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Histopathological alterations and parasitic infection in *Oreochromis niloticus* fish inhabiting the River Nile water.

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ABSTRACT

Histological and parasitic examinations represent an excellent tool for determining the effect of Nile water contamination on fish health status. This paper outlines the effect of sewage, industrial and agricultural drainage water into six selected sites (El-Kanater El-Khyria, El-Qatta, Tamalay, Kafr El-Zayat, Benha and Talkha) at River Nile branches on *Oreochromis niloticus* fish. Water samples were collected from the investigated area during winter 2019 to assess the status of water by determining some physicochemical characteristics (temperature, electrical conductivity, transparency, pH, oxygen and nutrient salts). Also, histological features for some organs (liver, kidney, and gills) and parasitic infestation in fish were studied. The results revealed that the uncontrolled inputs of wastes altered the water quality of investigated areas leads to the prevalence of the most common parasites genera which infected *Oreochromis niloticus* health status in the form of histological alteration.

INTRODUCTION

The River Nile is considered as one of the most important rivers in the world **(Ahmed, 2012).** The River Nile towards El-Kanater El-Khyria is bifurcated at the north of Cairo into two branches, Rosetta and Damietta branches each of which runs separately to the Mediterranean Sea embracing the Delta in between **(Kadry *et al*., 2015)**. The Nile branches suffering from several types of pollution mainly including industrial, agricultural and sewage wastes discharged to the River Nile **(Mahmoud and Abd El-Rahman, 2017).** Along Damietta Branch, there are Benha site that received agricultural wastes discharged from neighboring villages and Talkha site that received industrial wastes from fertilizer plant **(Saad *et al*., 2011)**. However, along Rosetta Branch, there are El-Qatta and Tamalay sites which received sewage from Giza governorate and Kafr El-Zayat site that receives also industrial effluents from Maleya and Salt and Soda companies **(Abd El-Rahman, 2013)**. In addition to El-Kanater El-Khyria site before bifurcation that received agricultural wastes discharged from the neighboring field.

Although water pollution is usually caused by human activities, polluted water has a harmful impact on human health directly by drinking it or indirectly by eating the polluted fish **(Bayomy *et al*., 2017).**

Oreochromis niloticus (*O. niloticus*) fish is selected for our investigation because of its economic importance and representing a high percentage of the total catch each year along the River Nile. It is considered as a well marketable fish also it has tolerance for a wide range of environmental condition, salinity and pollution and shows little susceptibility to diseases **(Tayel *et al*., 2014).**

Parasitic diseases are representing 80% of fish diseases **(Eissa, 2006)**. There is an interrelationship between fish parasitic infection and pollutants in the aquatic habitat, so parasites used as a bioindicator of water pollution **(Vidal-Martinez, 2007).** This relationship is not simple and in essence involves a double-edged phenomenon, in which parasitization may increase host susceptibility to toxic pollutants or in which pollutants may result in increased (or in some decrease) in the prevalence of certain parasites. The parasitism caused fish stress which will reduce the fish resistance to the bacterial co-infections, and they caused a portal of entry to secondary invaders **(Bowers *et al*., 2000)**.

Histological analysis used to indicate the pathological anatomy-related diseases, and effects of toxicant exposures. In this study, we selected specific target organs including liver, kidney and gills that are responsible for vital functions, such as respiration, excretion and the accumulation and biotransformation of xenobiotic in the fish **(Bayomy and Mahmoud, 2007).**

The aim of the study is 1) to assess the physicochemical characteristics of water at six sites, including El-Kanater El-Khyria (before bifurcation), three sites at Rosetta Branch, and two sites at Damietta Branch, 2) to study the impacts of three types of Nile pollutions on the prevalence of parasites and susceptibility of studied fish to parasitic infection and 3) to study the effect of pollution and parasitic infection on the histological structure of selected organs.

MATERIALS AND METHODS

Area of investigation

Six sites are selected at River Nile to be the area of investigation. One site was selected at El-Kanater El-Khyria city before bifurcation. Along Rosetta Branch, El-Qatta, Tamalay and Kafr El-Zayat sites were selected. While, Benha and Talkha sites were selected to represent Damietta Branch (Table 1).

Water analysis

The physical and chemical parameters of water samples were determined according to the American public Health Association standard methods for water and wastewater analysis (**APHA, 2012).** Water temperature was measured during the time of sampling using an ordinary centigrade thermometer (0 – 100^{o}C). The transparency of water at different sites was measured using Secchi Disc (20 cm in diameter). Electrical

Conductivity (EC) was measured using hydrolab model Orion Research Ion Analyzer 399 A; the values are expressed as mS/cm.

Table (1): Description of River Nile sampling sites

Site code	Site	Latitude	Longitude	Distance from El-Kanater El-Khyria
K	El-Kanater El-Khyria (before bifurcation)	$30^0 10^{/} 22^{//}$ N	$31^0 08^{/} 22^{//}$ E	0.0 Km
R1	El-Qatta (Rosetta Branch)	$30^0 13^{/} 26^{//}$ N	$30^0 58^{/} 24^{//}$ E	20.0 Km
R2	Tamalay (Rosetta Branch)	$30^0 30^{/} 30^{//}$ N	$30^0 50^{/} 02^{//}$ E	72.2 Km
R3	Kafr El-Zayat (Rosetta Branch)	$30^0 49^{/} 29^{//}$ N	$30^0 48^{/} 31^{//}$ E	126.0 Km
D1	Benha (Damietta Branch)	$30^0 28^{/} 58^{//}$ N	$31^0 10^{/} 47^{//}$ E	58.0 Km
D2	Talkha (Damietta Branch)	$31^0 03^{/} 49^{//}$ N	$31^0 24^{/} 03^{//}$ E	151.0 Km

