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Contribution to the study of the digenean trematode *Clinostomum complanatum* parasite of the Nile Tilapia (*Oreochromis niloticus*) in breeding basins in southern Mauritania

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ABSTRACT

Parasites of the genus *Clinostomum complanatum* (Rudolphi, 1814), colloquially known as white grubs, are cosmopolitan parasites of fish-eating birds, freshwater snails, fish and amphibians. The first case report of Clinostomum on human infection was seen in 1995 in Korea, it was considered a zoonotic parasite called yellow group diseases; this parasite causes significant damage to fish farms. This parasitic species has been observed in recent years in Japan, China, and Iran to the west, Taiwan, Turkey; and began to be reported from country to country. Thousands of specimens of Tilapia fish (*Oreochromis niloticus*, Linnaeus, 1758) from the ISET experimental station in Rosso were examined for the *Clinostomum complanatum* parasites. Parasites taken directly from the attachment sites on the fish are fixed in 70% alcohol and stained with acetic carmine. The number of parasites found was recorded per fish. The sex, total length and weight of the fish are also recorded. The parasites were mainly found attached to the tissues behind the oral cavity, gill cavity, and eyes. 253 Fish were found infested with six hundred and sixty-one (661) parasites; the results obtained showed a prevalence of 29.05% greater in females than 22.30% in males. The females are more vulnerable to being infested with roughly an intensity of 2.93 parasites per fish while males carry less than 2.27 parasites. The infestation of farmed fish by this freshwater parasite moved for the first time in Mauritania, is a limiting factor in the increase in farm productivity in the country.

INTRODUCTION

Fish consumption is increasingly important worldwide. Because of this high demand, fish farming is growing more and more in the world. Providing consumers with parasite-free farmed fish is a real challenge. Unfortunately, the introduction of non-native species into new ecosystems can influence communities by altering species diversity

(Mack, 2000; Kanev, 2002). Trematodes are widespread parasites of fish, piscivores birds, mollusques, and amphibians.

In Mauritania, parasitic trematodes are not well studied despite causing very serious damage in fish *Oreochromis niloticus*, Linnaeus, 1758 (M'bareck et *al.* 2019 a and b).

The parasitic Trematode *Clinostomum complanatum* (Rudolphi, 1814), Braum, 1899 is a metacercariae infesting the skin, muscles, fins, head and viscera of Tilapia fish. It causes pathologies and behavioral changes in the host fish, leading to economic losses in fish farms (Kagei and *al.*, 1984; Mitchell, 1995; Aktop, 2021).

In this research work we propose to study the size, sex and weight of fish in relation to the seasonal fluctuations of the parasite *Clinostomum complanatum* through an analysis of the prevalence, the average intensity and the abundance. To help alert fish farmers to health risks and threats to their production.

MATERIALS AND METHODS

The sampling of Tilapia fish took place in the experimental fish farming station of the Higher Institute of Technological Education (ISET) which is located on the banks of the Senegal River in the town of Rosso in the Wilaya of Trarza in southern Mauritania. It is located between 16°34'18.038" north latitude and 15°48'36.906' west longitude (Figure 1). The climate in Rosso is of the desert type; the hottest month of the year is June with an average temperature of 30.7°C and the coldest month is January with 23.0°C and the average temperature is 27.7°C. The average precipitation is 224 mm and the difference in precipitation between the driest month and the wettest month is 85 mm (M'bareck et *al.* 2019a).

This study was carried out between December 2017 and December 2021, on a total of 1000 specimens of Tilapia fish (*Oreochromis niloticus*) (Figure 2). The fish are caught with a line, hooks using wet bread. The fish are kept in insulated bags to prevent spoilage and parasite migration and are transported to the laboratory for parasitological examination (M'bareck et al. 2019a).

The measurements of the physico-chemical parameters of the water (temperature, pH, salinity, etc.) are carried out "in-situ". Using hand-held devices, such as thermometers, oximeters.

In the laboratory, the sex of the fish was determined. The weight and size of the fish were measured and recorded in a technical sheet. The surface of the body, the oral cavity, the nostrils, the branchial cavity as well as all cavities capable of harboring the parasites and which communicates with the outside, were well examined (Figures 2 and 3). All the parasites collected were removed from the oral cavity at the level of the pharynx and fixed in 10% formalin. For the morphological examination in the laboratory, they were examined under the binocular magnifying glass and the optical microscope (Youssir, 2017; Sean, 2018; M'bareck et al. 2019 a and b).

Figure 1: Location of the study area, Rosso fish farming station.

Figure 2: Dissection of Nile Tilapia fish at the ISET Rosso laboratory.

