Parasitic disease in Koi fish (Cyprinus carpio) in freshwater ponds with different densities in Sukabumi, West Java

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Abstract. Koi fish (Cyprinus carpio) is one type of freshwater ornamental fish that is in high demand, and easy to culture. The main problem that often becomes an obstacle in fish farming is the emergence of parasitic diseases. The aimed of the study was to determine the types of parasites in Koi fish (C. carpio) rearing ponds with different fish densities in Sukabumi, West Java. The method used in this study is a survey method. Fish samples were taken every week in three different ponds, namely the cage pond (150 fish/m²), pond 10 (66 fish/m²), and pond B7 (33 fish/m²) using the Purposive Random Sampling method. Parasite found in Koi fish (C. carpio) is Argulus sp., Trichodina sp., Gyrodactylus sp., Dactylogyrus sp., Ichthyophthirius multifilis, and Glossatella sp. on the gills and body surfaces of the fish. The types of parasites found in all ponds were Trichodina sp., and Dactylogyrus sp. The highest prevalence of Trichodina sp., and Dactylogyrus sp. was found in cage ponds 80% and 60%, respectively. The highest Trichodina and Dactylogyrus infestations were found in cage ponds with an average value of five individuals/fish and seven individuals/fish.

1. Introduction

Indonesia is the third-largest ornamental fish exporting country in the world at 7.5 percent. Indonesian Koi fish production has increased in export value, namely in 2010 it increased by 8 million dollars, from 12 million dollars to 20 million US dollars in 2011 and the export value of Koi fish in 2016 reached 65 million dollars. The increase in the market for Koi fish encourages Koi fish farmers to always improve their cultivation business [1].

According to the Ministry of Marine Affairs and Fisheries [2], the achievement of ornamental fish production until mid-2019 reached 367.28 million fishes or around 66.8% of the target. The total achievement of ornamental fish production is dominated by Koi fish with a production achievement level of 115,230 individuals. The success of the cultivation business is determined by good seed quality. Each fish has a different resistance to pathogens and the environment. At the seed stage, fish are more susceptible to diseases, especially parasitic diseases. Young fish have a slower antibody response than adult fish, so it is necessary to monitor the health of fish seeds in a controlled manner [3].

The main problem that often becomes an obstacle in fish farming is the emergence of parasitic diseases. Parasitic diseases that often infect Koi fish include diseases caused by Trichodina sp.,...
Chilodonella sp., Myxobolus sp., Ichtyopthirius multifilis, Dactylogyrus sp., Gyrodactylus sp., and Argulus japonicus [4]. The disadvantages caused by ectoparasite infestation in fish are that the fish looks weak, fish scales can peel off, and cuts from small to large, making it difficult to be sold to consumers. Parasitic infections can cause damage to the external organs, namely the skin, fins, and gills. Parasite attacks can cause a decrease in the quality of farmed fish. Besides, the high intensity of parasite attacks will reduce fish productivity which causes economic losses for farmers. Parasitic infestation in the fish body also triggers secondary infection which has the potential to cause mass death [5].

One of the factors influencing the parasitic disease in Koi fish is the amount of stocking density. High stocking density can increase parasite prevalence [6]. In connection with this, it is necessary to carry out a study of parasitic diseases in Koi fish with different stocking densities. The purpose of this study was to determine the effect of stocking density on the level of parasite infestation and to determine the types of parasites infesting Koi fish (Cyprinus carpio).

2. Material and Methods

2.1 Time and place
This research conducted at the Center for Freshwater Aquaculture in Sukabumi, West Java. The research was conducted for 21 days, on 23 December 2019- 14 January 2020 in Koi fish farming.

2.2 Tools and materials
The tools used in this study included scissors, tweezers, scalpels, trays, Petri dish, object-glass, cover glass, binocular microscope, and sample container. The materials required include aquadest, Koi fish samples, and tissue.

2.3 Research methods
The method used in this research is survey method. Koi fish seeds were taken from 3 hatcheries with different construction and stocking densities, namely Pond 10 with concrete construction with a fish density of 66 fish / m2. Cage pond with concrete construction with a fish density of 150 fish / m2 and a B7 pond with a tarpaulin pond construction with a fish density of 33 individuals / m2. Sampling was carried out every week by taking 5 fish from each of three different ponds. Ectoparasites observations were made on the body surfaces, fins, and gills. The examination is carried out by the native method or scraping the body surface, fins, and tail.