Hydrogen Ion Concentration (pH value) was determined by means of Orion Research Ion Analyzer 399A pH meter. The determination of dissolved oxygen (DO) was carried out using the modified Winkler method. Biochemical Oxygen Demand (BOD) was determined using 5 days incubation method. Chemical Oxygen Demand (COD) determined using potassium permanganate method. Ammonia was determined using the Phenate Method. Nitrite (NO_2^-) is determined through formation of a reddish purple azo-dye produced at pH 2.0-2.5 by coupling diazotized sulphanilamide with N-(1-naphthyl)-ethylenediamine dihydrochloride (NED), and measure, the developed color at 543 nm wavelength. Nitrate (NO_3^-) was reduced into NO_2^- using a mixture of solution of copper sulphate: hydrazine sulphate; 1: 5. In order to adjust pH of sample, sodium phenate is added as a buffer solution.

Fish analysis

Parasitic examination

Clinical and postmortem examination: The collected fish were subjected to clinical and postmortem examinations, according to the method described by **Noga (2010).** Parasitological examination: Wet mount was prepared from skin mucous, liver, kidney, gills, and musculature and examined microscopically then the positive smears were air-dried, fixed with methanol and stained with Giemsa stain. The internal organs and gastrointestinal tract of fish were examined for the presence of any parasites or cysts. The identification of parasites was carried out according to the method described by **Ali (1992)** for *Trichodina spp*. Encysted metacercariae were examined according to **Lucky (1977).** The examination of the gastrointestinal tract for digenetic trematodes and acanthocephalans was carried out according to **Kruse and Pritchard (1982).** The collected helminthes were left at 4˚C till complete relaxation then fixed in 50% formalin and stained with acetic acid alumn carmine stain. The prevalence incidence for each parasite was also determined.

Histopathological examination:

After dissection of fish samples, tissue specimens from liver, kidney, and gills were taken and fixed in 10% neutral-buffered formalin. The material was dehydrated, embedded in paraffin wax and cut in 4-6μm thick sections then stained with haematoxylin and eosin according to the method described by **Bernet *et al.* (1999)**.

Consequently, these sections were examined microscopically and their photos were taken by the microscopic camera. This method cited by **Tayel *et al.* (2018).**

RESULTS AND DISCUSSION

1. Water quality

The results of physico-chemical parameters of water samples collected from the investigated area during winter season 2019 tabulated in Table 2**.**

Table 2. Average values of physical and chemical parameters for River Nile water

Site	Temp. (^{0}C)	EC (mS/cm)	Trans. (cm)	pH	DO mg/l	BOD mg/l	COD mg/l	NH_4^+ mg/l	NO_2^- µg/l	NO_3^- µg/l
El-Kanater	17.8	0.710	110	8.24	8.2	3.2	11.4	0.09	14.09	157.96
El-Qatta	17.4	1.040	23	7.04	0.8	61.6	41.2	13.37	8.30	12.61
Tamalay	15.7	1.000	50	7.42	1.6	34.8	30.0	10.28	10.77	16.60
Kafr El-Zayat	16.9	0.990	60	7.48	3.4	20.0	28.0	6.36	8.50	13.88
Benha	17.3	0.490	110	8.25	9.6	2.2	13.2	0.09	2.85	149.75
Talkha	23.3	0.600	115	7.78	7.0	2.6	14.8	0.57	57.75	19.90

The maximal water temperature recorded at Talkha may be due to thermal pollution produced from Talkha Electric Power Plant this observation agreed with that obtained by **Abdo (2004)** in the same area. Increasing conductivity at El-Qatta may be attributed to the presence of suspended particles that originate from domestic sewage, fertilizers and industrial effluents that increase the ability to convey electrical current this notice in agreement with that obtained by **Abdo (2013**). The decrease in transparency at El-Qatta site may be attributed to the discharge of agriculture, and domestic wastes, while the increase in transparency at Talkha may due to increasing solar radiation penetrating the surface water, as well as settling out of suspended particles to the bottom sediments this observation agrees with that reported by **El-Sayed (2011)**. The decrease in pH value at El-Qatta site may be related to the lower activities of phytoplankton, however the increase in pH value at Benha site may be due to the increase of phytoplankton activities as recorded by **Ahmed (2012).** The depletion of dissolved oxygen at El-Qatta may be due to decomposition of organic matter and domestic wastes that discharged into this site and decreasing the water level in the River Nile during winter season (drought period), while the increase in dissolved oxygen at Benha site may be due to increase of photosynthesis activity of phytoplankton, this finding agrees with that obtained by **Saad *et.al.* (2011)**. The increase in BOD and decrease DO values at El-Qatta indicate more amount of organic matter present in sewage as reported by **Wagh Vaishali *et al.* (2005).** The high value of COD was recorded at El-Qatta site where high algal biomass recorded (**Abdo 2010).** Increasing ammonia at El-Qatta may be due to sewage wastes and their decomposition of the organic matter. While the decrease in the ammonia concentrations at El-Kanater & Benha sites may be related to nitrification occurs in the water column as reported by **Moustafa *et al*. (2010).** The recorded low values of nitrite at Benha site might be attributed to the fast conversion of NO_2^- by nitrobacteria to NO_3^-. However, the high nitrite level at Talkha site might be attributed to the decomposition of organic matter present in the wastewater where nitrosomonas bacteria oxidize ammonia to nitrite as recorded by **Tayel (2007)**. The recorded low nitrate concentration at El-Qatta site might be attributed to the uptake of nitrate by natural phytoplankton and its reduction by denitrifying bacteria and biological denitrification as cited by **Bayomy and Mahmoud (2007).** However, the increase of nitrate levels at El-Kanater might be attributed to low consumption of phytoplankton as well as the oxidation of ammonia by nitrosomonas bacteria and biological nitrification as recorded by **Saad *et al*. (2011).**

