

$$\text{Infestation index (IX)} = \frac{\text{No. of infected host x no. of parasites}}{(\text{No. of host examined})^2}$$

4. Results

Taxonomic summary of the host:
Phylum: Chordata
Class: Teleostei
Order: Perciformes
Family: Centropomidae
Lates niloticus (Linnaeus, 1758)-Nile Perch

Taxonomic summary of the isolated parasite:
Phylum: Nematode
Class: Chromadorea
Order: Rhabditida
Family: Anisakidae
Contracecum spp. Railliet & Henry, 1912

Twenty-five (15 males & 10 females) freshwater fish of genus *Lates niloticus* (Family Centropomidae) were examined for helminth infection. Seven specimens were found infected by nematodes. The isolated parasitic nematodes were identified as third stage (L3) larva *Contracecum* spp. of the family Anisakidae. The percentage of infection was (28%) (Table, 1). The larvae were collected from the body cavity, attached to the stomach, and small intestine of the infected hosts with a total number of 1414 (Table, 2). We can see that the mean number of parasites is significantly higher in males (282±388) compared to females (2±0.0).
Also, we observed that the nematode larvae are

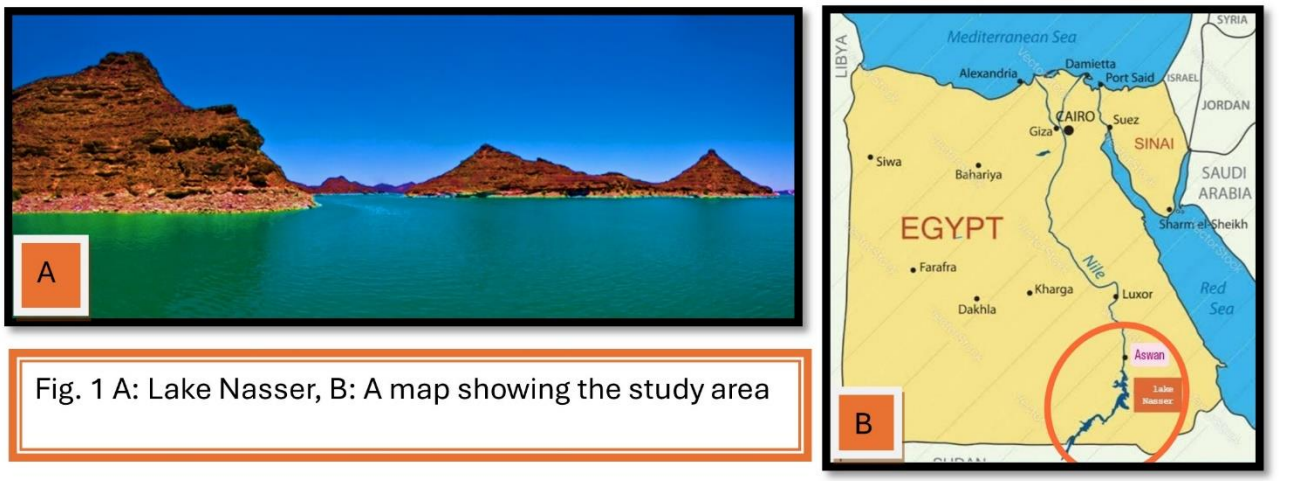

Fig. 1 A: Lake Nasser, B: A map showing the study area

encapsulated in large numbers within the different parts of the intestinal canal and attached to mesenteries. The parasite abundance and the mean intensity were 56.56 and 202±345, respectively. Five males were infected (33.33%) while two females (20%) out of 10 were found infected with the nematode parasite (Fig. 4). The infestation index (IX) was 15.84. Some of the infected fish were found to be infected with a higher number of larvae, reaching more than 500 larvae in each host.

Morphological description by Light Microscope (Fig. 5, A-H)

The isolated nematodes are identified as larvae of genus *Contracaecum* spp. Railliet & Henry, 1912 in the third larval stage (L3) of development (All measurements are in millimeter)

The specimens are white, medium to large, with pointed ends. Each worm measures 2.2±0.54 long (range 1.4-3.1) and 0.18±0.02 wide. Cuticles are transversely striated, particularly at the anterior and posterior body parts. Mouth is triangular, surrounded by three inconspicuous lips, one dorsal and two ventrolateral, each lip measures 0.013±0.0026 long (range 0.01-0.02). Cephalic capsule is 0.04±0.01 long (0.03-0.05). Nerve ring is 0.22±0.04 from the anterior extremity (range 0.17-0.25). Oesophogus is 0.67±0.15 long (1.1-1.5). Ventricular appendix is 0.57±0.07 long (range 0.52-0.65). Ventriculus is 0.06±0.01 long (0.05-0.07). Anus is situated at 0.1±0.015 from posterior end of the larva (range 0.09-0.12). Tail is 0.15±0.01 long (range 0.14-0.16).

