Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 24(4): 463 – 478 (2020)
www.ejabf.journals.ekb.eg

Two gastrointestinal parasites from freshwater sharptooth catfish, *Clarias gariepinus* (Burchell, 1822)

Medhat Ali[1,2*], Amira Lotfy[1] and Ahmed Nigm[1]

[1]Department of Zoology, Faculty of Science, Ain Shams University, Cairo, 11566, Egypt
[2]Department of Biology, College of Science, Taibah University, Al-Madinah Al-Munawwarah, KSA
***Corresponding Author: medhat_s1@yahoo.com**

ARTICLE INFO

Article History:
Received: June 15, 2020
Accepted: July 5, 2020
Online: July 8, 2020

Keywords:
Catfish;
Polyonchobothrium clarias;
Procamallanus laeviconchus;
Parasites;
gastrointestinal;
gall bladder

ABSTRACT

The sharptooth catfish, *Clarias gariepinus* is a popular tropical catfish in Africa. *C. gariepinus* considered a good source of protein for human consumption and has been believed as an important fish for farming. The present study aims to investigate gastrointestinal parasites of *C. gariepinus* in a local area within Qaluobaya Governorate, Egypt. Thirty males and females *C. gariepinus* (Teleostei: Clariidae) were examined for the presence of gastrointestinal parasites. Two parasite species were found naturally infect *C. gariepinus*. *Polyonchobothrium clarias* (Cestoda: Pseudophyllidea) which infected the pyloric stomach, small intestine, bile duct, and gall bladder. The other parasite was *Procamallanus laeviconchus* (Nematoda: Camallanidae) which infects the small intestine of *C. gariepinus*. The prevalence of *P. clarias* was 33.33 % which was higher than the prevalence of *P. laeviconchus* (6.67 %). The prevalence of infection in males of *C. gariepinus* was 26.67 %, however, the prevalence of infection in females was 6.67 % which was significantly lower than prevalence of infection in males. The total recovered *P. clarias* was 188 worms, while the total number of *P. laeviconchus* was 23 worms. It was also observed that the tissues at the infected sites were greatly destructed. This study reinforced that *C. gariepinus* is highly susceptible to infection with different helminths.

INTRODUCTION

Clarias gariepinus is a common and important tropical catfish in Africa and the Middle East **(Clay, 1979; Marcogliese and Cone, 2001, Hassan *et al*., 2010)**. It is widely distributed, occupying tropical swamps, lakes, and rivers in Africa **(Olufemi *et al*., 1991)**. *C. gariepinus* is regard as one of the best models of omnivorous fishes **(Holden and Reed, 1972; Clay, 1979)**. It is considered as a predator, feeding mainly on aquatic insects, molluscs, fishes; it also feeds on plant debris and fruits **(Micha, 1973 and**

Bruton, 1979). *Clarias gariepinus* has been considered as an important fish for farming in Africa. *C. gariepinus* has many advantages such as, having a wide range of geographical distribution, an extraordinary growth rate, nearly unaffected with handling and trauma, and well appreciated in many African countries **(Akinsanya and Otubanjo 2006)**.

Clarias gariepinus is an important human food fish, as it considered as a good source of protein and had low level of cholesterol. Economically *C. gariepinus* is considered as a source of subsistence income **(Aken'ova, 2000; Steffens, 2006 and Eyo and Effanga, 2018)**. In Egypt, parasitic diseases stand for nearly 80 % of fish diseases **(Eissa, 2006)**. Parasitic infections in fishes lead to decreased production that results in economic loss through fish mortality, drop in fish growth and fecundity, rise the susceptibility of fish to more diseases, and elevated cost of treatment **(Cowx, 1992)**. Under normal circumstances, 50-90 % of freshwater fishes, harbor one parasite species **(Sineszko, 1979)**. It was also reported by **Palm (2011)** that, based on a cautious estimate, there is an average of 3-4 parasites in each living species of fishes and the described fishes were about 31,400 species, so it can be estimated that up to 120,000 parasite species may be found in fishes.

Fishes are affected by different parasites, as they are not only can act as intermediate hosts for many digeneans and cestodes, but they also can act as definitive hosts for many helminths. The infection of wild fish with parasites are common where the requirement of parasites for intermediate and definitive hosts are chanced **(Feist and Longshaw 2008)**. Piscivorous birds, in which several helminths develop into adult stages, are important, as they can spread parasite eggs over extended distances, making it difficult to control the propagation of infections among water bodies **(Saayman *et al.*, 1991)**. The most common parasites are gastrointestinal parasites that compete with the fish host for nutrients, hence reducing the essential nutrients to be absorbed by fish. Subsequently, these parasites hamper the growth of fish leading to morbidity and mortality and making the fish more susceptible to surrounding predators **(Azadikhah *et al.*, 2014 and Omeji *et al.*, 2015)**.

Fish helminthology is not as broadly researched as other aspects of aquatic parasitology and fish biology. This is possibly because helminths are principally infecting the internal organs, chiefly the gastrointestinal tract. For humans, the gastrointestinal tract does not involve the edible part of the fish **(Ibrahim *et al*, 2008)**.

Hamouda (2019) examined two catfishes, *Synodontis serratus* and *Synodontis schall* from lake Nasser, Egypt for endoparasites. She found in both catfishes, one cestode: *Wenyonia virilis*, and three nematodes: *Cithariniella citharini*, *P. laeviconchus*, and *Spirocamallanus pseudospiralis*. She also found a cestode, *Proteocephalus sulcatus*, and one acanthocephalan, *Rhadinorhynchus* sp. were only recorded from *Synodontis schall*.

Polyonchobothrium clarias is extensively distributed in African freshwater *C. gariepinus* having been documented from Nigeria **(Aderounmu and Adeniyi 1972)**. It was also described from the Bagrid catfish *Chrysichthys thonneri* from Gabon, the mudfish *Clarias anguillaris* and *Heterobranchus bidorsalis* from Senegal **(Khalil 1973)**, and in *C. anguillaris* from Egypt **(Amin 1978)**. *P. clarias* was first spotted by **Mashego (1977)** from *C. gariepinus* in seven dams in the Le bowa region, Limpopo province, South Africa. Concerning *P. laeviconchus*, it belongs to family Camallanidae whose members commonly infect clariid fishes of African freshwaters such as *C. gariepinus* **(Moravec, 2019)**.