2. Parasitic examination

Different types of external and internal fish parasites were recorded in this study. The effects of pollution on those parasites may be positive or negative; pollution may increase parasitism or decrease parasitism. Generally, infections with Ectoparasites tend to increase with pollution whereas infections with internal helminthes tend to decrease with pollution this was agreed with **Madanive-Moyo and Barson (2010)** and **Nashat (2017).** Concerning with the infestation rate of different type of parasites the highest infestation with the external protozoa were mainly in Kafr El- Zayat site (Table 3), this may be due to presence of industrial pollution which may lead to irritation of fish skin and causes good media and portal of entry for external protozoa as *Trichodina sp.* and *Ambiphyra.* In addition, Ectoparasites are sensitive to changes in environmental condition hence those parasites which might have been present on fish from Kafr EL-Zayat site could have disappeared from other sites due to changes in water chemistry **(Kristmundsson *et al*., 2006).**

Table 3. Parasitic species collected from different sites at Rosetta Branch.

Site	Total No. of fish	Trichodina sp.	Ambiphyra	Kudoa	*Clinostomatid EM.*	*Euclinostomum EM*	*Enterogyrus cichlidarum* Trematodes	Acantho cephalans
El-Qatta	10	3 (30%)	__	1(10%)	__	2 (20%)	1 (10%)	3(30%)
Tamalay	10	3 (30%)	__	__	2(20%)	5 (50%)	__	__
Kafr El Zayat	10	3 (30%)	3 (30%)	__	__	__	__	__

The highest infestation with internal parasites was mainly detected in El-Qata and Tamalay due to the effect of sewage pollution which acts as a stress factor in the fish decreasing its immunity and increasing susceptibility to diseases with the presence of first intermediate hosts as mollusks and crustaceans. In the other side, there was marked infestation with internal parasites in Benha and Talkha (Table 4) which represent agriculture pollution also, it may be due to the presence of first intermediate host and definitive host, so completing the life cycle of the parasite **(Eissa *et al*., 2011)**.

Table 4. Parasitic species collected from different sites at Damietta Branch.

Site	Total No. of fish	*Clinostomatid EM.*	*Euclinostomum EM*	Acanthocephalans
Benha	14	3 (21.5%)	1 (7%)	3 (21.5%)
Talkha	20	8 (40%)	2 (10%)	__

External Protozoa

1. *Trichodina* spp.

Two types of *Trichodina* spp. were recorded in examined *O. niloticus*. The infestation rate was 30% in El-Qata, Tamalay and Kafr El –Zayat (Figure 1A and Table 4).

- ***Trichodina heterodentata***

Trichodina heterodentata was detected on skin and fins of *O. niloticus*. It was a large Trichodinid. The border membrane was finely striated, surrounding the denticular ring. The denticle had sickle- shaped blades and the central part was triangular in shape **(Shehata *et al.*, 2018)** (Figure 1B).

- ***Trichodina truttae*:**

Trichodina truttae was detected on the gills and skin of *O. niloticus*. The parasite was characterized by its large size. The adhesive disc was saucer shaped and also large. The ray of the denticle was long, thin, slightly curved and had a sharp pointed tip. The blade was narrow, slightly curved posteriorly **(Noga, 2010) (Figure 1C)**.

