Research Article

Intensity and prevalence of endoparasite helminths in little tuna (*Euthynnus affinis*) at Muncar and Panarukan Fish Auction Place, East Java, Indonesia

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Abstract

Little tuna (*Euthynnus affinis*) is an important economics commodity consumed daily. This study aims to identify the type of endoparasites that infect little tuna (*E. affinis*), calculate and analyze the prevalence and intensity of endoparasitic helminth that infect *E. affinis* in Fish Auction Place Muncar, Banyuwangi Regency and Panarukan, Situbondo Regency. The method used in this research is a survey method by sampling at the research location directly. Totally 150 samples were taken, three times. The parameters of this study are the prevalence and intensity of endoparasitic helminth. The results showed that the endoparasitic helminths which infecte little tuna were larvae of *Anisakis simplex*, *Rhadinorhyncus cololabis* and *Rhipidocotyle* sp. The prevalence level of little tuna endoparasite helminth in Fish Auction Place Panarukan was 51.11% which is frequent while in FAP Muncar was 47,78 % which is general. Intensity of endoparasite helminth in FAP Panarukan is higher, which was 3.86 where as in Fish Auction Place Muncar was 3.37, both are in low category.

Keywords: Parasite, Helminths, Little tuna (*Euthynnus affinis*), Fish Auction Place, Indonesia

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Introduction

Little tuna (*E. affinis*) is a pelagic fish which has become an important economic commodity. According to Sanger (2010), *E. affinis* has a high nutrient that is in 100 grams of little tuna fish containing 26.2 % protein. Production of little tuna fish catch in Indonesia is quite high. According to the Ministry of Marine Affairs and Fisheries (2015), the production of tuna during the year 2015 increased from quarter I to

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II by 4.1% while the second quarter to III increased by 16.65%.

E. affinis is produced from various regions, including East Java which has the potential of capture fishery is large enough. The catch of little tuna fish will be marketed in various Fish Auction Places (FAP), located in East Java, in the Panarukan and Muncar Fish Auctions. The catch of little tuna fish that are at FAP in Panarukan mostly comes from Madura Strait, whereas at FAP in Muncar most catch of little tuna comes from Bali Strait (Hidayah and Mahatmawati, 2010).

Fish populations that come from nature do not rule out the possibility of diseases. The process of disease occurrence in fish is caused by the interaction between agents or factors causing the disease, host and environmental factors (Kurniawan, 2012). The infectious agent commonly found in little tuna which causes infection is endoparasitic helminths.

Some endoparasites found to infect little tuna are *Anisakis simplex* (87%) of samples obtained from FAP in Lhoknga in Aceh Besar (Hidayati *et al*., 2016). Fish infected by endoparasite Helminths can decrease in size to 150 - 200 mm compared to the normal size of little tuna which is 400 mm (Madhavi and Ram, 2000). Differences in the spread of endoparasit helminth, especially in the waters of Java Island in the north and south are scientific information that needs to be studied. Beside that, these *Rhadinorhynchus* helminths have been found to infect *E. affinis* in previous studies by Madhavi and Ram (2000) in the Bay of Bengal, India. In addition according to Amin and Nahhas (1994), 4 species of fish that have been examined including little tuna have been found in the Fijian Islands *(E. affinis*) known to be infected with *Rhadinorhynchus*. Because of this, it is important to know and to identify the type of endoparasites that infect little tuna (*E. affinis*).

Materials and methods

Materials used in this research were little tuna fish from FAP in Panarukan, Situbondo and FAP in Muncar, Banyuwangi with a total length of about 20-30 cm. The research method used was survey method. A large number of samples refer to the statement of Cohen *et al*. (2007), the number of sample limits that must be taken by researchers was 30 samples from the existing population. This is consistent with previous studies, namely the number of fish examined their digestive tract, intestine organ, for each species was 30 (Hafid and Anshary, 2016). According to Cameron (2002), the minimum sample size for correlational descriptive research is 27 to 30 individuals per population. Sampling location was at Fish Auction Place in Muncar and Panarukan. The identification of parasites is based on specific organs associated with systematic determinants such as endoparasite helminths of the Nematode class, Trematodes and Cestoda. Identification of helminths is based on identification keys (Margolis and Kabata, 1989, Grabda, 1991, Gibson, 2002).