Fig. 2 *Lates niloticus*

Fig. 3, A: Nematodes in fixative formalin 7% B: The isolated

Table 1: The prevalence (%) of *Contracecum* spp. concerning the sex of the host

Fish Sex	Body weight (g)	No. Examined Fish	No. Infected Fish	Prevalence %
Male	450-490	15	5	33.33
Female	520-590	10	2	20
Total	450-590	25	7	28

Table 2: The total number of *Contracecum spp*. in relation to the sex of the host

Fish Sex	No. of parasites	Type of parasite	location	Mean Int.±SD
Female	4	Nematode larvae	Body cavity	2±0.0
Male	1410	Nematode larvae	Attached to stomach & intestine	282±388
Total	1414			

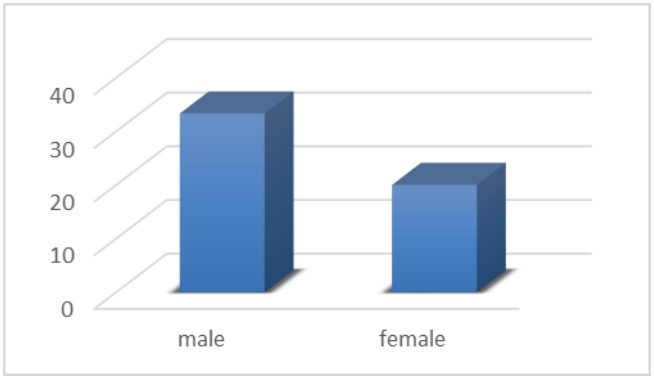

Fig. 4: The incidence of infection by *Contracecum* related to host's sex

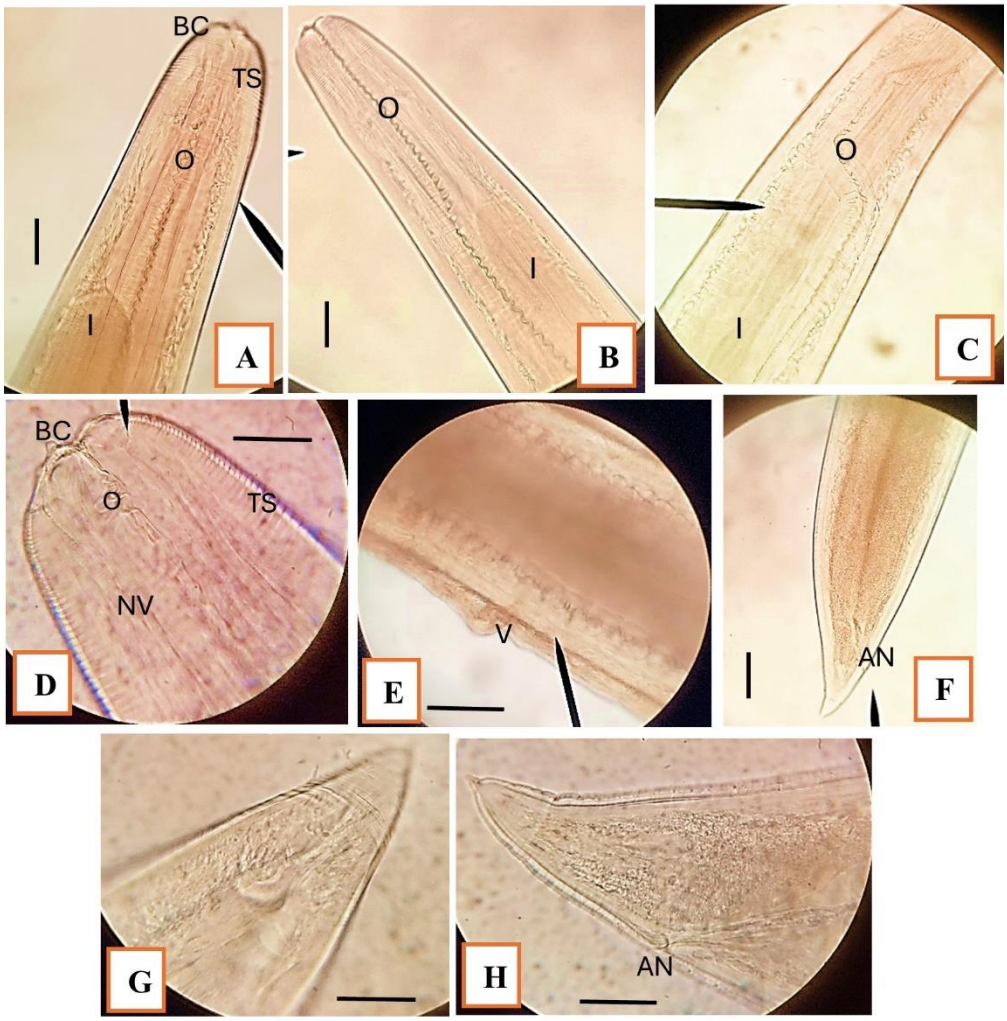

Fig. 5 (A-H): Light photomicrographs of the (L3) nematode *Contracaecum* spp. from *L. niloticus*. A-D: Anterior end of female, C: Anterior part of nematode body, E: The middle part of the worm. F-H: Posterior end. BC (buccal capsule), O (oesophogus), TS (transverse striations), I (intestine), NV (nerve ring), V (vulva), AN (anus). Scale bars (A,B,C & F) =0.01, (D,E,G &H) = 0.02 mm.

5. Discussion

The Anisakid nematodes are parasites of the gastrointestinal tract of a wide variety of animals, particularly fish. The fish acts as a transport or paratenic host in which the larvae grow but do not molt to become an adult. If as is often, the first transport host is in turn ingested by a larger fish, the larvae continue to infect a new host. In this manner, fish at the top of the food chain may become very heavily infected (Markell et al. 1992). Most fish-borne parasitic diseases are transmitted to humans by feeding row fish contains the third-stage larvae encapsulated in the fish muscles resulting in the fatal disease Anisakidosis (Taha 2020). The most popular symptoms resulted from the infection in human are abdominal pain, nausea, vomiting and diarrhea, with signs of peritoneal irritation and incomplete ileus of the small intestine. The life cycles of these Anisakids involve two distinct hosts: 1. A vertebrate animal, which includes fish, birds, reptiles, and aquatic mammals as definitive hosts. 2. Fish and aquatic invertebrates represent intermediate or paratenic hosts (Murrell and Fried, 2007). Any aquatic animal, including micro-crustaceans, can carry these nematodes to fish, where their larvae develop into third-stage larvae (Oshima, 1972). Before reaching the final host, it may spread from one fish to another, multiple several times and invade different fish tissues and organs, including the liver, gonads, somatic musculature, digestive canal, blood