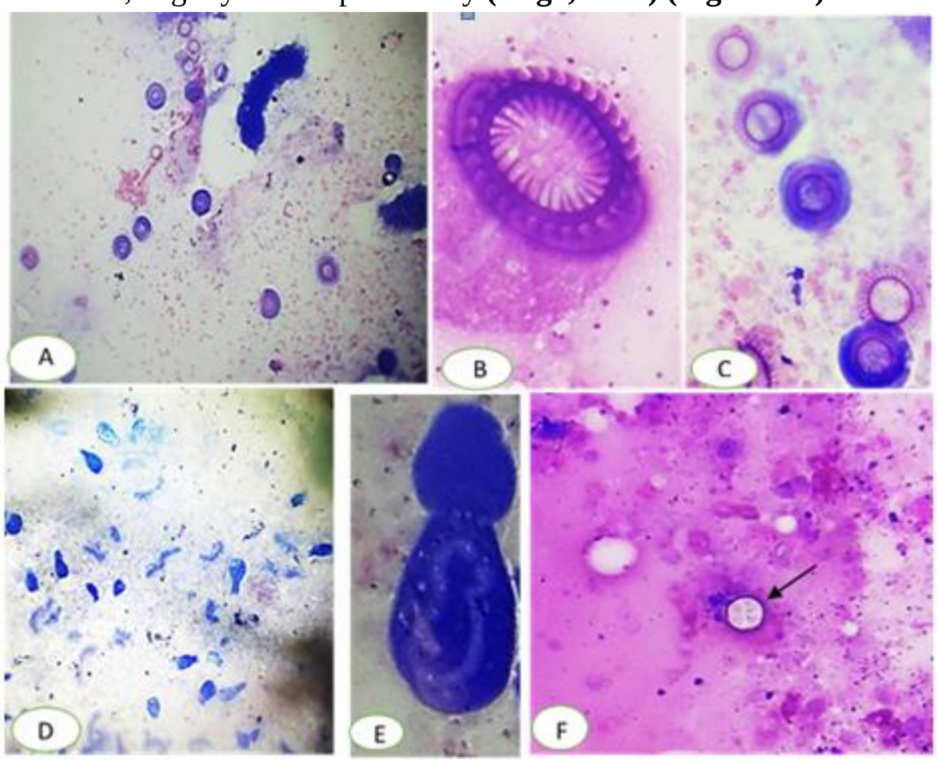


Figure 1. A) showing *Trichodina* trutte isolated from gills of *Oreohromus niloticus* stained with Giemsa stain (X10). B) *Trichodina heterodentata* stained with Giemsa (X40). C) *Trichodina truttae* stained with Giemsa (X40). D) & E) *Ambiphrya ameiuri* stained with Giemsa (X40). F) Kudoa sp. Stained with Giemsa (X40).

2. *Ambiphrya. ameiuri*

Ambiphrya ameiuri is solitary sessile ciliates with large vase shaped body. The body is divided externally by a permanent equatorial ciliary girdle motionless into an oral. According to **Lom and Dykova (1992)** macronucleus is ribbon-like forming an orally situated U-shape sinuous; its limbs descend parallel to each other and ends at the level of the ciliary girdle by hook-like shape. Micronudeus is rounded situated adjacent to one end of macronucleus. Food vacuoles are distributed in the oral part (Figs 1D, E) **(Thompson *et al*., 1947 and Enayat, 2011).** It was isolated from *O. niloticus* fish collected from Kafr El-Zayat. The infestation rate was 30% (Table 4).

3. *Kudoa* sp.

Kudoa sp. was isolated from fish collected from El-Qata, (Figure 1F). The infestation rate was 10% (Table 4). There are multivalvulid myxozoans named as *Kudoa* spp. It was recognized within the musculature of several marine fish species which severely reduce the flesh quality and in some cases cause extensive myoliquefaction, rendering the product unmarketable as situated by **Noga (2010).**

4. *Cichlid gyrus tilapiae*

Cichlid gyrus tilapiae is detected on the gills of *O. niloticus* collected from El-Kanater site the collected fish appeared normal without any signs of disease. The postmortem examination showed presence of Monogenean parasite in gills (Figure 2).

Figure 2. *Cichlid gyrus tilapiae* isolated from *Oreochromus niloticus* gills collected from El-Kanater site

Internal parasite

1. Encysted metacercariae:

- ***Clinostomum phalacrocorasis*:**

Clinostomum phalacrocorasis encysted metacerariae isolated from pharyngeal region and branchial chamber. The cysts had thin transparent membrane and contained a yellowish fluid. They were yellow to orange and varied in size from 2.7-5.2 mm as described by **Shehata *et al.* (2018)**.The infestation rate was 21.5, 40, 20 % in Benha, Talkha & Tamalay , respectively. The intensity of infection ranged from 5-7 metacercarial cysts per fish (Figure 3 A,C,E) (Tables 3,4).

- ***Euclinostomum ardeolae***

Euclinostomum ardeolae encysted metacercariae were embedded in the tissues of the anterior portions of the kidney of *Oreochromis niloticus*. The cysts are of variable size (2-4 mm) with thin wall but completely tight and exerting pressure on its content so that there is no free space inside the cyst around the larva. They appear as round to oval grayish black cysts and give the area around it faint black color as revealed by **Shehata *et al.* (2018).**The prevalence rate of infection was 7, 10 % in Benha and Talkha respectively. The intensity of infection varies from 2-3 metacercarial cyst per infected fish (Figs. 3 B,D) (Tables 3,4).

