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Ectoparasites of mangrove crabs (*Scylla serrata*) and white shrimps (*Litopenaeus vannamei*) from Gresik, Indonesia

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Abstract

The ectoparasites that infest two hosts, mangrove crabs (*Scylla serrata)* and white shrimps (*Litopenaeus vannamei)* of the subphylum crustacea were studied. The study revealed that *Octolasmis* sp., *Zoothamnium* sp. and *Epistylis* sp. were found to infest mangrove crabs, while *Zoothamnium* sp. and *Epistylis* sp. were found parasitizing the white shrimp (*Litopenaeus vannamei*). The most common organ attacked by the ectoparasites was the gills. Stagnant water with limited or no flow of water in the ponds was an important factor that supported the infestation of parasites.

Keywords: **Arthropod, Ectoparasite, Mangrove crabs, Protozoa, White shrimp.**

Introduction

Mangrove or mud crabs (*Scylla serrata*) are one of the crustaceous decapod groups which are important fishery commodities in Indonesia. Several cultivation methods have been developed to increase the production of both commodities. The development of the mangrove crab trade business has continued to increase until now because of the wide-open export market opportunities with considerable potential for mangrove areas and increasing technology for both cultivation and capture. (Center for Fish Quarantine and Fish Safety, 2016).

Another important fishery commodity produced by Indonesia is white shrimp (*Litopenaeus vannamei)*. White shrimps were officially introduced to the cultivating community in 2001 after a decline in tiger shrimp (*Penaeus monodon*) production due to various problems encountered in the production process, both technical and non-technical problems (Subyakto *et al*., 2009). In line with a large number of enthusiasts for shrimp farming, there are also a number of problems that interfere, thus hampering the development of aquaculture, namely the presence of parasites that can inhibit shrimp growth.

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Several studies on ectoparasite infestations in both mangrove crabs and white shrimps have been reported. Ectoparasites *Chilodonella* sp., *Ichthyobodo* sp., *Epistylis* sp., *Carchesium* sp., *Vorticella* sp., *Octolasmis* sp., and *Lepeophtherius* sp. were found to be able to infest mud crab and white shrimp (Sarjito *et al*., 2016; Maldini *et al*., 2017; Hamid *et al.*, 2019; Hafidloh and Sari, 2019).

This research was conducted to determine the types of ectoparasites that infest mud crabs and white shrimps. The coastal waters in Gresik Regency were chosen because one-third of the Gresik area is a coastline with a length of 140 km stretching from the Districts of Kebomas, Gresik, Bungah, Panceng, and Ujungpangkah (Statistics of Gresik Regency, 2011).

Materials and Methods

Eighty mud crabs (*S. serrata)* with weights ranging between 100-200 g were collected from fattening culture in Ujung Pangkah coast water Gresik, Central Java, Indonesia. A total of 150 white shrimps (*L. vannamei*) with weight ranging between 9-20 g each were collected from brackish water pond, in Ujung Pangkah coast water Gresik, Central Java, Indonesia. Observations on gill filaments and leg scrapings of the mud crabs and white shrimps were made using a binocular microscope. Illustrations were made with the camera lucida attached to the microscope.

Results and Discussion

In this study, arthropods and protozoan ectoparasites infesting the gills of mud crab were *Octolasmis* sp., *Epistylis* sp. and *Zoothamnium* sp. While in white shrimp the protozoan ectoparasite infesting the gills were *Epistylis* sp. and *Zoothamnium* sp. (Table 1).

Table 1. Ectoparasites of mud crab (*S. serrata)* and white shrimp (*L. vannamei*)

Genus	Predilection	*Scylla serrata* (80)		*Litopenaeus vannamei* (150)
		Male	Female	
Octolasmis	Gills	55	21	-
Epistylis	Gills	20	48	67
Zoothamnium	Gills	23	11	-
	Gill Filament	-	-	37

Ectoparasites:

The observations on the morphology of ectoparasites of mud crabs (*S. serrata*) and white shrimps (*L. vannamei*) showed slight differences when compared to those that have been recorded by Ma and Overstreet (2006), Jie *et al.* (2006), Chan *et al.* (2009), Ihwan *et al.* (2014), Xinlu *et al.* (2014) and Shinn *et al.* (2015).

