Vol. 3, No. 4, pp. 392-400, (December2022)
DOI: 10.21608/aujes.2022.165440.1098
Aswan University Journal of Environmental Studies (AUJES)
Online ISSN: 2735-4237, Print ISSN: 2735-4229
Journal homepage: https://aujes.journals.ekb.eg/ E-mail: AUJES@aswu.edu.eg
Original research

Seasonal variation of Cestoda parasite infection in some common fishes in Lake Nasser

Omayma Mohamed Abd Alkareem*[1], Mohamed H. Abd-Ellal ELdeeb[2].

1.Fish Health and Diseases Department, Faculty of Fish and Fisheries Technology, Aswan University, Aswan, Egypt
2. Graduated from Faculty of Fish and Fisheries Technology, Aswan University, Aswan, Egypt

Received: 15/10/2022 Accepted: 17/11/2022

Abstract:

The A total of 160 fish were collected alive with different sizes and lengths from several and various locations in Lake Nasser during November 2021- June 2022 during four seasons, from different types of fish in Lake Nasser **(*Claris gariepinus, Malapterurus electricus, Oreochromis nilotics, Hydrocynus forskalii, Lates niloticus, Mormyrus Cashive, Auchenoglansis biscutatus, Chrysichthys auratus*, *Claris gariepinus*** and ***Malapterurus electricus*)**. Fish were examined for infections by cestoda species parasites during different seasons. We determined the isolated cestoda parasite and identified them according to morphological feature bands. According to other literatures, the infection of ***Malapterurus electricus*** and ***Claris gariepinus*** by light microscopic (LM) examination and comparison with the published descriptions of the parasite, it was clear that it belongs to ***Polyonchobothrium clarias*** (Woodland, 1925) as shown by LM. In addition, the health status of fish was determined through the determination of growth parameters by the equation of condition factor, and the results showed that only 2 types of fish were infected, while others were free from cestodal infection. The main rates of infection in ***Malapterurus electricus*** fish during 4 seasons were in autumn (70 %), winter (95%), spring (85%), and summer (75%). While infection in ***Claris gariepinus*** occured in autumn (75%), winter (60%), spring (50%), and summer (90%). On the other hand, other types of examined fishes (***Oreochromis nilotics , Hydrocynus forskalii, Lates niloticus , Mormyrus Cashive , Auchenoglansis biscutatus , Chrysichthys auratus , Claris gariepinus*** and ***Malapterurus electricus***) were clear from infection. External clinical examinations showed no abnormalities between the infected and non-infected fish with no significant differences in the condition factors between infected and non-infected fish.

Keywords: Cestoda infection, fish, seasonal variation, Lake Nasser

1- Introduction

Now the demand for fish increases as a source of protein due to the increasing price of beef and poultry meat. Lake Nasser is considered the main source of natural sources of fish, which are not affected by the raising of artificial food.

Corresponding author*: E-mail address: omymaabdelkareem@aswu.edu.eg; oabdelkareem@yahoo.com

In the last few years, Lake Nasser has suffered from increasing parasitic infections among the fish, which led to a drastic decrease in fish yields, low marketability, and rejection of the fish by consumers who fear the macroscopic parasites. Moreover, some parasitic infections in the fish have zoonotic importance, delay the sexual maturity of the fish, and increase fish mortality, causing great economic losses (Noga, 2010; Younis et al., 2017).

Claris gariepinus, Malapterurus electricus , Oreochromis nilotics , Hydrocynus forskalii, Lates niloticus , Mormyrus Cashive , Auchenoglansis biscutatus , Chrysichthys auratus are from the popular fish species of Lake Nasser.