Data analysis

The prevalence values were calculated for each species of helminths found in little tuna. Data analysis was conducted descriptively to identify and analyze the prevalence and intensity of endoparasite helminths.

Results

The results showed that 43 of the 90 samples of *E. affinis* examined at FAP in Muncar, Banyuwangi were infected with endoparasite helminths in the intestine, while at the auction place of fish in Panarukan, Situbondo 46 fish were positively infected by endoparasitic helminths. The results of the endoparasite helminths identification on little tuna were found at FAP in Muncar and Panarukan on three species of helminths namely *Anisakis simplex* (Figures 1 and 2), *Rhadinorhyncus cololabis* Figures 3 and 4) and *Rhipidocotyle* sp. (Figures 5 and 6).

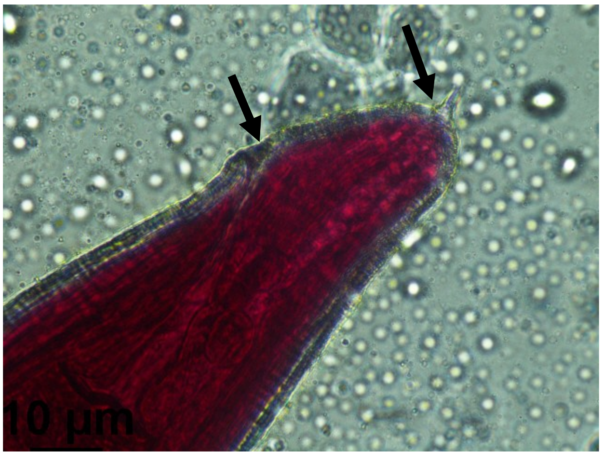

Figure 1. Posterior view of anus and mucron of *Anisakis simplex* (arrows).

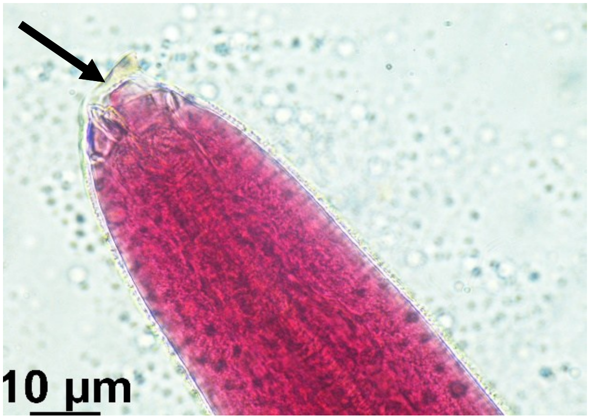

Figure 2. Anterior view of boring tooth of *Anisakis* simplex (arrow).

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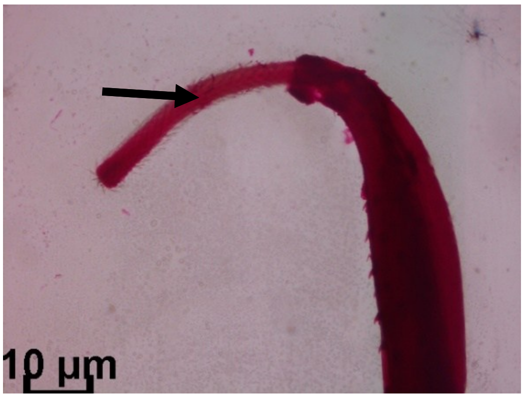

Figure 3. Anterior view of proboscis of *Rhadinoryhncus cololabis* showing head with hooks (arrow).