Polyonchobothrium clarias infects pyloric stomach of *C. gariepinus*. It is deeply embedded by its scolex into the infected tissue which induces a deep cavity-like depression inside mucosal tissue. Also, it destroys mucosal epithelia around the site of infection comparable with uninfected tissue leading to dilation of blood capillary of the infected tissue. **(El-Mansy *et al.*, 2011)**. *P. clarias* was also collected from the gall bladder of *C. gariepinus* that looked enlarged with thickened bile duct; *P. clarias* was also gathered from the glandular stomach. The parasites were mainly attached at the junction between the muscular and glandular stomach and sometimes, they were attached near the beginning of the bile duct in the glandular stomach. **(Eissa *et al*., 2012)**.

Procamallanus laeviconchus is an intestinal nematode of many fishes. It is prevalent in many African fish families such as Clariidae and Schilbeidae from Lake Kariba. In Nigeria, **Chishawa (1991)** and **Douëllou (1992)**. **Khalil (1973)** recovered *P. laeviconchus* from seven species of fishes from Ghana belonging to the Mormyridae, Schilbeidae, and Mochokidae. Many species of *Procamallanus* infecting freshwater fishes have also been documented in Europe **(Moravec 1994)** and the Neotropical region **(Santos *et al.*, 1999)**. **Opara and Okon (2002)** and **Yakubu *et al*., (2002)** reported *P. laeviconchus* from *Oreochromis niloticus* (Cichlidae) and from both *C. gariepinus* (Clariidae) and *Tilapia zilli* (Cichlidae) respectively.

El-Mansy *et al*., (2011) observed *P. laeviconchus* embedded its buccal capsule in the cardiac portion of the stomach of *C. gariepinus* causing damage, rupture to mucosal tissue and hemorrhage at the attachment site of the parasite.

Due to the wide geographic distribution, the diverse diet of *C. gariepinus*, as well as its commercial and aquaculture values, the investigation of the helminth parasites of *C. gariepinus* as well as their effects on this important catfish were explored in the present work.

MATERIALS AND METHODS

Sample collection and worm staining:

Thirty *C. gariepinus* fish were obtained randomly from a fish market in Qaluobaya Governorate, Egypt. Specimens were brought to the invertebrate Laboratory, Department of Zoology, Faculty of Science, Ain Shams University. The gills of fish were dissected out, deposited in Petri dishes containing saline solution (0.85 % NaCl), and checked for parasites. Then fishes were opened ventrally, and the body cavities and mesenteries were examined for parasites. The gastrointestinal tract was opened from the oesophagus to the rectum and parasites were encountered carefully from the pyloric portion of the stomach, gall bladder, bile duct, and intestine. The collected helminth parasites were put in the saline solution, then fixed in 70 % ethyl alcohol, counted, and recorded. Parasites were then washed in distilled water and stained in borax carmine (ADWIC company, Egypt). Differentiation was carried out in acidified alcohol (70 % ethyl alcohol and few drops of HCl) for few minutes this was followed by dehydration in an ascending series of ethyl alcohol (70-100 %) 15 minutes each. The clearing was performed in clove oil and eventually mounted in DPX and covered with glass slips. The parasite identification is carried out according to **Barson and Avenant-Oldewage (2006), Ibrahim *et al*. (2008), Iyaji and Eyo (2008), Kuchta *et al*. (2012), Moravec and Jirků (2017)** and **Moravec and Scholz (2017)**.

Histological preparation:

Stomach and bile duct were fixed in Bouin's solution for 24 hours and were put in 70 % ethyl alcohol. They were dehydrated in an ascending concentrations of ethyl alcohol and cleared in terpineol. This step was followed by embedding in paraffin wax, sectioned with microtome at 6 µm thickness, stained in hematoxylin and eosin and finally examined and Photographed using Kodak digital camera (model 1450Z) attached to the compound microscope.

Statistical analysis:

Statistical analysis was done using one-way ANOVA to determine the variations between prevalence as well as the intensity of infections in males and females of *C. gariepinus*. The *p*-value was set at 5 %.

RESULTS

In this study, ten *Clarias gariepinus* fishes out of thirty dissected were infected **(Table 1)**. The prevalence of infection in fishes was 33.33 % (26.67 in males and 6.67 in females) **(Table 2)**. The prevalence of infection in *C. gariepinus* males was significantly higher than that of females ($P < 0.05$). Generally, the intensity of parasites recovered from infected *C. gariepinus* ranged from 1 to 58 (1-23 in females and 4-58 in males) **(Table 2)**. The mean intensity of infection in males was 14.38±5.59. The mean intensity of infection in females was 1.62±1.54 which was significantly lower than that of males ($P < 0.05$). There were two parasite species recovered, the cestode *P. clarias* and the nematode *P. laeviconchus* **(Fig. 1)**.

The first parasite *P. clarias* infected both pyloric and cardiac stomach, the intestine, gall bladder, and bile duct of *C. gariepinus* **(Table 1)**. *Polyonchobothrium clarias* attached firmly by its scolex into the mucosal epithelium of the stomach destroying mucosal epithelia around the site of infection compared to non-infected tissue **(Figs. 2A-E)**. *Polyonchobothrium clarias* was also recovered from the bile duct of *C. gariepinus* **(Table 1)**, causing erosion to mucosal layer **(Figs. 2F-H)**.

It was observed that the intensity of *P. clarias* was 1-51 (1-20 in females and 4-51 in males). **(Table 2)**. The mean intensity of infection of *P. clarias* in the pyloric stomach was 11.90±4.28, the mean intensity of its infection in the intestine was 3.50±2.09 **(Table 1)**. There was no significant difference between the mean intensity of infection of *P. clarias* in both pyloric stomach and intestine ($P > 0.05$). The intensity of infection of *P. clarias* in other infected sites (Cardiac stomach, gall bladder and bile duct) ranged from 2 to 30 **(Table 1)**.

Polyonchobothrium clarias which belongs to pseudophyllidean cestodes was collected from both the pyloric and cardiac portions of the stomach, intestine bile duct, and gall bladder. The infected parts of the gastrointestinal tract appeared enlarged. Infected bile duct had thickened walls and containing a pale-colored watery bile. The scolex of *P. clarias* was elongated, nearly rectangular, and carries two opposite rows of hooks and possesses laterally two shallow bothria **(Fig. 1A, 1B and 1C)**. Immature proglottides of strobila followed the scolex and they were partially segmented **(Fig. 1D)**. In mature proglottides, the ovary is centrally located **(Fig. 1E)**. The gravid proglottides were greatly occupied by uteri and were filled with eggs **(Fig. 1F)**.