Fish parasitic diseases are considered one of the most important roles in the biology of fish and can affect their health and distribution (Rohde, 1993). Parasitological studies of freshwater fish are important from the points of view of both economics and human health (Woo 1995). Parasites affect fish production. They can act as severe pathogens, causing direct mortality or indirect mortality, through rendering the fish more vulnerable to predators (Kunz and Pung, 2004). Parasitic diseases of fish are very common all over the world (Roberts and Janvoy, 2002). Fish diseases, especially parasitic ones, have a serious impact on the fish as they cause mortality, a low growth rate, lower food conversion rates, decreased marketability, and may even pose zoonotic threats to human consumers (Elsheikha, 2008; Noga, 2010).

Cestodes (commonly known as tapeworms) are flat, segmented worms in Phylum Platyhelminthes, Class Cestoda. They have complex life cycles that involve three hosts: the first intermediate host is a copepod, the second intermediate host is a fish, and the final host is a fish-eating bird, mammal, or other fish. In fish, juvenile cestode stages (metacestodes) are found in internal organs or muscles, with the adult stages in the intestine. Cestodes rarely cause high mortality but may retard growth and lead to adhesions that impair host metabolism and reduce fecundity.

The first record of tapeworms is by Leydig (1853) and Wedl (1861). While the first record of a tapeworm in freshwater fish in Africa is mentioned by Khalil (1971a), who reported a total of 359 species of helminths, including 61 species of adult and larval tapeworms (Cestoda).

Cestodes infecting *Clarias gariepinus* include: *Polyonchobothrium clarias, Stocksia pujehuni, Wenyoni acuminata, Anomotaenia* sp., *Monobothrium* sp., *and Proteocephalus* sp. (Paperna, 1996). (Aderounmu & Adeniyi 1972) mentioned that adults of cestoda usually parasitize in intestinal tract of vertebrates, bodies generally characterized by a ribbon shape that is divided into short segments: the scolex is located at the anterior end, followed by the neck (1 segment), and then the strobili.

There are numerous synonymies of *bothriocephalidean* species, including taxa reported from African freshwater fish (Kuchta and Scholz 2007).

The present study aimed to determine of the prevalence of infection by cestoda parasites in some common types of fish during the 4 seasons, recording the effect of infection on condition factors of the examined fish.

2- Material and methods

Ethical approval

Animal ethics committee, Faculty of Fish and Fisheries Technology, Aswan University, Egypt, approved the protocol and conducting of study.

Study area:

Lake Nasser is a large reservoir in southern Egypt and northern Sudan; one of the greatest artificial lakes in Africa. The study took place from November 2021 to June 2022 during four seasons.

Fish samples:

We collected 160 fish *(Claris gariepinus, Malapterurus electricus, Oreochromis nilotics, Hydrocynus forskalii, Lates niloticus, Mormyrus Cashive, Auchenoglansis biscutatus, and Chrysichthys auratus*) for each season, with different weights and sizes, from various natural fish populations of Lake Nasser.

Clinical and postmortem examinations:

Collected fish were examined clinically in situ for the presence of any external abnormalities by naked eyes and with the aid of a hand lens to determine abnormal changes on the external body surface, as discolorations on the skin, fins, branchial cavity, and gills; swellings, hemorrhages, and ulcerations, exophthalmia and cloudiness of the eyes; detection of external macroscopic lesions and cysts' etc., according to the methods described by **Lucky (1977)** and **Woo (1995)**. After recording the results, the fish were transmitted to the laboratory for further examinations. Body weight to the nearest gram and the total body length to the nearest cm were measured for the different fish samples for the determination of the growth parameter by determining of the condition for individual fish using the formula recommended by Shreck and Moyle (1990).

$$\text{Condition factor} = \frac{w \times 100}{L^3}$$

Where: W is the weight of the fish in grams. L is the total length of the fish in cm

Parasitological examinations:

According to Roberts (1989) and Lucky (1977), fish were dissected to look for cestoda parasites in the body cavity, various organs, and muscles. Every season, there was an incidence of cestodal parasite infection, as well as a number of parasites per infected fish. Morphological examination was performed in accordance with Soulsby (1982), as some of the recovered parasites had been fixed in 70% ethyl alcohol.