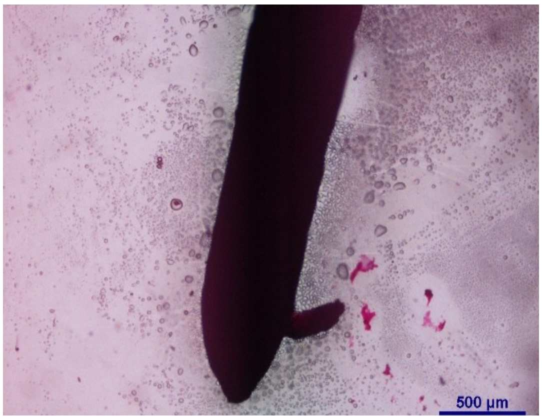

Figure 4. Posterior view of *Rhadinoryhncus cololabis*.

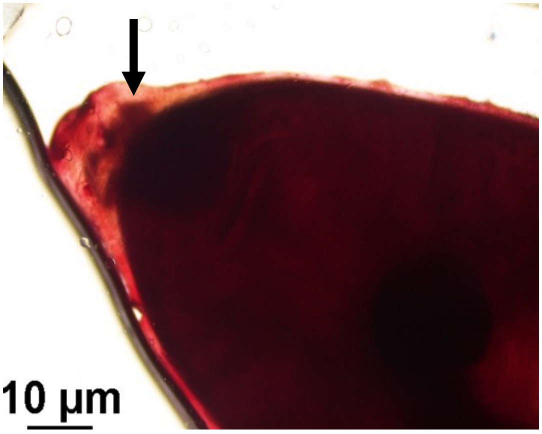

Figure 5. Anterior view of sucker of Rhipidocotyle sp. (arrow).

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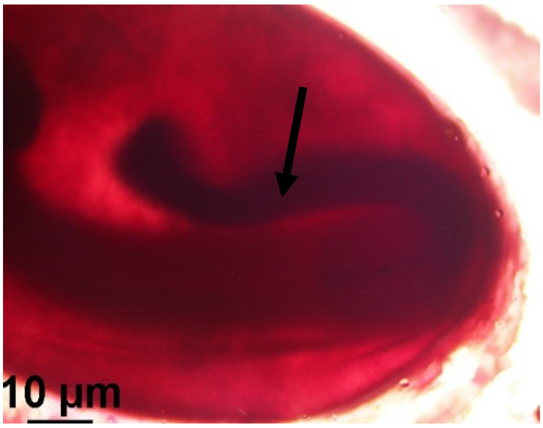

Figure 6. Posterior view of terminal genitalia of *Rhipidocotyle* sp. (arrow).

The results of the intensity calculation of helminths in each fish auction place shows that the intensity of endoparasitic helminths that infect the little tuna at FAP in Panarukan is greater than 3.86 while Muncar FAP showed a lower intensity of 3.37. The data on the calculation of the intensity of the endoparasitic helminth are mentioned in Table 1. The results showed that the prevalence of little tuna at FAP in Panarukan was 51.11% while at the FAP in Muncar was 47.78%. Data on the prevalence calculation in little tuna infected with endoparasitic helminths are shown in Table 2.

Table 1. Intensity of Endoparasitic Helminth that infected Little Tuna in FAP Muncar and Panarukan

Sampling Location	The Type of Helminth Found	Number of Parasites Found (Tails)	Number of Infected Fish (Tails)	Intensity (/Fish Tail)	Category (Williams and Williams, 1996)
Fish Auction Place Muncar	*Anisakis simplex*	131	36	3.64	Low
	Rhadinorhyncuscololabis	13	9	1.44	Low
	Rhipidocotyle sp.	1	1	1	Low
	Muncar	**145**	**43**	**3.37**	**Low**
Fish Auction Place Panarukan	*Anisakis simplex*	135	38	3.55	Low
	Rhadinorhyncuscololabis	8	7	1.14	Low
	Rhipidocotyle sp.	5	3	1.67	Low
	Panarukan	**148**	**46**	**3.86**	**Low**

