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Effect of *Dactylogyrus* Parasite on External Organs of the Nile Tilapia (*Oreochromis niloticus*)

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ABSTRACT

This study aimed to identify the type of ectoparasite in the adult tilapia. For this study, 20 specimens of the tilapia fish, with an average weight of 247.68± 69.47g, were collected. The fish samples were placed in the rearing unit at the Higher Institute of Maritime Fisheries, Agadir, Morocco. The study was conducted from October 2023 to April 2024. 16 samples were examined in the physiology and oceanography laboratory. The samples were eviscerated to detect the parasite. The fish had ectoparasites in the gills, eyes, and on scales. The parasite was identified as *Dactylogyrus* sp. and was found only on the tilapia's scales and in its gills.

INTRODUCTION

The tilapia are the most prevalent fish species in commercial fish farming **(FAO, 2015)**. They are important to rivers and lakes **(Sirima et *al*., 2009)**. Fish farmers and consumers appreciate this species for it is easy to raise **(Toguyeni et *al*., 2002)**.

The tilapia has many benefits, including ease of farming and fast growth. It also has ease of breeding, salt tolerance, and resistance to environmental problems **(Koniyo, 2020)**. However, the tilapia farming faces challenges, among which is the disease, which represents a great problem in aquaculture. Parasites are one of the most common disease agents that harm farmed fish in water **(Ali et *al*., 2023)**.

Parasites are organisms that can infect their hosts. They spread disease by eating their resources. Parasites can hurt farmed fish. They do this by killing the fish or stunting their growth **(Cahyadi *et al*., 2019)**. Ectoparasites live on the external body parts of the organism, such as its gills, fins, scales, or eyeballs. This is different from the endoparasites, which live inside an organism's body **(Ali *et al*., 2023)**.

Ectoparasite infections can hurt farmed fish. However, their harm doesn't surpass the losses associated with viruses and bacteria. However, ectoparasites must be avoided, since they might cause infection, which is risky. Moreover, ectoparasite infections cause losses, such as those related to the high stress sensitivity, the harm posed to external organs, in addition to lowering marketability **(Putri *et al*., 2016; Wulandari *et al*., 2019)**.

The objective of the study was to determine the type of ectoparasites that infect the tilapia in different test basins. Given the significant impact of ectoparasite infections on the tilapia, it was imperative to conduct research on the identification of ectoparasites in this species. To understand the stress and diseases affecting the tilapia, the breeding unit at the Higher Institute of Maritime Fisheries in Agadir was examined.

MATERIALS AND METHODS

The research was conducted over the period from October 2023 to April 2024. Sampling of fish was conducted in the fish unit. The study of ectoparasite identification was conducted in the physiology and oceanography laboratory at the Higher Institute of Maritime Fisheries in Agadir.

1. Water quality evaluation

The laboratory of the National Drinking Water Office was responsible for the analysis of water quality data, including temperature, pH, dissolved oxygen (DO), nitrate, phosphate, and ammonia.

2. Biological species

A total of 20 tilapia fish were utilized in this identification study. The fish were reared in tanks with a volume of 0.5m^3 of water in a well-controlled closed system. They were fed twice a day with a well-determined feed, with aeration depending on biomass. Sampling and monitoring were conducted twice a month.

3. Parasite identification

The scales, gills, and fins of fish were examined for the presence of parasites. A sample of gills was collected and placed in a glass object. The gills were then sprayed with distilled water and crushed, after which they were examined under a microscope. The fins of the fish's body were cut and placed on a glass object. The fins were then finely scraped. Subsequently, the fish scales were sprayed with distilled water, and the parasites were examined. The fish scales were collected, placed on a glass surface, moistened with distilled water, and examined under a microscope. The fish eyeballs were removed using forceps and scissors, placed on a glass surface, moistened with distilled water, and examined under a microscope.

RESULTS

1. Water quality

The results of the physicochemical parameters of the water indicated that the water temperature was 27°C, dissolved oxygen was 4mg/ l, and the pH ranged from 6.5- 7.3.

The water quality in this experiment was conducive to the survival of fish, in accordance with the breeding standard **(Suresh, 2003)**, which states that the tilapia (*Orechromis niloticus*) can tolerate temperatures between 26 and 29°C. Dissolved oxygen levels were also within an optimal range of 3- 10mg/ l. The optimal oxygen level for the tilapia growth was 4mg/ l. Furthermore, the tilapia demonstrated tolerance to salinity conditions. As indicated by **Suresh (2003)**, the optimal pH range for tilapia is between 6.5 and 7, with a pH level of approximately 6.5, representing a high-quality water standard. The water quality results for the tilapia specimens from the Higher Institute of Maritime Fisheries did not exceed the threshold and are in alignment with the quality standards **(Suresh, 2003)**.

Table 1. Water quality parameters of the water utilized in the unit

Parameter	**Result**	**Water quality required for breeding tilapia (Suresh, 2003)**
Temperature (° C)	27	26 – 29
pH	7.20	6.5 – 7.3
Dissolved oxygen (mg/l)	4	3 –10
Electrical conductivity (uS/cm^2)	1335	1455
TH (meq/l)	8.96	50 – 250
alkalimetric title (meq/l)	0	<175
Chloride (mg /l)	250.3	0-400
Nitrate (NO_3^-)(mg /l)	13.8	5-18
Nitrite (NO^-_2) (mg /l)	1.5	< 2,1
Salinity	6	1 – 8
Phosphate (PO_4) mg/l)	0.1	0.2

1. Types of ectoparasites

The results of the identification of ectoparasites on the adults of the Nile tilapia *(Oreochromis niloticus*) in the breeding unit revealed the presence of a single type of ectoparasite, *Dactylogyrus* sp., in the tilapia population. This finding is illustrated in Fig. (1).

