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Research Article

Detection of Ectoparasites in Farmed Striped Catfish (*Pangasius hypophthalmus*) in Karangpilang, Surabaya, Indonesia

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Abstract: This research aimed to identify ectoparasites infecting farmed striped catfish in Karangpilang Surabaya, Indonesia. Individual catfishes with visible lesions on the body surface and abnormal behaviors were included in the study. Mucilage samples of 90 fishes were examined under a microscope for the presence of ectoparasite on the body surface of the fish, in the area of gills, skins, fins, and tails. Gills were cut with scissors and combed with a tweezer. Skin and fin were also scrapped with a sterile scalpel. The mucus obtained was put on an object glass and was observed under the microscope. The fish pond water was analysed for Oxygen Demand (DO), pH and temperature three times two weeks apart, starting from the day of fish sampling. Results showed that 42.2% (n=90) of samples were infected by ectoparasites. The ectoparasites identified were *Gyrodactylus sp., Dactylogyrus sp., Trichodina sp.* and *Chilodonella sp.* Fish pond water in the study site was of suitable quality for the growth of catfish. This study suggested that pathogens other than ectoparasites play roles in the development of pathologic conditions of stripped catfishes in the study area.
Keywords: ectoparasite, striped catfish, Surabaya

INTRODUCTION

The Surabaya has potential as a fish meat producer. Central Bureau of Statistics of Surabaya reported that seawater fish production in Surabaya reached 10 thousand tons per year, and freshwater fish production reached 15 thousand tons yearly (BPS Kota Surabaya, 2018). The demand for freshwater fish in the Surabaya has encouraged local communities to expand freshwater farming businesses, and catfish (Pangasianodon hypophthalmus) has been one of the most popular freshwater species farmed in the region. Catfish is a preferred species for cultivation owing to its fast-growing characteristics and its high rate of survivability under extreme conditions (Lisachov et al., 2023).

Catfish however, is not free from disease threat. Among of the most common diseases in catfish are ectoparasites. Ectoparasite infections on the fish skin could reduce their market value due to defects in the body surface, and in severe cases, they may cause mortality. Further, ectoparasitosis could reduce fish immunity, which in turn would lead to its increased susceptibility to viral and bacterial pathogens (Iyaji & Eyo, 2009).

Sekarjaya Farmer Group in Karangpilang, Surabaya, is a catfish farming community established in 2018. It uses traditional farming systems and utilises former paddy rice fields as ponds. A disease outbreak erupted in this catfish population in 2019, taking 40% of its fish population. Diseased fish showed scab lesions on the surface of the skin, experienced growth retardation, and were rejected in the markets for their unpleasant appearance. The cases have been endemic in the area, causing suboptimum performance of fish farming in the area, and ectoparasitoses have been speculated to be associated with the endemicity of the disease.

Parasitoses have been thought to be associated with low-quality water used in fish cultivation (Putra et al., 2021).Surabaya Environmental Agency (2012) reported that high pollution levels from industrial activities in Surabaya have caused poor water body quality in the region. The location of the fish pond of Sekarjaya Farmers Group is surrounded by rice fields, plantations, and industrial factories, which allows polluted water from factory waste to enter the water body of the fish pond.

However, whether parasitosis existed in the diseased fishes in the fish farm was unknown. Further, the water quality in the Sekarjaya Farmer Group fish pond remained obscure. Therefore, this study aimed to describe ectoparasite infections in clinically ill Striped Catfish (Pangasius hypothalamus) and to examine the water quality in the Sekarjaya Farmer Group in Karangpilang Surabaya.

MATERIALS AND METHODS

Fish Sampling

The survey was conducted on the Sekarjaya Farmer Group ponds, Karangpilang sub-district, Surabaya (-7.33, 112.68). Using a presumed prevalence of 37%, precision of 0.1 and confidence level of 0.05, sample size was calculated using the formula according to Martin et al. (1987). To improve the sensitivity of the ectoparasitic detection, inclusion criteria for sampling were individuals with lesions on the body surface and abnormal behaviors.

The life fish samples were put into plastic bags containing clean water, one fish in a bag to avoid direct contact among fishes. The fish samples were then put into a styrofoam box and immediately sent to the laboratory of Parasitology, Faculty of Veterinary Medicine, Airlangga University, Surabaya, for examination in the same day as the sampling. Briefly, 90 fishes aged 3 - 5 months with body lengths of 15 - 30 cm were included in the study.

Fish Sample Examination

In the laboratory, the fish was euthanized, and mucous of the caudal fin, pectoral fin, abdominal fin, and tail fin, as well as the surface of the apparent lesions, were scrapped using sterile scalpel, put on the object glass and examined under a light microscope at 400x magnification. Further, gills were cut and combed using an anatomical tweezer and the mucous was put on the glass slide for examination under a microscope.

Water Sampling and Examination

Water sampling was carried out three times two weeks apart, starting on the same day as the catfish sampling. Water samples were taken directly from the catfish ponds at the middle of the pond and at the middle of the water depth. Parameters of pond water examined on-site include temperature using pond thermometer (Aquascape Smart Pond Thermometer w/o Transformer, Bensalem, Pennsylvania, USA), pH using litmus paper (Juanjuan, Guangzhou, China), and dissolved oxygen (DO) using DO meter, Hanna, HI4421 (Darmstadt, Germany).