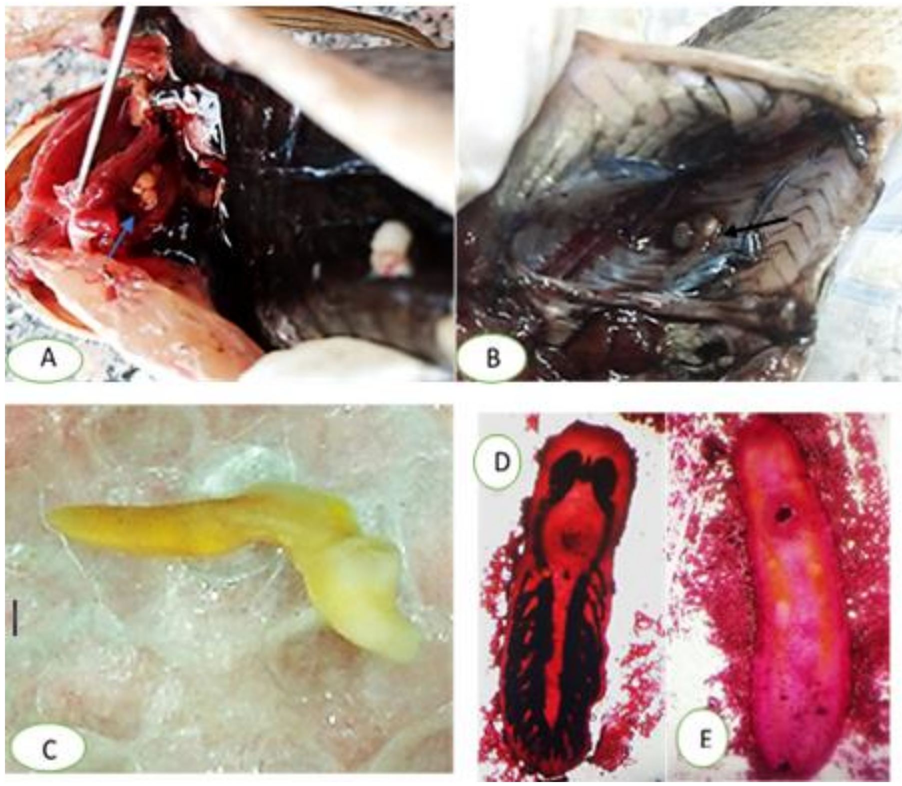


Figure 3. A) *Clinostomum phalacrocorasis* encysted metacerariae present in the pharyngeal region and branchial chamber. B) *Euclinostomum ardeolae* encysted metacercariae embedded in the tissues of the anterior portions of the kidney. C) *Clinostomum phalacrocorasis* metacerariae. D) *Euclinostomum ardeolae* metacercariae stained with acitic acid alumn carmine stain under dissecting microscopy. E) *Clinostomum phalacrocorasis* metacerariae stained with acitic acid alumn carmine stain under dissecting microscopy.

2. *Enterogyrus cichlidarum* trematode

Enterogyrus cichlidarum attached to the gastric mucosa of *Oreochromis niloticus* collected from El-Qatta site as described by **Eissa *et al*. (2011)** with infestation rate10%. While **Elkamel (2012)** revealed 23.33% infestation rate with *E. cichlidarum* and the examined fish showed signs of emaciation with enlarged head (Figure 4A) (Table 4).

3. Acanthocephalans

Acanthosentis tilapiae were collected from the intestines of *O. niloticus* and characterized by thorny headed worm with anterior narrow retractile proboscis and abroad bulb-shaped posterior body. The parasite tegument has a series of alternative folds and a large number of pores. The testes were unequal in size and usually slightly overlapping each other as described by **Eissa et al. (2011).** The infestation rate was 21.5 and 30 % in Benha & El-Qatta respectively (Figure 4 B,C) (Tables 3,4).