Fixation of worms:

Collected cestodes had been inserted into test tubes with physiological saline for washing them from any debris. The collected worms fixed and stored in alcohol formalin acetic acid (**Woodland 2006)** or 70% ethyl alcohol (**Lucky 1977)**.

Staining and mounting of worms preparations:

The obtained cestodes parasites had been stained with Semichon's acetocarmine stain and mounted according to the method described by **Woodland (2006**). The mounted specimens were identified according to **Yamaguti (1975), Myers (1985**), **Paperna (1980),** and **Morvic (1994),** and incidence of infection by parasites for all fish that had been examined at the time of experiment was determined.

Statistical analysis:

Using IBM SPSS version 22 (SPSS 2013) and Microsoft Excel 365, the obtained results were statistically analyzed using the mean and standard error of the mean (SEM).

3- Results and Discussion

Clinical examinations:

Except for excessive mucus secretion and hemorrhagic patches, many samples showed no external signs of infection on their bodies.

Postmortem examinations:

The internal organs of naturally infected fish with cestodes were congested. Visible parasites could be seen by the naked eye in several parts of the internal body, especially in the intestine and stomach.

External body surface:

No cestodes were found on the external body surface.

Internal organs:

In the present study, we only found cestoda parasites in infected *Malapterurus electricus* and *Claris gariepinus* fish, rather than other examined fish (*Oreochromis niloticus, Hydrocynus forskalii, Lates niloticus, Mormyrus cashive, Auchenoglansis biscutatus, and Chrysichthys auratus*), which were completely free of cestodal infections, which agreed with the literature by FAO (1996), which mentioned that the importance of host spasticity in tapeworms is widespread in Africa. Infected fish's intestine and stomach were found to be infected. The muscles, brain, gills, and eye of the examined fish were free from infection by cestoda. Figure (1) depicts the parasites that were obtained.

