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Types, Prevalence, and Infection Rate of Ectoparasites on Dumbo Catfish (*Clarias gariepinus*)

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Abstract

Catfish (*Clarias gariepinus*) is a fish that is cultivated for human consumption. The success rate of cultivation is influenced by many factors, including the presence or absence of parasitic infections in cultivated fish. This study aims to determine the type, prevalence, and level of ectoparasite attacks on Dumbo Catfish in the Rajabasa Raya fishing pond, Bandar Lampung. The ectoparasites were taken using the method of scraping mucus and staining the ectoparasites on the surface of the fish's body, and then identified. The prevalence rate is determined using the Kabata prevalence formula. The results showed that two types of ectoparasites were found, namely *Dactylogyrus* sp. with the highest prevalence of 100% (infection rate is always), and *Gyrodactylus* sp. with the highest prevalence of 80%. (infection rate is common).

Keywords: *Clarias gariepinus*, *Dactylogyrus* sp., *Gyrodactylus* sp., infection rate

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INTRODUCTION

Indonesia is a tropical country that is rich in natural water resources, both land and marine waters. The biological resource that is widely cultivated here is fish due to high public demand. In Indonesia, annual marine fisheries production reaches 74%, while land fisheries account for around 26% [1].

One of the inland fisheries business sectors which is very common in Indonesia is the cultivation of Dumbo catfish (*Clarias gariepinus,* family of Claridae) because its cultivation technique is easier. Here, catfish production continues to increase significantly, reaching 47.21% between 2010-2013 [2].

In Lampung Province, one of the provinces in Indonesia, catfish cultivation is also quite widespread. In 2018 catfish production in this province reached 25,744.60 tons [3]. In the city of Bandar Lampung, the provincial capital, there are several catfish farming places, one of which is in the Rajabasa sub-district where this research was carried out. Here, catfish cultivation is considered very suitable because it has ideal soil and landscape conditions as well as height above sea level [4].

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Apart from the economic benefits obtained, dumbo catfish cultivation faces many challenges, including parasitic fish diseases. Parasite attacks are very detrimental because they can cause mass deaths, weight loss, and reduced fecundity (Gusrina, 2008). Based on where they live, parasites can be classified into two, endoparasites and ectoparasites [5].

The effect of ectoparasitic infections on fish is not as great as viral and bacterial infections, but parasitic infections can predispose to infections with more dangerous pathogens. If the level of parasite infection is high, it will result in mortality without any symptoms [6].

Parasite attacks have an impact on morphology and physiology and reduce the weight of fish, therefore they are often rejected by consumers. This research aims to determine the types of parasites in catfish and analyze the prevalence and level of ectoparasite attacks in fish ponds in the Rajabasa Raya sub-district, Bandar Lampung.

METHODS

Catfish Sampling

From a home fish pond in the sub-district of Rajabasa Raya, Bandar Lampung, 25 dumbo catfish with a length of 10-20 cm and weighing 50-100 g were collected using a fish dip net. Live fish are put in plastic bags containing oxygen and taken to the Zoology Laboratory, at the Department of Biology, Faculty of Math and Sciences, University of Lampung.

Parasite Examination and Identification

In the laboratory all fish were stunned using clove oil and their weight and length were measured using a digital balance and ruler respectively and then labeled [5]. Ectoparasite examination is carried out by scraping the mucus on the surface of the skin, fins, and gills of the fish using an aseptic scalpel. The scraped sample was placed on a glass slide then dripped with physiological NaCl, left for 1 minute, covered with a cover glass, then observed under a microscope at a magnification of 10 x 10 [7]. Staining was carried out using the Semichen-Acetic Carmine method which aims to make it easier to observe the organs of the Monogenea parasite Kuhlman. Identification of ectoparasite types refers to Kabata's guidelines based on the suitability of the observed morphological characteristics.

Determination of Parasite Prevalence

The prevalence of parasite attacks on catfish is determined in percent using the following Kabata [8] formula.

$$Prevalence(\%) = \frac{\text{number of fish infected}}{\text{totalof fish examined}} x\ 100\%$$

The prevalence percentage obtained was then matched with the categorization of parasite prevalence as presented in Table 1.

Tabel 1. Category of parasite prevalence

Prevalence (%)	Category
1-9%	Occasional
10-29%	Frequent
30-49%	Common
50-69%	Very often
70-89%	Moderate
90-98%	Severe
99-100%	Highly severe

Determination of Physicochemical Factors

The physicochemical factors of fishpond water determined were temperature, dissolved oxygen, pH, and total ammonia content. The physicochemical data was then compared with the water quality standard of SNI 01-6484.5. The relationship between the physical and chemical quality of the water and the level of parasite prevalence was analyzed using Pearson Correlation in SPSS 25.

