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Population dynamics of copepods (*Lamproglena monodi* Capart, 1944) Tilapia parasites from the Senegal River – Mauritania

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Abstract

Tilapia farming plays a very important role in the fish farming sector in sub-Saharan Africa. Parasitism is a factor that negatively affects fish performance; copepods are the most common parasites found at breeding stations in this region.

The objective of this study is to establish the effect of biotic factors on the parasitism of tilapia (*Oreochromis niloticus* Linnaeus, 1758) raised in extensive rearing system.

The fish are sins in the experimental fish lakes of the ISET fed by the waters of the Senegal River to the city of Rosso-Mauritania. In the laboratory all the organs (skin, fins, lids, gills, digestive tract, liver, muscles) of the collected fish were carefully collected and examined for parasites. The gills were dissected and placed in Petrie dishes containing water and examined under the binocular magnifying glass. The parasites were collected and stored in 70% alcohol.

Examination of 1000 fish specimens (556 males and 444 females) identified 2660 copepods parasitized by *Lamproglena monodi* Capart, 1944.

Thus the results revealed that parasite indices are 59.2%; 4.49 and 2.66 respectively for Prevalence, Intensity and Abundance. ANOVA shows that sex has no significant effect ($p > 0.05$) on parasite burden and weight has no effect on infestation. While the season has a highly significant effect ($p < 0.05$) on parasite load.

Ultimately, parasite indices obtained can help alert fish farmers to the health risks and threats to their production with regard to the presence of parasites in the breeding environment. In this context, it will be possible to use antiparasitics with a dual advantage, that of reducing prevalence and that of improving zootechnical performance.

Keywords: Fish Farming, Tilapias, Parasitology, Copepods, Rosso, Mauritania**.**

I. INTRODUCTION

High population growth, changes in consumer tastes and eating habits all contributed to a significant increase in the demand for animal protein.

For example, fish, which are very rich in high biological value proteins, are highly consumed (FAO, 2004); but this important demand for fish is less and less satisfied by capture fisheries; to meet their needs, people are therefore increasingly using aquaculture.

Tilapia is a fish that lives in freshwater, is of African origin and also populates the basins of Niger, Volta, Senegal and Congo (Philippart and Ruwet, 1982); it has great economic importance in the region.

In the family of Cichlids, two species are mainly cultivated: the Mozambique Tilapia (*Oreochromis mosambicus*) and the Nile Tilapia (*Oreochromis niloticus*) (FAO, 2017), the latter which is raised in the fish station of the city of Rosso in Mauritania.

We are faced with the fact that a large part of the yield is lost due to the presence of parasites in the breeding environment because they influence the zootechnical performance of the fish, they also influence the quality of the product and have a health risk of the consumer. As a result, we proposed to study the effect of biotic factors in an extensive rearing system on parasitism.

In this study, we opted for the analysis of the population dynamics of the parasite most represented in the parasitic communities of Tilapia in our study site, the copepod *Lamproglena monodi* Capart, 1944; for this we examined the impact of fish sex on parasitism and size evolution, the weight of fish on parasite fluctuations through an analysis of prevalence, mean intensity and abundance. ; To help alert fish farmers to health risks and threats to their production.

II. STUDY AREA, MATERIALS AND METHODS

Sampling of a total of 1000 fish (*Oreochromis niloticus*) (44.4% males and 55.6% females) was conducted at the Experimental Fish Culture Station of the Higher Institute of Technology Education (ISET) , located on the banks of the Senegal River in the town of Rosso in the Trarza Wilaya of southern Mauritania. It is located between latitude 16 ° 34'18.038 " N and longitude 15 ° 48'36.906 'W (Figure 1).

Figure 1: Location of the study area

The climate in Rosso is called desert; 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 precipitation varies 224mm, with an average of 85 mm. The driest change of precipitation is between the driest month and the wettest month.

In the field, measurements of the physicochemical parameters of the water (temperature, pH, salinity, etc.) are carried out in situ. Tilapias are caught by hooks using wet bread. The sex of the fish was determined; they are kept in insulated bags to prevent the deterioration and migration of parasites and are transported to the laboratory for parasitological examination.