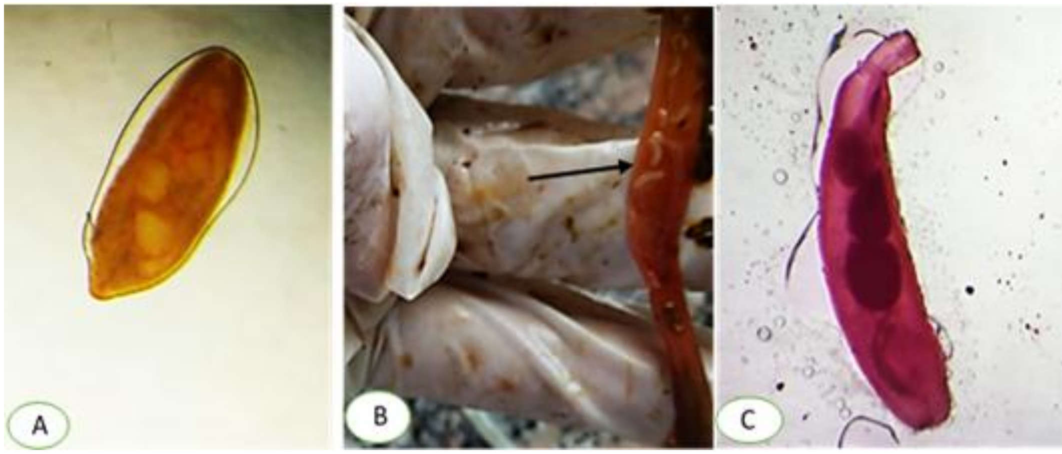


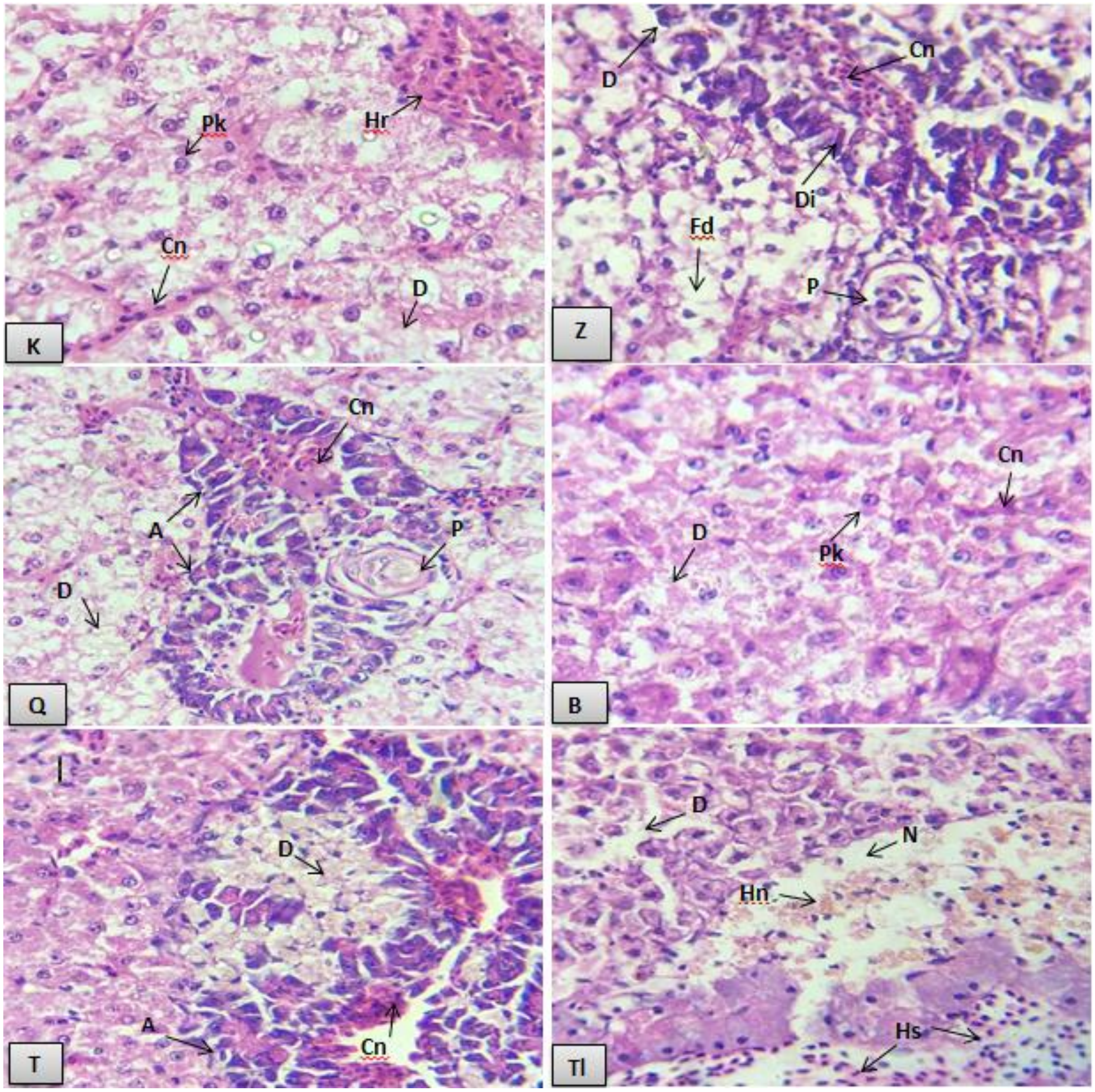
Figure 4. A) *Enterogyrus cichlidarum* trematode isolated from *Oreochromus niloticus* stomach wet mount (X4). B) Intestine of *Oreochromus niloticus* infested with acanthocephalans. C) *Acanthosentis tilapiae* stained with acitic acid alumn carmine stain under dissecting microscopy.

3. The histological alterations

Several histopathological alterations were observed in the liver, kidneys and gills of *O. niloticus* fish collected from six sites during the period of study.

- **Liver**

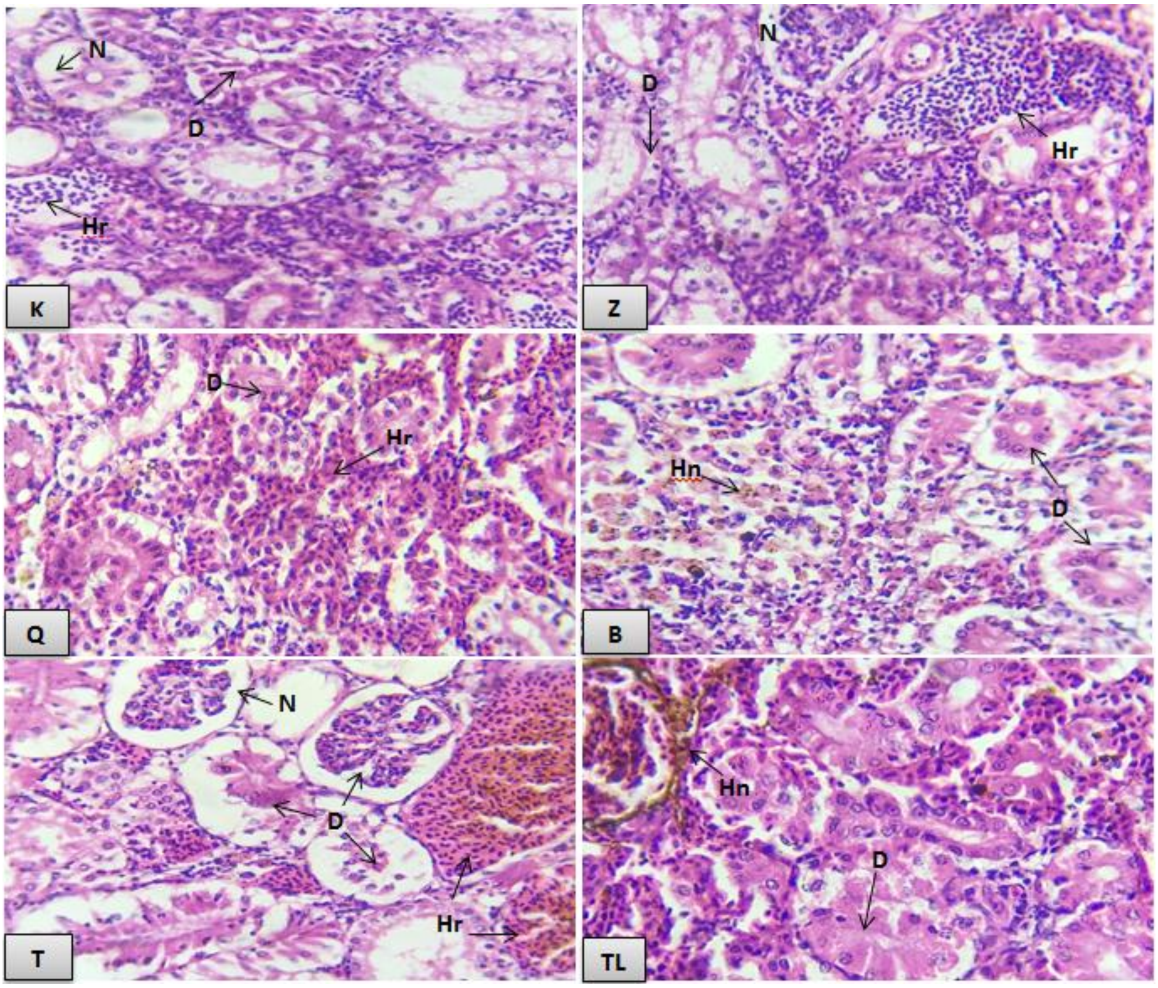
The histopathlogical alterations observed in the liver of *O.niloticus* fish samples collected from the six studied sites including degeneration (D), piknosis (Pk) , hemorrhage (Hr) between the hepatic cells and congesion (Cn) in blood sinusoid (for samples collected from El-Kanater (**K)**). Fatty degeneration (Fd) and parasitic form (P) in hepatic cells, dilation (Di), degeneration (D) and congestion (Cn) in blood vessels (for samples collected from Kafer El-Zayat (**Z**)). Degeneration (D) in hepatic cells, anastimosis (A), congestion (Cn) and parasitic form (P) in blood vessels (for samples collected from El-Qatta (**Q**)). Degeneration (D) and piknosis (Pk) in hepatic cells and congesion (Cn) in blood sinusoid (for samples collected from Benha (**B**)). Anastimosis (A), congesion (Cn) and degeneration (D) in blood vessels (for samples collected from Tamalay (**T**). Degeneration (D), necrosis (N), hemolysis (Hs) and hemosidrin (Hn) between the hepatocytes (for samples collected from Talkha (**TL**)) (Plate I).