RESULT AND DISCUSSION

Type of Ectoparasites

In this study, 2 parasites were found that attack dumbo catfish, namely *Dactylogyrus* sp. and *Gyrodactylus* sp. The description and number of the two ectoparasites are presented in Table 2.

Table 2. Ectoparasites found infected dumbo catfish

Ectoparasite types	Part infected	Description	∑ Parasite
Dactylogyrus sp. (Figure 1.)	+++ gill +++ skin + body and caudal fin	Cylindrical and elongated in shape, the eyespot is clearly visible on the anterior part, on the posterior part there is an anchor and a small hook	440
Gyrodactylus sp. (Figure 2.)	+++ gill + skin and fins	Cylindrical and elongated in shape, there are 2 lobes on the anterior part, there are no eyespots on the anterior part, there is an anchor and a small hook on the posterior part	247

Note: +++ = a lot; ++ = moderate; + = little

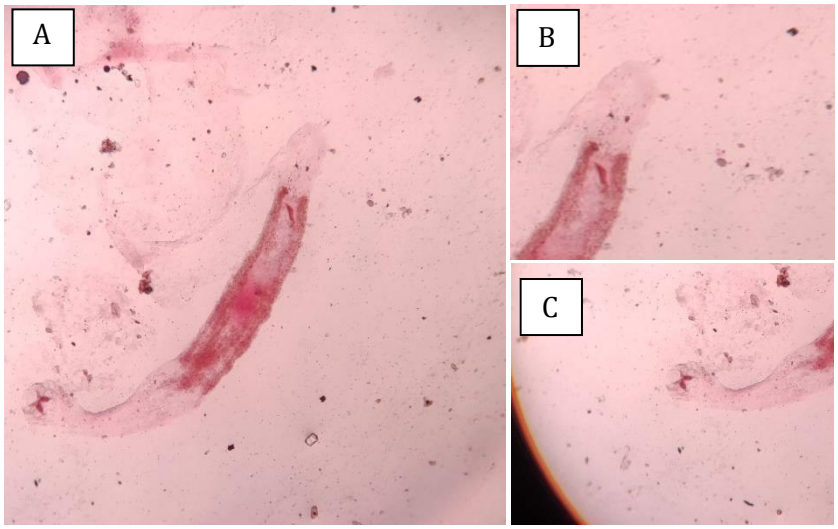

Figure 1. Morphology of *Dactylogyrus* sp. at 10x10 magnification. (A) anterior (B) eyespot and head (C) posterior

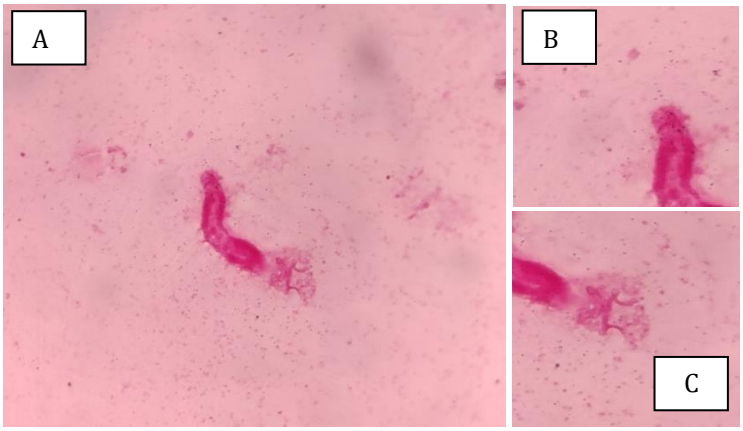

Figure 2. Morphology of *Gyrodactylus* sp. at 10x10 magnification.

(A) anterior (B) eyespot and head (C) posterior

Most ectoparasites are found on the gills of fish, followed by the surface of the skin, body fins, and finally the caudal fin. According to Solikhah [9], many parasites are found in gills because gills play a role in gas exchange and the disposal of metabolic waste substances such as nitrogen. Gills are also external organs that directly connect fish to the water medium in which they live. So if the water where the fish live is polluted, the gills are the organs that are first affected.

The skin surface is the second part of the catfish that is often infected with parasites. A catfish is a fish with a skin surface that is not scaly but slippery and slimy. According to Sarjito [10], parasitic infections on the surface of catfish skin easily occur due to friction between catfish so that previously healthy fish can become infected with parasites. Clinical symptoms of African catfish skin infected with parasites include the skin looking pale, having white spots, and being slimier than uninfected fish.