In the present study, the nematode *Procamallanus laeviconchus* (Camallanidae) was also recognized. This parasite was collected from the intestine of *C. gariepinus*. The prevalence of infection of *P. laeviconchus* in *C. gariepinus* was 6.67 % with an intensity of infection ranged from 3 to 20 parasite per fish **(Table 2)**. *Procamallanus laeviconchus* **(Fig. 1G)** has a buccal capsule, which is well chitinized with a wide oral ring; the buccal capsule was divided into two cavities anterior and posterior **(Fig. 1H)**. The oesophagus is long, cylindrical, and muscular **(Fig. 1H)**. In females, the uterus was large occupying most of the posterior third of the body and was filled with larvae **(Fig. 1I)**. The vulva opened at an elevated fold of the body **(Fig. 1I)**. The female posterior end was pointed **(Fig. 1J)**.

Double infections with cestodes and nematodes were only recorded in two fishes **(Table1)**. It was also observed from all infected *C. gariepinus* fishes, there were no infections with nematodes alone; however, the nematode infection was always combined with cestode infection. The prevalence of double infection concerning all fishes was 6.66 %. The double infections were 5.88 and 7.69 % in male and female fishes, about the total numbers of males and females, respectively.

The gastrointestinal epithelium of infected *C. gariepinus* with *P. clarias* had damaged mucosal layer **(Figs. 2C, 2D and 2E)** after the attachment of *P. clarias* with its hooks. It was noted that, there was a loss of continuity of columnar epithelial cells of mucosal layer; this destruction of the mucosal epithelial was proportional to the number of parasites. Pathological changes obviously appeared in infected stomach of *C. gariepinus* **(Fig. 2E)**, which include pressure and damaging lesions and severe torn out mucosal and submucosal layers. The normal *C. gariepinus* gastrointestinal had an intact mucosal layer, with firmly attached columnar cells **(Figs. 2A and 2B)**. The bile ducts infected with *P.*

clarias had also damaged mucosal layer with completely torn out epithelial cells **(Fig. 2G)** compared to non-infected bile duct with intact mucosal cells **(Fig. 2F)**.

Table 1. Detailed information of the examined in males (M) and females (F) *Clarias gariepinus* fishes infected with either *Polyonchobothrium clarias* (*P.c.*) or *Procamallanus laeviconchus* (*P.l.*) or both recovered from different infected organs. *: refers to double infection.

<table>
<tr><th>Fish Sex</th><th>Number of Fishes</th><th>Infected Organs</th><th>Parasite</th><th>Number of Parasites</th><th>Mean intensity</th></tr>
<tr><td>F</td><td>11</td><td>—</td><td>—</td><td>—</td><td rowspan="12">P.c.
Intestine
3.50±2.09
Pyloric stomach
11.90±4.28
Cardiac stomach
0.2±0.2
Gall bladder
0.2±0.2
Bile duct
3±3
P.l.
Intestine
2.3±1.99</td></tr>
<tr><td>F</td><td>1</td><td>Intestine</td><td>P.c.</td><td>1</td></tr>
<tr><td>F*</td><td>1</td><td>Intestine</td><td>P.l.
P.c.</td><td>3
20</td></tr>
<tr><td>M</td><td>1</td><td>Pyloric stomach</td><td>P.c.</td><td>30</td></tr>
<tr><td>M</td><td>1</td><td>Pyloric stomach</td><td>P.c.</td><td>11</td></tr>
<tr><td>M</td><td>1</td><td>Pyloric stomach</td><td>P.c.</td><td>4</td></tr>
<tr><td>M</td><td>9</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>M*</td><td>1</td><td>Intestine
Pyloric stomach</td><td>P.l.
P.c.</td><td>20
38</td></tr>
<tr><td>M</td><td>1</td><td>Intestine</td><td>P.c.</td><td>4</td></tr>
<tr><td>M</td><td>1</td><td>Pyloric stomach</td><td>P.c.</td><td>22</td></tr>
<tr><td>M</td><td>1</td><td>Pyloric stomach</td><td>P.c.</td><td>7</td></tr>
<tr><td>M</td><td>1</td><td>Intestine
Cardiac stomach
Gall bladder
Bile duct
Pyloric stomach</td><td>P.c.</td><td>10
2
2
30
7</td></tr>
</table>

Table 2. Number (No.), Prevalence (%) and the intensity of infection of *Polyonchobothrium clarias* (*P.c.*) and *Procamallanus laeviconchus* (*P.l.*) in males (M) and females (F) *Clarias gariepinus* (*C.g.*) fishes.

<table>
<tr><th colspan="2">C.g. Fishes</th><th colspan="2">No. of Infected Fishes</th><th colspan="2">No. & Prevalence (%)</th><th colspan="4">No. & Prevalence (%)</th><th colspan="4">Intensity of Infection</th></tr>
<tr><td>M</td><td>F</td><td>M</td><td>F</td><td>M</td><td>F</td><td colspan="2">P.c.</td><td colspan="2">P.l.
(double infection)</td><td colspan="2">M</td><td colspan="2">F</td></tr>
<tr><td>17</td><td>13</td><td>8</td><td>2</td><td>26.67</td><td>6.67</td><td>M</td><td>F</td><td>M</td><td>F</td><td colspan="2">4-58</td><td colspan="2">1-23</td></tr>
<tr><td colspan="2" rowspan="2">30</td><td colspan="2" rowspan="2">10</td><td colspan="2" rowspan="2">33.33</td><td>8</td><td>2</td><td>1</td><td>1</td><td>P.c.</td><td>P.l.</td><td>P.c.</td><td>P.l.</td></tr>
<tr><td>26.67</td><td>6.67</td><td>3.33</td><td>3.33</td><td>4-51</td><td>20</td><td>1-20</td><td>3</td></tr>
</table>

