



Identification of Ectoparasites and Endoparasites in Snakehead Fish (*Channa striata*) and Climbing Perch Fish (*Anabas testudineus*) Caught in the Sebangau River of Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2023/v25i4686

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/107441>

Original Research Article

Received: 08/08/2023

Accepted: 12/10/2023

Published: 20/10/2023

ABSTRACT

Ectoparasites are parasites that can infect the external organs of fish (skin, gills and the outer surface of the body) while endoparasites are parasites that infect the internal organs of fish. This study aims to determine the types of ectoparasites and endoparasites that infect snakehead fish (*Channa striata*) and climbing perch fish (*Anabas testudineus*). Sampling was carried out at the Sebangau River while the identification was carried out at the *Fish Quarantine Station, Quality Control and Safety of Fishery Products* in Palangka Raya. Examination of ectoparasites includes *mucus, gills, scales, and fish fins*. Examination of endoparasites by observing the organs of the fish

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such as liver, meat, intestines and stomach. There are eight types of ectoparasites in snakehead fish, namely *Trichodina sp*, *Dactylogyrus sp*, *Gyrodactylus sp*, *Apiosoma sp*, *Tetrahymena sp*, *Aelosoma sp*, *Lamproglena sp*, and *Henneguya sp*, while there are four types of endoparasites in snakehead fish, namely *Camallanus sp*, *Procamallanus sp*, *Neoechynorynchus sp*, and *Senga sp*. There are five types of ectoparasites in the climbing perch fish caught in the Sebangau River, namely *Trichodina sp*, *Dactylogyrus sp*, *Aelosoma sp*, *Myxobolus sp*, and *Epistylis sp*. Meanwhile, there is only one type of endoparasite that attack snakehead fish, namely *Procamallanus sp*. The total prevalence of snakehead fish's ectoparasites was 81.7%, with an intensity level of 6.1 individual parasites per fish. The total prevalence of ectoparasites in climbing perch fish is 45%, with an intensity level of 5.4 individual parasites per fish. The total prevalence of snakehead fish endoparasites is 65%, with an intensity level of 9.8 individual parasites per fish. The prevalence of climbing perch fish's endoparasites is 31.7%, with an intensity level of 19 individual parasites per fish.

Keywords: Ectoparasites; endoparasite; snakehead fish; climbing perch fish; Sebangau river.

1. INTRODUCTION

The Sebangau River is a peat swamp river in Central Kalimantan which produces the black waters characteristics [1]. The habitat which influences the types of available fish. Snakehead fish (*Channa striata*) and climbing perch fish (*Anabas testudineus*) are the mostly fish caught in the Sebangau River. However, the surrounding area still has many settlements, agriculture, ponds or aquaculture, while the estuary area becomes a place for catching the fish. Disposal of liquid and solid waste is expected to cause the changes in quality or increase in environmental pollution and sources of disease [2]. Besides being obtained from catches, these two fish have also begun to be cultivated [3,4]. Taking fish directly in the waters for cultivation purposes certainly needs to consider the adaptation of these fish to be placed in a new environment. One of the things that determine the success of a fish farming business is the control of pests and diseases. The emergence of infections in the fish's body which will slowly affect the growth and productivity of the fish [5].

In general, diseases are caused by microbial agents including parasites. Parasites can cause serious problems to the point of causing mass death in cultivated fish [6]. In addition, parasites can cause economic losses and have an impact on human health when consumed raw or cooked imperfectly. Prevention of disease is the first thing of fish farmers need to do. Several studies on parasites in fish caught in the Sebangau River have been conducted [7-9]. However, overall, there are no reports regarding to the type and distribution of ectoparasites and endoparasites that attack snakehead fish and climbing perch

fish caught in the Sebangau River, it causes the further research need to be conducted so the data can provide information of early disease control and further development of aquaculture.

2. MATERIALS AND METHODS

2.1 Materials

The tools used in this study consisted of scales, rulers, microscopes, dissecting sets, glass objects, cover glasses, pipettes, preparations, trays, digital cameras and stationery. The materials used consisted of test fish and chemicals. The fish used in this study were snakehead fish (60 samples) and climbing perch fish (60 samples). The chemicals used were distilled water/aquadest (500 ml) and NaCl (500 ml).

2.2 Methods

The numbers of snakehead fish and climbing perch fish used were 60 samples for each. Samples were taken directly from the Sebangau river and brought to the laboratory for parasite examination. Sample fish were measured for the total of length (cm) and weight (g). Examination of ectoparasite infection, included: body surface (mucus), gills, scales, and fins of fish taken with a sterile scalpel. Then, after taking the fish's organs, it was placed on a glass object and dripped with distilled water/aquadest or NaCl, then covered with a cover glass and then to be observed under a microscope.