Parasites were identified at the generic level based on morpho-anatomical criteria and at the species level based on both morpho-anatomical and biometric criteria (Loukili, 2010; Shawket et al., 2018; M'bareck, 2019a).

Data were entered into Excel and analyzed by SPSS version 22.0. The distribution parameters: frequencies, arithmetic means, standard deviations and coefficient of variation were calculated for the different variables. The levels of infestation are expressed in prevalence, average intensity and abundance according to the definitions of Bush and al., (1997). An ANOVA was done to test the effect of size, sex and season on the infestation rate.

RESULTS

The parasitological study of the Tilapia fish (*Oreochromis niloticus*, Linnaeus, 1758) took place in the experimental fish farming stations of the Higher Institute of Technology Education of Rosso (ISET). Of which 55.6% of the males and 44.4% of the females were examined, This survey enabled us to collect from the oral cavity, the branchial cavity, the peritoneal cavity and the visceral cavity of the fish, 661 specimens of a digenic trematode;

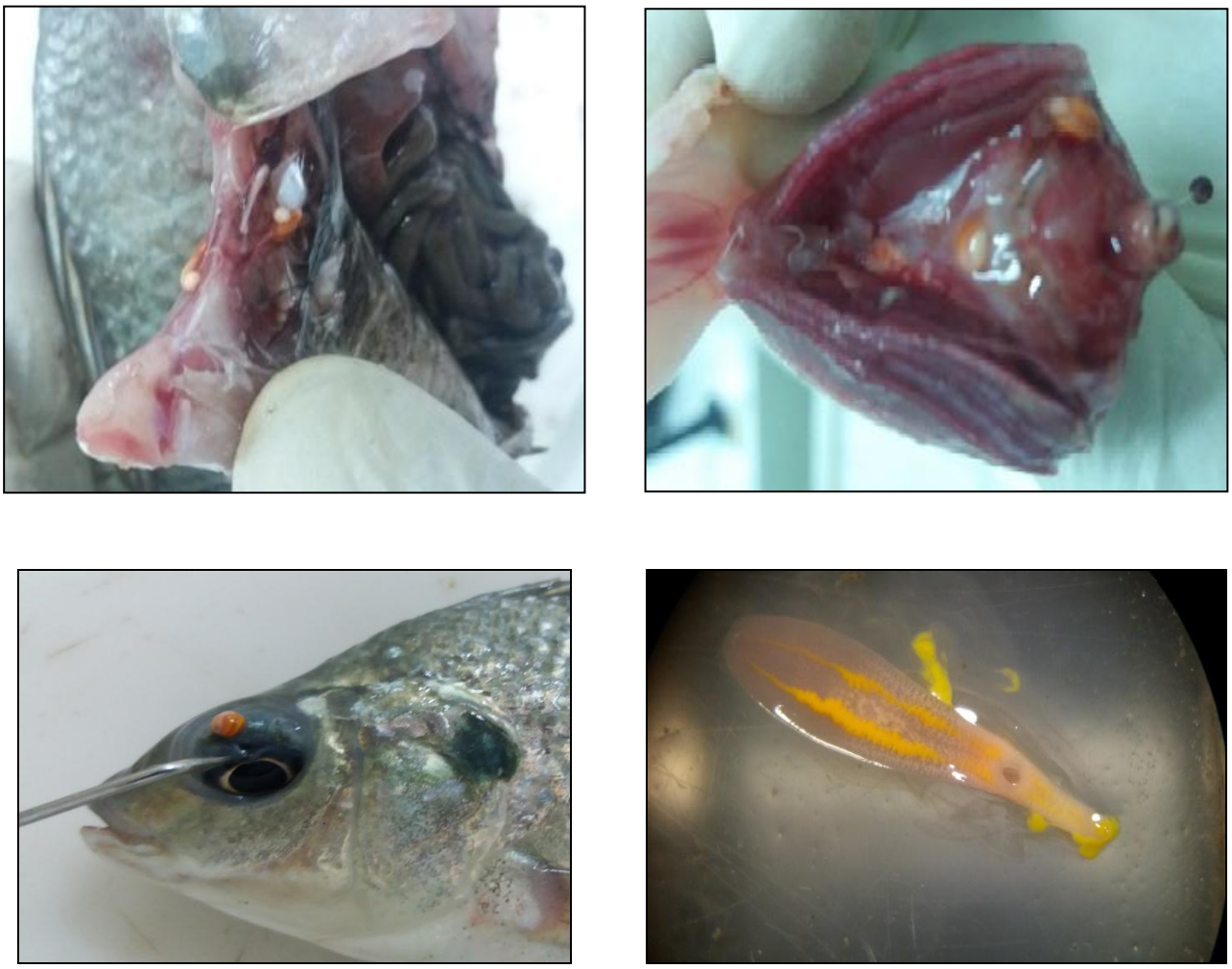

Figure 3: Sampling of parasites from their locations on fish: oral cavities or gills

Clinostomum infestation increases with host size, suggesting a cumulative process (Kalantan *et al*., 1987). The comparison of morphological, anatomical and biometric criteria and the comparison with other parasites found in other regions in this species of fish or in other neighboring species (Khan et *al.* 2018; Ribeiro et *al.*, 2019) allowed us to classify this digenean trematode parasite of Tilapia, in the species *Clinostomum complanatum* (Rudolphi, 1814).