In the laboratory, the weight and size of the fish were measured and recorded in a data sheet, the body surface, the oral cavity, the nostrils, the branchial cavity as well as any cavity capable of harboring the parasites and which communicates with outside, are well examined (Figure 2). The gills are taken, placed in petri dishes, numbered from left to right, and examined carefully; the copepods are fixed and stored in 70% alcohol, for further study. For examination of morphology and anatomy, the copepods were examined under the light microscope and the binocular loupe (Belghyti et *al.* 1997).

Figure 2: Nile Tilapia fish (*Oreochromis niloticus*)

The identification of parasites is generic, based on morpho-anatomical criteria and species based on morpho-anatomical and biometric criteria (M'bareck and *al.*, 2019, Al-Nasiri and *al.*, 2012, Loukili, 2010).

The data was entered on 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. Infection levels were expressed as prevalence, mean intensity, and abundance as defined by Bush, Lafferty, Lotz, and Shostak (1997). An ANOVA was done to test the effect of height, sex and season on the rate of infestation.

III. RESULTS

Lamproglena monodi is a branchial parasite of Tilapia fish (*Oreochromis niloticus*, Linnaeus, 1758) in experimental fish farms of the Higher Institute of Technology Education (ISET), which lies on the Senegal River in the southern city of Rosso from Mauritania (M'bareck and *al.*, 2019).

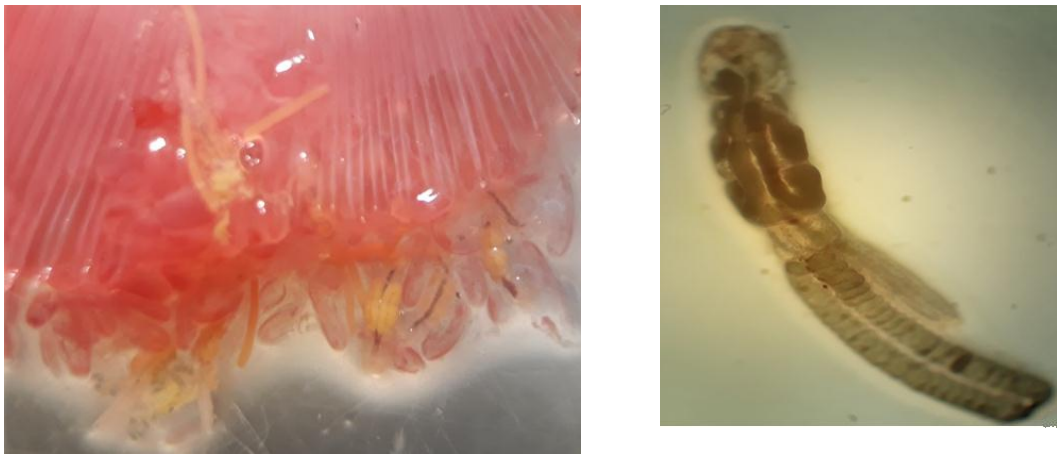

Figure 3 : *Lamproglena monodi*

It is observed that this parasite prefers gill arches II and III for both sides of the fish compared to gill arches I and IV in both sexes of Tilapia.