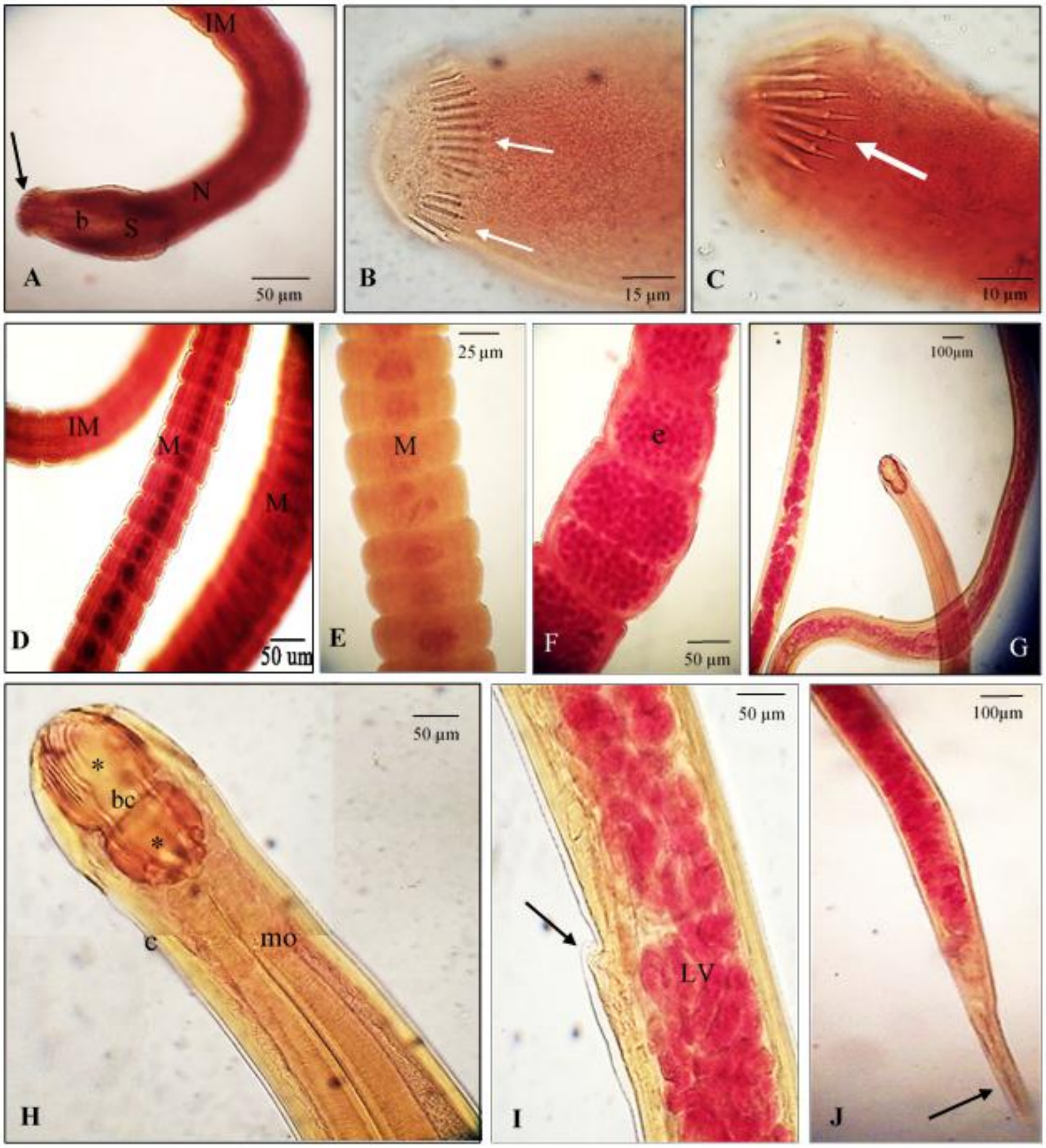

Figure 1. Photomicrographs of *Polyonchobothrium clarias* (A-F) and *Procamallanus laeviconchus* (G-J) showing **A:** The scolex (S) with hooks (black arrow), bothria (b) that followed by an unsegmented neck (N). **B** and **C:** higher magnifications of the scolex with two opposite rows of hooks (white arrows); each hook has two portions, a proximal thick portion and a distal thin portion (white thick arrow) **D:** The immature (IM) and mature proglottides (M). **E:** The mature proglottides. **F:** The gravid proglottides with uterus filled with eggs (e). **G:** The whole worm coiled on itself, **H:** Anterior end of the worm with buccal capsule (bc) which divided into two cavities (*); a long muscular esophagus (mo) extends from the buccal cavity. **I:** The posterior third of the worm at the region of the vulva (black arrow), note the presence of larvae (LV) in this region. **J:** The posterior pointed end of the female worm.