Table 2. Prevalence of Little Tuna in FAP Muncar and Panarukan Infected with Endoparasitic Helminth

Sampling Location	The Type of Helminth Found	Number of Fish Checked (Tail)	Number of Infected Fish (Tails)	Prevalence (%)	Category (Williams and Williams, 1996)
Fish Auction Place Muncar	**Muncar**	90	**43**	**47.78**	***Commonly***
	Anisakis simplex		36	40	*Commonly*
	Rhadinorhyncuscololabis		9	10	*Often*
	Rhipidocotyle sp.		1	1.11	*Ocassionally*
Fish Auction Place Panarukan	**Panarukan**	90	**46**	**51.11**	***Frequently***
	Anisakis simplex		38	42.22	*Commonly*
	Rhadinorhyncuscololabis		7	7.78	*Ocassionally*
	Rhipidocotyle sp.		3	3.33	*Ocassionally*

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Discussion

The endoparasitic helminths found at FAP in Muncar and Panarukan in this study were *A. simplex, R. cololabis* and *Rhipidocotyle* sp. The results showed that *A. simplex* L3 was found attached to the peritoneum, liver, stomach, intestine (mucosa) and gonads. Setyobudi *et al*. (2011) stated that distribution and locality of infection by *Anisakis* sp. shows that most nematodes are found in the digestive tract, the peritoneum and the gonads. Additionally the *A. simplex* worm was found in the muscle. It is worth noting that the possibility of *A. simplex* L3 distribution pattern between the muscle and viscera is associated with the availability of nutrients in the host's body. *A. simplex* is included in Phylum Nemathelminthes, Ascaridida Order Nematode Class, Family Anisakidae, Genus *Anisakis* and *Anisakis simplex* species (Grabda, 1991).

A. simplex has pores or expenditure pores, drainage channels and lip labia in the anterior portion of larval teeth. In the middle of this endoparasite helminth, there is the esophagus and ventriculus or cavities in the intestine and the posterior part of *A simplex* consists of the anus and mucron. *A. simplex* has been found to have an average body length of 13.8 mm, while the length of the ventriculus is about 0.8 - 0.9 mm. According to Arai and Smith (2016), *A. simplex* has a body length of about 8.8 to 30 mm and with an average ventriculus length of 0.89 mm.

According to Muttaqin and Abdulgani (2013), there is a boring tooth on the anterior which is attached to the small intestine and serves to perforate, while there are mucrons on the posterior side. This helminth has a sharp spikulum and the large and anatomical form of this helminth serves as a factor for differentiating the type of Nematode (Grabda, 1991). *A. simplex* helminths infection found in the little tuna is caused by infective larvae ingested by crustaceans which develops into larvae (L3), then infects little tuna (Parker and Parker, 2002). *A. simplex* has been found to infect little tuna *(E. affinis*) in the southern part of Makassar (Anshary *et al*., 2014).

In addition, other researches results have found little tuna infected by *A. simplex* in Lhoknga Aceh Besar FAP (Hidayati *et al*., 2016). Some cases in Scombrid fish are often infected with *A. typica*, but have a higher prevalence and intensity than Carangid fish, because Scombrid fish is a better intermediary host for Nematodes (Palm *et al*., 2008). *Anisakis* helminths are also found to infect 18 species of sea water fish such as *E. affinis, Katsuwonus pelamis*, *Auxis thazard* and *Caranx* sp. (Anshary *et al*., 2014). In addition of *A. simplex* helminths of the class Acanthocephala, *R. cololabis* was also found in this study.