1. Epidemiological indices

The parasitic indices which were revealed in the results of this study show that the parasitic infestation is very important and reaches 25.3% for both sexes combined.

The results obtained also show a prevalence of 29.05% higher in females against 22.30% in males (Table 1). Females are more vulnerable to being infested with roughly an intensity of 2.93 parasites per fish while males carry less than 2.27 parasites.

Table 1: Parasitic indices

fish sex	Fish examined	Infested fish	Number of Trematodes	prevalence	Intensity	Plenty
females	444	129	379	29,05%	2.93	0.85
Males	556	124	282	22,30%	2.27	0.5

2. Variation according to the season

Regardless of the sex of the fish examined, the prevalence of infestation by this parasite is very high in winter and spring and lower in autumn and summer (Figure 4).

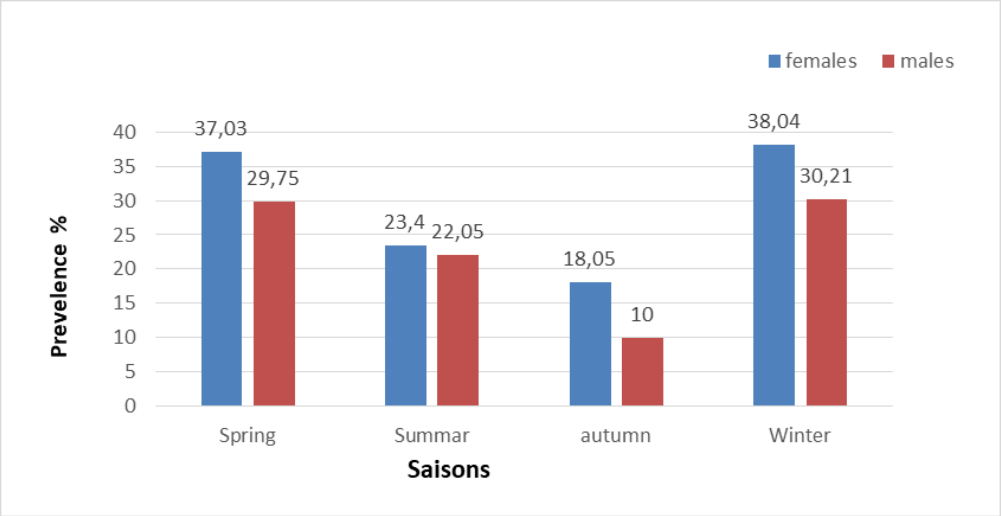

Figure 4: Seasonal variation in prevalence

Depending on the sex of fish examined, parasite intensity was lower in males than females in all seasons. This while the parasite intensity recorded the lowest values in autumn and the highest values in winter (Figure 5).