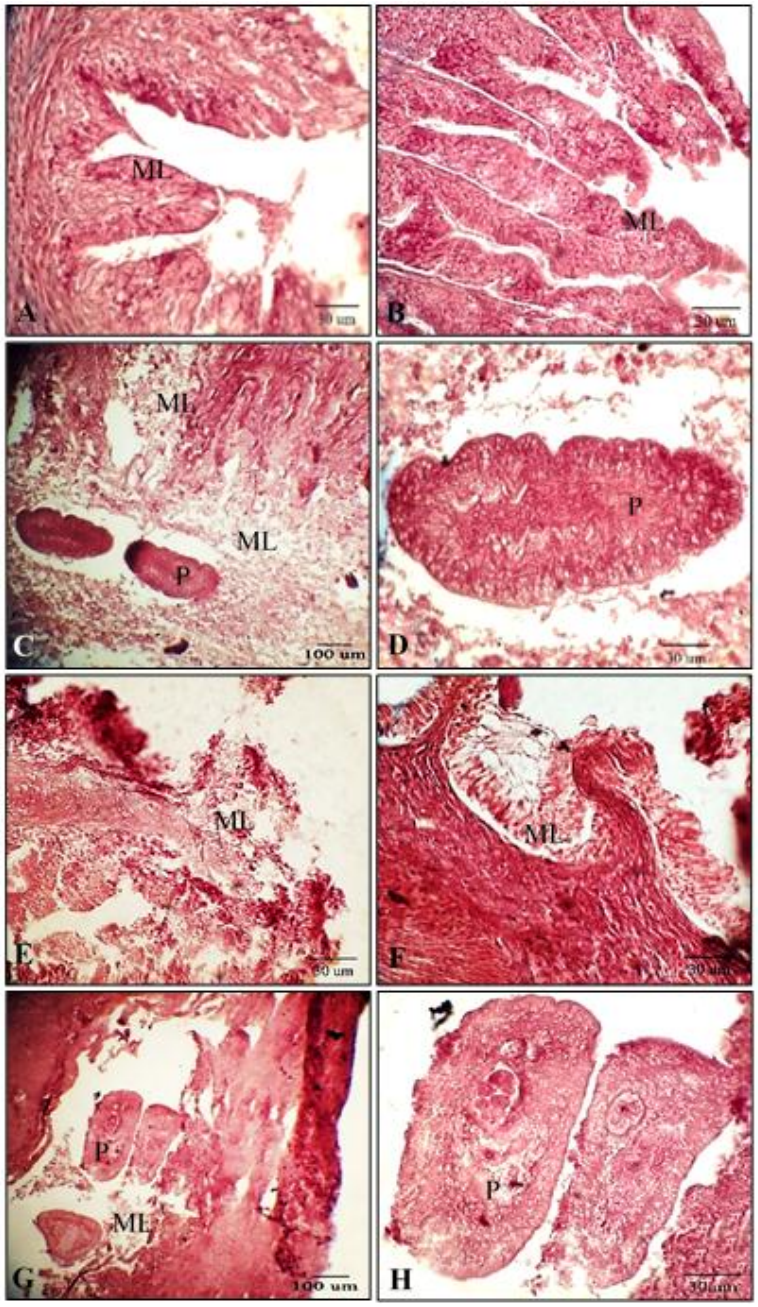

Figure 2. Photomicrographs showing different sections of the stomach of *C. gariepinus* (A-E). **A:** Non-infected pyloric portion of the stomach showing normal mucosal layer (ML). **B:** Magnified section of the non-infected stomach of *C. gariepinus* with intact mucosal layer (ML).**C:** Infected pyloric portion of the stomach with *Polyonchobothrium clarias* showing destructed mucosal layer (ML) and sections of the parasite (P), were clear. **D:** Magnified section of *P*. *clarias* within the pyloric portion of the stomach. **E:** Infected stomach with *P*. *clarias* showing highly destructed mucosal layer (ML). Photomicrographs showing different sections of the bile duct of *C. gariepinus* (F-H). **F:** Non-infected bile duct showing normal intact mucosal layer (ML). **G:** Infected bile duct with *P*. *clarias* and the mucosal layer (ML) was destructed, sections of two *P*. *clarias* were observed. **H:** Magnified sections of the two *P*. *clarias* within the infected bile duct.

DISCUSSION

The results of the present work showed the existence of two parasites, one belongs to cestodes, *Polyonchobothrium clarias* and the other belongs to nematodes, *Procamallanus laeviconchus*. Thirty fishes were examined, ten of them were infected with *P. clarias* (33.3 %). Two fishes of ten were also infected with *P. laeviconchus* (6.66 %). So the prevalence of infection with *P. clarias* was higher than that with *P. laeviconchus*, this observation agrees with that in Isaac's work (2009) as he found that a higher prevalence of *P. clarias* (3.75 %) than that of *P. laeviconchus* (0.625 %), and the infection with *P. clarias* was six times of infection with *P. laeviconchus* which is nearly similar to that of the present study.

It was observed that 26.6 % *C. gariepinus* males were infected. This percentage was higher than the infection of *C. gariepinus* females which was 6.6 %. A similar trend of results was found in the study done by Hassan *et al*., (2010), as they found that a higher percentage of infection in males (70.58 %) than that in females (68.25 %). **Akinsanya and Otubanjo (2006)** found the same trend with lower infection rates in males and females of *C. gariepinus* as they were 5.75 and 3.76 % respectively. **Ayanda (2009)** found that, the same prevalence of intestinal helminth infection (26.25 %) in both *C. gariepinus* males and females. The disparity in the prevalence of infection between males and females in many studies may be attributed to the numbers of fishes examined or to the locality, seasonal variation, and water temperature, size of fish, or differences in immunity against helminth parasites between males and females. **Sinaré *et al*., (2015)** reported a bothriocephalidean cestode, *Tetracampos ciliotheca* from the gall bladder of *Clarias anguillaris* from Burkina Faso. Prevalence of infection was 30 % with a mean intensity of infection was 4.3. There was no significant difference in infection between males and females. They also found that there was a positive correlation between fish size and the recovered number of parasites.

Clarias gariepinus can be infected with many of helminth species. It was reported, for example, by **Oniye *et al*., (2004), Barson and Avenant-Oldewage (2006), Goselle *et al.*, (2008), Madanire-Moyo and Barson (2010), Enyidi and Eneje (2015)** and **Rindoria *el al*., (2020)** that a variety of gastrointestinal helminths have been recovered from *C. gariepinus*. From these helminthes, *Diplostomum spathaceum*, *Alloglosidium corti* (trematodes), *Anomotaenia* sp. *Monobothrium* sp., *Proteocephalus glanduliger, P. clarias*, *Diphyllobothrium latum*, and *Diphyllobothrium plerocercoid* (cestodes), *P. laeviconchus*,*Paracamallanus cyathopharynx* and *Contracaecum* sp. (nematodes) and *Neoechinorhynchus rutli* (acanthocephalan).

Sosanya (2002) reported a positive relationship between pollution and the prevalence rate of helminths. Sosanya also reported that some Physico-chemical properties such as total dissolved solids (TDS) and biological oxygen demand (BOD) affected helminths positively. It was also reported by **Palm (2011)** and **Lacerda *et al*., (2018)** that there is an association between the fish parasites and the pollution, so these parasites can be used as biological markers for water pollution.

Poulin (1995) and **Lile (1998)** documented that parasite variety and richness was correlated with free-living fauna biodiversity in a specified area. Also, the high prevalence of intestinal parasites may be ascribed to the presence of their intermediate host for instance, copepods which would have been consumed by *C. gariepinus* due to their omnivorous behavior **(Bruton, 1979)**.

Aderounmu and Adeniyi (1972) and **Mashego (1977)** reported heavy infections of *P. clarias* in *C. gariepinus*, causing knots at the point of attachment. Physical resistance of detachment of *P. clarias* from the gastrointestinal mucosa of *C. gariepinus* indicates that the suction created by the bothria and the clasping of the scolex hooks could result in serious pathological impacts especially in intense infections. In this work, it was found that the epithelial layer of the mucosa of the gastrointestinal tract was highly damaged and torn out due to the attachment of *P. clarias* by its hooks.

The presence of *P. clarias* in the gall bladder may be rare. But according to the previous studies it has been reported that some parasites infect it as in *C. anguillaris*, *C. mossambicus,* and *C. gariepinus* **(Amin, 1978; Wabuke-Bunoti, 1980; Nkwengulila and Mwita; 2004** and **Barson *et al*., 2008)**. In the present work, the bile duct and gall bladder of *C. gariepinus* were infected with *P. clarias*; It was observed that one *C. gariepinus* was infected with 51 *P. clarias*, this large number of worms may lead some worms to migrate to the bile duct and gall bladder as reported herein to find escape resource competition with other worms.