Adult helminths of *R. cololabis* are found in the intestine (mucosa), stomach, peritoneum, muscle and liver. *R. cololabis* is included in Phylum Acanthocephala, Palaeacanthocephala class, Order of Echinorhynchida, Rhadinorhynchidae family, *Rhadinorhychus* genus and *Rhadinorhynchus cololabis* species (Margolis and Kabata, 1989). This helminth has cylinder probosis with 8 - 37 hooks and 1.2 mm proboscis length, each hook indicating dorsoventral asymmetry. The body length of this helminth is about 5-12 mm. In addition, the *Rhadhinorhynchus* genus has a proboscis and a hook that has an important role for the identification of this species.

According to Margolis and Kabata (1989), the general characteristic of *Rhadinorhynchus cololabis* is having a very long proboscis and the anterior portion is larger than the posterior. There are 8 to 26 lines extending from 8-37 hooks. Probosis and hook have an important role in the identification of species of the *Rhadinorhynchus* genus (Purivirojkul, 2012). *Rhadinorhyncus* can infect little tuna because it's natural food derived from nature is the arthropod which is the host medium as a place to develop to acanthor and then become acathella and juvenile. Arthropods eaten by fish will develop into adulthood and infect fish or host through the gastrointestinal tract (Smales *et al.,* 2007).

Digenea helminths are commonly found in fish in the form of larvae or adulthood helminths. The helminths found is *Rhipidocotyle* sp. *Rhipidocotyle* sp. is found in the stomach, liver and peritoneum. The Digenea helminths were found to have predilections in the liver, stomach and peritoneum. This helminths is included in Phylum Platyhelminthes, Thermatada Class, Order of Plagiorchiida, Bucephalidae Family, *Rhipidocotyle* genus and *Rhipidocotyle* species (Gibson, 2002). This helminths has a round and flat morphology and there is a sucker in the anterior part whereas there is a curved genital lobe in the posterior part of the round body. The body of this helminths is oval and lengthwise with a length of 6.94 mm. According to Bartoli *et al*. (2006), the general morphology of the *Rhipidocotyle* helminths is the elongated body with a curved posterior part, having a tool like a sucker or a cone-shaped rhyncus. The main characteristics of *Rhipidocotyle* are pretesticular ovaries and vacuum devices in the anterior part of the rhyncus are simple, whereas in the posterior part there is the reproductive tract and the curved genital terminal (Gibson, 2002). This helminths can infect the little tuna because after the first sekaria equipped with a propulsion tool out from the intermediate host has the ability to penetrate the membrane of the second intermediate host. Digenea helminths life cycle requires a second intermediate host among other fish to complete its life cycle. According to Madhavi and Ram (2000), the little tuna (*E. affinis*) is infected by helminths from the Digenea class of *Rhipidocotyle pentagomum* in the Bay of Bengal, India. *E. affinis* can be infected by endoparasitic helminths due to the ingestion of helminths eggs released by the definitive host.

The results of prevalence and intensity in Panarukan is higher than Muncar. Based on Wiliams and Williams (1996) category, the prevalence of FAP Panarukan shows the value of 51.11% while in FAP Muncar it is 47.78%, both of which are included in the category "frequently". On the other hand the results of the calculation of intensity in Muncar FAP were 3.37 and Panarukan FAP was 3.86, both of which were included into the "low" category from Williams and Williams (1996) category.

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According to the previous research, prevalence of little tuna infection by endoparasite helminths was 66.7% which is included in the category "frequently" with an average intensity amount of 1 and is included in the "low" category (Anshary *et al*., 2014). In contrast to previous research results by Hidayati *et al*. (2016), the infection rate in little tuna is very high reaching 87%, being in the "usually" category. While the results reported by Hafid *et al*. (2016), showed the prevalence of little tuna was 43.3%, being included in the "commonly" category.