Examination of endoparasites was carried out by observing the organs of the fish such as liver, meat, intestines and stomach. Observation of fish endoparasites was carried out by dissecting

Table 1. Prevalence criteria of parasites attack

No	Levels of Attack	Descriptions	Prevalences
1	Constantly	Very severe infection	100 - 99%
2	Almost constantly	Severe infection	90 - 99%
3	Ordinarily	Moderate infection	89 - 70%
4	Very often	Very frequent infection	69 - 50%
5	Normally	Common infection	49 - 30%
6	Often	Frequent infection	29 – 10%
7	Occasionally	Sometimes infection	9 – 1 %
8	Seldom	Rare infection	>1 – 0,1%
9	Very Rare	Very rare infection	>0,1 – 0,01%
10	Almost never	Never Infection	>P0,01%

Table 2. Intensity criteria of parasites attack

No	Level of Attack	Intensity
1	Very low	<1
2	Low	1 – 5
3	Moderate	6 – 55
4	Severe	51 – 100
5	Very severe	>100
6	Super Infection	>1000

parts of the fish to extract the internal organs, then taking and placing them on a glass object. dripped with distilled water/aquadest or NaCl solution and covered with a cover glass. The observation of parasites was carried out using a microscope and identification of parasites using a guidebook [10].

2.3 Statistical Analysis

The data of ectoparasites and endoparasites that found from the results of examination sample were then recorded so that the number and types of ectoparasites and endoparasites were then counted. And to determine the level of parasites attack on fish, it could be analyzed by calculating the prevalence and intensity according [10]:

$$P = N / n \times 100\%$$

Descriptions:

- Q: Prevalence
- N: Number of infected samples
- N: Number of samples observed

while the intensity is calculated using the formula:

$$I = P / N$$

Descriptions:

- I: Intensity of parasite attack (ind/tail)
- P: The number of infecting ectoparasites (ind)
- N: Number of infected samples (tails)

Parasite prevalence and intensity levels were analyzed using criteria that referred to [11], which are presented in the following Table 1.

3. RESULTS AND DISCUSSION

Based on the identification results that carried out for 3 months (90 days) there were 60 snakehead fish and 60 climbing perch fish with a total of 120 fish observed. Then be found as many as 8 types of ectoparasite species and 4 types of endoparasite species in snakehead fish caught in the Sabangau river namely, *Trichodina sp*, *Dactylogyrus sp*, *Henneguya sp*, *Lamproglena sp*, *Tetrahymena sp*, *Epistylis sp*, *Apiosoma sp*, and *Gyrodactylus sp* ectoparasites, with the target of scales and mucus, fins, and gills were then carried out to identify the endoparasites obtained, namely *Camallanus sp*, *Procamallanus sp*, *Neoechynorynchus sp*, and *Senga sp* targeting the liver, intestines, and meat. Then the identification of the betok fish was carried out, there were 5 types of ectoparasitic species, namely *Trichodina sp*, *Dactylogyrus sp*, *Aelosoma sp*, *Myxobolus sp*, and *Epistylis sp* with the target of scales and mucus, fins, and gills [Fig. 1].