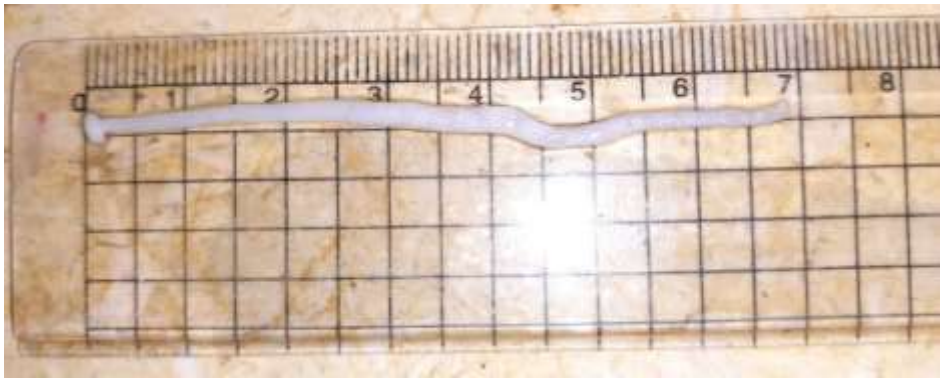

Figure (1): cestode worm isolated from *Malapterurus electricus*

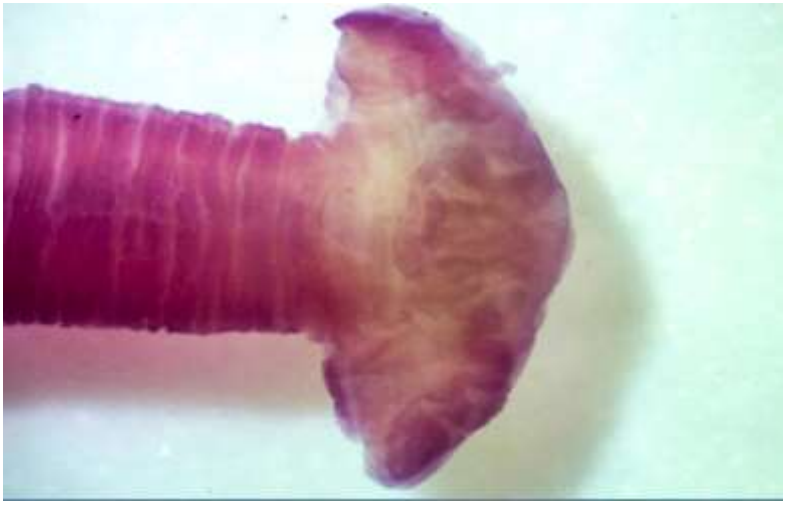

Figure (2): Scolex, uper part of cestoda parasite stained by Semichon's acetocarmine isolated from *malapeterurus electricus* fish

The obtained cestodal parasites from our study were visible with the naked eye and obtained from the intestine, which agrees with Iyaji (2011), who reported that all cestode parasites were obtained from the intestines of fish hosts.

According to characteristic feature revealed by light microscopic examination and comparison with the published descriptions of the parasite, it was clear that it belonged to ***Polyonchobothrium clarias*** (Woodland, 1925). Scolex was rectangular with a flat to slightly raised apex (rostellum), and immature proglottids of strobila were not completely segmented (Figs. 2, 3). With reference to the description by Yamaguti 1959), the genus *Polyonchobothrium* (1959) is characterized by a nearly rectangular scolex with hooks arranged in four quadrants, which agrees with many authors who recorded *Polyonchobothrium clarias* in Africa in the *Clarias lazera* and with Aderounmu and Adeniyi (1972) who said that it is widely distributed in Africa. And also, *Polyonchobothrium clarias* was recorded in Egypt by Amin (1978).

Figure (3): cestoda parasite isolated from *Claries garpinius* from Lake Nasser

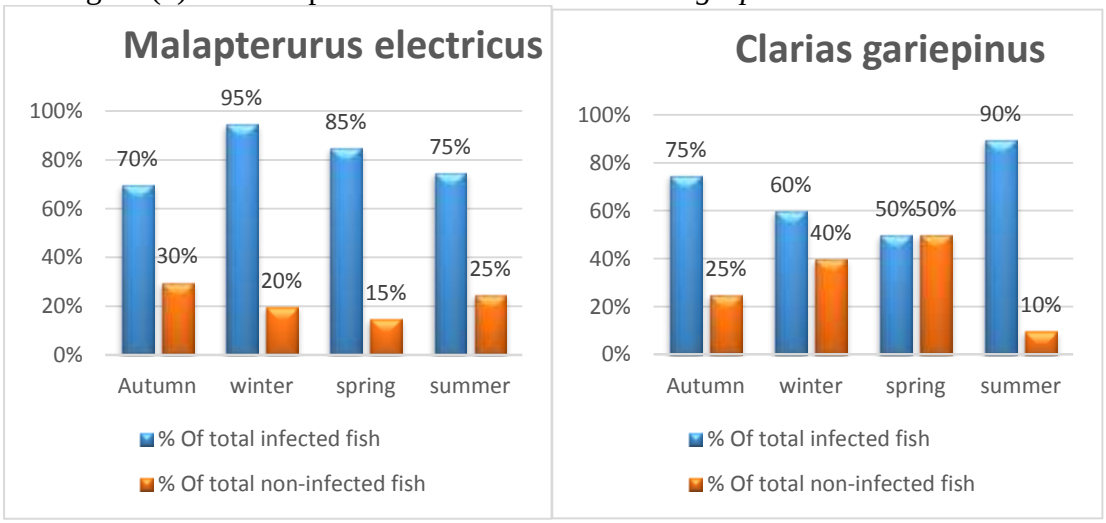

Figure (4): Rate of Cestodal infections of *Malapterurus electricus* and *Claris gariepinus* from Lake Nasser during different four seasons.

