OPEN ACCESS
Advances in Animal and Veterinary Sciences
Research Article

Prevalence and Intensity of Ectoparasites in Catfish (*Clarias sp*) Cultivated with Biofloc System

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Abstract | Catfish is one of the most common high-protein food sources. Biofloc is a collection of microorganisms that promote fish growth and development. The purpose of this study is to inventory ectoparasites in catfish (Clarias sp.) cultivated with Biofloc in Gorontalo. This study was carried out from November to December 2023 at Gorontalo State University's Integrated Laboratory of Maritime Affairs and Fisheries Technology. A total of 40 catfish samples measuring 20-25 cm from cultivation sites using a biofloc system were selected using saturated sampling based on the sustainability of the catfish business (5 years), which included 20 businesses. Ectoparasite observations were conducted using a ZEISS Axioscope 5 Smart Laboratory Microscope. The descriptive method was used to identify and analyze the observational results. Gyrodactylus and Dactylogyrus parasites were discovered in mucus and gills. The Vorticella parasite was found on the gills, while Lernea was discovered on the skin. In this study, the prevalence and intensity of ectoparasites were 15% and 0.35 for Gyrodactylus sp; 10% and 0.26 for Dactylogyrus sp, while Lernea sp and Vorticella sp were 7.5% and 0.18, respectively. The most common infection was Gyrodactylus sp., which was classified as a "frequent infection." The infection with Lernea sp. and Vorticella sp. had the lowest prevalence rate, classified as "infection sometimes." All parasites found had a low attack intensity (<1). More research is needed to examine the environment factors where the catfish were reared, the parasites discovered, and the economic losses caused by parasitic infection.

Keywords | Ectoparasites identification, Microscopy, Prevalence, Intensity biofloc, Catfish

Received | July 03, 2024; **Accepted** | August 30, 2024; **Published** | September 03, 2024
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Citation | Fachrussyah ZC, Ahmad IG, Lantu IS, Lamadi A, Nento WR (2024). Prevalence and intensity of ectoparasites in catfish (*clarias sp*) cultivated with biofloc system. Adv. Anim. Vet. Sci. 12(10): 2029-2033.
DOI | https://dx.doi.org/10.17582/journal.aavs/2024/12.10.2029.2033
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

The aquaculture industry is a fisheries sub-sector that plays an important role in national development because it contributes to national economic growth and food security (Oktopura *et al*., 2020). Due to overfishing, aquaculture now supplies 50% of global fish demand (FAO, 2018; Naylor *et al*., 2021). Fish is a popular food commodity in the community. Gorontalo's freshwater fish production capacity has increased to 1048.00, 1087.00, and 1267.00 (Tons)

in the last three years (BPS Gorontalo, 2022), including catfish. Catfish, also known as the order Siluriformes, are a large and diverse group of freshwater fish with ray fins. Catfish is a popular fish due to its low price, high protein content, adaptability to environmental changes, rapid growth, and high market demand. It is widely grown by Indonesians due to high consumer demand, which requires fish farmers to produce on a regular basis to meet demand (Senthilkumaran and Kar, 2021; Rizki *et al*., 2016; Salsabila *et al*., 2021). Catfish can tolerate low dissolved oxygen (DO) levels in water and can be grown in fish cages, concrete tanks, or ponds (Vaishnav *et al*., 2017). Catfish is widely cultivated in many countries, including Myanmar, Thailand, Cambodia, Vietnam, and Indonesia. Some catfish species are reared as research animals due to their more adaptability for culture and artificial spawning (Ng and Kottelat, 2008).

Efforts to increase catfish production can be done through the biofloc technique. Biofloc are microorganisms (bacteria, fungi, algae, worms, and protozoa) that form beneficial clumps or flocs in rearing media to support better fish growth and development (Direktorat Produksi dan Usaha Budidaya, 2017). The biofloc technique, which involves multiplying beneficial microorganisms, is used to support better fish growth and development. However, increasing catfish productivity through the biofloc system is influenced by internal and external factors such as environment, feed, and disease attacks. Parasites, such as Trichodina sp., Zoothamnium sp., Glossatella sp., Ichthyophthirius multifiliis, Gyrodactylus sp., and Dactylogyrus sp., can cause significant losses, slow growth, and even death in catfish cultivators in Gorontalo. Other issues include declining water quality due to pollution, low knowledge and skills in fish cultivation, and inefficient production factors.