(Plate I) Liver sections of *O. niloticus* fish obtained from six studied sites; (**K**): from El-Kanater showing degeneration (D), piknosis (Pk) , hemorrhage(Hr) between the hepatic cells and Congesion (Cn) in blood sinusoid. (**Z**): from Kafer El-Zayat showing fatty degeneration (Fd) and parasitic form (P) in hepatic cells, dilation (Di), degeneration (D) and congestion (Cn) in blood vessels. (**Q**) from El-Qatta showing degeneration (D) in hepatic cells, anastimosis (A), congestion (Cn) and parasitic form (P) in blood vessels. (**B**): from Benha showing degeneration (D) and Piknosis (Pk) in hepatic cells and congesion (Cn) in blood sinusoid. (**T**): from Tamalay showing anastimosis (A), congestion (Cn) and degeneration (D) in blood vessels. (**TL**) from Talkha showing degeneration (D), necrosis (N), hemolysis (Hs) and hemosidrin (Hn) between the hepatocytes (H&E).

- **Kidney**

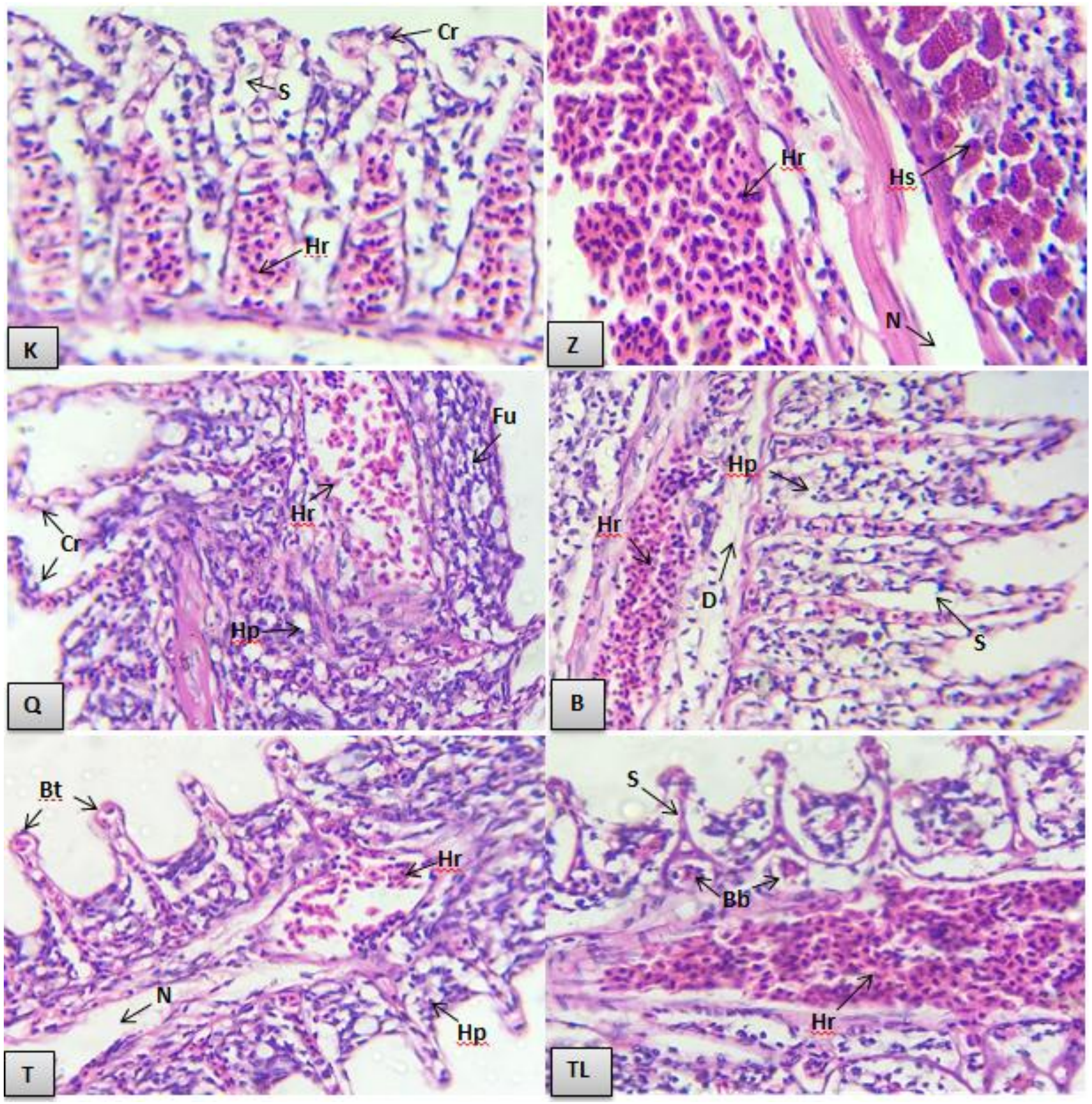
The histopathlogical alterations observed in kidney of *O. niloticus* fish samples collected from six studied sites including degeneration (D) and necrosis (N) in kidney tubules and hemorraghe (Hr) between tubules (for samples collected from El-Kanater (**K**) and Kafer El-Zayat (**Z**). Degeneration (D) in kidney tubules and hemorraghe (Hr) between tubules (for samples collected from El-Qatta (**Q**). Degeneration (D) kidney tubules and hemosidrin (Hn) between tubules (for samples collected from Benha (**B**) and Talkha (**TL**). Degeneration (D), necrosis (N) and hemorraghe (Hr) in kidney tubules and (for samples collected fromTamalay **(T)**. (Plate II).