2.4 Parasite examination
Examination of ectoparasites in koi fish, includes sampling activities, preparation of tools and materials, observation of clinical symptoms, making wet preparations, observing under a microscope, identifying the ectoparasite genus, calculating prevalence, and calculating intensity. To determine the level of ectoparasite infestation, the prevalence and intensity are calculated using the following formula:

\[
\text{Prevalence (P)} = \frac{\text{Number of infected samples (N)}}{\text{Number of samples observed (n)}} \times 100%
\]

\[
\text{Intensitas (I)} = \frac{\text{Number of parasites infecting (individual)}}{\text{Number of infected fish samples (fish)}}
\]

Note, N value is obtained when conducting the fish inspection, where the number of fish samples containing the same parasite. n the number of samples is determined based on the minimum number of samples taken, namely 5 tails randomly based on laboratory test standards which are taken from the number of at least 5-10 individuals [6].
3. Result and discussion

3.1. Prevalence

Prevalence is number of fish in a population invaded by parasites at a certain time and condition. Parasitic examination on Koi fish (Cyprinus carpio) for 21 days obtained the following prevalence data.

Table 1. Average Prevalence of Parasites in Koi Fish (Cyprinus carpio)

| Pond          | The type of parasites | Prevalence (%) | Average |
|---------------|-----------------------|----------------|---------|
|               |                       | week 1 | week 2 | Week 3 |         |
| Pond 10       | Trichodina sp.        | 60     | 20     | 60     | 40      |
|               | Dactylogyrus sp.      | 20     | 20     | 20     | 20      |
|               | Gyrodactylus sp.      | 40     | 40     | 40     | 40      |
|               | Ichthyophthirius multifilis | 20 | 20 | 20 | 20 |
|               | Glossatella sp.       | 20     | 20     | 20     | 20      |
|               | Argulus sp.           | 20     | 40     | 0      | 20      |
| Cage pond     | Trichodina sp.        | 100    | 80     | 60     | 80      |
|               | Dactylogyrus sp.      | 60     | 60     | 40     | 60      |
|               | Trichodina sp.        | 20     | 20     | 20     | 20      |
| Pond B7       | Dactylogyrus sp.      | 40     | 20     | 60     | 40      |
|               | Gyrodactylus sp.      | 20     | 20     | 20     | 20      |
|               | Glossatella sp.       | 40     | 0      | 20     | 20      |

Koi fish seed samples were taken from several different ponds. There are 5 koi fish taken randomly each time sampling. It is intended that the results obtained are more objective and it is assumed that the results of the examination can represent the fish population in the pond. Taking a sample of 5 fish, because it is not possible to take 5-10% of the total population according to the SNI so that the number of 5 fish is taken according to the minimum limit according to Marlan and Sri [7], namely the number of at least 5-10 fish from each pond.

Based on the results of the examination of parasitic diseases for 21 days in Koi fish farming, it can be seen that the results of ectoparasite examination found several types of parasites including Argulus sp., Trichodina sp., Gyrodactylus sp., Dactylogyrus sp., Ichthyophthirius multifilis, and Glossatella sp. (Figure 1). Two species of parasites dominated at each examination, the parasites are Trichodina sp. and Dactylogyrus sp. this is because these two parasites are a type of parasite commonly found in freshwater fish and often attack seed-sized fish. Parasites attack fish more at the seed stage because the more mature the host specificity decreases. If left untreated it can stress the fish, causing secondary infection and death [8].
3.2. Intensity

Intensity is the number of parasites that invade organisms in a unit of time and space. Based on 21 days of parasite examination on Koi fish (Cyprinus carpio), the following results were obtained (Table 2).

### Table 2. The intensity of type of parasites in Koi Fish (Cyprinus carpio)

| Pond       | The type of parasites       | Intensity (ind/fish) | Average |
|------------|-----------------------------|----------------------|---------|
|            |                             | Week 1   | Week 2   | Week 3   |
| Pond 10    | *Trichodina* sp.            | 4        | 3        | 4        | 4       |
|            | *Dactylogyrus* sp.          | 4        | 5        | 3        | 4       |
|            | *Gyrodactylus* sp.          | 1        | 1        | 2        | 1       |
|            | *Ichtyophthirius* multifilis| 4        | 5        | 3        | 4       |
|            | *Glossatella* sp.           | 7        | 10       | 13       | 10      |
|            | *Argulus* sp.               | 1        | 2        | 0        | 1       |
|            | *Trichodina* sp.            | 5        | 3        | 6        | 5       |
| Cage pond  | *Dactylogyrus* sp.          | 6        | 7        | 6        | 7       |
|            | *Trichodina* sp.            | 3        | 5        | 2        | 3       |
| Pond B7    | *Dactylogyrus* sp.          | 6        | 5        | 6        | 6       |
|            | *Gyrodactylus* sp.          | 1        | 2        | 1        | 1       |
|            | *Glossatella* sp.           | 6        | 0        | 3        | 3       |