Isaac (2009) reported the cestodes *Amonotaenia sp.* and *P. clarias* and nematodes *Paracamallanus* sp. and *P. laeviconchus* infect *C. gariepinus*. The cestodes' prevalence of infection was 5 % (1.25 % for *Amonotaenia* sp and 3.75 % for *P. clarias*), and the nematodes' prevalence of infection was 6.25 % (5.625 % for *Paracamallanus* sp. and 0.625 % for *P. laevionchus*). In the present investigation, the prevalence of cestode infection was much higher if compared with that in Isaac's study, where the nematodes prevalence of infection was similar in the present and Isaac's study. **Bichi and Yelwa (2010)** recorded helminth infection in *C. gariepinus* with 35.53 % prevalence of cestodes which comprising *Anomataenia* sp, *Bothriocephalus aegypticus*, *Polyonchobothrium polypetri* and *Polychobothrium* sp, two species from nematodes (28.13 %), with *P. laevionchus* and unknown species. In the present work, the prevalence of cestodes and nematodes infection is lower than that of **Bichi and Yelwa (2010)**. Eissa *et al*., (2012) isolated *P. clarias* from the intestine of *C. gariepinus* with 50.5 % prevalence. **Nnabuchi *et al*., (2015)** also recorded a variety of parasites infected *C. gariepinus* and *C. anguilaris* with a total prevalence of 42.1 %; these parasites comprised *P. clarias* and *P. laeviconchus*. The difference in prevalence of clariid fishes among different studies may be related to the differences in localities, water temperature and may also be attributed to the size of *C. gariepinus*.

Eissa *et al*., (2012) observed hemorrhagic and congested gastrointestinal tract of *C. gariepinus* infected with *P. clarias*. In the present work, similar pathological changes appeared in the infected fish tissues with *P. clarias*, as remarkable damage of the mucosal layer and loosely attached columnar epithelial cells were observed. The bile ducts infected with *P. clarias* had also destructed mucosal layer compared to the non-infected bile duct.

Concerning the description of *P. clarias*, **Barson and Avenant-Oldewage (2006), Ibrahim *et al*., (2008)** and **Eissa *et al*., (2012)** found that the scolex was elongated and had a flat to a somewhat raised rostellum. This rostellum was equipped with one row of hooks in the form of a crown with 26-30 hooks. These hooks were split up into two semicircles, each holding 13-15 hooks. Hooks at the end of each semicircle are tinier than those in the center. Two elongated shallow bothria are lined up with the space between the crowns of hooks. Immature proglottids are not entirely segmented. Some mature proglottids appeared fused. the ovary is rounded to oval and centrally situated in the proglottid. The structure of *P. clarias* in the present work was like the description made by **Barson and Avenant-Oldewage (2006), Ibrahim *et al*., (2008)** and **Eissa *et al*., (2012)**.

Eissa *et al*., (2012) collected *P. clarias* from the gall bladder near the beginning of the bile duct. *P. clarias* was also detached from the glandular stomach which appeared clogged. The parasites were mainly appended at the connection between the muscular and glandular stomach and sometimes, they were attached close to the opening of the bile duct in the glandular stomach. In the present work, *P. clarias* was also recovered from comparable sites in addition to the intestine.

CONCLUSION

It was concluded that males of *C. gariepinus* were most susceptible to infection than females. *P. clarias* predominated *P. laeviconchus* and mostly infected pyloric stomach and the bile duct. *P. laeviconchus* represented fewer recovered parasites and mainly infected the intestine. Some cestodes move to the gall bladder in case of high infection, causing enlargement and obstruction of the bile duct. In *C. gariepinus* females, fewer numbers of cestodes and nematodes were reported. The parasitized sites of the gastrointestinal tract as well as bile duct and gall bladder were highly damaged.

ACKNOWLEDGEMENT

Our deep thanks to Dr. Abdalla Ibrahim, Professor of aquatic biology, Department of Zoology, Faculty of Science, Ain shams university, for his support, precious advice during the performing this study.

REFERENCES

Aderounmu, E. A. and Adeniyi, F. (1972). Cestodes in fish from a pond at Ile-Ife, Nigeria. The Afr. J. Trop. Hydrobiol. Fish., 2: 151-156.

Aken'ova, A. A. (2000). Copepod parasites of the gills of *Clarias gariepinus* in two lakes in a river in Zaria. Nigerian J. Parasitol., 20: 99-112.

Akinsanya B. and Otubanjo O. A. (2006). Helminth Parasites of *Clarias gariepinus* (Clariidae) in Lekki Lagoon, Lagos, Rev. Biol. Trop., 54: 93-99.

Amin O. M. (1978). Intestinal helminths of some Nile fishes near Cairo, Egypt, with redescription of *Camallanus kirandensis* Baylis 1928 (Nematoda) and *Bothriocephalus aegyptiacus* Rysavy and Moravec 1975 (Cestoda). J. Parasitol., 64: 93-101.

Ayanda O. I. (2009). Comparison of parasitic helminthes infection between the sexes of *Clarias gariepinus* from Asa dam Ilorin, north-central Nigeria. Sci. Res. Essays, 4(4): 357-360.

Azadikhah, D.; Nekuie Fard, A.; Seidgar, M. and Amin, H. (2014). The infection rate and pathologic lesions induced by *Proteocephalus osculates* (Goeze, 1782) in European catfish (*Silurus glanis*) from North-west of Iran. Bull. Env. Pharmacol, Life Sci. 3 (V): 63-68.

Barson, M.; Bray, R.; Ollevier F. and Huyse, T. (2008). Taxonomy and faunistics of the helminth parasites of *Clarias gariepinus* (Burchell, 1822), and *Oreochromis mossambicus* (Peters, 1852) from temporary pans and pools in the Save-Runde River floodplain, Zimbabwe. Comp. Parasitol., 75: 228-240.

Barson. M and Avenant-Oldewage. A. (2006). On cestode and digenean parasites of *Clarias gariepinus* (Burchell, 1822) from the Rietvlei Dam, South Africa. Onderstepoort J. Vet. Res., 73:101-110.

Bichi A. H. and Yelwa S. I. (2010). Incidence of piscine parasites on the gills and gastrointestinal tract of *Clarias gariepinus* (Teugels) at Bagauda fish farm, Kano. Bayero J. Pure App. Sci., 3: 104-107.

Bruton M. N. (1979). The food and feeding behaviour of *Clarias gariepinus* pisces: Claridae in lake Sibaya, South Africa, with its emphasis on its role as predator of cochlids. Trans. Zool. Soc. Lond., 35: 47-114.

Chishawa, A. M. M. (1991). A survey of the parasites of three Siluriformes [sic] fish species in Lake Kariba. University Lake Kariba Research Station Bulletin, 1/91: 15-30.

Clay, D. (1979). Population biology, growth and feeding of the African catfish *Clarias gariepinus* with special reference to juveniles and their importance in fish culture. Arch. Hydrobiol., 87(4): 453-482.

Cowx, I. G. (1992). Aquaculture development in Africa, training, and reference manual for Aquaculture Extensionists. Food production and Rural Development Division. Commonwealth Secretariat London, PP. 246-295.

