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Detection parasites of Indian Mackerel (*Rastrelliger kanagurta*) in North Sumatera, Indonesia

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ABSTRACT

The purpose of this study was to identify ectoparasites and their prevalence infecting *Rastrelliger kanagurta* in North Sumatera, Medan. So far, people use this fish as a processed product. The method used in this study is a survey method with direct collection at the research site. Samples were taken using random sampling technique. Sampling was carried out in five places in Belawan with the number of samples studied as many as 30 individuals with an average length of 25.3 cm and a weight of 193.7 grams. Identification was carried out in a laboratory using a light microscope at the Faculty of Agriculture, University of North Sumatra. The results of this study found seven types of parasites that infect the surface in the muscles, fins and gills. The parasites found in their respective prevalence were infected *Dactylogyrus* sp. 13.33% was found in muscus, *Austrobdella* sp. 30% found in fin. While the parasites found in the gills were *Zoothamnium* sp as much as 6.67%, *Diphyllobothrium* sp as much as 16.67%, *Rhadinorynchus* sp. 53.33%, *Camallanus* sp. 20% and *Anisakis* sp. 3.33%. *Rhadinorynchus* sp. is the parasite with the highest prevalence rate, found on the scales, gills and fins respectively of mackerel.

Introduction

The production of small pelagic fish resources from year to year in North Sumatra Province, especially in the Belawan Ocean Fishing Port, has increased. Based on the PPS Belawan Statistics Report (2018), mackerel fish production is one of the dominant small pelagic fish caught and has increased production, which is 652.6 tons. Mackerel is one type of seawater fish that is in demand by Indonesians as a consumption fish because in addition to having a good taste, mackerel fish is also classified as a very economical fish so that it can be reached by people from all walks of life. According to Fadhilah *et al.* (2021), it is known that 63% of animal protein consumed by Indonesians comes from fish, especially pelagic fish.

Mackerel as one of the seawater fish from the genus Rastrelliger which is commonly consumed by humans, can be found in its gills various types of parasites both in the form of larvae and adults. Various losses can be caused by the presence of parasitic worms such as economic, health and ecological losses (Yamaguti, 2007). Diseases caused by microorganisms are usually called "microbial disease". The groups of microorganisms that often attack marine fish are bacteria, viruses, fungi and other protozoa (Meron *et al.*, 2020). Parasites are organisms whose lives can adapt to and harm other organisms they inhabit (host) and cause disease. Parasites harm the host because they take nutrients from the host which can cause death (Ali *et al.*, 2013).

Based on the organs infected by parasites, the parasites are classified into two different groups, namely ectoparasites and endoparasites (Bellay *et al.*, 2015). Because ectoparasites are parasites that attack the outside of the fish's body or parts that still get air from the outside, while endoparasites are parasites that attack the inside of the host's body (Munar *et al.*, 2016) The mackerel also were consump for the many people in Indonesia. Therefore, this species needs to

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be researched because the parasites can inffect to the people when they consump it.

Materials and Methods

Location and time of research

This research was conducted from September to November 2021, Fish samples were taken from traditional fishermen who landed fish at the Samudera Belawan Fishing Port, Province of North Sumatera within one week. The identification and prevalence of ectoparasites were carried out at the Technical Implementation Unit of the Laboratory of Fisheries Product Quality Control and Testing (UPT LPPMHP) Mabar, Medan, Province of North Sumatera.

Reseach procedure

Sample collection

The method used in this study is a survey method with direct collection at the research location. The sample was taken using random sampling techniques. Mackarel samples that have been taken then measured the length and weight. Ectoparasite research was conducted on 30 fish samples, with an average size of 21.65 cm and an average weight of 193.7 gram.

Examination of ectoparasite

The fish was dissected by cutting three parts, namely the lower part of the stomach starting from the front of the anus to the lower operculum passing through the pectoral fin, the front of the anus upward towards the linear lateral, and then the cutting along the linear lateral direction to the operculum and finally the scissors connecting the three parts of the cutout. The fish organs to be examined are the muscles, fins and gills. Furthermore, the organs are opened by cutting. Then scraped using a spatula, then placed on a glass slide and dropped with physiologic NaCl solution, then covered with a cover glass and observed under a microscope with a magnification of 40X. The organs walls are examined again to take parasitic worms that stick to them and are examined again under a microscope. Ectoparasite identification was carried out based on Arai and Smith (2016).

Data analysis

Research data is presented in the form of tables and figures and analyzed descriptively based on the identification of *Rastrelliger kanagurta*. Then the fish were counted using the following formula by Kabata (1985).

$$\text{Prevalence} = \sum \frac{\text{fish infected}}{\text{fish examined}} \text{x } 100\%$$

The infection category was based on prevalence using the reference by Williams and Williams (1996), as shown in Table 1.

