

The host preference and impact of *Argulus japonicus* ectoparasite on cyprinids in Central Java, Indonesia

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The host preference and impact of *Argulus japonicus* ectoparasite on cyprinids in Central Java, Indonesia

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Abstract. The most widely cultivated freshwater fish are from Familia Cyprinidae, among others goldfish (*Carassius auratus*), koi (*Cyprinus carpio*) and comet goldfish (*Carassius auratus auratus*). One of the constraints of freshwater fish cultivation is ectoparasite infestation *Argulus japonicus*. Financial losses have been experienced by some farmers, caused by these ectoparasitic infestations. This study was aimed to determine the impact of ectoparasite *Argulus japonicus* infestation on host (freshwater ornamental fish from Familia Cyprinidae), in order to find a preventive solution to treatment on the host. The results showed that prevalence of infested fish by *Argulus japonicus* were 57 % goldfish, 31 % comet fish and 65 % koi. Changes of histopathology on host were congestion, haemolysis degeneration, epithelium erosion and inflammatory cell infiltration. The image of infected leukocytes infested by *Argulus japonicus* were 8.5 % of lymphocytes, 4.7 % neurophils, 3.9 % monocytes, 1.45 % eosinophils and 0,17% basophils.

1. Introduction

One area of the *minapolitan* area development in Central Java that is based on aquaculture is Magelang regency. Here, the cultivation of freshwater ornamental fish being optimized are fish from the Cyprinidae family, such as koi fish, goldfish and comet fish. Disease is the main problem in fish farming, one of which is the *Argulus* ectoparasite, which is a major ectoparasite in fish from the Cyprinidae family with predilection of the gills, fins and skin (body surface) [1,2,3]. *Argulus* sucks blood and injects anti-coagulants that cause the immune response of the host to be disturbed [4]. These ectoparasites can also cause stunted growth and even death, resulting in the decreased production (weight) and quality of the ornamental fish that ultimately leads to economic losses for the cultivators.

The purpose of this study was to determine the prevalence, degree of infestation, histopathological changes and the description of leukocytes of goldfish, comet fish and koi fish due to *Argulus* infestation.

2. Methodology

The method used in this research is survey method, with the research taking place at the Center of Fish Culture in the Magelang regency of Central Java. Fish samples were taken from the Mungkid and Muntilan sub-districts from six cultivation ponds consisting of two goldfish farming ponds, two koi fish ponds and two fish comet fish ponds. 50 fish samples were taken from each pond, so that each type of fish amounted to 100 samples. After the prevalence is calculated, the degree of infestation is



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then drawn up by blood to calculate the leukocyte image and the final stage of histopathologic preparation of the infected organs.

3. Results And Discussions

3.1. Prevalence, degree of infestation and leukocyte features

The results covering prevalence are presented in table 1. We can see that more than 80% are classified as always there [5], with the highest degree of infestation in koi fish and the highest percentage of lymphocytes that is more than 88 %.

Table 1. Prevalence, degree of infestation and overview of leucocytes of Cyprinidae fish.

Infested <i>Argulus japonicus</i> Fish Species	Prevalence	Infestation Level	Lymphocyte	Neutrophil	Monocyte	Eosinophils	Basophil
Koi	65	medium	89.5	4.9	3.98	1.45	0.17
Goldfish	57	heavy	88.3	5.95	3.9	1.70	0.15
Fish comet	31	medium	88.9	5.1	3.6	1.56	0.14

The highest prevalence was found in koi fish hosts, followed by goldfish and comet fish. Among the three species of ornamental fish, koi fish is proved to be the most susceptible to environmental changes and to *Argulus japonicus* ectoparasite, although the degree of infestation is moderate. In goldfish, the prevalence is lower but the degree of infestation is severe so that the impact is similar or even more severe. The comet fish was the most resistant to changes in aquatic environments and had the lowest prevalence value with a medium degree of infestation.