Douëllou, L. (1992). A survey of fish parasites in Lake Kariba. Kariba: University of Zimbabwe. University Lake Kariba Research Station Bulletin, 1/92: 1-71.

Eissa, I. A. M. (2006): Parasitic fish diseases in Egypt. Dar El-Nahda El-Arabia Publishing, 32 Abd El-Khalek Tharwat St. Cairo, Egypt.

Eissa, I. A. M.; Zaki, V. H.; Ali, N. G. M. and Zaki, M. S. (2012). Studies on prevailing cestodiasis in wild African catfish *Clarias gariepinus* at Kafr El-Sheikh Governorate. Life Sci. J., 9(3):506-511.

El-Mansy A.; Hamada S.; Hasan S. and El-Sarnagawy D. (2011). Histopathology of farmed freshwater fish infested with different Helminthes. Egypt. J. Aquatic Biol. Fish., 15(1): 1-13.

Enyidi, U. D. and Eneje, U. L. (2015). Parasites of African catfish *Clarias gariepinus* cultured in homestead pond. Researchjournali's J. of Agric. 2(12): 1-10

Eyo, V. O. and Effanga, E. O. (2018) Ectoparasitic infestation of the Nile Squeaker, *Synodontis schall* (Bloch and Schneider, 1801) from the Cross-River Estuary, Nigeria. Int. J. Aquat. Biol., 6(1): 37-43.

Feist, S.W. and Longshaw, M. (2008). Histopathology of fish parasite infections - importance for populations. J. Fish Biol., 73: 2143-2160.

Goselle, O. N.; Shir, G. I.; Udeh, E. O.; Abelau, M. and Imandeh, G. N. (2008). Helminth parasites of *Clarias gariepinus* and *Tilapia zilli* at Lamingo Dam, Jos, Nigeria. Sci. world J., 3(4): 23-28.

Hamouda, A. H. (2019). Parasitic infections and histopathological changes in the squeaker fishes, *Synodontis serratus* and *Synodontis schall* from lake Nasser, Egypt. Assiut Vet. Med. J., 65(161): 208-224.

Hassan, A. A, Akinsanya, B. and adegbaju, W. A. (2010). Impacts of Helminth parasites on *Clarias gariepinus* and *Synodontis clarias* from Lekki lagoon, Lagos, Nigeria. Report and opinion, 2 (11): 42-48.

Holden, M. and Reed, W. (1972). West_African Freshwater Fish. Longman group Ltd. Pp 67.

Ibrahim, A. M.; Taha, H. A. and El-Naggar, M. M. (2008). Redescription of the cestode *Polyonchobothrium clarias* and its histopathological impact on the stomach of *Clarias gariepinus*. Egypt. J. Aquat. Biol. Fish.,12(4): 165-174.

Isaac, O. A. (2009). Comparative parasitic helminth infection between cultured and wild species of *Clarias gariepinus* in Ilorin, North-Central Nigeria. Sci. Res. Essay, 4(1), 018-021.

Iyaji, F. O. and Eyo, J. E. (2008). Parasites and their Freshwater Fish Host. Biores., 6(1): 328-338

Khalil, L. F. (1973). Some helminth parasites from African freshwater fishes with the description of two new species. Rev. Zool. Botan. Afric., 87(4): 795-807.

Kuchta, R.; Burianová, A.; Jirků, M.; de Chambrier, A.; Oros, M.; Brabec, J. and Scholz, T. (2012). Bothriocephalidean tapeworms (Cestoda) of freshwater fish in Africa, including erection of Kirstenella n. gen. and description of Tetracampos martinae n. sp. Zootaxa 3309: 1-35

Lacerda, A. C. F.; Roumbedakis, K.; Bereta Junior, J. G. S.; Nuñer, A. P. O.; Petrucio, M. M. and Martins, M. L. (2018). Fish parasites as indicators of organic pollution in southern Brazil. J. Helminthol., 92(3): 322-331. doi:10.1017/S0022149X17000414

Lile, N. K. (1998). Alimentary tract helminth of four pleuronectid flatfish in relation to host phylogeny and ecology. J. Fish Biol., 53: 945-953.

Madanire-Moyo, G. and Barson, M. (2010). Diversity of metazoan parasites of the African catfish *Clarias gariepinus* (Burchell, 1822) as indicators of pollution in a subtropical African river system J. of Helminthol., 84, 216-227

Marcogliese, D. J. and Cone, D. K. (2001) Myxozoan Communities Parasitizing Notropis hudsonius (Cyprinidae) at Selected Localities on the St. Lawrence River, Quebec: Possible Effects of Urban Effluents. J. Parasitol., 87: 951-956. http://dx.DOI.org/ 10.1645/0022-3395(2001)087[0951: MCPNHC]2.0.CO;2

Mashego, S. N. (1977). A seasonal investigation of the ecto- and endoparasites of the Barbel, *Clarias gariepinus* (Burchell, 1822) in Lebowa, South Africa. M.Sc. thesis, University of the North.

Micha, J. C. (1973). Etude des populations piscoles de pubangui et tentative de selection et d' adaptation de quelques especes a l'etang de piscecuture. Center Technique Forestiere Tropical, Nogent 1961.

Moravec, F. (1994). Parasitic nematodes of freshwater fishes of Europe. Prague and Dordrecht: Academia and Kluwer Academic Publishers.

Moravec, F. (2019). Parasitic nematodes of freshwater fishes of Africa. Academia, Prague, Czech Republic, 406 p.

Moravec, F. and Jirků, M. (2017). Some nematodes from freshwater fishes in central Africa. Folia Parasitol., 64: 033 doi: 10.14411/fp.2017.033

Moravec, F. and Scholz, T. (2017). Some nematodes, including two new species, from freshwater fishes in the Sudan and Ethiopia. Folia Parasitol., 64: 010 doi: 10.14411/fp.2017.010

Nkwengulila, G. and Mwita, C. (2004). Spatial distribution of parasites along the gut of the catfish *Clarias gariepinus* (Burchell, 1822) (Clariidae) from the Mwanza gulf, Lake Victoria. Tanzania J. Sci., 30: 63–70.

Nnabuchi, U. O.; Ejikeme, O. G.; Didiugwu, N. C.; Ncha, O. S.; Onahs, S. P. and Amarachi, A. C. (2015). Effect of parasites on the biochemical and haematological indices of some clariid (Siluriformes) catfishes from Anambra River, Nigeria. Int. J. Fish. Aquat. Stud., 3(2): 331-336

Olufemi, B. E.; Akinlabi, D. A. and Agbede, S. A. (1991). Aerobic bacterial pathogens isolated from the African catfish *Clarias gariepinus*. Trop. Vet., 9: 177-180.