Table 1. Category of prevalence ectoparasite

Prevalence (%)	Infection Category
<0.01	Almost never
<0.1-0.01	Very rarely
<1-0.1	Rarely
1-9	Occasionally
10-29	Often
30-49	Commonly
50-69	Frequently
70-89	Usually
90-98	Almost always
99-100	Always

Results

Mackerel is characterized by two separate dorsal fins, each consisting of 8 to 9 weak fingers. The pectoral fin consists of 16 to 19 weak fin radii, the pelvic fin consists of 7 to 8 weak fingers, the caudal fin consists of 50 to 52 weakly branched fingers and the scales on the rib line (linea lateralis) consist of 127 to 130 scales. In addition, this fish has a total length of 3.4 to 3.8 times the body weight and a head length greater than the head height (Wandira *et al.*, 2018).

Types of ectoparasites found

The results of ectoparasite identification in mackerel *R. kanagurta* landed at the Belawan Ocean Fishing Port found seven types of ectoparasites that infect mackerel. A total of 30 mackerel fish were examined with a length between 17-25.3 cm and a weight of 53.43-193.7 grams. All of them were infected with ectoparasites in their organs, especially in the gills and only a few fish were infected on the scales and fins.

Table 2. Identification of ectoparasites that infect the body organ of mackerel (*R. kanagurta*)

Family	Genus	Total Ind
Dactylogyridae	*Dactylogyrus*	8
Diphyllobothiidae	*Diphyllobothrium*	14
Camallanidae	*Camallanus*	26
Anisakidae	*Anisakis*	1
Zoomthamniidae	*Zoothamnium*	4
Pisciolidae	*Austrobdella*	19
Rhadinorhynchidae	*Rhadinorhynchus*	66

The ectoparasites found infecting the body surface of mackerel fish are dominanted of 18 ind with the genus *Dactylogyrus* and *Diphyllobothrium* was found of 14 ind (Table 2).

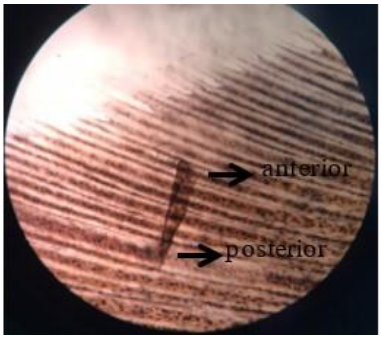

Figure 1. *Dactylogyrus* sp. on the scales magnification of 40x.

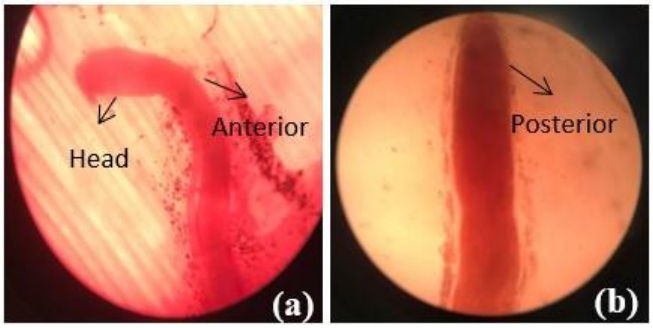

Figure 2. *Diphyllobothrium* sp. in head (a. Anterior and b. Posterior) magnification 40x.

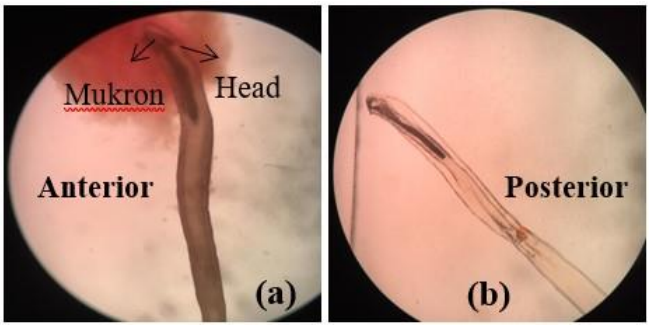

Figure 3. *Camallanus* sp. on the gill (a. anterior, b. Posterior, TR: Trunk) magnification 40x.

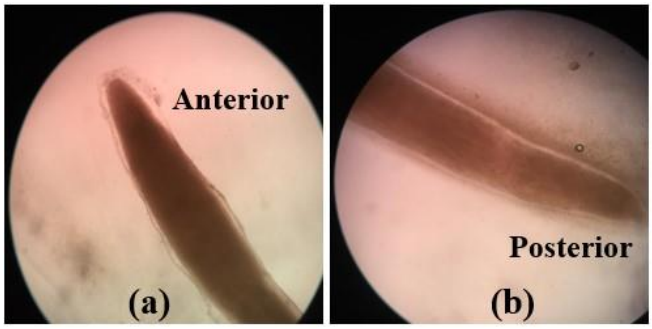

Figure 4. *Anisakis* sp. on the gill (a. Anterior and b. Posterior) magnification of 40x.