The success of catfish cultivation can be influenced by the presence of parasites that attack the external and internal organs of the catfish's body, disrupting their metabolism. This research aims to identify and measure the prevalence level of ectoparasite types in catfish kept in a biofloc system, as it can help control the presence of parasites and improve the overall growth and development of catfish.

MATERIALS AND METHODS

This research was conducted in November–December 2023. A total of 40 catfish samples used were taken from biofloc cultivation located in Gorontalo city, with a size of 20–25 cm. Saturated sampling based on the sustainability of the catfish business (5 years) with a total of 20 businesses was used in the study. Saturated sampling is a sampling technique where all members of the population are used as samples.Catfish farming in Gorontalo is very limited; business capacity sizes were 1000-2000 (5 businesses), 2000-5000 (3 businesses), >5000 (1 business), and <1000 (11 businesses). The fish's body length was measured using a caliper. Ectoparasite examination was conducted at the Integrated Laboratory of the Faculty of Maritime Affairs and Fisheries Technology, Gorontalo State University. The target organs for examination were gills, mucus, and fins. Prevalence category of ectoparasites can be seen in Table 1.

Table 1: Prevalence category.

No	Prevalence (%)	Category	Description
1	100 – 99	Always	Very severe infection
2	98 – 90	Almost always	Severe infection
3	89 – 70	Usually	Moderate infection
4	69 – 50	Very often	Very frequent infection
5	49 – 30	Generally	Common infection
6	29 – 10	Often	Frequent infection
7	9 – 1	Sometimes	Infection sometimes
8	<1 – 0,1	Seldom	Rare infection
9	<0,1 – 0,01	Very rarely	Very rare infection
10	<0,01	Almost never	Never

Source: (Syukran *et al*., 2017).

Ectoparasite examination of the fish was carried out using a ZEISS Axioscope 5 Smart Laboratory Microscope. The detection of parasites from the gills of the sampled fish was done by using the methods described by Ekanem *et al*. (2014). The operculum was cut open to expose the gills by using dissecting scissors; the exposed gills were detached on object glass and dripped with distilled water; and the gill filaments and the gill arches were examined under the microscope. The same thing was done with the fin inspection. The fins examined were the tail fin, dorsal fin, pectoral fin, and pelvic fin. Observation of mucus was carried out by scraping off the mucus on the surface of the catfish's body. Then, placing it on a glass object and dripping it with distilled water, observe it under a microscope. Intensity Category of ectopasites attack can be seen in Table 2.

Table 2: Intensity Category.

No	Prevalence (%)	Category
1	<1	Very low
2	1 – 5	Low
3	6 – 55	Currently
4	51 – 100	Critical
5	>100	Awfully
6	>1000	Super infection

Source: (Syukran *et al*., 2017).

Data Analysis

Results were identified and recorded, i.e., the type of parasite and fish organs where the parasite was found. The prevalence and intensity of ectoparasites were calculated using