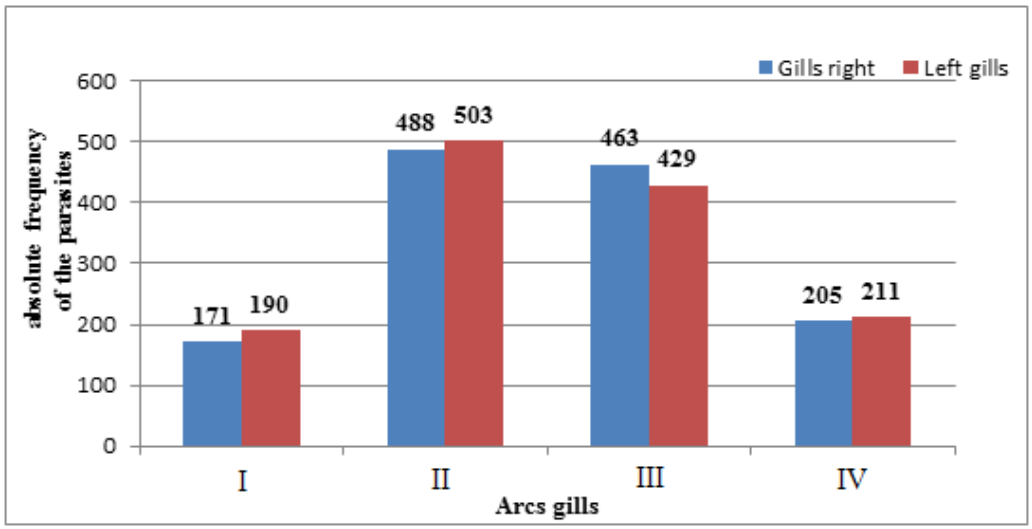

Figure 4: Distribution of *Lamproglena monodi* on the different branch arches.

1. Fluctuation by gender

Of the 1000 Tilapia fish examined in the ISET fish station, we collected 2660 copepod specimens from the gills of 591 infested fish;

For both sexes the epidemiological indices (Table 1), are in agreement with those cited by Paperna 1982, (the prevalence of infestation varies between 50 and 95% and the average number of parasites per fish between 2 and 9).

Table 1: Epidemiological indices

Copepode	**Prevalence (P)**	**Intensity (I)**	**Abundance (A)**
Lamproglena monodi	**59,2%**	**4,49**	**2,66**

Infestation rate of the parasite *Lamproglena monodi* shows fluctuations between the two sexes of fish (Table 2).

Table 2: According to the sex of Fish

Copepods	**Fish sex**	**Fish examined**	**Infested fish**	**Number of Copepods**	**Prevalence**
Lamproglena monodi	Females	444	278	1273	62,8%
	Males	556	313	1387	56,2%

The results show a 62% higher prevalence in males than females despite the fact that copepods collected and infested fish are more numerous in females.

2. Seasonal fluctuations

For both sexes of the fish examined, it is observed that the number of infested fish is very important during the months of October, November, December, January and February: the months at average temperature; it is less important in the high temperature months (Figure 5).

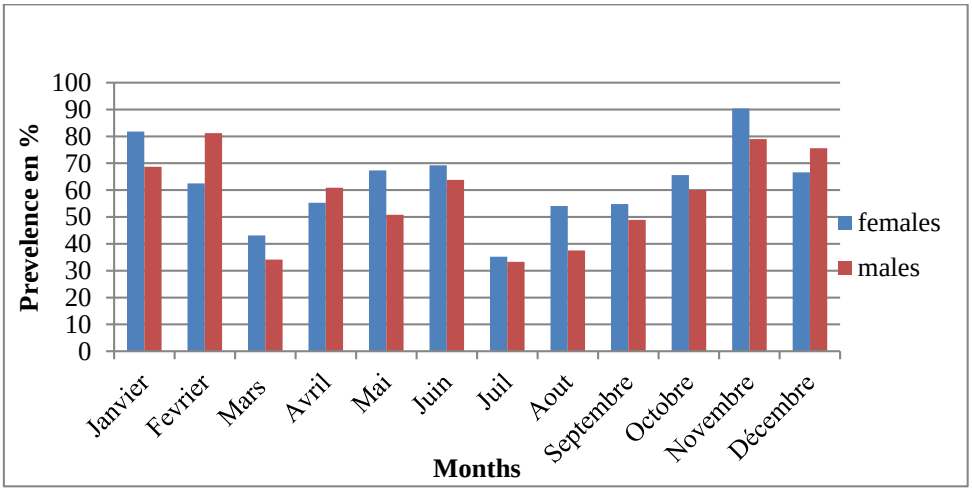

Figure 5: Monthly variation of prevalence

Parasite intensity is lower in the spring and winter months than during the summer and autumn months for both sexes of Nile tilapia (*Oreochromis niloticus*).