Other external parts of catfish that are commonly infected with ectoparasites are body fins and caudal fins. The body and caudal fins are easily infected by parasites because these two body parts often come into contact with other fish. According to Mas'ud [11], some parasites can also spread through the digestive system throughout the body which means parasites can be found in several parts of the body.

In this study, the ectoparasite *Dactylogyrus* sp. is more commonly found than *Gyrodactylus* sp. Of the 25 catfish examined *Dactylogyrus* sp. found 440 individuals and *Gyrodactylus* sp. only 247 individuals. The high level of Dactylogyrus sp infection can occur because the water conditions in the pond where the samples were taken are relatively suitable for the life of *Dactylogyrus* sp. namely low pH.

According to Hardi [12] *Dactylogyrus* sp. is an ectoparasite that is classified as a stronger or more resistant parasite in the egg and larval stages than *Gyrodactylus* sp. In the egg phase, resistance is characterized by being able to survive temperatures of 13-14°C. Meanwhile, in the larval phase, *Dactylogyrus* sp. can survive without infecting its host and will only cause disease if environmental conditions are not suitable, causing the fish to experience stress.

Parasite Prevalence

The prevalence percentage and category of ectoparasite infection levels determined according to the Kabata method [8] can be seen in Table 3.

Table 3. Prevalence percentage and infection category of ectoparasites in catfish at different sampling plots

Ectoparasites	Sampling Plots	Prevalence	Infection Category
Dactylogyrus sp.	A	40%	Common
	B	100%	Highly severe
	C	80%	Moderate
	D	100%	Highly severe
	E	0%	Almost never
Gyrodactylus sp.	A	40%	Common
	B	80%	Moderate
	C	60%	Very often
	D	80%	Moderate

E	0%	Almost never

The data in Table 3 shows that sample sites B and D have a high prevalence of ectoparasites. In plots B and D, the prevalence of *Dactylogyrus* sp. infection reached 100%, which means the level of ectoparasite attack was very severe. In this plot, the prevalence of *Gyrodactylus* sp. infection is also high, reaching 80%, which means the level of ectoparasite attacks is moderate. However, in plot E, which is the central part of the pool, the prevalence of the two types of parasites is 0%, which means the level of ectoparasite attacks is almost never.

Still, according to the data in Table 3, the prevalence of attacks by the ectoparasite *Dactylogyrus* sp. is slightly higher than the prevalence of attacks by *Gyrodactylus* sp. The higher prevalence of *Dactylogyrus* sp. infection compared to the prevalence of *Gyrodactylus* sp. is thought to occur because *Dactylogyrus* sp. is an ectoparasite that is classified as strong or resistant in its egg and larval stages. This difference in resistance makes it easier for *Dactylogyrus* sp. to reproduce, making it more likely to infect fish [12].

Both of these parasites attack their hosts using hooks on the posterior part of their bodies. With these hooks, these parasites penetrate the connective tissue of the gill lamella and other parts of the body. In the gills, if penetration occurs it can cause damage to the filaments and make the fish gill filaments turn pale. In addition, the penetration of parasitic hooks on the gill lamella will enlarge at the tip rather than the base, causing the lamella to fill with blood [11].

The prevalence data in Table 3 shows that spots B and D have a higher prevalence of parasite attacks than other spots. This is likely due to poor water quality. Prasetyo [13] states that poor water quality while the fish population is high will accelerate the transmission of parasites because there is friction between fish which causes secondary infections. Low water quality in ponds with high fish populations is related to high levels of leftover feed. According to Hardi [12], several parasites can live in environmental conditions that contain high levels of organic compounds, one of which is found in this research, *Dactylogyrus* sp.

Fish Pond Water Quality

Data on the physico-chemical quality of the catfish pond water examined are presented in Table 4.

Table 4. Physicochemical quality of fish pond water at each sampling spots

Parameters	Catfish sampling spots					Quality standard (SNI, 2002)
	A	B	C	D	E	
Temperature (°C)	27.33	27.57	27.43	27.53	27.87	25-30
pH	6.56	6.36	6.53	6.43	6.67	6.5-8
DO (mg/l)	13.00	13.00	13.67	13.00	13.67	>3
Amonia (mg/l)	0.53	0.67	0.56	0.67	0.50	<0.01

Based on the data in Table 4, it can be seen that the pH value and ammonia content in the water do not comply with the SNI water quality standards for keeping and cultivating dumbo catfish. The pH values at standard for the pH value of water according to SNI is 6.5 - 8, whereas in this study the pH of the water was around 6.36 - 6.67 which can be said to be slightly more acidic than it should be. The ammonia level according to SNI quality standards is less

locations B and D are lower than the water quality standards according to SNI, while the ammonia levels at all spots are greater than the SNI quality standards. According to the National Standardization Agency, the

than 0.1 mg/l, while in this study the ammonia level contained in fish pond water was far beyond this limit, namely around 0.50-0.67 mg/l.