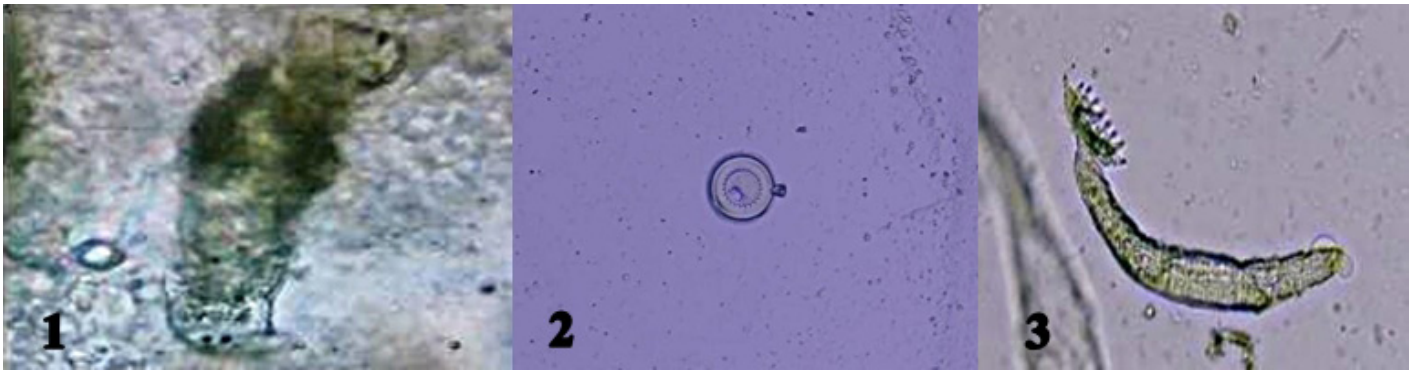

Figure 1: Ectoparasites found; **1:** Dactylogyrus sp.; **2:** Gyrodactylus; **3:** Trichodina sp.

the formula Kabata (1985), then analyzed descriptively.

$$\text{Prevalence} = \frac{\sum Fish\ infected\ with\ disease}{\sum Fish\ being\ examined}\ X\ 100$$

$$\text{Intensity}\ (^{ind}/_{head}) = \frac{\sum Parasites\ found}{\sum Infected\ fish}$$

RESULTS AND DISCUSSION

The results of the research found four types of ectoparasites that attack catfish cultivated using the biofloc system, namely Gyrodactylus sp., Dactylogyrus sp., Lernea sp., and Vorticella sp., whose prevalence and intensity levels can be seen in Table 3. Ectoparasites found in the study showed the same research results as those by Afolabi et al. (2020) on African catfish and Mavuti et al. (2017) on catfish in Kenya, i.e., Gyrodactylus sp. and Dactylogyrus sp.; Salsabila et al. (2021) on Catfish (Clarias sp.) in Aquaculture-Ponds and Bioflocs System in Aceh Besar, Indonesia, i.e., Dactylogyrus sp.; Vorticella sp.; Yusni and Rambe (2019) on Fry Tilapia (Oreochromis niloticus) in Aquaculture Pond, i.e., Dactylogyrus sp.

Table 3: Prevalence and Intensity of Ectoparasites infected Catfish in Biofloc Cultivation Ponds.

Type of parasites	Predilection	Number of infected fish	Prevalence (%)	Intensity
Gyrodactylus sp	Gills	6	15	0,35
Dactylogyrus sp	Gills	4	10	0,26
Lernea sp.	Skin	3	7,5	0,18
Vorticella sp.	Gills	3	7.5	0,18

Ectoparasites like Gyrodactylus sp., Dactylogyrus sp., and Vorticella sp. (Figure 1) are commonly found in the gill organs. This is consistent with the explanation (Suhardi *et al.*, 2014) that both types of parasites belong to the monogenea class, which only attacks the outside of the fish's body and is commonly found in freshwater fish. Gyrodactylus are viviparous skin and gill parasites found in many freshwater and marine fish (Přikrylová *et al.*, 2012).

Lernea sp. is found on catfish skins. According to the Indonesian Institute of Sciences (2019), Lernea-type parasites can be found in the gills, eyes, and skin (fins and scales). The area infected by this parasite is damaged and will serve as the starting point for secondary infections of other diseases. Lernaea cyprinacea, or anchor worm, is a parasitic cyclopoid copepod that parasitizes culture systems in freshwater aquaculture ponds and hatcheries. Lernea sp. infestations have been found in catfish, minor carps, major carps, and perches. Lernaea infestation included fins, skin, the oral cavity, and gills. Female parasites attach to the fish by burrowing deep into its tissue. The attachment site may experience intense hemorrhage and focal inflammation. A small number of parasite infections are not fatal, but they are extremely irritating to the fish. Lernaea's intense inflammation can cause secondary bacterial and fungal infections. Secondary infections can worsen and kill fish. A larger number of parasites on the gill can interfere with respiration, resulting in death. Chronic Lernaea infestation causes poor growth and makes fish more susceptible to secondary infection by fungus and bacteria, which eventually kills them (Hossain *et al.*, 2013; Sayyadzadeh *et al.*, 2015).

