Prevalence and intensity of ectoparasites in gabus fish (*Channa striata*) at Cangkringan Fishery Cultivation Technology Development Center, Sleman, Yogyakarta

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Abstract. Diseases caused by parasitic groups get less serious attention from farmers because its chronic morbidity and mortality rates are small. However, if observed further, parasitic diseases may trigger secondary infection that can be a predisposing factor for infection by more dangerous pathogenic organisms such as bacteria, viruses and fungi. This study aims to obtain data on the types of ectoparasites and the prevalence (P) and intensity (I) of the ectoparasites in gabus fish (*Channa striata*). The ectoparasite samples were taken from the natural gabus fish; 39 fish were cultured by scraping method. The preparations (results of scraping/gills) were placed on glass objects and dripped with distilled water using a dropper pipette. The preparations were closed using a cover glass and then observed under a binocular microscope with 100x and 400x magnification. The results of the observation found there to be 4 types of ectoparasites, namely *Dactylogyrus* sp. (P = 94%, I = 6.64 individual per fish), *Trichodina* sp. (P = 64%, I = 6.64 individual per fish), *Gyrodactylus* sp (P = 89%, I = 2 individual per fish) and *Ichthyophthirius multifiliis* (P = 30%, I = 1.41 individual per fish). The prevalence value is more influenced by the abiotic factor in the form of temperature, as this inhibits the development of the infective phase of the parasite.

1. Introduction
Snakehead fish are a type of freshwater fish commodity that containing protein and albumin, which are very important for health [1]. In addition, the fish are liked by the people because it tastes delicious, and is savory and tasty [2]. According to the statistical data of the Ministry of Marine and Fisheries in 2012, the amount of aquaculture production in the Kalimantan region of snakehead fish was 420 tons and 5,895 tons for cage aquaculture, while fishery production has amounted to 18.269 tons. However, in 1998 – 2008, the number of snakehead fish caught from open waters increased by an average of 2.75% per year, while the production of snakehead fish farming increased by 5,535 tons in 2008 [3]. Therefore, the potential of snakehead fish farming as a fishery resource needs to be developed and studied further as an effort to meet the demand for snakehead fish, which is increasing. However, the cultivation of snakehead fish is also never free from the threat of many diseases, including the parasite *Tricodina* [4] and the bacteria *Aeromonashydrophila* [5]. This bacterium is very influential in freshwater fish farming and a disease outbreak can cause levels of high mortality (80 – 100 %) in just 1 - 2 weeks [6,7]. The degree of virulence of *A. hydrophilacan* depends on the
poison generated. Genes Aero and hly A play an important role in producing aerolysin and hemolysin toxins in the genus Aeronomas [8].

Ruthellen and Floyd [9] stated that the classes of parasites that are invading freshwater fish are protozoans, monogenea, digenea, nematodes, cestodes and arthropods. The genuses of some of the classes of parasites include Ichthyophthirius multifilis, Chilodonella, Tetrahymenta, Trichodina, Ambiphyra, Aplosoma, Epistyliis, Icthyobodo, Cryptobia, Dactylogyrus, Gyrodactylus, Camallanus, Ergasilus, Lernaea, and Argulus. The ectoparasites commonly attack freshwater fish such as nile tilapia, goldfish, carp, java barb, catfish, and tilapia. However, Abyan et al [10] has reported that an infestation of ectoparasites in white shrimp (Litopenaeus vannamei) in seawater cultivation in Gresik, Indonesia, had a prevalence 86.6%. According to Sindermann [11], the presence of parasites in fish will have an impact on consumption, including the deterioration of cultivation, fish body weight reduction, and rejection by the consumers due to their abnormal morphology or shape. On the scale of cultivation, the parasites can also increase the mortality of larvae in bulk and can cause significant losses if it is not controlled [12]. This ectoparasite infects the fins, scales, operculum and gills of fish [13]. The high death rate of ectoparasite infection can lead to an acute mortality rate that occurs without symptoms beforehand [14][15].