High ammonia levels and low pH can trigger parasite attacks on African catfish. Low pH conditions (acid) can trigger heavy metals such as aluminum to increase in activity and will cause toxic properties in the water and can indirectly cause poisoning in fish so that the fish experience stress, loss of appetite, decreased immunity, and are easily attacked by parasites. Even though pond water quality that does not comply with SNI does not directly cause fish deaths, if not addressed it can cause the condition of fish in the pond to worsen and lead to mass deaths.

Apart from having an indirect impact on fish, water with a low pH can trigger some parasites to grow and develop well. The more parasites that live and develop in water, the higher the chance of fish being infected with parasites. Therefore, in fish farming, it is necessary to regularly monitor water parameters following SNI water quality standards so that parasitic infections in fish can be prevented [14]. Apart from pH and ammonia, this research also measured temperature and dissolved oxygen levels. As a result, these two parameters are still in the range that follows the SNI quality standards for catfish farming. The temperature of the catfish pond water from each spot ranges between 27.33°C-27.87°C while the SNI water quality standard is 25-30°C. The oxygen content of the catfish pond water examined ranges from 13.00-13.67 ppm while the standard SNI oxygen level quality is >3. So, the temperature and dissolved oxygen levels in the catfish ponds studied were still relatively good.

Correlation of Water Quality and Ectoparasite Prevalence

Pearson correlation analysis to determine the relationship between water quality parameters and ectoparasite prevalence produced coefficient data as presented in Table 5.

Table 5. Coefficient of *Pearson* correlation between water quality ectoparasite prevalence

Parameter of water quality	Value and strength of correlation	
	Dactylogyrus sp.	*Gyrodactylus* sp.
Temperature	-0,485 *	-0,549 *
pH	-0,927 **	-0,940 ***
Dissolved oxygen	-0,505 *	-0,600 **
Ammonia content	0,904 ***	0,905 ***

Note: * = moderate; ** =high; *** =very high

Based on the data in Table 5, it is known that the prevalence of *Dactylogyrus* sp. and *Gyrodactylus* sp. negatively correlated with temperature, pH, and DO, which means that the attacks of these two ectoparasites increased with decreasing temperature, pH, and oxygen levels. On the other hand, the prevalence of the two types of parasites is positively correlated with ammonia levels, meaning that the higher the ammonia content in the pool water, the higher the probability of ectoparasite infection.

Among the parameters assessed, pH and ammoniac content showed the highest correlation coefficient (>0.9) with the infection prevalence of the two parasites. The infection prevalence of *Dactylogyrus* sp shows a negatively strong correlation against pH with a coefficient of -0.927, along with that the prevalence of *Gyrodactylus* sp. also shows a negative strong correlation with pH with a coefficient of – 0.940. Regarding the ammonia content, the prevalence of the two types of parasites also shows a very strong but positive

correlation. The correlation coefficient of ammonia with the prevalence of *Dactylogyrus* sp. is 0.904 while the correlation coefficient with *Gyrodactylus* sp. is 0.905.

The correlation coefficient is a measure of the strength or weakness of the correlation between two variables. Whatever the nature of the correlation, negative or positive, will negatively affect both the host and the parasites. As indicated by Hardi [12], changes in each parameter can affect the survival of fish and ectoparasites. In fish, changes in water parameters will cause the fish to experience stress. Meanwhile, in ectoparasites, there are several conditions for changing parameters which can be a good medium for the survival of ectoparasites.

CONCLUSION

There are two types of ectoparasites found infecting African catfish in cultivation ponds on Jalan Komarudin, Rajabasa Raya sub-district, Bandar Lampung, namely *Dactylogyrus* sp. with a prevalence ranging from 40-100% with attack rates categorized as general to very severe. Meanwhile, the prevalence of *Gyrodactylus* sp. infection ranges from 40-80% with the infection level generally being moderate to moderate. The prevalence of infection with both types of ectoparasites was strongly negatively correlated with pH and positively with ammonia content.

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