Data Analysis

Data of the identification of ectoparasites and water quality were presented descriptively.

RESULT AND DISCUSSION

Ectoparasitic infection in Catfish

Laboratory examination showed that 38 (42.2%, n=90) of fish samples were infected with ectoparasites (**Table 1**). Two Trematoda were identified: *Gyrodactylus* sp. and *Dactylogyrus* sp.. *Gyrodactylus* sp. was identified to infect the the fins and the body surfaces of catfishes, while *Dactylogyrus* sp. infected gills. Two Protozoa were also identified in this study: *Trichodina* sp. and *Chilodonella* sp., both appeared to infect the body surface and fins. The arthropod was not detected in this study. Arthropods such as Argulus sp. could only survive at a water temperature of below 10°C (Wardany & Kurniawan 2014).

The most common ectoparasitic infection identified was *Gyrodactylus* sp. (26.7%, n=90). It was detected as a single infection or as a co-infection with *Dactylogyrus* sp. The trematode of *Gyrodactylus* sp. has the morphological characteristic of a long oval body, with a length of 0.28 mm and 0.08 mm width. Posteriorly was a distinctive organ called ophishaptor, with a crown-shaped consisting of 14 marginal hooks and 1 - 2 pairs of anchors (**Figure 1 (A)**). Anchors serve as a tool for parasites to attach to the body surface of the host. The anterior part was called the haptor or the mouth organ (Kabata, 1985).

Table 1. Ectoparasites identified in the catfish pond in Karangpilang, Surabaya, Indonesia, 2023.

Ectoparasites	Total (%)
Gyrodactylus sp.	18 (20.0)
Dactylogyrus sp.	8 (8.9)
Trichodina sp.	2 (2.2)
Gyrodactylus sp. + *Dactylogyrus* sp.	6 (6.7)
Dactylogyrus sp. + *Trichodina* sp.	3 (3.3)
Dactylogyrus sp. + *Chilodonella* sp.	1 (1.1)
Total	38 (42.2)

Gyrodactylus sp. causes Gyrodactyliasis with clinical signs of excess mucous production, pale skin colour, and erosion of the gill lamellae. It also manifests as gill damage, such as hyperplasia, hypertrophy, haemorrhage and even fatal outcome (Schelkle et al., 2009) .

Although dominant among ectoparasites identified in this study, the infection with *Gyrodactylus* sp was considered low. The ponds were previously paddy rice fields where the use of inorganic fertilizers and insecticides has been common practice. This might have had a positive side effect on reducing fish ectoparasites in the study site. (Hansen et al., 2016) reported that the low infection rate of *Gyrodactylus* sp. occurred due to anthropogenic factors related to human activities.

Gyrodactylus sp. has a slightly higher infection rate than *Dactylogyrus* sp. The latter has a longer life cycle involving four phases of Mature parasites, Pre-cyste, Cyste and Post-cyste phases. This complex life cycle could slow its reproduction rate compared to *Gyrodactylus* sp. (Afrianto & Liviawaty, 1992). Co-infection of the two parasites occurred in 11.1% of the samples.

Dactylogyrus sp. or gill fluke was identified in this study in 20.0% (n=90) of the samples. The trematode of *Dactylogyrus* sp. had a 0.27 mm body length and 0.06 mm width. The shape of the head was flat, tapered at the most anterior part, while the head had four eye spots. The posterior part of the body had an ophishaptor which consisted of an anchor and a marginal hook as a tool for parasites to attach to the gills (Gusrina, 2008).

Dactylogyrus sp. was detected as single infection or as co-infection with *Gyrodactylus* sp., *Trichodina* sp. or *Chilodonella* sp. It seemed to benefit most from a co-infection with other parasites in this study. A possible pathway of the apparent co-infection might be that the infection with the first parasite caused a decreased immunity of the host that enabled the secondary parasite to infect the vertebrate host (Akhira et al., 2013). Co-infection among the parasites may reflect a mutualism between the existing species, and may cause a more severe outcome to the infected host (Noble & Noble, 1989). Similar to *Gyrodactylus* sp., *Dactylogyrus* sp. single infection may cause Dactylogyriasis with clinical signs of pale skin, excess mucous production, increased respiratory rate, pale gills, swollen blood clots and erosion of the gill structure (Putri et al., 2018).

Protozoa *Trichodina* sp. was detected in 5.5% (n=90) of samples, as single infection or in co-infection with *Dactylogyrus* sp. It appeared to have a shape resembling an axle wheel with 88.95 µm diameter (**Figure 1 (B)**). *Trichodina* sp. has cilia surrounding its body and has a function to support its movement (Mahasri & Kismiyati, 2011). *Trichodina* sp. was not found on the gill in this study. It supported the previous finding by (Supu, 2020), who reported that *Trichodina sp*. has a predilection for the body surface of the fish.