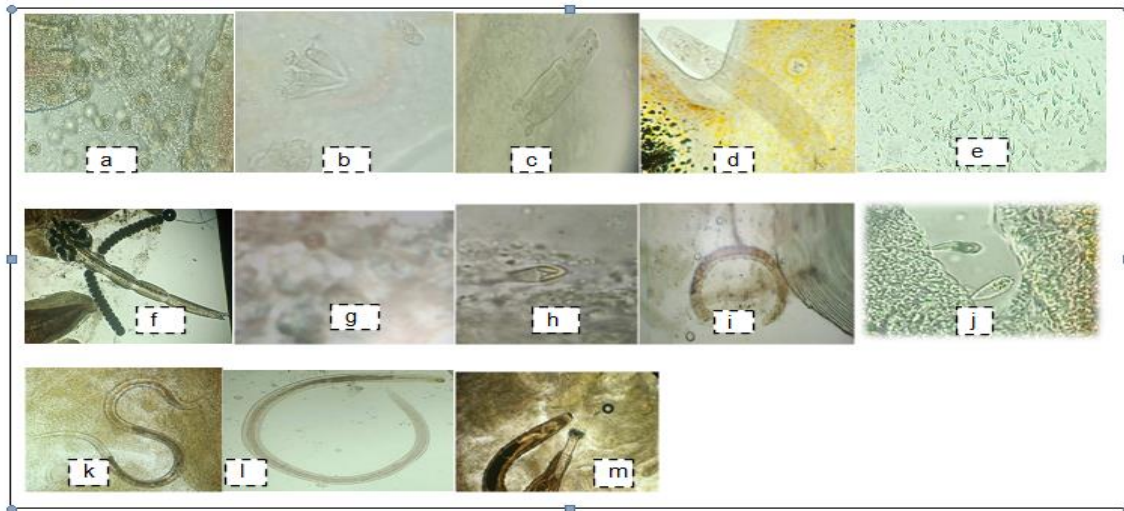


Fig. 1. Ectoparasites and endoparasites which found in snakehead fish and climbing perch fish: a. *Trichodina* sp.; b. *Epistylis* sp.; c. *Dactylogyrus* sp.; d. *Gyrodactylus* sp.; e. *Henneguya* sp.; f. *Lamproglene* sp.; g. *Tetrahymena* sp.; h. *Myxobolus* sp.; i. *Aelosoma* sp.; j. *Apiosoma* sp.; k. *Camallanus* sp.; l. *Procamallanus* sp.; m. *Neoechinorhynchus* sp.

Henneguya sp became the most dominant ectoparasite infecting snakehead fish in the Sebangau River, with gills being the most frequently infected organ. This can happen because the gill organ is an organ that often comes into direct contact with the environment, so it is susceptible to parasites. Stated that the high presence of parasites in the gills was caused by the direct contact with the water [12]. According to [13] stated that the infected fish by the parasite did not show severe clinical symptoms in the infected organs. This can happen because the fish's body had strong immune response and the influence of water quality in the location could still be tolerated by snakehead fish. Furthermore, *Trichodina* sp became the most dominant ectoparasite infecting climbing perch fish, with the gills being the most frequently infected organ. Infected fish got skin irritation, excessed mucus production, pale gills, gasping so that the fish often hangs on the surface of the water, decreased appetite, weak fish movements, damaged tail fin and reddish color due to broken capillaries in the fins [14]. *Trichodina* sp was very often found in the Sebangau River and was most commonly found in the gills. After the gills that were most often infected, the next part were the scales, mucus, and fins. Scales and mucus became the most numerous organs after gills that were attacked by parasites because scales and mucus became innate body protectors and become a separator between the internal and external environment of fish [15].

In the activity of identifying endoparasites in snakehead fish and climbing perch fish, the types of endoparasites that were found in snakehead fish were dominated by 4 types of endoparasites, namely *Camallanus* sp, *Procamallanus* sp, *Neoechinorhynchus* sp, and *Senga* sp.

Procamallanus sp became a parasite that often infects endoparasites in snakehead fish and climbing perch fish in the Sebangau River, the intestine being the organ that was often infected by this type of parasite. This can happen because the intestine is an organ that digests the foods consumed by fish from their environment. According to [16] that the intestine provides a source of nutrition for nematodes including blood, tissue cells, body fluids and food essences contained in the lumen of the small intestine.

Snakehead fish infected with the ectoparasite species which were identified in this study had an average length of 18.7 cm and a weight of 99.8 grams, and the type of endoparasite that attacked snakehead fish in this study had average of length 16.7 cm and weight of 97.3 grams. In climbing perch fish, ectoparasites attacked this fish with an average length of 13.6 cm and weight of 37.7, while endoparasites attacked the climbing perch fish in this study had an average length of 12.9 cm and weight of 36.2 grams. In some fish species, the larger the size/weight of the host, the higher the infection by certain parasites. The older hosts may contain larger numbers of parasites, although if becomes

an adaptation, the host will tolerant to the parasites [17].

The results of the number of ectoparasites and endoparasites in snakehead fish and climbing perch fish caught in the Sebangau river (Table 3,4).

Based on the table 3 above, as many as 8 types of parasitic ectoparasites are found in snakehead fish in the Sebangau River with the number of parasites of 3.750 ind/cell, *Henneguya sp* being the ectoparasite type that most infects these fish, with a total of 2.250 ind/cell. Whereas *Epistylis sp* with 9 ind/cell and *Gyrodactylus sp* with 1 ind/cell, become the fewest ectoparasites that infect the fish. Ectoparasites are the most found in the gill organ, then followed by mucus, and then scales.

Then, as many as 5 types of ectoparasites are obtained from climbing perch fish in the Sebangau River with a total of 725 ind/cell, *Trichodina sp* being the most common type of

ectoparasites found in the area, namely with a total of 554 ind/cell. *Epistylis sp* with 8 ind/cell and *Aelosoma sp* with 1 ind/cell are the fewest ectoparasites that infect the fish.