The species *Dactylogyrus* sp. (Figure 1) found in this mackerel has an unclear body structure and is found in the scales. Sudaryatma and Eriawati (2012) state that *Dactylogyrus* sp. is a parasite that attacks freshwater fish, brackish water fish and sea water fish. It has a wide distribution, has a direct life cycle and includes external parasites that attack the gills, fins and in the oral cavity. The biological properties of *Datylogyrus* sp. is hermaphrodite. This parasite is included in the monogeneous class with the largest size and has a length of 0.30-1.00 mm (Susanti, 2008).

Diphyllobothrium sp. belongs to the phylum Platyhelminthes, the Diphyllobothriidae family. This worm has the characteristics of a long and flat body where the parts of the body have a line that resembles a divider and has a sharp tip (Figure 2). Harmah *et al.* (2018) *Diphyllobothrium* sp. has an elongated body shape like a ribbon consisting of segments called proglottids.

The species *Camallanus* sp. (Figure 3) which was found to infect the gills of mackerel is known to be a parasitic nematode with elongated cylindrical body size. Its body is covered by a layer of fine cuticle that runs from the anterior tip to the tip of the tail, orange to brown. The end of the head is rounded while the end of the tail is tapered. Amrina (2014), the mouth has a narrow open opening with a rounded corner. The typical organ of *Camallanus* is the buccal capsule.

Anisakis sp parasite (Figure 4) on the gill organs of mackerel. Has a body structure that is elongated and tapers in the posterior part. This is supported by Nuchjangreed *et al.* (2006) who stated that Anisakis sp. is a parasite that is often found infecting the intestines of marine fish, but it is possible that this parasite is found in the gills of marine fish. Puspitasari (2014) which also found the parasite *Anisakis* sp. on the gill organs of mackerel with a prevalence rate of 13.33%.

Zoothamnium sp. (Figure 5) is characterized by its inverted bell-like body shape, including the colonized, whitish-colored protozoan class ciliate that attaches to the substrate using a branching pedicle that is found to attack the gill organs. Safratilofa and Rizki (2019) stated that *Zoothamnium* sp. has a cone shape, tends to be rounded and has a hair-like stalk, colonizes. This parasite is a type of parasite that is often found and attaches to the surface of the body and gills.

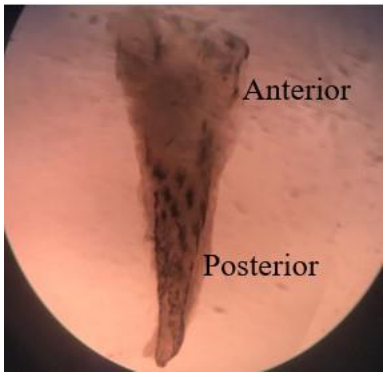

Figure 5. *Zoothamnium* sp. on the gill (a. Anterior and Posterior) magnification of 40x.

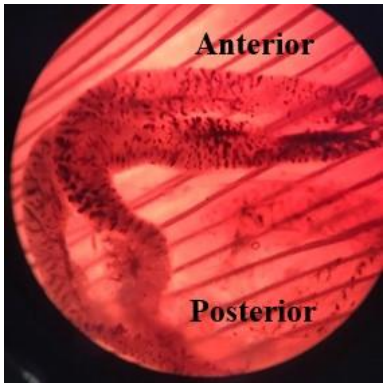

Figure 6. *Austrobdella* sp. on the fin (a. Anterior and Posterior) magnification of 40x.

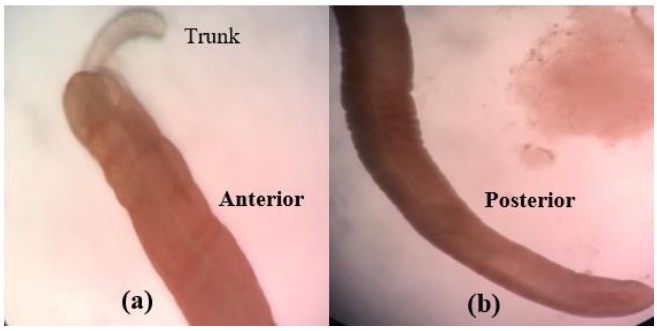

Figure 7. *Rhadinorynchus* sp on the gill (a. Anteriorm, b. Posterior) magnification of 40x.