Trichodina sp. was detected in this study but in a very small proportion. Setiadi (2008) reported that *Trichodina* sp. maintains its life by moving freely and sticking onto the surface of the fish body. Trichodina sp. has a single host life cycle. It reproduces by binary fission and conjugation at 20°C. *Trichodina sp.* causes Trichodiniasis with clinical signs of excess mucous production, the presence of wounds on the surface of the body, and structural damage to the fins.

Chilodonella sp. was only detected in one fish sample and thus considered a rare infection in this study. *Chilodonella* sp. on the fish skin had morphological characteristics of 123.3 µm in body length and 94.56 µm in width, was oval in shape and had cilia around the body surface (**Figure 1 (C)**) (Durborrow, 2003). *Chilodonella* sp. reproduces through mitotic division and conjugation and can reproduce at temperatures below 20°C. However, it is a fragile parasite that cannot survive without a host within 12 to 24 hours (Tobler et al., 2007).

Water Quality Analysis

The water quality of the catfish pond in the current study is presented in **Table 2**. The temperatures of pond water were 27 - 32°C. Pond water temperature affects the immune system of fish (Haris & Yusanti, 2019) and the optimum metabolism of catfish is obtained at 30°C (Putra et al., 2019). The finding of the study thus indicated that the pond water temperature was suitable for catfish farming activities. The pH of the pond water ranged between 6 - 8. Freshwater fish generally have an acidic critical point tolerant at pH 4.0 and an alkaline critical point tolerant at pH 11 but, grow optimally at pH 5 – 9 (Ha et al., 2023). A low pH value would cause the fish to decrease mucus production (Noga, 2010). This finding indicate that the pH of the pond was suitable for catfish production. Further, the study showed that the dissolved oxygen (DO) levels in the pond ranged between 6 - 8 ppm. According to the National Standard of cultivating carp fish in Indonesia (SNI 7550:2009), DO levels above 3 ppm are suitable for a fish pond and the higher the DO value, the better for the survival of farmed fish.

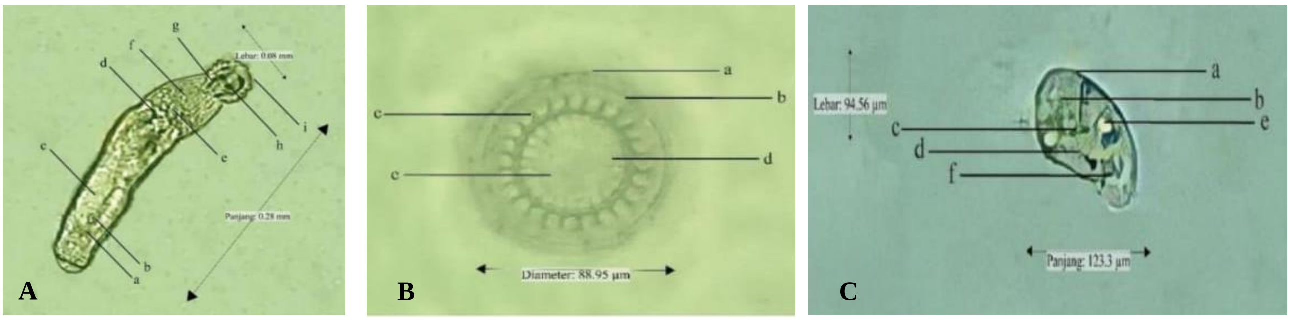

Figure 1. (A) *Gyrodactylus* sp. 100x manification: (a) Mouth; (b) Pharynx; (c) Caecum; (d) Testis; (e) Ovarium; (f) Egg; (g) Testis; (h) Bar; (i) Anchor; **(B)** Protozoa *Trichodina* sp. Under light microscope at 400x magnification: (a) CiIia; (b) Border Membrane; (c) RadiaI Pin; (d) Ray; (e) Adhesive Disk; **(C)** Protozoa *Chilodonella* sp. under light microscope at 1000x magnification: (a) CiIia; (b) MacronucIeus; (c) MicronucIeus; (d) Food VacuoIa; (e) Contractile vacuola; (f) Cytopharynx.

Table 2. Catfish pond water quality in karangpilang, Surabaya, Indonesia, compared to The Indonesia National Standard of Carp pond water quality (SNI 7550:2009)

Temp (ºC)		pH		DO	
Test	**Standard**	**Test**	**Standard**	**Test**	**Standard**
29 - 32	25 - 32	6 - 8	6.5 – 8.5	6.5 – 8.5	≥3

CONCLUSION

Ectoparasites found to infect catfish in the study site were the Trematoda of *Gyrodactylus sp*. and *Dactylogyrus sp*. while protozoa infected the catfishes were genera from the ciliate class, namely *Trichodina sp.* and *Chilodonella sp.* Water quality in the study site was considered suitable for optimum growth of farmed catfish. The overall level of infection was moderate and was an alarm for the fish farmer to prepare with appropriate control measure to reduce the incidence of ectoparasitoses. In addition, this study indicates that pathogens other than ectoparasite play a role to the development of disease in stripped catfishes in the study area.

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