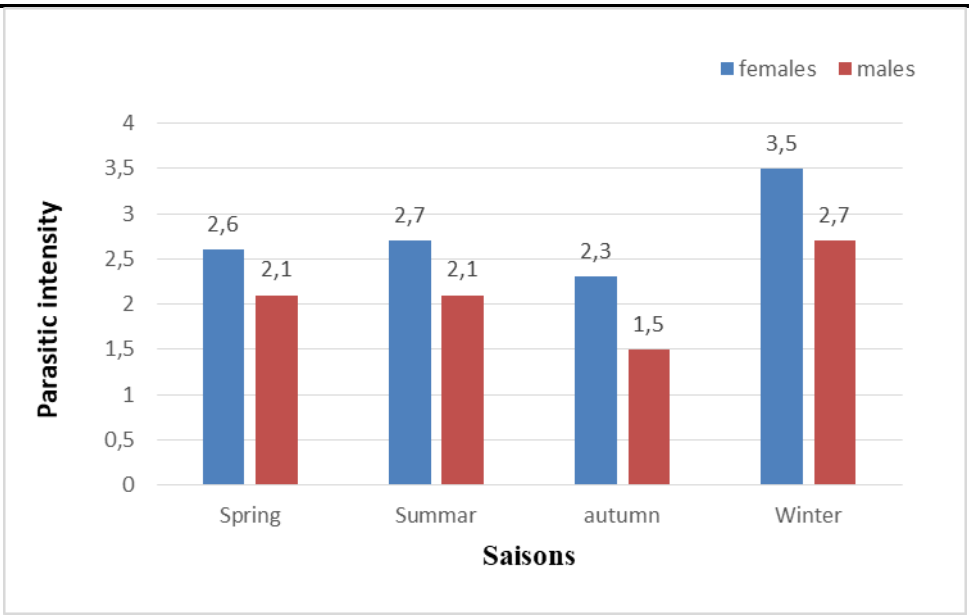

Figure 5: Seasonal variation in parasite intensity

According to the sex of the fish examined, the values of the abundance of the parasite were very low in autumn, relatively high in the hot season and in summer and very high in winter and returned to decrease in spring. Parasite abundance reached a maximum of 14 parasites in some fish in December (Figure 6).

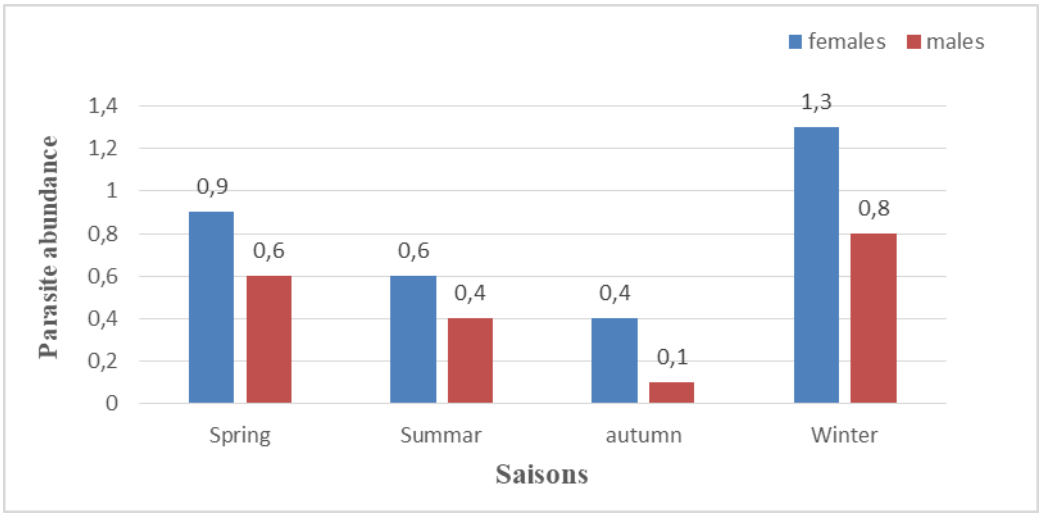

Figure 6: seasonal variation in parasite abundance

3. Variation according to Size

The graph below shows that the prevalence increases with height especially in the interval (27.5-31.5) (Figure 7) and that it was generally higher in males than in females.

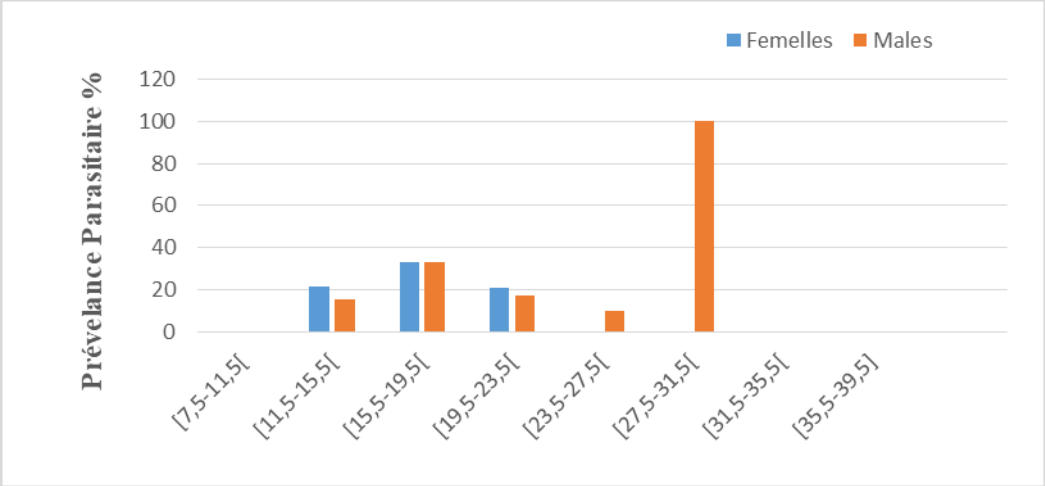

Figure 7: Variation in prevalence according to height

Parasite intensity increases with size in both sexes and is greater in females than males in the intervals of (11.5) ranging from (23.5) in average size (Figure 8).