Based on the research by [16], two types of parasite which infect snakehead fish were found; Pallisentis nagpurensis (P. nagpurensis) and Trichodina spp. In paddy eels, the endoparasites found in M. albus were Gnathostoma sp. [17], and the results of [18]’s research into catfish (Claria gariepinus) in the village of Lambro Dayah Aceh Besar district of Kuta Baro, Dactylogyrus, showed that Gyrodactylus, Tricodina, and Camallanus sp were found. Ectoparasites are a classic problem that causes many disadvantages, but they have not received appropriate attention. Knowledge of the prevalence and intensity of ectoparasites in fish is fundamental and important, because this type of disease can potentially be a constraint in aquaculture ponds. The purpose of this study was to obtain data on the types of ectoparasites in snakehead fish (C. striata), as well as obtaining data on the prevalence and intensity of the ectoparasites of snakehead fish (C. striata) from aquaculture ponds.

2. Methodology

2.1 Sampling

The tools being used in this research included pH paper, a secchi disk, plankton net, bailer, hand counter, hemocytometer, drop pipette, microscope, object glass, cover glass, test kit, and a sample bottle. The materials being used in the research included the sample water from the intensive system vaname shrimp (Litopenaeus vannamei) pond and the lugol to deactivate the plankton movement.

2.2 Preparation of the sample

The snakehead fish samples were taken, as many as 39 fish from the aquaculture pond, for the morphometric measurements. The intake of fish’s body weight data was done using a digital analytical scale. The method of ectoparasite examination was conducted using the method of scraping and the results were then put in the labeled plakon bottle [19]. Removing the gills of the fish was done using a pair of tweezers and scissors. The mixture (from the scraping / gills) was placed on an object glass slide and then distilled water was added using a pipette. To avoid the buildup of scales and gills, any filaments were flattened using scalpel.

2.3 Observation and Identification

Observations were carried out by making a solution from the scraped skin and gills, before each respective sample was dropped on a glass object. The mixture was closed using a cover glass and observed under a dissecting microscope with a magnification of 100x and 400x. The identification of the parasite was done using books and journals [20][21]

2.4 Analysis of the Ectoparasite Prevalence and Intensity

Based on the results of the species and number of parasites, the results were then analyzed
descriptively to calculate the prevalence and intensity of the parasites using the following formula:

\[
\text{Prevalence} = \frac{\text{Number of infected fish}}{\text{Number of fish examined}} \times 100\% 
\]

Intensity is the number of parasites that attack the fish at certain times compared to the total number of fish infested.

\[
\text{Intensity} = \frac{\text{Number of parasites that infect}}{\text{Number of fish attacked}} 
\]

3. Results and Discussion
The results of the analysis of the water quality sampling sites - both for the wild-caught snakehead fish and in the pond aquaculture (Table 1) - indicated a range in temperature, pH, salinity and DO that is standard for the life of a snakehead fish (C. striata) [22]. However, for the life of ectoparasites, the temperature and pH range is a lot narrower. Therefore, differences in the temperature and pH at the sampling locations could potentially affect the parasite's life. The pH factor greatly influenced the development of any ectoparasites [23,24].

| No. | Parameter          | Location     | Reference |
|-----|--------------------|--------------|-----------|
| 1   | Temperature        | 30,5±0,57 °C | 25-32°C   | 17]       |
| 2   | pH                 | 7,00±0,00    | 6,2 - 7,8 | 18]       |
| 3   | Salinity           | 0 ppt        | 0 – 0,5 ppt | 19]       |
| 4   | Dissolved oxygen (DO) | 3,15±0,12 mg/liter | >3 SNI : 01- 6141 – 1999 |

Note: TA=Wild Catch, BD=culture

Observation of the Types of Ectoparasites (C. striata)
Based on observations, we determined there to be 4 types of ectoparasite, namely Ichthyophthirius multifiliis, Gyrodactylus sp. Trichodina sp. and Dactylogyrus sp.

Figure 1. Observation of ectoparasites: [A] I. multifiliis; [B] Gyrodactylus sp; [C] Trichodina sp; [D] Dactylogyrus sp.
*I. multifilis* is round or oval, measuring ± 50-100 μm, with a macronucleus, and micronucleus [25]. This parasite has a horseshoe-shaped transparent macronucleus, and it also has a micronucleus attached to the macronucleus [26].

*Gyrodactylus* sp. was found to have a fusiform-like body shape. *Gyrodactylus* sp. has a pair of anchor rods with two backer and 16 marginal hooks, and no eyespots. The attachment to the fish is done with marginal hooks, and the anchors are used to help the marginal attachment hooks [27]. *Gyrodactylus* sp. has a V-letter-shaped head. *Trichodina* sp. was found to have a round shape with a size of 68.7 μm, and body parts such as radial pins, membranes, and an adoral zone.

