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by Y T Januarista

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1 Prevalence and intensity of endoparasitic helminth on swamp eel (*Monopterus albus*) from natural caught and cultivation

Y T Januarista¹, Kismiyati², and M F Ulkhaq^{2*}

¹Program Study of Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Jalan Mulyorejo, Surabaya 60115 Jawa Timur, Indonesia.

²Department of Aquaculture and Fish Health Management, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Jalan Mulyorejo, Surabaya 60115 Jawa Timur, Indonesia.

*Corresponding Author: m-faizalulhaq@fpk.unair.ac.id

Abstract. Swamp eel (*Monopterus albus*) is one of the highly prospect freshwater fisheries commodities that are consumed by broad community. Marketed swamp eels are generally derived from natural caught and cultivated eels. Natural caught swamp eel has high risk of infected parasites from a natural feed that contaminates with larvae of the parasite of cultured swamp eel could be infected with a parasite from poor pond biosecurity. Information about the types of parasites that infect swamp eels from natural caught and culture has never been reported before. The aims of these studies were to identify the endoparasite and calculate the prevalence and intensity of endoparasite in swamp eel from natural caught and cultivation. A total of one hundred and twenty swamp eel (37.7±2.5 cm height) collected from natural caught and pond culture in Banyuwangi. Two endoparasites helminth were infected to eels from natural caught and cultivation i.e *Eustrongylides ignotus* and *Pingus sinensis*. The higher prevalence and intensity of endoparasites helminth were found in swamp eel from natural caught than cultivation. Further studies were needed to molecular identified of endoparasite in swamp eel with a scanning electron microscope or 16rDNA.

1. Introduction

Swamp eel is one of the freshwater fisheries commodities that are consumed by people, it brings swamp eel has a high market prospect, even as export commodity. Swamp eels in the market came from caught and cultivated eels. Caught swamp eels have a higher risk of parasites than a cultivated eel in controlled environments [1]. Parasites can infecting eels through the natural food their consume because natural food is a carrier agent (intermediate host) such as annelids (*Lumbricus variegatus*, *Tubifex tubifex*, and *Limnodrilus* sp.) are natural food for eels which as a intermediate host the endoparasites in the eel's body [2,3].

Bad environment cultivation can cause parasites to attack swamp eels. This causes the eel stress, and can reduce the body's resistance, so it can make it easier for pathogens to infect [4]. Inappropriate environmental conditions can lead to decreased growth of swamp eel (*Monopterus albus*), it causes to be susceptible infected by pathogens.

Some endoparasite worms such as *Gnathostoma spinigerum* [1], *Proleptine* sp, *Clinostomum complanatum* [5], *Procammallanus*, *Pingus sinensis*, and *Eustrongylides ignotus* [6] are found in swamp eels that can make consumers and cultivators loss. A disadvantage is a potential disease in human that consumes it [7] such as Gnathostomiasis [1]. The existence of the parasites that did not know by cultivators can cause many decreases in the quality and quantity of products, therefore that it has an impact on an economic losses in cultivation [8]. Information about the types of parasites that infected



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in cultivation eels has never been reported, therefore research on identifying parasites that infect natural catches and cultivation is needed to obtain basic data in the prevention of zoonotic diseases in humans.

2. Material and methods

The research study was implemented in January to March 2020. Swamp eel samples came from cultivator, and catcher of swamp eel (*M. albus*) in Banyuwangi District. Total of samples examined was 120 eels (37.7 ± 2.5 cm height). The organs examination are skin, fins, body cavity, kidneys, gonads, and digestive tract. The staining was performed by using the Semichen Acetic Carmine method [9]. The parasites were observed with a microscope each 100x and 400x, and morphologically identification are based from Xiong *et al.*[10], Moravec *et al.* [11], Moravec *et al.*[12], Aray and Smith [13]. Calculations of prevalence and intensity rates used the formula [14]:

Prevalence = (fish infected by parasite/fish samples examined) \times 100%

Intensity = (parasites found/fish samples infected)

3. Result and discussion

3.1. Result

The results showed that from a total of 120 samples, there were 14 eels (23.3%) from caught swamp eels and 3 eels (5%) from cultivated swamp eels that are positively infected by *Eustrongylides ignotus* (Figure 1) and *Pingus sinensis* (Figure 2). They infected the digestive tract of caught swamp eels. Meanwhile, the endoparasite that infected cultivated swamp eels is *P. sinensis* (Figure 2). The prevalence and intensity of swamp eels from natural caught respectively 23.3% and 1.5, was higher than they that were cultivated of swamp eels respectively 5 % and 1 (Table 1).

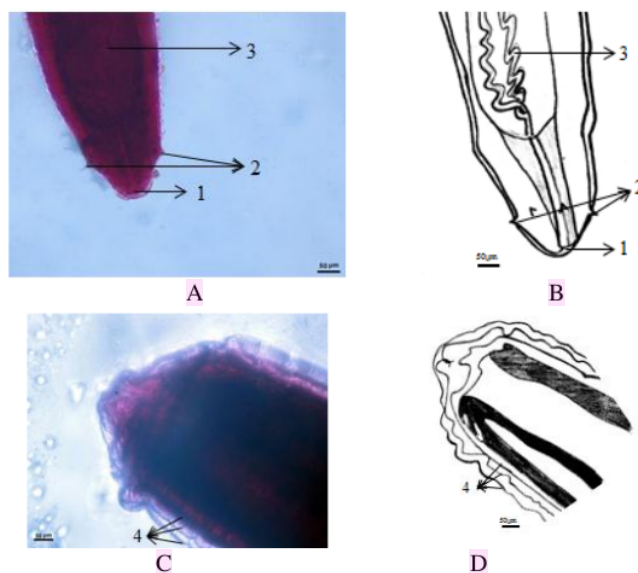


Figure 1. *Eustrongylides ignotus*. Images taken using Semichoer Acetic Carmine staining, and with a binocular microscope equipped with a Lucida camera; bar scale = 50 μ m. (A-B) Anterior; (C-D) Posterior; (1) Mouth; (2) Labial papillae; (3) digestive tract; (4) cuticle layer.