3.2. Pathological changes

The pathological changes seen were: congestion, ballooning degeneration, epithelial erosion, and inflammatory cell infiltration. An *Argulus japonicus* infestation causes a pathological change of congestion, indicated by the presence of thickened blood vessels with a darker red color due to the accumulation of blood cells and forming special patterns such as circles. In the change of ballooning degeneration, the cell looks enlarged and there is an empty space inside just like balloon cells. Erosion of the epithelium is indicated by the erosion of soft tissue on the pectoral fins [6].

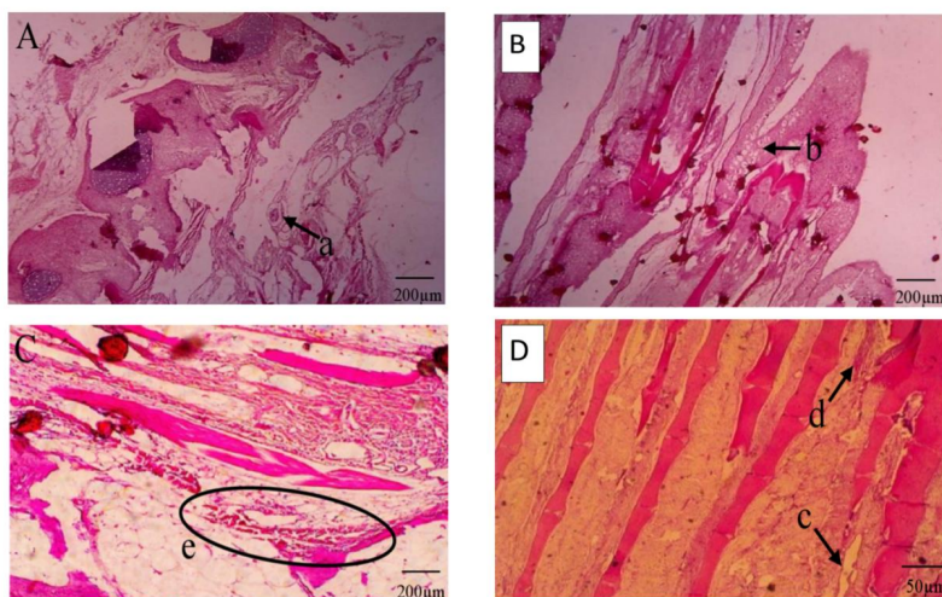


Figure 1. The histopathological features of koi fish infested by *Argulus* (A. pectoral fin organs in mild infestations (100 x magnification); B. caudal fin organs on moderate infestation (magnification 40x); C. skin organ on mild infestations (100 x magnification); a. congestion; b. ballooning degeneration; c. erosion of the epithelium).

4. Conclusion

As a conclusion, the highest prevalence was found in koi fish, this fish is most favored by *Argulus japonicas*. The most vulnerable host is the goldfish, with an average degree of infestation. The highest percentage of leukocytes is lymphocytes (more than 80 %). The dominant histopathological change due to the infestation of *Argulus japonicus* is congestion.

5. References

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RUBRIC: 6TH-8TH SCIENCE ARGUMENT (CER)

CLAIM

Take an arguable position on the scientific topic and develop the essay around that stance.

ADVANCED	The essay introduces a precise, qualitative and/or quantitative claim based on the scientific topic or text(s), regarding the relationship between dependent and independent variables. The essay develops the claim and counterclaim fairly, distinguishing the claim from alternate or opposing claims.
PROFICIENT	The essay introduces a clear, qualitative and/or quantitative claim based on the scientific topic or text(s), regarding the relationship between dependent and independent variables. The essay effectively acknowledges and distinguishes the claim from alternate or opposing claims.
DEVELOPING	The essay attempts to introduce a qualitative and/or quantitative claim, based on the scientific topic or text(s), but it may be somewhat unclear or not maintained throughout the essay. The essay may not clearly acknowledge or distinguish the claim from alternate or opposing claims.
EMERGING	The essay does not clearly make a claim based on the scientific topic or text(s), or the claim is overly simplistic or vague. The essay does not acknowledge or distinguish counterclaims.

EVIDENCE

Include relevant facts, definitions, and examples to back up the claim.