*Trichodina* sp. has a circular shape with an adoral zone [28]. *Trichodina* sp. is classified as being a round-shaped parasite measuring between 50 - 90 μm [26]. *Epistylis* sp. was found to have a fusiform shape, with a length that can reach 2 mm and a width of 400 um. It has 2 pairs of eyespots on the anterior end. The mouth is located near to the anterior end of the body. At the posterior end of the body is an engaging tool consisting of two pairs of large hooks (anchors) surrounded by 14 smaller hooks called opisthaptor [27].

*Dactylogyrus* sp. often infects parts of the gills of freshwater fish in brackish water and sea. Adult worms are up to 0.2 - 2 mm. They have two pairs of eye spots on the anterior end. They have a sucker located near to their anterior end. At the posterior end of the body, there is a sticking device which consists of 2 large hooks surrounded by 14 smaller hooks called opisthaptor [29].

**Types, prevalence and intensity of the Ectoparasites of Snakefish (C. striata)**

| No | Species of parasite | Number of samples | Number of fish infested | Number of ectoparasites | Prevalence (%) | Intensity |
|----|---------------------|-------------------|-------------------------|-------------------------|----------------|----------|
| 1  | *Dactylogyrus* sp. | 39                | 37                      | 246                     | 94.87          | 6.64     |
| 2  | *Trichodina* sp.   | 39                | 25                      | 166                     | 64.10          | 6.64     |
| 3  | *I. multifilis*    | 39                | 12                      | 17                      | 30.76          | 1.41     |
| 4  | *Gyrodactylus* sp. | 39                | 35                      | 70                      | 89.74          | 2.00     |

For the amount of 12 snakehead fish, there were 17 ectoparasites, including *Ichthyophthyrius multifilis* with an intensity of 1.41. Pujiastuti [30] stated that the fish infected by *Ichthyophthyrius multifilis* causes inactive fish, and visible white spots on the surface of the skin, gills, and fins. If *Ichthyophthyrius multifilis* infects the gill then the protozoa may damage the gills so then the process of gas exchange (oxygen, carbon dioxide, and ammonia) can be blocked. The predilection of these parasites is a part of the bodily surface of the fish. The results of the calculation of the population prevalence of snakehead fish (*C. striata*) infected by ectoparasites showed that the difference between the prevalence rates was low, i.e. 30.76%. This is likely influenced by the temperature, where the temperature of the water at the sample location was 30.5 ± 0.57 ° C. The life cycle of *I. multifilis* is highly dependent on temperature, where the temperature 30°C experiences an inhibition of cleavage [31]. *I. multifilis* parasite population control can be done by maintaining the temperature at 29 - 30°C [32]. Accordingly, the water sampling sites showed a temperature of 30.5 ± 0.57 ° C, which could potentially hinder the development of *I. multifilis*. Such conditions can lead to a decrease in population in the next stage, namely the trophont stage (infective stage), thereby reducing the transmission due to reduced frequency of interaction between the host with the infective phase [33].

From the observation, the Trichodina spp. parasite was found in the snakehead fish’s skin mucus smears. This parasitic body is shaped like a plate, with cilia around the body. It moves sideways using the cilia so then it looked like it was swirling around. There is a circular radial pin that protects the dentikel, which is a knife-shaped blade. It is similar to that reported by Onhoiulun [34], who found *Trichodina* spp. in the skin, fins, and operculum of fish that have characteristics such as those mentioned. From these results, the rate of prevalence of parasitic infestations of *Trichodina* sp. was only 64.10%. This figure is still low compared to the results of the research conducted by Noble and
Noble [35], which reported that the prevalence rate of *Trichodina* sp. reached 80%. The low prevalence of *Trichodina* sp. in this study was probably due to several factors, one of it was because the snakehead fish had undergone a change of water. It can also be due to snakehead fish habitat being open waters, and not a tightly-kept system. Winaruddin and Eliawardani [36] added that the number of parasitic species in open water will be less compared to those present in a cultivation system.