Octolasmis *sp.:*

Octolasmis (Fig. 1) were found with capitulum, scutum, tergum, and carina. The posture of the capitulum and the peduncle were up-straight with a capitulum shaped like a pointed oval on the dorsal portion. There were three plates in the capitulum, namely the carina, a pair of gums and a pair of scutum in the middle of the capitulum. Ectoparasites of the genus *Octolasmis* in this study were found only on the gills because a lot of nutrients are contained in the gills, also their life cycles require more nutrition than that required by the protozoan parasites (Jeffries *et al*., 2005). Irvansyah *et al*. (2012) stated that gills are one of the organs that are well supplied by the blood. There are blood vessels that are protected by a thin layer of tissue which makes it easy to be attacked by ectoparasites. Ectoparasites are very rarely found in swim foot or carapace because the protective tissues had very hard texture and are actively used for swimming and walking so that it is difficult for ectoparasites to hold on.

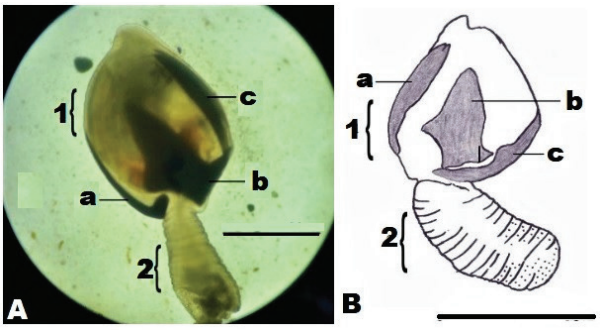

Fig. 1. Photomicrograph of *Octolasmis* sp. (A) and (B) camera lucida drawing showing anterior side (1) peduncle (2) with (a) carina (b) scutum and (c) tergum (Bar in both-20µm)

Epistylis *sp.:*

The body of *Epistylis* (Fig. 2) was found to be in the shape of a bell on a branching stalk, resembling a thin and long funnel. *Epistylis* had a bell-shaped zooid form which was slender elongated with the size average 40-50 µm and there was a peristome in anterior zooid. They lived in a colony form and were sometimes found with zooids loose from the stalk. Live, sessile *Epistylis* observed in this research had a branched stalk, 10 µm in diameter. There was an anterior cilium in the zooid. *Epistylis callinectes* previously has been identified by Ma and Overstreet (2006), where it is found that the genus *Epistylis* with features of a rounded body with a very small anterior tip whose diameter is much different from its zooid, transparent body as the cause of food vacuole and has a strong stalk to grip the host.

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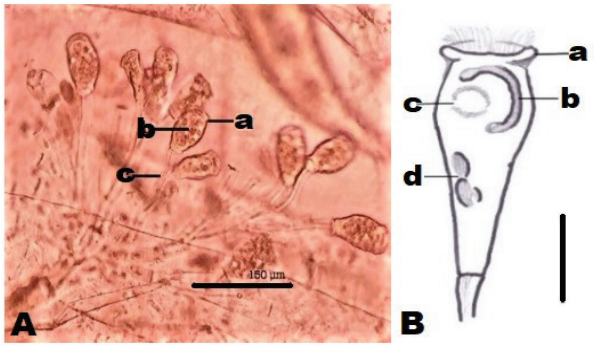

Fig.2. Photomicrograph of *Epistylis* sp. (A) and (B) camera lucida drawing showing (a) peristome (b) contractile vacuole (c) macronucleus and (d) food vacuole (Bar in A-150 µm and B-20 µm).