Oreochromis nilotics, *Hydrocynus forskalii*, *Lates niloticus*, *Mormyrus cashive*, *Auchenoglansis biscutatus*, and *Chrysichthys auratus* fish were completely free from cestodal infections.

The prevalence of infection in *M. electricus* fish was highest in autumn (70%), winter (95%), spring (85%), and summer (75%), while infection in C. gariepinus fish was highest in autumn (75%), winter (60%), spring (50%), and summer (90%), while infection in other types of examined fish was clear. External clinical examinations showed no abnormalities between the infected and non-infected fish, except for some hemorrhagic patches externally and congestion of the infected intestines. We recorded the higher prevalence and intensity of infection in large fish, which indicated an increase in parasitism with an increase in size, which agrees with several researchers who found positive correlations between host size and increase in parasitism (Betterton, 1974; Madhavi and Rukmini, 1991; Chandler et al., 1995; Brickle et al., 2003).

Results of condition factors of examining fish were showed in table (1) as the following condition factors of ***M. electricusin*** and ***C. gariepinus,*** respectively were Autumn (1.78 ± 0.08 , 1.41 ± 0.03) , (1.28 ± 0.05, 0.95 ± 0.03) , in Winter (1.89 ± 0.03, 1.74 ± 0.02), (1.47 ± 0.03, 1.06 ± 0.04) , in Spring (1.87 ± 0.03, 1.69 ± 0.02) , (1.5 ± 0.04, 1.38 ± 0.04) , in Summer (1.93 ± 0.07, 1.64 ± 0.05), (1.93 ± 0.07, 1.45 ± 0.02). With no significant differences between infected and non-infected.

Table (1): The Mean± SE of condition factor for infected and non-infected fishes Malapterurus electricus and Claris gariepinus in four seasons.

		Autumn	Winter	Spring	Summer
***Malapterurus electricus* fish**	Non infected	1.78 ± 0.08	1.89 ± 0.03	1.87 ± 0.03	1.93 ± 0.07
	Infected	1.41 ± 0.03	1.74 ± 0.023	1.69 ± 0.02	1.64 ± 0.05
***Claris Claris gariepinus* fish**	Non infected	1.28 ± 0.05	1.47 ± 0.03	1.5 ± 0.04	1.93 ± 0.07
	Infected	0.95 ± 0.03	1.06 ± 0.04	1.38 ± 0.04	1.45 ± 0.02

We noticed no external signs of abnormalities except some had hemorrhagic patches externally and congestion of the intestine at infected fish, and the isolated parasites were visible by the naked eye, so they were rejected by the consumer, according to the results of the examination of the infected fish. These findings may differ partially or completely from those of other authors, which could be attributed to different sources of examined fish as well as water chemistry in each location.

Conclusion

To summarize, Cestoda parasite infection has no significant effect on the growth rate of infected fish compared to non-infected fish, is present in the non-edible part of the fish (the intestine), and is detected by the discerning eye of the consumer.

References

Aderounmu, E. A. and Adeniyi, F. (1972). Cestodes in fish from a pond at Ile-Ife, Nigeria. The African Journal of Tropical Hydrobiology and Fisheries, 2: 151-156.

Amin, O.M. (1978). Intestinal helminths of some Nile fishes near Cairo, Egypt, with redescriptions of Camallanus kirandensis Baylis, 1928 (Nematoda) and

Bothriocephalus aegyptiacus Rysavy and Moravec, 1975 (Cestoda). Journal of Parasitology 64: 93-101.

Abowei, J. F. N. and Ezekiel, E.N. (2011): Trematoda, tape worms: Infections by larval and other tape worms; and nematoda in African fish (A review). International Journal of Animal and Veterinary Advances, 3(5): 352-366.