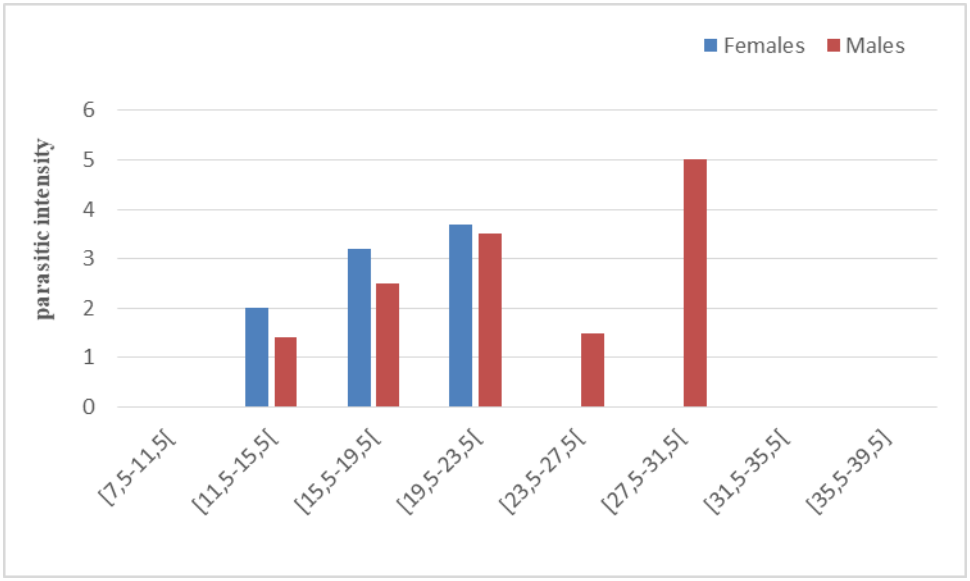

Figure 8: Variation of parasite intensity according to size.

The analysis of graph 9 below shows that parasite abundance increases with size and that it was greater in males than females in intervals of [27.5-31.5 [.

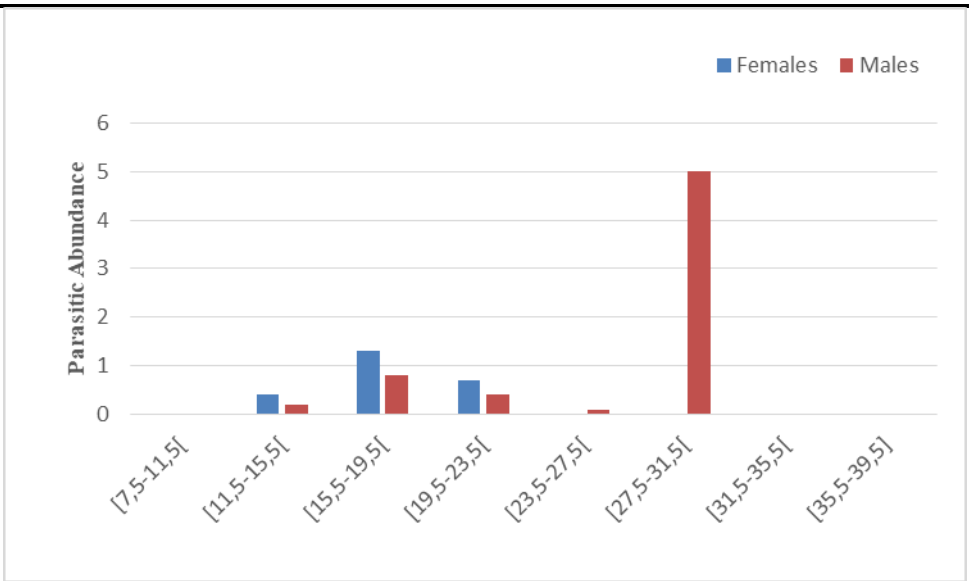

Figure 9: Variation in parasite abundance according to size

4. Variation by Weight

The analysis of figure (10) shows that the prevalence decreases with increasing weight and the highest value is found from 74-118 g ranging from 118 -162 g.