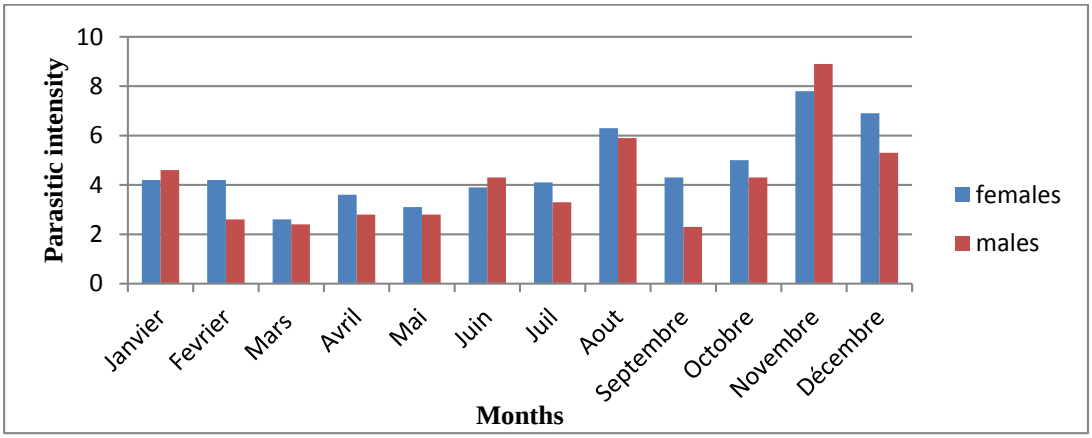

Figure 6: Monthly variation of parasite intensity

Parasite abundance values are very high in late autumn and early winter and are relatively low in other seasons of the year for both sexes, and this abundance also peaks at seven parasites by fish in November.

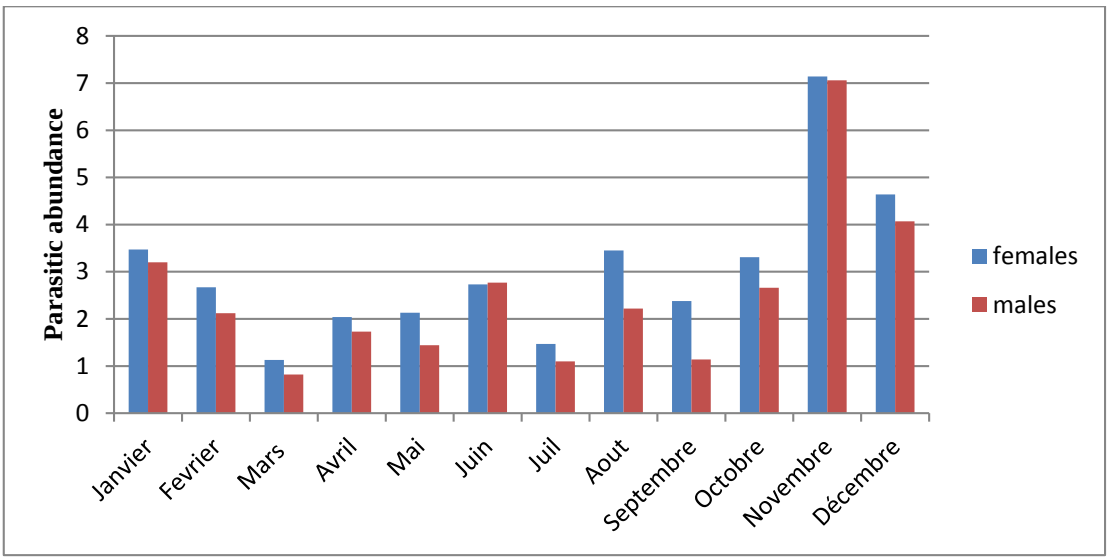

Figure 7: Monthly variation of parasite abundance

3. Fluctuation according to the size of the fish

The most infested fish are the youngest fish, whose size between 11.5cm and 31.5 cm in both sexes, with a maximum in size fish between 15.5cm and 19.5cm.