The prevalence and intensity for each endoparasite helminths species that infects little tuna (*E. affinis*) is known to be *A. simplex,* which is higher than other endoparasite helminths species. The result of calculation of prevalence in little tuna infected by helminths *A. simplex* in Panarukan FAP was 42, 22% and Muncar FAP was 40%, while the calculation result of intensity of *A. simplex* in FAP Muncar was 3.64 and Panarukan FAP was 3.55. *Anisakis* are helminths that are often found in tropical waters. According to Hafid *et al*. (2016), *A. simplex* is the dominant species in the tropics, especially in Indonesia. The helminths *A. simplex* found in little tuna (*E. affinis*) were found to be more numerous than other types of helminths because of the natural food consumed by little tuna containing crustaceans Euphasudiidae (70%), Loligo (5%) and unrecognizable foods (25%) (Williamson, 1970). The larvae of *Anisakis* consumed by shrimp type Thysanoessa and Euphausia (Sakanari and McKerrow, 1989). Therefore the little tuna can be infected by *A. simplex* helminths after eating the shrimp species.

The results of the prevalence and intensity at Panarukan FAP (mean 24.54 cm) were higher because the size of the little tuna varied and the samples obtained of some little tuna were longer than those obtained in Muncar FAP (mean 25 , 30 cm). The size differences showed the need for different foods for each fish. The fish with longer size needs the higher necessary food. This matter is supported by Hidayati *et al*. (2016) which states the larger the size of fish, the more the number of parasites that live in the body of little tuna. In addition to the size of fish according to Griffiths *et al*. (2009), the difference in the size of the fish will affect the composition of feed to be eaten. The consumption of the natural feed increases with increasing size of the little tuna (*E. affinis*).

Natural feed derived from nature does not omit the possibility of its ability to infect larvae of helminths endoparasite. The endoparasitic helminths were found in the waters where the fish are located (Strømnes and Anderson, 2003). The prevalence results obtained in Muncar FAP are included in the "commonly" category, whereas Panarukan FAP falls into the category of "frequent infections". The results of the intensity of both fish auction sites fall into the "low" category. The possible factor causing high prevalence and intensity of parasite attacked on little tuna is the difference of fish size obtained from each fish auction place.

In addition to differences in the size of fish and natural feed, water conditions are also could be an effective factor of helminths endoparasite infection in Panarukan FAP. Varied feeds, high movements and long life spans are some of the factors responsible for the

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development of parasitic communities in sea water fish. Scombridae fish have the ability to migrate across the ocean and require high metabolic energies that are met through the search for food in large quantities (Madhavi and Ram, 2000).

Fishing ground from Panarukan FAP is located on the north coast of Java Island which is a residential area so that the pollution of household waste is huge enough. According to Darmawan and Masduqi (2014), Panarukan FAP is a northern coastal area of Java Island that became the center of economy and population distribution especially in East Java so that the potential for environmental damage is also higher than the southern coastal areas. This condition caused more than one type of endoparasitic helminths in one little tuna.

This combination infection occurs because of the possibility of eating natural feed by little tuna (*E. affinis*) which is consumed as an intermediate host by both *A. simplex* and *R.cololabis*. According to Johnson and Tamatamah (2013), the eating habitat of little tuna is crustacean, which is a natural food that is always found in the digestive tract of *E. affinis*. Crustacea is the intermediate host of the *Anisakis* and *Rhadinorhyncus* helminth which corresponds to its life cycle.

Disadvantages of little tuna infected by endoparasitic helminths in addition to losing weight and size also cause the zoonotic disease. Zoonotic helminths can enter and infect humans by consuming raw, undercooked, smoked, frozen, marinated or acidified fish that contain parasitic larvae in fish meat. In addition, *Anisakis* infection can lead to lesions of the intestine and result in severe abdominal pain (Ortega, 2006).

Helminths most commonly found in this study are Larva 3 *Anisakis simplex*, *R. cololabis* and R*hipidocotyle* sp. The intensity of endoparasite helminths in Panarukan FAP is 3.86 whereas Muncar FAP's intensity equals 3.37, both belonging to the "low" category. Prevalence of little tuna endoparasite helminths in Panarukan FAP which is 51.11% is included in the category "frequently" whereas Muncar FAP prevalence being 47.78% which is included in the category "commonly".

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Conflict of interest

Authors have no conflict of interest on this work.

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