The types of parasites found in all ponds were *Trichodina* and *Dactylogyrus*. The highest prevalence was *Trichodina*, which was found in cage ponds is 80% which included in the normal category. The highest intensity was also found in the cage pond with an average intensity value of 5 individuals/fish which included in the low category. Likewise with the *Dactylogyrus* parasite, where the highest prevalence and intensity levels were found in the cage pond with an average prevalence of 60% which included in the very frequent category and an average intensity of 7 individuals/fish which was in the moderate category [9]. This is because the cage pond has the highest stocking density compared to the other two ponds, namely 150 fish/m². The stocking density of the pond affects the level of parasite infestation, this is because the organic waste from residuals feed that is not consumed and the feces will be higher when compared to fish that have low density. So that the higher the density the chance of being attacked by parasites will be higher. This condition causes the fish to frequently rub against each other, which can cause blisters on the skin of the fish and the fish will be susceptible to parasite infestation. Transmission of parasitic diseases through horizontal transmission or transmission from one fish to another due to frequent contact. This is following the results of the research by Pillay & Kutty [10] which states that the higher the density level, the greater the friction that can occur between fish that can infect parasites directly or cause wounds that can become targets of pathogenic organisms.
Pujiastuti & Setiati [11] stated that the high density of ponds causes the fish to be easily stressed and attacked by several parasites.

The types of parasites that attack koi fish in pond B7 and pond 10 are almost the same, in general the parasites that attack Koi fish are the protozoa group, namely *Trichodina* sp., *Ichtyophthirius multifilis*, and *Glossatella* sp. while the parasite from the helminth group, namely *Dactylogyrus* sp. and *Gyrodactylus* sp. While in pond 10 there were arthropod parasites, namely *Argulus* sp. as much as 1 individual with a prevalence of 20%.

*Trichodina* sp. living cosmopolitan and can reproduce rapidly, so that it can spread widely, and is a parasite commonly found in freshwater fish [12]. Meanwhile, *Ichtyophthirius multifilis* a parasite that can cause white spot disease. Based on the research data, it shows that *Ichtyophthirius* was only found in ponds 10 with an intensity of 4 individual/fish which is very low and a prevalence of 20% is included in the frequent category, meaning that the infestation rate is frequent but still very low. This disease is characterized by the presence of protozoa clustered on the gills, there are white spots on the body surface [13].

*Glossatella* sp. that found in pond number 10 has a high demand intensity with the intensity rate is 10 individual/fish and included in the category of moderate infestation. The prevalence rate *Glossatella* sp. in pond 10 is 20%, but it often means that it is relatively low. *Glossatella* sp. is a ciliate class parasite which is a name change from *Apisoma* spp. This parasite is a parasite that lives solitary and generally infects with a prevalence of 25%. Among the protozoan parasites *Ichthyophthirius multifilis*, *Trichodina* spp., *Trichophyra*, *Amphiphyra*, *Hexamita*, and *Apisoma* are some of the most significant pathogens in fish farming. *Apisoma piscicola* is frequently found in *Cyprinus carpio* [14].

*Dactylogyrus* sp. and *Gyrodactylus* sp. is a helminth group parasite that often infect freshwater fish. The predilection of *Dactylogyrus* sp. is on the gills so these parasites are called gill worms. Meanwhile, *Gyrodactylus* can be found on the surface of the body, mucus, and gills. Based on the results it is known that *Dactylogyrus* sp. found in all ponds with the highest infestation rate in the cage pond. *Dactylogyrus* sp. is a monogeneas that lay eggs and have two pairs of anchors. On the body, there is a posterior haptor. The haptor has no cuticular structure and has one pair of hooks with one row of cuticles, 16 main hooks, one very small pair of hooks [15]. In the genus *Gyrodactylus*, there is an opisthaptor in the abdomen which is equipped with two large hooks and 16 marginal hooks and the most prominent character is the ovary where the embryo develops. The parasite is viviparous which can produce offspring [16]. *Gyrodactylus* is an ectoparasite that lives in both freshwater and marine fish. *Gyrodactylus* was only found in pond B7 and pond 10 but it was still in the low infestation category, with an average intensity of 1 individual/fish and a prevalence of 20% and 40% respectively.

Based on the research results, it can be seen that the cage pond with high density has a high level of parasite infestation, but only 2 types of parasites were found. Meanwhile, ponds 10 and B7 had a greater diversity of parasites, but the infestation rate was low. Another factor that can affect the types of parasite diversity is the conditions of the cultivation environment. Ectoparasites in general can arise due to several factors. Poor water quality, overfeeding of fish and climate change are contributing factors for the emergence of parasites [17].

4. Conclusion
It can be concluded that the higher the stocking density is given, the higher the parasite infection rate. The higher the density level, the organic waste produced will increase, which causes the water quality to decrease and can cause pathogens to develop properly. The predominant parasite type is *Dactylogyrus* sp., and *Trichodina* sp. The highest intensity and prevalence of *Trichodina* and *Dactylogyrus* were found in the cage pond with a fish density of 150 fish/m².
5. Reference

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