Omeji, S.; Obande, R. A. and Member, S. T. (2015). Prevalence of endoparasites of *Synodontis shcall* and *Synodontis ocellifer* (Upside-Down Catfish) from Lower River Benue, Nigeria. Int. J. Anim. Biol., 1(5): 176-181.

Oniye, S. J.; Adebote, D. A. and Ayanda, O. I. (2004). Helminth parasites of *Clarias gariepinus* in Zaria, Nigeria. J. Aquat. Sci., 19(2): 71-76.

Opara, K. N. and Okon, A. O. (2002). Studies on the parasites of cultured *Oreochromis niloticus* (Cichlidae) in a rainforest fishpond in South East Nigeria. J. Aquat. Sci., 17: 17-20.

Palm, H. W. (2011) Fish parasites as biological indicators in a changing world: can we monitor environmental impact and climate change? Progress in Parasitology, Parasitology Research Monographs 2, H. Mehlhorn (ed.). Springer-Verlag Berlin Heidelberg. doi: 10.1007/978-3-642-21396-0_12

Poulin, R. (1995). Phylogeny, ecology, and the richness of parasites communities in vertebrates. Ecol. Monogr., 65:283- 302.

Rindoria, N. M.; Dos Santos, Q. M., and Avenant-Oldewage, A. (2020). Additional morphological features and molecular data of *Paracamallanus cyathopharynx* (Nematoda: Camallanidae) infecting *Clarias gariepinus* (Actinopterygii: Clariidae) in Kenya. J. Parasitol., 106(1) 157-166. doi: 10.1645/19-62

Saayman, J. E.; Mashego, S. N. and Mokgalong, N. M. (1991). Parasites of the fish population with notes on the helminth parasites of the water birds of Middle Letaba Dam, in a post impoundment ecological study of the Middle Letaba Dam, Gazankulu, edited by J.E. Saayman, H.J. Schoonbee and G.L. Smit. Pretoria: Department of Development Aid.

Santos, C. P.; Cárdenas, M. Q. and Lent, H. (1999). Studies on *Procamallanus* (*Spirocamallanus*) *pereirai* Annereaux, 1946 (Nematoda: Camallanidae), with new host records and new morphological data on the larval stages. Mem. Inst. Oswaldo. Cruz. Rio., 94: 635-640.

Sinaré, Y.; Boungou, M.; Ouéda, A.; Mano, K.; Kpoda, W. N.; Sakiti, N. G. and Kabré, G. B. (2015) Occurrence of *Tetracampos ciliotheca* (Cestoda: Bothriocephalidea) in the gall bladder of *Clarias anguillaris* in Burkina Faso. Afric. J. Aquat. Sci., 40(4): 433-437

Sineszko, S. F. (1979),"Effects of environmental stress on outbreak of infectious diseases of fishes". J. Fish Biol., 6:157-208.

Singh, H.; Kaur, P.; Shrivastav, R.; Borana, K.; Manohar, S. and Qureshi, A. T. (2013). "Endo- parasitic helminths of two dominating species of family Clariidae", J. of Chem., Biol. Phys. Sci., 3 (2):1149-1154.

Sosanya, M. O. (2002). Fish parasite as indicators of Environmental quality M. Sc Thesis, University of Ibadan pg 142.

Steffens, W. (2006) Freshwater fish - wholesome foodstuffs. Bulg. J. Agric. Sci., 12: 320-328.

Wabuke-bunoti, M. A. N. (1980). The prevalence and pathology of the cestode *Polyonchobothrium clarias* (Woodland, 1925) in the teleost, *Clarias mossambicus* (Peters). J. Fish Dis., 3: 223-230.

Yakubu, D. P.; Omoregie, E.; Wade, J. W. and Faringoro, D. U. (2002). A comparative study of gut helminths of *Tilapia zilli* and *Clarias gariepinus* from River Uke, Nigeria. J. Aquat. Sci., 17: 137-139.

ARABIC SUMMARY

أثنان من الطفيليات المَعدية المَعوية لسمك قرموط المياه العذبة *Clarias gariepinus* (Burchell, 1822)

مدحت علي[١،٢] ، أميرة لطفي[١] ، أحمد نجم[١]

[١] قسم علم الحيوان، كلية العلوم، جامعة عين شمس، القاهرة ، مصر.
[٢]قسم علم الأحياء، كلية العلوم، جامعة طيبة، المدينة المنورة ، السعودية.

سمك قرموط المياه العذبة *Clarias gariepinus* هو سمك السلور الحاد الاستوائي الشائع في أفريقيا ويُعتبر مصدرًا جيدًا للبروتين للاستهلاك البشري ويُعتقد أنها سمكة مهمة للمزارع. وتهدف الدراسة الحالية إلى استكشاف الطفيليات المَعدية المَعوية في سمك السلور بمنطقة محلية في محافظة القليوبية بمصر. فقد تم فحص ثلاثين من ذكور وإناث هذه السمكة لاستكشاف هذه الطفيليات. وقد تم في البحث الحالي العثور على نوعين من الطفيليات التي تُصيب سمك السلور بشكل طبيعي. الطفيلي الأول (Cestoda: Psudophyllidea) *Polyonchobothrium clarias* الذي يُصيب المعدة البوابية والأمعاء الدقيقة والقناة المرارية والمرارة. أما الطفيلي الآخر *Procamallanus laeviconchus* (Nematoda: Camallanidae) الذي يُصيب الأمعاء الدقيقة لسمكة السلور. وكانت نسبة انتشار طفيلي *Polyonchobothrium clarias* ٣٣.٣٣ بالمئة وهي أعلى من نسبة انتشار الطفيلي *Procamallanus laeviconchus* التي كانت ٦.٦٧ بالمئة. وكانت نسبة انتشار العدوى في ذكور سمك السلور (٢٦.٦٧ بالمئة) أعلى بشكل واضح من نسبة انتشارها في إناث سمك السلور (٦.٦٧ بالمئة). وبلغ العدد الإجمالي للطفيلي *Polyonchobothrium clarias* ١٨٨ دودة، في حين كان العدد الإجمالي للطفيلي *Procamallanus laeviconchus* ٢٣ دودة. كما لُوحظ أن الأنسجة في المواقع المصابة دُمرت بشكل كبير. وعززت هذه الدراسة أن سمك السلور (*Clarias gariepinus*) أكثر عرضة للإصابة بالديدان الطفيلية المختلفة.