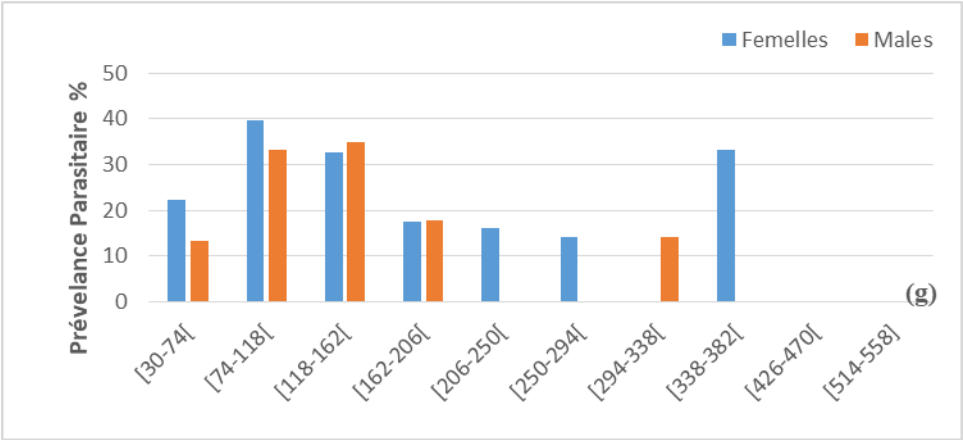

Figure 10: Variation in prevalence according to weight

According to the different weights of the fish examined, the parasitic intensity increases with the weight of the individuals, even more important in females than in males (Figure 11).

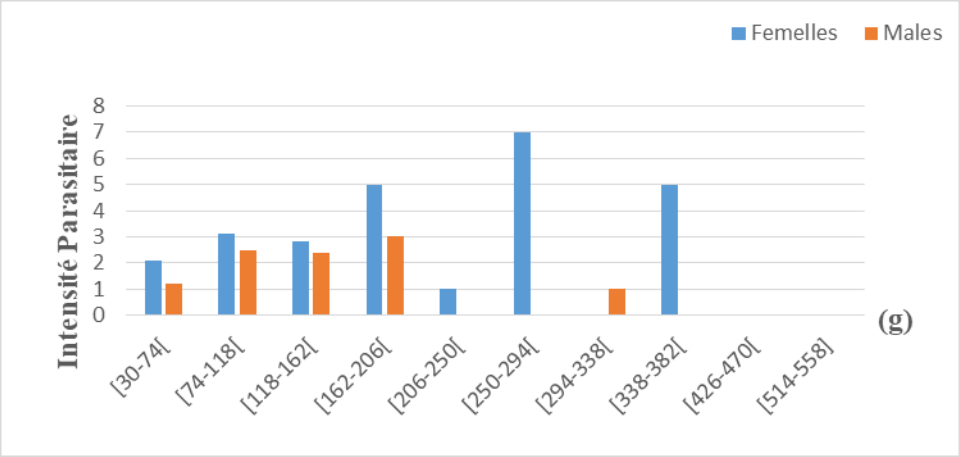

Figure 11: Variation of parasite intensity according to Weight

Parasite abundance values were very high in males and relatively high in females with an average weight ranging from the interval [74-118[to [162-206] (Figure 12).

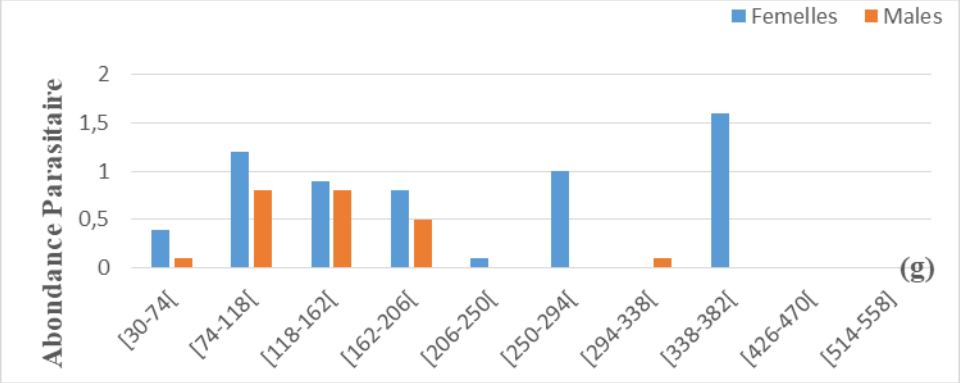

Figure 12: Variation in parasite abundance as a function of weight.

DISCUSSION

The attachment site on the fish tissue showed a cyst, with the metacercariae thought to make this cycle a form of protective mechanism to prevent displacement. It was also concluded that the cyst was produced by the fish as a defense mechanism to prevent further tissue damage by the parasite. According to Hung et al. 2013, these metacercariae can remain viable for increasingly longer periods in hosts. This could last the lifetime of the fish hosts due to the difficulty of locating their definitive hosts which are fish-eating birds such as *Egretta garzetta*, Linnaeux, 1966. Debate on the number of species is ongoing, but contemporary studies on genetic variation within the genus revealed new species.