ADVANCED	The essay supplies sufficient relevant, accurate qualitative and/or quantitative data and evidence related to the scientific topic or text(s) to support its claim and counterclaim.
PROFICIENT	The essay supplies relevant, accurate qualitative and/or quantitative data and evidence related to the scientific topic or text(s) to support its claim and counterclaim.
DEVELOPING	The essay supplies some qualitative and/or quantitative data and evidence, but it may not be closely related to the scientific topic or text(s), or the support that is offered relies mostly on summary of the source(s), thereby not effectively supporting the essay's claim and counterclaim.
EMERGING	The essay supplies very little or no data and evidence to support its claim and counterclaim, or the evidence that is provided is not clear or relevant.

REASONING

Explain how or why each piece of evidence supports the claim.

ADVANCED	The essay effectively applies scientific ideas and principles in order to explain how or why the cited evidence supports the claim. The essay demonstrates consistently logical reasoning and understanding of the scientific topic and/or text(s). The essay's explanations anticipate the audience's knowledge level and concerns about this scientific topic.
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PROFICIENT	The essay applies scientific reasoning in order to explain how or why the cited evidence supports the claim. The essay demonstrates logical reasoning and understanding of the scientific topic and/or text(s). The essay's explanations attempt to anticipate the audience's knowledge level and concerns about this scientific topic.
DEVELOPING	The essay includes some reasoning and understanding of the scientific topic and/or text(s), but it does not effectively apply scientific ideas or principles to explain how or why the evidence supports the claim.
EMERGING	The essay does not demonstrate clear or relevant reasoning to support the claim or to demonstrate an understanding of the scientific topic and/or text(s).

FOCUS

Focus your writing on the prompt and task.

ADVANCED	The essay maintains strong focus on the purpose and task, using the whole essay to support and develop the claim and counterclaims evenly while thoroughly addressing the demands of the prompt.
PROFICIENT	The essay addresses the demands of the prompt and is mostly focused on the purpose and task. The essay may not acknowledge the claim and counterclaims evenly throughout.
DEVELOPING	The essay may not fully address the demands of the prompt or stay focused on the purpose and task. The writing may stray significantly off topic at times, and introduce the writer's bias occasionally, making it difficult to follow the central claim at times.
EMERGING	The essay does not maintain focus on purpose or task.

ORGANIZATION

Organize your writing in a logical sequence.

ADVANCED	The essay incorporates an organizational structure throughout that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. Effective transitional words and phrases are included to clarify the relationships between and among ideas (i.e. claim and reasons, reasons and evidence, claim and counterclaim) in a way that strengthens the argument. The essay includes an introduction and conclusion that effectively follows from and supports the argument presented.
PROFICIENT	The essay incorporates an organizational structure with clear transitional words and phrases that show the relationship between and among ideas. The essay includes a progression of ideas from beginning to end, including an introduction and concluding statement or section that follows from and supports the argument presented.
DEVELOPING	The essay uses a basic organizational structure and minimal transitional words and phrases, though relationships between and among ideas are not consistently

clear. The essay moves from beginning to end; however, an introduction and/or conclusion may not be clearly evident.

EMERGING

The essay does not have an organizational structure and may simply offer a series of ideas without any clear transitions or connections. An introduction and conclusion are not evident.

LANGUAGE

Pay close attention to your tone, style, word choice, and sentence structure when writing.

ADVANCED

The essay effectively establishes and maintains a formal style and objective tone and incorporates language that anticipates the reader's knowledge level and concerns. The essay consistently demonstrates a clear command of conventions, while also employing discipline-specific word choices and varied sentence structure.

PROFICIENT

The essay generally establishes and maintains a formal style with few possible exceptions and incorporates language that anticipates the reader's knowledge level and concerns. The essay demonstrates a general command of conventions, while also employing discipline-specific word choices and some variety in sentence structure.

DEVELOPING

The essay does not maintain a formal style consistently and incorporates language that may not show an awareness of the reader's knowledge or concerns. The essay may contain errors in conventions that interfere with meaning. Some attempts at discipline-specific word choices are made, and sentence structure may not vary often.

EMERGING

The essay employs language that is inappropriate for the audience and is not formal in style. The essay may contain pervasive errors in conventions that interfere with meaning, word choice is not discipline-specific, and sentence structures are simplistic and unvaried.