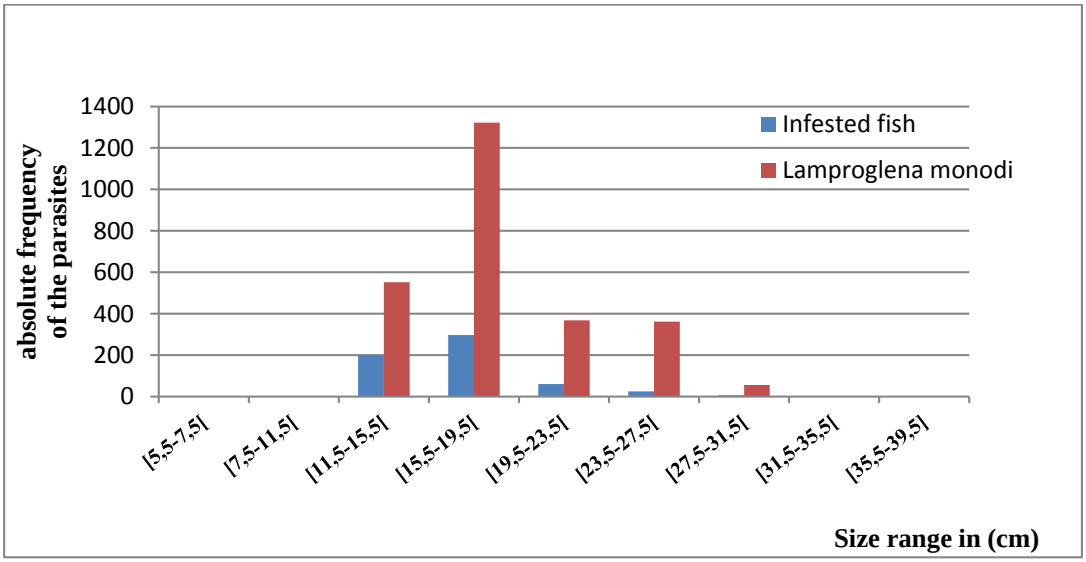

Figure 8: Number of parasites depending on the size of the fish

4. Fluctuation according to the weight of the fish

Young fish with low weight are still the most heavily infested, with the greatest frequency occurring in fish weighing less than 206g in both sexes.

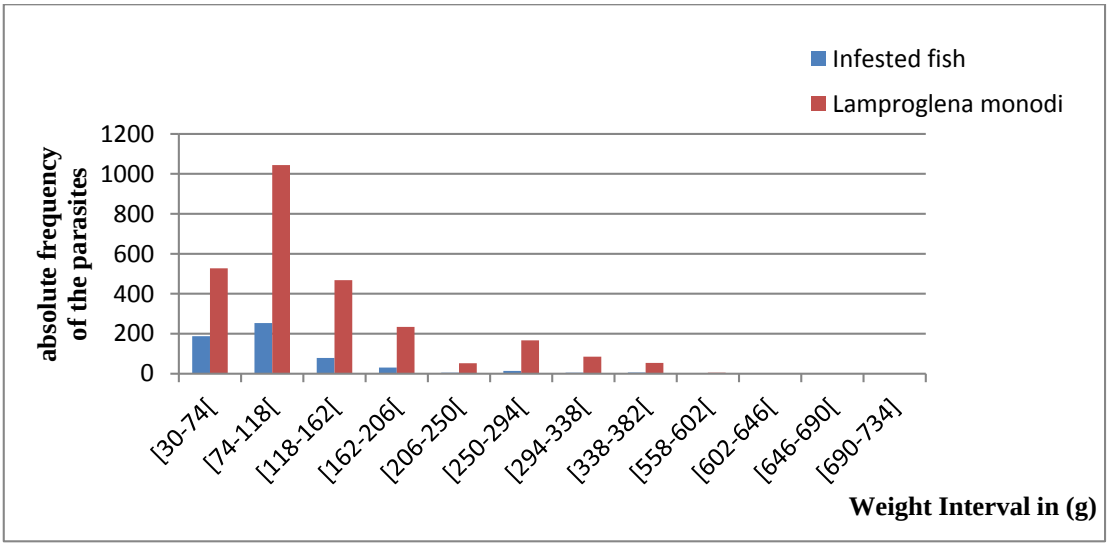

Figure 9: Number of parasites according to the weight of the fish

IV. DISCUSSION

In our work we found more than 8 parasites infesting Tilapias in fish ponds (Three Copepods, Three Trematodes, an Acanthacephalon and a Cestode), according to Arguedas and coll., 2017 in northern Costa Rica Tilapia are infested by ten species of parasites, classified into five taxonomic groups (two subtypes of protozoa, two classes of metazoans and one mollusk); more than 11 species of Lamproglena and one species of Lamproglenoides have been reported in these fish in Africa (Paperna, 1982).