Zoothamnium *sp.:*

Zoothamnium (Fig. 3) was found in mud crabs and white shrimps with a bell-shaped zooid 42-50 µm in diameter. The contractile vacuole was single and there was a macronucleus at the bottom of the peristome. They were found in mud crab and white shrimp, attached to gill filaments. Andrew *et al*., (2004) found that *Zoothamnium duplicatum* in the gills of *Litopenaeus setiferus* caused anoxia where oxygen exchange in the gills was very limited. The *Zoothamnium* found in the oval zooid morphology where the lip diameter (peristome) is smaller than the zooid body and very thin. In the study of Jie *et al.*, (2004), *Z. duplicatum* had an oval body and tended to be round with a small peristome on the anterior part. *Zoothamnium* had a transparent body that has an average zooid size of 30-45 µm and a stalk 10 µm in diameter. Firdaus and Ambarwati (2019), as well as Mahasri *et a*l. (2016) identified the existence of *Zoothamnium* infestation in ponds due to the accumulation of artificial feed which was not consumed at the bottom of the pond, thereby affecting the content of organic matter.

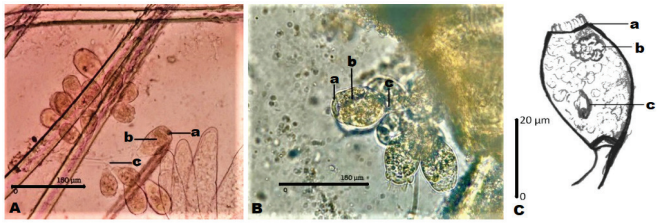

Fig 3. Photomicrograph of *Zoothamnium* sp. in infested mud crab (A) and from infested white shrimp (B) and camera lucida drawing (C) showing (a) peristome (b) macronukleus and (c) contractile vacuole (Bar in A and B 150 µm and in C 20 µm).

The study showed that the most common organ attacked by ectoparasites was the gills. This could be because gills are the respiratory organs that have direct contact with the environment which filters out materials, feed particles and bind oxygen. According to Yuliarti (2011) the location of gills, their structure and contact mechanisms with the environment make gills more vulnerable to the changes in the environmental conditions and thereby gills become more vulnerable to infection by ectoparasites.

Ectoparasites of genus *Epistylis* were found in environments with low water quality, a lot of organic matter and less intensive handling (Pritchett and Sanders, 2007). This follows the condition of the research pond where a traditional culture method that doesn't use waterwheels providing several kinds of organic material as a plankton grower, is still used. This system causes protozoan ectoparasites such as *Epistylis, Zoothamnium* to reproduce well as the required nutrients for the ectoparasites were well fulfilled. Also, poor water quality which is influenced by uncontrolled environmental factors can cause a lack of nutritional needs, so that ectoparasites can attack shrimp easily. Jithendran *et a*l. (2010) stated that fouling protozoans such as peritrichous ciliates may be a problem especially if associated with poor water quality due to elevated nutrient and organic matter.

We analyzed that the growth of protozoan ectoparasites in this research was supported by the pond condition which had stagnant water with limited or no flow. This is suspected because the fish culture pond still used in the traditional culture system where waterwheels are not used in these ponds. In a study by Utami (2013), it was stated that ectoparasites in no-flow water could potentially increase. Ectoparasite attacks are a result of the inconsistency between the environmental conditions and the host which creates weak self-defense against ectoparasites. If the water quality is low, it can affect the health condition of fish, so the fish that were already presented in the pond are infected by the parasites. Severe infestation of the parasites in fish will cause organ damage in the gills and cause anemia and even

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mortality (Saptiani *et al.,* 2017). This is due to the ability of certain ectoparasites in adapting to the environment they grow. According to Fenchel and Finlay (2006), the environmental conditions that support infestation with ectoparasites are temperature range of 28 to 35°C, 17 ppm in salinity, pH range of 7.63 - 8.80 and 3-4 ppm of dissolved oxygen.

Conclusion

The ectoparasites *Octolasmis*, *Epistylis* and *Zoothamnium* were found infesting mud crab and white shrimp with *Zoothamnium* were found to infest both hosts. Sub-optimal water conditions in the pond, including stagnation was found to increase parasitism.

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