(Plate II) Kidney sections of *O. niloticus* fish obtained from six studied sites; (**K**): from El-kanater and (**Z**): from Kafer El-Zayat showing degeneration (D) and necrosis (N) in kidney tubules and hemorraghe (Hr) between tubules. (**Q**) from El-Qatta showing degeneration (D) in kidney tubules and hemorraghe (Hr) between tubules. (**B**): from Benha and (**TL**) from Talkha showing degeneration (D) kidney tubules and hemosidrin (Hn)between tubules. (**T**) from Tamalay showing degeneration (D) and necrosis (N) in kidney tubules and Malpigian corpuscle and hemorraghe (Hr) between tubules. (H&E).

- **Gills**

The histopathlogical alterations observed in gills of *O. niloticus* fish samples collected from six studied sites including currling (Cr) and hemorraghe (Hr) in secondary lamellae and separation (S) in its epithelial cells (for samples collected from El-Kanater (**K**)). Necrosis (N) in primary lamellae and hemorraghe (Hr) with hemolysis (Hs) in secondary lamellae (for samples collected from Kafer El-Zayat (**Z**)). Currling (Cr) in secondary lamellae and hyperplasia (Hp), hemorraghe (Hr) and fusion (Fu) in primary and secondary lamellae (for samples collected from El-Qatta (**Q**)). Degeneration (D) and hemorraghe (Hr) in primary lamellae and hyperplasia (Hp) with separation (S) in secondary lamellae (for samples collected from Benha (**B**)). Necrosis (N) with hemorraghe (Hr) in primary lamellae and bump tip (Bt) with hyperplasia (Hp) in secondary lamellae (for samples collected from Tamalay (**T**). Bump base (Bb) and separation (S) of secondary lamellae and hemorraghe (Hr) in primary lamellae (for samples collected from Talkha (**TL**). (Plate III).



(Plate III) L.S. of gills section of *O. niloticus* fish obtained from six studied sites; (**K**): from El-Kanater showing currling (Cr) and hemorraghe (Hr) in secondary lamellae and separation (S) in its epithelial cells. (**Z**): from Kafer El-Zayat showing necrosis (N) in primary lamellae and hemorraghe (Hr) with hemolysis (Hs) in secondary lamellae. (**Q**) from El-Qatta showing currling (Cr) in secondary lamellae and hyperplasia (Hp), hemorraghe (Hr) and fusion (Fu) in primary and secondary. (**B**) from Benha showing degeneration (D) and hemorraghe (Hr) in primary lamellae and hyperplasia (Hp) with separation (S) in secondary lamellae. (**T**) from Tamalay site showing necrosis (N) and hemorraghe (Hr) in primary lamellae and pumb tip (Bb) with hyperplasia (Hp) of secondary lamellae. (**TL**) from Talkha site showing pumb base and separation (S) of secondary lamellae and hemorraghe (Hr) in primary lamellae.H&E.

The above alterations in liver, kidney and gills also noticed by several authers **(Ashry** et al., **2013; Tayel** et al., **2014; Kadry** et al., **2015; Mahmoud and Abd-El-Rahman 2017; Bayomy** et al., **2017; Tayel** et al., **2018** and **Ahmed** et al., **2019** who revealed these malformations to industrial, agricultural and sewage wastes that alter the water quality and cause parasitic infection.

CONCLUSION

The investigated area subjected to various types of pollutants that alter the water quality and allows to prevalence of parasites leading to alterations in histology of *O. niloticus* liver, kidney and gills.

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