vessels, fins, and eyes (Moravec, 1994; Dezfuli et al. 2007). Anisakid nematode larvae infection in fish causes severe inflammatory reactions, tissue deformation, cellular infiltration, nodules in the intestinal serosa, and hemorrhage (Dezfuli et al. 2007, Levsen and Berland, 2012, Marci et al. 2010). In the present study, we detected the third-stage larvae of genus *Contracaecum* infecting 7 out of 25 (28%) freshwater fish *L. niloticus* collected from Lake Nasser, Aswan. There is little data on the distribution of these anisakids in fish, especially those that are commercially significant and primarily eaten by humans, notably in Egypt.

The percentage of infection reported in the present work is lower than (66.96%) recorded by Thabit and Abdallah (2022) who discovered the infection by the larvae *Contracaecum quadripapillatum* in the same present fish species collected from Assiut province. Also, the present infection rate is lower than that presented by (Taha, 2020) (56.4%) from the Sea Bream *Pagrus pagrus* collected from different areas in Cairo province and lower than (23%) by Moravec et al. (2016) who presented *Contracaecum* sp. for the first time from *Sandelia capensis* in South Africa. They showed that the infection has low pathogenicity in fish and doesn't have a danger to this fish. The current result is more than (0.14%) by Moravec et al. (2016) and than (19.4%) from *Pagrus pagrus* from the State of Rio de Janeiro, Brazil, by Soares et al. (2014) who recorded twenty-four larvae of the species Anisakid, *Contracaecum*, *Hysterothylacium*, and *Raphidascaris*. Additionally, Chen et al. (2018) found that *Conger myriaster* in China had a 100% prevalence of infection by L3 larvae. The infection rate in males (33.33%) than (20%) in females in the obtained data which agrees with the results presented by (Taha, 2020). The current study found that the body cavity of the fish *L. niloticus* serves as the most advantageous medium for the infection by the larval stages of anisakid nematodes, particularly *Contracaecum* larvae which demonstrates a great specificity to that final host.

6. Conclusion

The findings of this study showed that the freshwater fish L. niloticus provides an ideal habitat for the third-stage anisakid larvae. Given the significant impact these parasites have on public health, further research is needed to reduce infection. To prevent infection, certain advice

should be followed, such as frying fish at 60 °C for a few minutes and then freezing it at -20 °C for 24 hours, which is sufficient to kill larvae.

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