Aderounmu, E.A. and Adeniyi, F. (1972) *Cestodes in fish from a pond at Ile-Ife, Nigeria.* African Journal of Tropical Hydrobiology and Fisheries, 2(2), pp. 151-156.

Aloo, P.A. Anam, R. O and Mwamgi, J.N. (2004). Metazoan parasites of some commercially important fish along the Kenyan coast. Western Indian Ocean. Mar. Sci. 3(1): 71-73.

Betterton, C. (1974). Studies on the host specificity of the eye fluke, *Diplostomum spathaceum*, in brown and rainbow trout. Parasitology, 69: 11 – 29.

Bjoern, C.S.; Miloslav, J.; Zuheir, N.M. and Tomas,˘S. (2011): Revision of Wenyonia Woodland, 1923 (Cestoda: Caryophyllidea) from catfishes (Siluriformes) in Africa. Syst Parasitol 79:83– 107.

Chandler and Chapman, C. A. (1995). Patchiness in the abundance of metacercariae parasitizing *Poecilia gillii* (Poeciliidae) isolated in pools of an intermittent tropical stream. Environmental Biology of Fishes, 42: 313 – 321.

De Chambrier, A.; Scholz, T.S.; Beletew, M. and Mariaux, J. (2009): A new genus and species of Proteocephalidean (Cestoda) from *Clarias* catfishes (siluriformes: Clariidae) in Africa. J. Parasitol. 95(1), 2009, pp. 160–168.

Eissa I.A.M. 2002. Text book of parasitic fish diseases in Egypt. Dar El-Nahdda El-Arabia, Cairo, Egypt Issa I.A.M., Ramadan A.F., Mohamed S.Y., Abdelmola H.I. 2010. Entero-parasitic infestation and the associated pathological lesions in Clarias gariepinus at Ismailia province. Journal of Agriculture and Veterinary Science, 3, 21– 32

El-Naffar, M.K.; Saoud, M.E. and Hassan, I.M. (1983): A general survey of helminth parasites of some fish from Lake Nasser at Aswan, Egypt. Assiut Vet. Med. J. 11 (2): 141-148.

El-Seify M.A., Mahmoud N.A., Abou El-Wafa S.A., Abd El-Aal A.M.I. 1997. Studies on some enteric helminths of Nile fishes from Sharkia province, Lower Egypt. Egyptian Journal of Aquatic Biology and Fisheries, 1, 431–449.

Hoffman, G.L. (1967): Parasites of North American Freshwater Fishes. University of California Press, Berkeley & Los Angeles

Iyaji, F. O. (2011). Parasites of Siluriformes at river Niger- Benue Confluence, Nigeria, Ph.D Thesis,University of Nigeria, Nsukka.

Karoline R., Serge M., Pauel H., Sona T., Martin F., and Andrea Simkova (2011). Are fish immune system really affected by parasites? An immunoecological study of Common Carp (CyprinusCarpio). Parasites and vectors 4:120. http;//parasites and vectors. Com/content 4/1/120.

Khalil, L. F. (1969). Studies on the helminth parasites of freshwater fishes of the Sudan. *Journal of the Zoological Society of London*, 158: 143 – 170.

Khalil, L.F. (1971a) Check list of the helminth parasites of African freshwater fish. Commonwealth Agricultural Bureaux, Farnham Royal, England, 80 pp.

Khalil, L.F. and Polling, L. (1997): Check list of the helminth parasites of African freshwater fishes. Department of Zoology/Biology, University of the North, Pietersburg, Republic of South Africa.

Kuchta, R. and Scholz, T. (2007) Diversity and distribution of fish tapeworms of the "Bothriocephalidea" (Eucestoda). Parassitologia, 49, 129–146.

Latif, A. E. A. 1974. Fisheries of Lake Nasser and Lake Nubia. In report on: Trips to Lake Nasser and Lake Nubia. By: B. Entz&A. F. A. Latif; Aswan Regional Planning, LNDC, A.R.E.