Noble and Noble [35] also expressed similar; that fish that spend their entire life cycle in only one type of water would have fewer parasites than fish that are on the move. The fish are reared mainly in the aquarium, where the intensity and prevalence of parasites tends to fluctuate according to the applied health management in aquaculture. *Trichodina* sp. thrives in water with a temperature range of 25 - 30°C [37]. The lower temperatures will increase the prevalence of parasites in fish, where an optimum growth is at a temperature of 21 - 26°C. If the temperature is higher (temperature 27 - 32°C), then the prevalence will decrease gradually. Based on this, the temperature factor can also cause the prevalence of *Trichodina* sp. in aquaculture ponds that have a temperature of 30.5 ± 0.57 °C, which is higher than the optimum temperature.

The highest number of ectoparasites on the seed and broodstock of snakehead fish was *Dactylogyrus* sp. A total of 37 out of the 39 snakehead fish were infested by *Dactylogyrus* sp. with a total of 246 ectoparasites with an intensity of 6.64 and a prevalence of 94.87%. The ectoparasites infest the gills and the fish bodily surface with the highest intensity of attacks compared to other ectoparasites. The highest intensity of the attack of *Dactylogyrus* sp. was found in weeks 2 and 3. An increasing number of ectoparasites is presumably because the state of the fish can be disrupted due to the high density in the pool, a lack of nutrients and poor water quality, leading to the condition that the fish become weak and susceptible to disease. The higher the density, the greater the likelihood of friction that can occur between the fish which can transmit the parasite directly or inflict wounds that can be the target of other pathogenic organisms.

Fish health management that is not done properly can lead to parasites in the cultivation environment. This can affect the farmed fish itself. A parasitic disease caused by infection can cause a decrease in the quality and quantity of the products, which has implications related to the economic losses to farmers [38]. Factors that can cause the parasite to evolve in the fish, among others, includes competition for space and over the acquisition of food, which triggers stress in the fish. Stressed fish can trigger disease [39]. In the 35 snakehead fish infected *Gyrodactylus* sp., 70 ectoparasites had an intensity of 2. These parasites invade the host by way of attaching to the host's body by using an opisthaptor that exists at the end of the body to suck and feed on the host tissues. They show symptoms such as the skin color becoming pale or the presence of gray coating. In severe infections, some scales come off and there is an interruption of respiration and osmoregulation [40].

Parasites in fish are greatly influenced by abiotic and biotic factors. Based on this research, it can be stated that the prevalence of ectoparasites in snakehead fish (*C. striata*) is more influenced by abiotic factors such as temperature, which inhibits the development of the infective phase of the parasite. The ectoparasites found include *Oodinium* sp., *Trichodina* sp., *I. multifiliis*, and *Epistylis* sp. These are the kinds of ectoparasites commonly found on the surface of the skin and gill epithelia [41]. Based on the abundance of ectoparasites shown in Figure 1, *Dactylogyrus* sp. has the highest total. This causes *Dactylogyrus* sp. to form colonies. *Oodinium* sp. is a parasite that live in colonies and is the cause of velvet disease in fish [42]. In addition, reviewed as a whole, the ectoparasites in snakehead fish (*C. striata*) are more prevalent in the skin than in the gill organ parts, either in farms or from natural catchment. Parasites that find it easier to stick to the skin compared to the gill organs are often closed by gill covers (operculum).

The behavior of snakehead fish means that they are often found living in the bottom of water, which probably causes ectoparasites in infective stage to attack to the substrate. They can easily carry infection. The trophont parasitic phase will enter a tomont phase, which will attach to the substrate at the bottom of the water. The tomont will then go through active cell division and enter the infective stage, which is the theront. The snakehead fish (*C. striata*) is a species of fish that is able to breathe using oxygen from the air (air-breathing fish). Fish in these groups can use their air-breathing organ
(ABO) to absorb oxygen in the air from above the water’s surface [43]. The presence of this organ leads to not very well-developed gills in snakehead fish. Chanidae is an air-breathing fish that has a supra-branchial chamber that is rich in vascular epitheliums as ABO. Chanidae shows the development of a supra-branchial chamber, which causes a reduction in the gills.

4. Conclusion
The results of the observation found there to be 4 types of ectoparasites, namely Dactylogyrus sp. (P = 94%, I = 6.64 individual per fish), Trichodina sp. (P = 64%, I = 6.64 individual per fish), Gyrodactylus sp (P = 89%, I = 2 individual per fish) and Ichthyophthirius multifiliis (P = 30%, I = 1.41 individual per fish). The prevalence value is more influenced by the abiotic factor in the form of temperature, which inhibits the development of the infective phase of the parasite.

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