Vorticella sp. is found in catfish gills. According to Khotimah *et al.* (2018), Vorticella sp. is an ectoparasite that attacks the gills of fish and crustaceans. This ectoparasite attack disrupts the respiratory system of fish and prevents crustaceans from molting.

The results show that the highest prevalence and intensity was the ectoparasite type Gyrodactylus sp. compared to other types of ectoparasites, namely 15% and 0.35, then Dactylogyrus sp. 10% and 0.26, Lernea sp., and Vorticella sp., respectively 7.5% and 0.18. With a prevalence value below 30%, catfish cultivated using the biofloc system are categorized as frequently and occasionally infected. Meanwhile, for intensity values below 1, they are categorized as very low. With relatively low prevalence and intensity of ectoparasite attacks, the possibility of death from catfish is also low. This can be caused by the biofloc system cultivation; there is a role of good bacteria that influence the immune system and also the environmental conditions of

the cultivation medium (water quality). As explained by Suhardi *et al.* (2014), low parasite attacks can be caused by good water quality, which causes fish to be stressed so that parasites develop quickly. The ectoparasite prevalence study yielded lower results than Afolabi *et al.* (2020) study on African catfish, which had the lowest prevalence of 20% and the highest of 75%. The highest prevalence was found in fish from rivers with natural habitats. The prevalence of Dactylogyrus sp. in the study was lower than that of (Salsabila *et al.*, 2021), but Vorticella sp. was more common. Dactylogyrus sp. from the study and previous studies by Salsabila *et al.*, 2021) infected the most. This is because Dactylogyrus sp. is a parasite that frequently infects both freshwater fish and ornamental fish. Dactylogyrus sp. frequently attacks koi, tilapia, and catfish, which live in fish gills. Gills of fish affected by Dactylogyrus sp look pale. Changing behavior was found in fish infected with Dactylogyrus sp. (Mohammadi *et al.*, 2012). Low prevalence from cultured habitat such as biofloc system may imply that there had been an improvement in management practices of cultured fish (Ayanda 2009). Meanwhile, higher prevalence from natural habitat may be due to many factors such as pollution of water, feeding habit, and availability of intermediate hosts which harbor the infective larval stage of parasites (Kawe *et al.*, 2016).

CONCLUSIONS AND RECOMMENDATIONS

The study found four types of ectoparasites in catfish cultivated using biofloc systems: Gyrodactylus sp, Dactylogyrus sp, Lernea sp, and Vorticella sp. Gyrodactylus sp had the highest prevalence rate which categorized as "often" or "Frequent infection", while Lernea and Vorticella sp had the lowest which categorized as "sometimes" or "Infection sometimes". The intensity attack of all parasites was very low. Further research is needed to understand environment factors, economic losses caused by parasitic infection in catfish.

ACKNOWLEDGEMENTS

The authors thank the Integrated Laboratory Assistant of the Faculty of Maritime Affairs and Fisheries, especially the Microbiology and Feed Laboratory division, who assisted in collecting and observing samples for this study.

NOVELTY STATEMENT

Ectoparasites in catfish have been studied, but research on ectoparasites in catfish cultivated with biofloc is limited, so it should be considered when selecting a cultivation method to avoid disease attacks caused by ectoparasites.

AUTHOR'S CONTRIBUTIONS

Zhulmaydin C. Fachrussyah and Indra G. Ahmad: Idea and design.
Iin S. Lantu, Arafik Lamadi and Wila R. Nento: Material sample collection and lab analysis.
Zhulmaydin C. Fachrussyah, Indra G. Ahmad and Iin S. Lantu: Write the manuscript.
Zhulmaydin C. Fachrussyah: Revision.

Conflict of Interest

The authors confirm that there is no conflict of interest in the manuscript.

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