Based on the table 4 above, as many as 4 types of parasitic endoparasites are found in snakehead fish in the Sebangau River with the number of parasites are 48 ind/cell, *Procalamallanus sp* being the most common endoparasite that attacks snakehead fish, with the number of 16 ind/cell, followed by *Camallanus sp* with the number of parasites 15 ind/cell and *Neoechynorynchus sp* with the number of 12 ind/cell. Research conducted by [8] showed that the parasites of *Procalamallanus sp* and *Camallanus sp* mostly attacked snakehead fish in the intestinal organs. *Senga sp* is the least endoparasite that infected snakehead fish.

In the climbing perch fish, there is only 1 type of endoparasite that infects this fish in the Sebangau River area, namely *Procamallanus sp* with the number of parasites of 42 ind/cell.

Table 3. Results of the number of ectoparasites in snakehead fish and climbing perch fish

Fish types	Parasites type	∑ Parasite in the target organ (Ind/sel)			Total
		Fins	Scale/mucus	Gill	
Snakehead Fish	<i>Trichodina sp</i>		455	331	786
	<i>Dactylogyrus sp</i>			422	422
	<i>Henneguya sp</i>			2.250	2.250
	<i>Lamproglena sp</i>			63	63
	<i>Apiosoma sp</i>	68	14	47	119
	<i>Tetrahymena sp</i>		100		100
	<i>Epistylis sp</i>		9		9
	<i>Gyrodactylus sp</i>	1			1
TOTAL	8	69	578	3.113	3.750
Climbing perch Fish	<i>Trichodina sp</i>	13	130	411	554
	<i>Dactylogyrus sp</i>			152	152
	<i>Aelosoma sp</i>		1		1
	<i>Mixobolus sp</i>			11	11
	<i>Epistylis sp</i>			7	7
TOTAL	5	13	131	581	725

Table 4. Results of the number of endoparasites in snakehead fish and climbing perch fish

Fish types	Parasite types	∑ Parasite in the target organ (Ind/sel)				Total
		Liver	Intestine	Meat	Stomach	
Snakehead Fish	<i>Camallanus sp</i>		14		1	15
	<i>Procamallanus sp</i>		12	1	3	16
	<i>Neoechynorynchus sp</i>		10	2		12
	<i>Senga sp</i>	1	4			5
TOTAL	4	1	40	3	4	48
Climbing perch Fish	<i>Procamallanus sp</i>		41		1	42
TOTAL	1		41		1	42

The results of the prevalence (%) and intensity of ectoparasites and endoparasites in snakehead fish and betok fish caught in the Sebangau river (Table 5,6).

From the table 5 above, it can be seen that *Dactylogyrus sp* is the parasite that has the highest prevalence in snakehead fish and climbing perch fish ectoparasites with a prevalence of snakehead fish of 43.3% and betok fish of 30%. *Dactylogyrus sp* is a parasite that has the highest prevalence of ectoparasites of snakehead fish and climbing perch fish, with a prevalence of 43.3% for snakehead fish and 30% for betok fish, which is include in the common infection category, but the highest intensity of snakehead fish is *Henneguya sp.* with 225 individuals parasites per fish which makes this parasite into the super infection category, while the highest intensity in betok fish is *Trichodina sp*, with 36.9 individual parasites per fish, makes this parasite into the moderate infection category. *Dactylogyrus sp.* parasite is an ectoparasites that attacks fish in peat swamp water such as javan combtail fish; climbing perch fish, red snakehead fish, ocellated fish, and catfish [7,9,18,19]. However, the highest intensity of snakehead fish

is *Henneguya sp*, with 225 individual parasites per fish, while the highest intensity of climbing perch fish is *Trichodina sp*, with 36.9 individual parasites per fish.

Camallanus sp and *Neoechynorynchus sp* are parasites that have the highest prevalence in snakehead fish endoparasites, which are 15% that makes these parasites into the frequent infections category. *Procamallanus sp* is the only endoparasite that attacks betok fish which has a prevalence of 33.3%, include in the common infection category, but the highest intensity of snakehead fish is *Camallanus sp*, with 1.1 individual parasites per fish which makes this parasite in the category of low infection, while the intensity of *Procamallanus sp* in climbing perch fish is 3.3 individual parasites per fish which is also in the low infection category (Table 6).

The mode of transmission of *Neoechynorynchus sp* is the same as other parasites of the *Acanthopcephala* phylum, that is through a definitive host of a crustacean containing *Acanthella*. *Acanthella* will attach to the surface of the intestine with the proboscis and will develop into adulthood [20].