A total of 661 Trematodes *Clinostomum complanatum* (Rudolphi, 1814) collected from 253 infested fish of 1000 fish examined, the localization of almost all of the parasitic trematodes is in the oral cavity, gills and on the eyes. With a relatively high

infestation prevalence rate of 29.05%, 22.30% respectively in males and females. In addition, the study revealed that the number of parasites increases with the size of the fish ($p<0.05$) like the cases in (Kassi G et al; 2009). This is because it allows us to affirm that fish with a total length between [27.5-31.5 [are more parasitized than those with a size between [11.5-15.5 [. Similar observations were obtained in Foulou, Cameroon by Tombi and Bilong-Bilong and *al*; (2005); on the branchial monogeneans of *Barbus martorelli*.

Clinostomid infection can have several effects on fish such as reduced growth, compensated weight loss and significant proptosis (Margolis et *al.*, 1982; Garacia et *al.*, 1993; Aktop et *al.*, 2021); the results obtained in this study shown that low-weight individuals are the most infected, which may explain a reduction in weight under the effect of parasitism. On the other hand, parasitism evolves independently of sex ($p>0.05$) as is the case according to (Bilong-Bilong, 1995; Kassi et *al.*, 2009). This indicates that males and females are infested in the same way. Moreover, the absence of the influence of the sex of the fish on the infestation has already been demonstrated by Bilong-Bilong (2005) in the branchial monogeneans of *Hemichromis fasciatus*.

The infestation of fish by these parasites varies significantly ($p<0.05$) depending on the season and their seasonal trend shows that the highest averages were recorded during the cold season in winter and spring while the lowest were recorded in the hot season in summer and autumn. Whereas, the variation in the order of infestation was in spring and winter. This could be due to the action of rainwater which would increase the sources of infestation. This phenomenon of seasonal variation has been widely observed in fishes, Prah (1969) observed in Ghana a seasonal variation of the genus Cichlidogyrus paperna, with a virtual disappearance of certain parasites during certain dry months.

CONCLUSION

It was concluded that the cyst was produced by the fish as a defense mechanism to prevent further tissue damage by the parasite; the number of parasites increases with the size of the fish ($p<0.05$);

Infestation by these parasites can have several effects on fish such as reduced growth, weight loss and severe proptosis; low-weight individuals are more infected than large-weight individuals, which can be explained by a loss of appetite in fish under the effect of parasitism.With regard to the variation of fish infestation according to the seasons and their seasonal trend, there is a significant variation ($p<0.05$), and that the highest averages were recorded during the cold season in winter and spring. therefore the increase in hemidity, and the decrease in temperature increase the sources of infestation.

REFERENCES

Aktop, Y.; Yılmaz, H. E. and Çağatay, T. (2021). Geographical distribution of freshwater fish parasite *Clinostomum* spp.. Menba Kastamonu Üniversitesi Su Ürünleri Fakültesi Dergisi, 7(1) : 58-63.

Bilong-Bilong, C.F. and Tombi, J. (2005). Temporal structure of a component community gill parasites of Barbus martorelli (Roman) (freshwater Cyprinidae) in the Centre province, Cameroon. Cam. J. Biochem. Sc. 13: 9-18.

Bilong–Bilong, C.F. (1995). Les Monogènes parasites des poissons d'eau douce du Cameroun : biodiversité et spécificité ; biologie des populations inféodées à Hemichromis fasciatus. Thèse de Doctorat d'Etat. Université de Yaoundé I, Yaoundé, Cameroun. 341 pp.

Bush, A.O.; Lafferty, K.D.; Lotz, J.M. and Shostak, A.W. (1997). Parasitology meets ecology on its own terms: Margolis et al., revisited. Journal of Parasitology, 83: 575–583.

Garacia, M.L.J; Osorio, S.O and Constantino, F. (1993). Prevalence of parasites and their histological lesions in tilapia from the lake of Amela, Tecoman, Colima, Mexico; Vet Mex; 24 (3) : 199-205.

Hung, N. M.; Madsen, H.; Fried, B. (2013). Global status of fish-borne zoonotic trematodiasis in humans. Acta Parasitologica, 58: 231-258.

Kagei, N.; Yanohara, Y.; Uchinawa, R. and Sato, A. (1984). On the yellow grubs, metacercariae of Clinostomum complanatum (Rudolphi, 1819), found in the cultured loach. Japanese J. Parasitol. 33: 59-62.

Kalantan, A. M.; Arfin, M. and Nizami, W. A. (1987). Seasonal incidence and pathogenicity of the metacercariae of Clinostomum. J. Parasitol., 36: 17-23.

Kanev, I.; Radev, V. and Fried, B. (2002). Family Cyclocoelidae Stossich, Keys to the Trematoda, CABI Publishing and The Natural History Museum, London, UK. 1902,. Vol.1 : 131–145 pp.