Table 3. Prevalence of ectoparasite mackerel (*Rastrelliger kanagurta*)

Types of Parasites	Prevalence (%)	Category
Dactylogyrus sp.	13.33	Often
Austrobdella sp.	30	Commonly
Zoomthamnium sp.	6.67	Occasionally
Diphyllobothrium sp.	16.67	Often
Rhadinorynchus sp.	53.33	Frequently
Camallanus sp.	20	Often
Anisakis sp.	3.33	Occasionally

Austrobdella sp. (Figure 6) of the Pisciolibdae family, which are mostly sea leeches that infect external parasites. has a lateral contractile duct (marginal lacuna) that lies outside the urosome somatic muscle. In addition, the presence of clitoral gland cells throughout the urosome, 5 pairs of testes in the urosomal somites, and mid-body somites with 6 anuli are common features for all *Austrobdella* species (Curran *et al.*, 2016).

Rhadinorhynchus sp. (Figure 7) generally has a proboscis separated by an aspinose region into two groups, which surround the anterior and posterior bodies but are limited to the ventral side (Amin *et al.*, 2011). The body of this parasite is rather small, cylindrical and curved backwards. There are two areas of the body that are separated by a zone without spines, then widen posteriorly. The outer trunk is much longer than the trunk with a cephalic ganglion near the middle (Amin and Heckmann, 2017).

The prevalence of ectoparasites found to infect the organs of mackerel fish has a different value for each organ. Based on the calculation of the prevalence of endoparasites, *Rhadinorhynchus* sp. has the highest prevalence with value of 53.33% found in the gills and the lowest is found in *Anisakis* sp. with a value of 3.33% (Table 3).

Discussion

Prevalence of ectoparasites based on Williams and Williams (1996), the parasite *Rhadinorynchus* sp. has the highest prevalence value of 53.33% with the category "very often" which contained gill organs. This means that this parasitic infection of the gill organs is a very frequent infection. This parasite was found to attack individual fish samples in the gills of the mackerel fish (*R. kanagurta*) very often. Meanwhile, *Anisakis* sp. The lowest prevalence value is 3.33% with the category "sometimes" which means infection from the parasite *Anisakis* sp. only sometimes found infecting mackerel landed in the Belawan Ocean Fishing Port. And this parasite only infects the gill organs and is not found to infect the scales and fins of the mackerel.

The prevalence of infecting mackerel was predominantly found in the gill organs and only a few were found in the fins and scales. This is because the gills are a place to exchange diffusion of oxygen and release the respiration of carbon dioxide which is directly related to blood vessels. And gills include organs that are close to the digestive tract. According to Puspitasari (2014) the suitability of the host to multiply and the ability to adapt in the host body can cause these parasites to be found in certain organs, and because the crustacean-eating mackerel carries the larvae and then the larvae are left in the gill filter.

Whereas in the fins and scales (mucus), only a few parasites are found that infect these organs. Judging from the morphology of mackerel fish (*R. kanagura*), this fish has very fine scales so it is suspected that parasites have difficulty attaching to the scales. This is in accordance with Telleng (2010) which states that mackerel fish is covered with fine scales, has 2 dorsal fins, there are 5-6 additional fins (finlets). Therefore, parasites cannot stick perfectly to the fins and scales.

The highest intensity was found in the parasites *Rhadinorynchus* and *Camallanus* species. with a value of 4 ind/fish. This is presumably due to the adaptability of parasites in the host body, the suitability of the host for parasite survival and environmental quality.

Meanwhile, the lowest intensity was found in *Anisakis* sp. with a value of 1 ind/fish. This is because the fish's immune system is running well so that the parasite *Anisakis* sp. unable to penetrate the wall of the test fish sample. This statement is in accordance with Salsabila (2020) which states that the factors that influence the high degree of parasite infection are thought to be due to the adaptability of parasites in the host's body, the suitability of the host for parasite survival and environmental quality. The low value of the degree of parasite infection in fish is due to the fish's immune system that is running well.

The intensity value is not always directly proportional to the prevalence value. In this study, it was because the highest prevalence value was obtained in the first group of fish size (small) so that the intensity results obtained were included in the low category according to Kabata (1985). This is in accordance with Maulana *et al.* (2017) which states that there are three patterns of parasite intensity relationship to fish age, namely independent of fish age, decreasing with increasing age of fish, and increasing with increasing age of the fish. This different pattern of relationships is caused by changes in fish size. Changes in fish size are related to changes in age, morphology, physiology and changes in fish ecology. This change is also closely related to changes in the type of food at each age/size of the fish.

Conclusion

The prevalence rate of ectoparasites infecting of Mackerel (*Ratrelliger kanagurta*) landed in the Belawan Ocean Fishing Port, North Sumatra Province, from the highest, namely Rhadinorynchus sp., Then *Camallanus* sp., *Austrobdella* sp., *Dactylogyrus* sp., *Diphyllobothrium* sp., *Zoothamnium* sp., and the lowest was *Anisakis* sp. and was predominantly found in the gill organs and only a few were found in the mucus and fins organs.

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