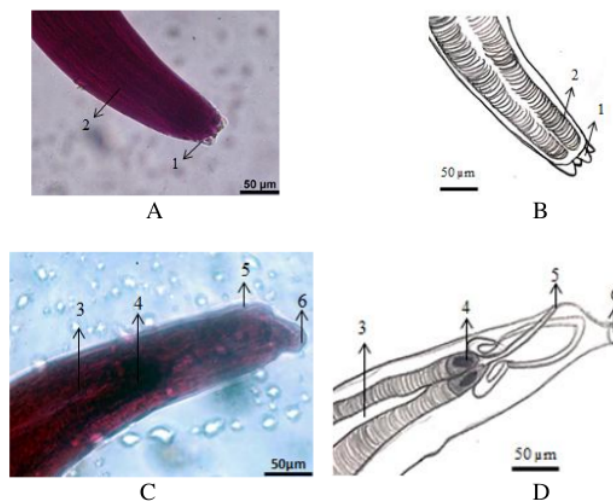


Figure 2. *Pingus sinensis*. Images taken by using Semichoen Acetic Carmine staining and with a binocular microscope equipped with a Lucida camera; bar scale = 50 µm. (A-B) Anterior; (C-D) Posterior; (1) Papillae (2). Esophagus; (3) Ventriculus; (4) Ovary; (5) Anal hole; (6) Caudal.

Table 1. Prevalence and intensity of caught and cultivated eels infected with the endoparasitic worms

Location	Total of sample	Infected fish	Amount of Parasite	Prevalence (%)	Intensity
Caught	60	14	21	23.3	1.5
Cultivation	60	3	3	5	1

3.2. Discussion

The endoparasitic helminth that found infected swamp eels were *E. ignotus* and *P. sinensis*. *E. ignotus* was found infect the digestive tract of catch and cultivated swamp eels. The identification of *E. ignotus* was implemented referring identification key of Xiong *et al.* [10], Aray and Smith [13]. Based on observations, *E. ignotus* has an elongated cylindrical shape with body lengths ranging from 40-50 mm. The anterior part of *E. ignotus* is more pointed with papillae, and gastrointestinal tract while the posterior part of *E. ignotus* has three layers of cuticle. The morphology of *E. ignotus* can be seen in Figure 1.

Other endoparasitic helminth that infected in swamp eels was *P. sinensis*. *P. sinensis* has an elongated cylindrical body shape with a body length of 3-8 cm, body width 0.12-0.16 mm, esophageal length 0.56-0.64 mm, the anterior part equipped with four papillae, whereas at the posterior portion of *P. sinensis* is equipped with anal, uterine, ventricular, and caudal. The morphology of *P. sinensis* worms can be seen in Figure 2.

The high score of the calculation prevalence and intensity of natural catches swamp eels can be caused by catches swamp eels consumed uncontrolled feed, that it was as an intermediate host of the endoparasites that was the potential to contain cysts or larvae parasite [15]. Besides that the presence of the endoparasite found in the host also influenced by several factors as follow: size, age, habitat, and the condition of the waters where the eels live [16], high soil nutrients, and high density of annelids (*Lumbricus variegatus*, *Tubifex tubifex*, and *Limnodrilus* sp.) as intermediate hosts endoparasite [2,3]. The prevalence of cultivated swamp eels was 5%, it classified as an Occasionally, and intensity of cultivated swamp eels was 1, therefore classified as low infected by parasites [17]. The low score of the prevalence and intensity of cultivated swamp eels because cultivated swamp eel feed is more controlled, therefore it can suppress infections the parasite. Beside that the endoparasitic

infections in eels is caused by eating habits host [1]. In cultivation swamp eels, it is not found *E. ignotus*, it's caused by geographical location of the cultivation sites located in highland (400-650 MDPL). Life cycle of *E. ignotus* has a definitive host, Ardeidae that is a bird that lives and eating in lowland and coastal areas [18] that was infected by *E. ignotus*, are reported to be in the estuary environment.

Intensity value which is classified low, this is causes the eel doesn't show clinical symptoms. If the scoring intensity is high, it causes eel's stress and it will be showing clinical symptoms [19]. A high value the intensity can threaten cultivation because it can increase the transmission of infection and causing environment to be potential in the spread of infectious diseases [20]. A value of intensity parasitic be affected by several factors such as body size, immune system, influence of movement, food, and environmental cultivation [21].

4. Conclusion

The conclusion of this study were two endoparasites helminth infected the eels from natural caught and cultivation are *E. ignotus* and *P. sinensis*. The prevalence and intensity of the endoparasites helminth were found from natural caught are higher than cultivation. Further studies were needed to identify the endoparasite in swamp eel with a scanning electron microscope or a molecular analysis.

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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.