Leydig, F. (1853) Ein neuer Bandwurm aus Polypterus bichir. Archiv fur Naturgeschichte, 19, 219 - 222.

Lucky, Z. (1977). Methods for the diagnosis of fish diseases (p. 131). Amerindpublishing Co, PVT. TD, New Delhi, Bombay, Calcutta and New York. https://www.amazon.com /Metho ds-Diagnosis-Diseases-Zdenek-Lucky/dp/B000J RBXDM.

Madhavi, R. and Rukmini, C. (1991). Population biology of the metacercariae of *Centrocestus formosanus* (Trematoda: Heterophyidae) on the gills of *Aplocheilus panchax*. Journal of Zoology, 223: 509 – 520.

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

Myers, I., & McCaulley, M. (1985). Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator. Palo Alto, CA: Consulting Psychologists.

Noga, E. J. (2010). Fish diseases, diagnosis and treatment (2nd ed.).Wiley. https://www.wiley.com/en-us/Fish+Disea se%3A+Diagnosis+and+Treat ment%2C+2nd+Editi on-p- 9780813806976.

Omeji. S. S.G. Solomon and R.A. Obande (2011). A Comparative Study of the Common Protozoan Parasites of *Clarias gariepinus* from the wild and Cultured Environments in Benue State, Nigeria. Journal of Parasitology Research Volume 916489.8 pages Doi. 10.1155/2011/9/916489.

Onyeidineke, N.E, Ofoegbu P.U., Ukogo, (2010). Helminth Parasites of Some Freshwater Fish from River.Niger at illushi, Edo State. Nig. J. Am. Sci. 6(3): 16-21 Pakistan Journal of Nutrition 9(9) 865-872. 2010. 1680-5194

Paperna, I. (1996). Parasites, infections and diseases of fishes in Africa: An update. FAO/CIFA Technical Paper, No. 31.

Paul, J.B.H and john, D.R., (2002) hand book of fish biology and fisheries, black we publishing, pp: 359-384.

Poulin, R. (2000). Variation in the intraspecific relationship between fish length and intensity of the parasitic infection: Biological and statistical causes. Journal of Fish Biology, 56: 123 – 137.

Woo P.T.K. (2nd Ed.) 1995. Fish diseases and disorders Vol. 1 (Protozoan and Metazoan infections) CAB, Int., Wallingford, Oxan, UK.

Woodland, J. (2006): National Wild Fish Health Survey – Laboratory Procedures Manual. 3.1 Edition. U.S. Fish and Wildlife Service, Pinetop, AZ.

Woodland, W.N.F. (1923): On some remarkable new forms of Caryophyllaeidae from the Anglo- Egyptian Sudan, and a revision of the families of the Cestodaria. Quarterly Journal of the Microscopical Science (New Series) 67: 435– 472.

Yamaguti, S. (1959): Systema Helminthum . Vol. II. The cestodes of vertebrates. Inter science Publ., New York. Yamaguti S. (1975). A synoptical review of life histories of digenetic trematodes of vertebrates with special reference to the morphology of their larval forms. Tokyo, Keigaku Publishing Co. pp. LXI I + 590 + 219 pis.

Wedl, K. (1861) Zur Helminthenfauna Agyptens. III. Nematoda. IV. Cestoda. Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Wien, 44, 463 - 482.

Yamaguti S. (1975). A synoptical review of life histories of digenetic trematodes of vertebrates with special reference to the morphology of their larval forms. Tokyo, Keigaku Publishing Co. pp. LXI I + 590 + 219 pis.

Younis, A. E., Saad, A. I., & Rabei, J. M. (2017). The occurrence of Contracaecum sp. larvae (Nematoda:Anisakidae) in four teleostean

species from Lake Nasser, Egypt: morphological and molecular studies. Journal of Basic and Applied Zoology, 78, 9.