1.1. ***Dactylogyrus* sp.**

Fig. 1. Microscope observation of *Dactylogyrus* sp. **(Handajani & Samsundari, 2005)**

Fig. 2. Visual observation of *Dactylogyrus* sp.

1.2. The parasite identified in fish

Photo a

Photo b

Photo c

Photo d Photo e

Fig. 3. Ulcers and redness under the abdomen, which are indicative of a *Dactylogyrus* ectoparasite infestation

Table 2. Distribution of ectoparasite infections

Location	Samples	Weight	Infected organs	Type of ectoparasite
Unit fish breeding	1	157	Scales	*Dactylogyrus* sp.
	2	211	Scales	
	3	428	Gills	
	4	369	scales	
	5	312	Gills	
	6	127	Scales	
	7	398	Gills	
	8	130	Gills	
	9	245	Scales	
	10	269	Gills	
	11	258	Gills	
	12	196	scales	
	13	157	Gills	
	14	263	Scales	
	15	168	Gills	
	16	248	Scales	

DISCUSSION

The study used the water quality test findings, as supporting information. The parameters measured were temperature, pH, dissolved oxygen (DO), and ammonia. The values are shown in Table (1). The measurements aimed to assess the pond water. During the investigation, the researchers had to determine if the conditions were suitable for aquaculture. The aquaculture basins at two locations were found to be suitable for growing the tilapia. Data from water quality measurements at both places showed good quality, with temperature at 27°C, pH at 7.20, and DO at 4mg/ L, all within the optimal range.

The results identified ectoparasites in the tilapia. They found ectoparasite-infected tilapia in the breeding unit's aquaculture tanks (Table 2). Fig. (3) depicts the ectoparasites found in the tilapia, *Dactylogyrus* sp., in which scales are their main habitat.

During our observations, *Dactylogyrus* sp., a type of ectoparasite was identified in the breeding unit. Moreover, the study found contamination in sixteen samples in the location. *Dactylogyrus* sp. attaches to the gills, and it is a small worm with two pairs of eyes near the throat and four protrusions on the head (Fig. 3).

The identification of ectoparasites in the tilapia revealed the presence of ectoparasite-infected fish. They were in the aquaculture tanks of the breeding unit (Table 2). Fig. (3) shows the ectoparasites found in the tilapia, *Dactylogyrus* sp. The scales are the main habitat for the parasites.

The ectoparasite *Dactylogyrus* sp. was discovered as a result of observations performed at the breeding unit, with 16 samples found to be contaminated. *Dactylogyrus* sp. attaches to the gills and is a small worm characterized by two pairs of eyes near the pharynx and four protrusions on the head (Fig. 3).

According to **Yusni and Rambe (2018)**, *Dactylogyrus* sp. is a monogenean that lays eggs and has two pairs of anchors. The posterior haptor of the body part lacks a cuticular structure and has one pair of hooks with a cuticular line. The head has four lobes with two pairs of eyes located in the pharynx area. Infection begins with adult worms attaching to the gills or other body parts.

In this study, we observed that fish infected by *Dactylogyrus* sp. had gills that turned pale red, and fish infected breathed faster. This is consistent with the observation of **Gusrina (2008)**, who postulated that *Dactylogyrus* sp. attacks fish gills, causing the fish to become skinny and their skin to become less transparent. These disruptions affect breathing and osmoregulation **(Kordi, 2004)**, manifesting as gasping and other breathing problems. Infected fish often rub against the bottom of the pond and have excessive white scales.

The scales in this experiment showed an evidence of infection by *Dactylogyrus* sp., exhibiting a slight reddish tint (Fig. 3). These tiny parasites often attack fish scales, causing skin sores and allowing them to invade the tilapia organs. The gills, being the fish's respiratory organs and in constant contact with water, are particularly susceptible to ectoparasite attacks. **Kurnia *et al.* (2019)** found that *Dactylogyrus* sp. causes gill infections.

According to **Handayani (2020)**, the tilapia fish infected with *Dactylogyrus* sp. develop weak, dull, and pale bodies, produce excessive mucus, and have limited appetites, leading to weight loss **(Bakke *et al.*, 2002; Fikri *et al.*, 2020)**.

This study found that fish infected with *Dactylogyrus* sp. exhibit a "flashing" behavior, rubbing against the bottom of the pools, causing light to reflect off their scales. Species of the *Dactylogyrus* genus also cause gill flounder disease, making the fish's gills red, sticky, and causing rapid breathing and weight loss.

CONCLUSION

Fish diseases remain the most significant factor affecting the growth and sustainability of aquaculture. The impacts of various management practices, including pond fertilization using raw livestock manure, high fish stocking density, and elevated levels of nitrates, nitrites, and high ammonia in fishponds, require urgent attention for the long-term and successive development of aquaculture. It is imperative to reinforce disease control measures by implementing optimal biosecurity measures and sound husbandry practices (improved seine practices, optimal nutrition, optimal water quality, and effective vaccination) to safeguard fish.

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