Copepods are the main parasites that infest *Oreochromis niloticus* fish in our study area, especially the copepod *Lamproglena monodi*, which is described as freshwater Tilapia parasite in the river Nile system in Egypt, with an infection rate of 20% according to Ibraheem and Izawa, in 2000; the latter is higher between 50% and 95% according to Paperna, 1982. Potentially all freshwater fish species are the potential hosts of this parasite, most commonly Cichlids and Cyprinids, including carp.

The results obtained in this study show that parasitism evolves independently of sex ($p>0.05$), the same results are observed by (Boucenna et *al.*, 2018) for the infestation of *Luciobarbus callensis* (Cyprinids) by parasitic copepods (Ergasilus, Neoergasilus and Lernaea) in the Foum El Khanga dam in Algeria;

In all our samples *Lamproglena monodi* is found only at the level of the gill arches, the gill arches II and III are more parasitized than the gill arches I and IV; the parasite loads are comparable and show bilateral symmetry for the right and left gills in the examined poisons. Rohde (1993) also suggested that the distribution of parasites on

the gills differs due to gill preference or size. The second branchial arc on both sides contained more *Lamproglena monodi* parasites than any other gill. The increase of the gill surface and the beginning of water through the gill chamber could explain why this distribution.

Infestation of *Oreochromis niloticus* by *Lamproglena monodi* copepods varies significantly ($p<0.05$) during the year; the seasonal trend of pests shows that the highest averages were recorded during the cold season (December to April) while the lowest averages were recorded in the hot season between May and October; the prevalence recorded during this study in our fish station (59.2%) was greater than that recorded previously in the same species by (Abdel-Gaber and coll., (2017) between 7.7% and 83.3% ; and by Ibraheem and Izawa (2000) by 20%. However, the prevalence's were relatively high above 60%, in both sexes of fish from November to February, compared with the considerably lower prevalence between March and June; According to Abdel-Gaber and coll. in Egypt in 2017, the season with higher infection was observed in summer and spring throughout the experimental study.

According to Austin (2006), these parasites attach to the host in winter and their ovaries become visible (mature); in the spring, fertilized eggs are stored in bags of eggs hanging from the body (gravid), indicating that the fertilized eggs begin to hatch in the spring and continue to hatch in the summer.

The study of parasitism as a function of the size of the fish revealed that the number of parasites increases with size ($p <0.05$), it is generally the medium-sized specimens that are the most parasitized; the same observations were obtained by Ibrahim and coll. (2012) in Tilapia zillii infested with *Ergasilus sp.* and *Lernaea cyprinacea*; this increase in host size is explained by the size of the gill surface (Bakke et *al.*, 2002). For these authors, large fish offer a larger branchial surface to accommodate many parasites.

The weight of the fish has no effect on the parasite infestation, while it is the parasitism that causes the weight of the fish to decrease because it weakens the host fish and negatively influences its weight gain (Boucenna et *al.*, 2018).

V. CONCLUSION

This study confirmed the pathogenicity of the *Lamproglena monodi* parasite infested with Nile Tilapia (*Oreochromis niloticus*) in experimental fish lakes of Rosso ISET at the Senegal River. The infestation rate in tilapia fish (59.2%) is relatively high in the cold months of the year.

In terms of size, individuals ranging in size from 15.5 to 19.5 were the most infested, the localization of the parasites is at the level of the gill arches and more than these copepods were very grouped at the level of the arches III and II, the latter was the most infested in both sides. The ANOVA analysis shows that the sex and weight of the fish have no significant effect ($p> 0.05$) on the parasite load. While the season and the size of the fish have a highly significant effect ($p <0.05$) on the parasite load which can lead to significant economic losses during the production process.

Therefore, it is necessary to monitor the fish during the year on all fish farms in the region and the intimate contact of the hosts actively promotes parasitic spread in the breeding system and facilitates the invasion of parasitic agents in the river.

According to the results of this study, the good periods of use of the antiparasites for better control and protection of the environment is winter and spring where *Lamproglena monodi* attaches to the host and the fertilized eggs are stored in bags of eggs hanging on the body.

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