Table 5. Prevalence (%) and intensity of ectoparasites of snakehead fish and climbing perch fish

Fish Types	Parasite Types	∑ Observed fish	∑ Infected Fish (tail)	Prevalence (%)	Intensity
Snakehead Fish	<i>Trichodina sp</i>	60	14	23,3	56,1
	<i>Dactylogyrus sp</i>	60	26	43,3	15,2
	<i>Henneguya sp</i>	60	10	16,7	225
	<i>Lamproglena sp</i>	60	16	26,7	3,9
	<i>Apiosoma sp</i>	60	13	21,7	9,2
	<i>Tetrahymena sp</i>	60	1	1,7	100
	<i>Epistylis sp</i>	60	2	3,3	4,5
	<i>Gyrodactylus sp</i>	60	1	1,7	1
Climbing perch Fish	<i>Trichodina sp</i>	60	15	25	36,9
	<i>Dactylogyrus sp</i>	60	18	30	8,4
	<i>Aelosoma sp</i>	60	2	3,3	0,5
	<i>Mixobolus sp</i>	60	2	3,3	5,5
	<i>Epistylis sp</i>	60	20	33,3	0,4

Table 6. Prevalence (%) and intensity of endoparasites of snakehead fish and climbing perch fish

Fish Types	Parasites Types	∑ Fish Observed	∑ Infected Fish (tail)	Prevalence (%)	Intensity
Snakehead Fish	<i>Camallanus sp</i>	60	9	15	1
	<i>Procamallanus sp</i>	60	8	13,3	1,1
	<i>Neoechynorynchus sp</i>	60	9	15	0,5
	<i>Senga sp</i>	60	5	8,3	0,3
Climbing perch Fish	<i>Procamallanus sp</i>	60	20	33,3	3,3

Camallanus worm infection does not show clinical symptoms, but if it is heavily infected it can cause fish to become weak, have injuries to the intestines, anemia, and emaciation (thin and dry body) [21]. *Camallanus sp* parasite is not specific because it is found in various types of fish with different water conditions such as seawater fish and freshwater fish [19].

The total ectoparasites of snakehead fish are 81.7% included in the moderate infection category, with an intensity level of 6.1 individual parasites per fish which is also in the moderate infection category. The prevalence of total ectoparasites in climbing perch fish is 45% in the common infection category, with an intensity level of 5.4 individual parasites per fish which is included in the low infection category.

Prevalence and total intensity of endoparasites of snakehead and climbing perch fish. Snakehead fish endoparasites are 65% include in the very frequent infection category, with an intensity level of 9.8 individual parasites per fish, include in the moderate infection category. The prevalence of climbing perch fish endoparasites was 31.7%, include in the common infection category, with an intensity level of 19 individual parasites per fish, include in the moderate infection category.

4. CONCLUSION

There were eight types of ectoparasites in snakehead fish caught in the Sebangau River, namely *Trichodina sp*, *Dactylogyrus sp*, *Gyrodactylus sp*, *Apiosoma sp*, *Tetrahymena sp*, *Aelosoma sp*, *Lamproglana sp*, and *Henneguya sp*. Meanwhile, there were four types of endoparasites in snakehead fish, namely *Camallanus sp*, *Procamallanus sp*, *Neoechynorynchus sp*, and *Senga sp*. There were five types of ectoparasites in the climbing perch fish caught in the Sebangau River, namely *Trichodina sp*, *Dactylogyrus sp*, *Aelosoma sp*, *Myxobolus sp*, and *Epistylis sp*. Meanwhile, there was only 1 type of endoparasite that attacked the snakehead fish, namely *Procamallanus sp*. *Henneguya sp* became the most dominant ectoparasite infecting snakehead fish in the Sabangau River and *Trichodina sp* became the most dominant ectoparasite infecting climbing perch fish. *Procamallanus sp* was a parasite that often infected endoparasites in snakehead fish and climbing perch fish in the Sebangau River. The total prevalence of snakehead fish ectoparasites was 81.7%, with an intensity level

of 6.1 individual parasites per fish. The total prevalence of ectoparasites in climbing perch fish was 45%, with an intensity level of 5.4 individual parasites per fish. The total prevalence of endoparasites of snakehead fish was 65%, with an intensity level of 9.8 individual parasites per fish. The prevalence of climbing perch fish's endoparasites was 31.7%, with an intensity level of 19 individual parasites per fish.

ACKNOWLEDGEMENT

We express our deepest thanks and appreciation especially to Fish Quarantine, Quality Control, and Safety Station, Palangka Raya for facilitating this research so that this research can run well and smoothly.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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