Kassi G. Blahoua; Valentin N'DOUBA ; Tidiani KONE and N'Guessan J. KOUASSI, (2009). Variations saisonnières des indices épidémiologiques de trois Monogènes parasites de Sarotherodon melanotheron (Pisces : Cichlidae) dans le lac d'Ayamé I (Côte d'Ivoire). Sciences & Nature Vol.6 N°1 : 39 – 47.

Khan, S.; Ahmed, S.; Serajuddin, M. and Saifullah, M.K. (2018). Variation in seasonal prevalence intensity of progenetic metacercariae of Clinostomum complanatum infection in Trichogaster fasciatus fish. Beni-Suef University Journal of Basic Applied Sciences, 7: 310-316.

Loukili, A. (2010). Études parasitologique de l'anguille européenne dans les eaux douce et marine de la plaine du Gharb ; Thèse de doctorat nationale, Université Ibn Tofail-Kenitra, Maroc.

M'bareck, I.; Shawket, N.; Aba, M.; Youssir, S.; Beyah, M.; El kharrim, K.; Loukili, A.; and Belghyti, D. (2019a). Population dynamics of copepods (Lamproglena monodi Capart, 1944) Tilapia parasites from the Senegal River–Mauritania. International Journal of Oceans and Oceanography. Volume 13, numéro 2 : Première page 377 et dernière page 387.

M'bareck, I.; Shawket, N.; Aba, M.; Youssir, S.; Beyah, M.; El kharrim, K.; Loukili, A.; and Belghyti, D. (2019b). Identification of copepod Lamproglena monodi parasite of Tilapia (Oreochromis niloticus) in the Senegal River Mauritania. Marine and Environment-universe Scientific Publishing Pte. Ltd. Volume 08, numéro 2 : Première page 1 et dernière page 5.

Mack, R.N.; Simberloff, D.; Lonsdale, W.M.; Evans, H.; Clout, M. and Bazzaz, F.A. (2000). Biotic invasions: causes, epidemiology, global consequences, and control. Ecological Applications 10(3): 689-710.

Margolis, L.; Esch, G. W.; Holmes, J. C. and Kuris, A. M. (1982). The Use of Ecological Terms in Parasitology (Report of an Ad Hoc Committee of the American Society of Parasitologists). SchadThe Journal of Parasitology, Vol. 68, No. 1: 131-133.

Mitchell, S.A.; Oslin, J.L. and Griffin, L.L. (1995). The effects of two instructional approaches on game performance. Pedagogy in Practice, 1: 36–48.

Prah, S.K. (1969). Observation on parasitic infection in freshwater fish in Ghana. In: Obeng, L.E., Ed. Academy of Sciences. Man-made lakes, the Accra Symposium. Accra University Press for Ghana. 261–268, pp.

Ribeiro, JS.; Oliveira FCR. and Ederli NB. (2019). First report of Diplostomidae metacercariae (Trematoda: Digenea) in African catfish Clarias gariepinus (Siluriformes: Clariidae) in Brazil. Rev Bras Parasitol Vet.; 28(4) : 677-684. doi: 10.1590/S1984-29612019081. PMID: 31691732.

Sean A Locke; Alex Van Dam; Monica Caffara; Hudson Alves Pinto; Danimar López-Hernández and Christopher A Blanar (2018). Validity of the Diplostomoidea and Diplostomida (Digenea, Platyhelminthes) upheld in phylogenomic analysis, International Journal for Parasitology, 48 (13) : 1043-1059.

Shawketa, N.; Elmadhi, Y.; M'bareck, I.; Youssir, S.; El Kharrim, K. and Belghyti D. (2018). Distribution of two monogenean (Gastrocotylidae) from the North Atlantic coast of Morocco. Beni-Suef University Journal of Basic and Applied Sciences, edition Volume 7, Issue 3: 270-275. https://doi.org/10.1016/j.bjbas.2018.03.008.

Yedehi, Euphrasie, Ado; Kassi, Georges Blahoua; Kamelan Tanoh Marius and Ndouba Valentin (2017). Prevalence and intensity of gill monogenean parasites of Tilapia guineensis, International Journal of Biological and Chemical Sciences 11(4) : 1559. DOI: 10.4314/ ijbcs.v 11 i4.13.

Youssir, S.; M'Bareck, I.; Shawket, N.; Hassouni, T.; El Kharrim, K. and Belghyti, D. (2017). Cutlassfish infestation (Trichiurus lepturus) by Anisakis simplex larvae in Moroccan Atlantic coast. Journal of Entomology and Zoology Studies. 5(3): 1857-1861.