Ectoparasite infections on Mangrove Crabs (Scylla sp.) in soft shell crab aquaculture in Banda Aceh city, Indonesia

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Abstract. This research examined the prevalence and intensity rate of ectoparasites that infected mangrove crab (Scylla sp.) at crab aquaculture area in Banda Aceh City, Indonesia. The study was conducted at three soft shell mangrove crab aquaculture in three different areas. Purposive sampling method was used within three aquaculture sites at Cot Langkeweh, Gampoeng Blang, and Lamjabat village. The targeted organ was carapace, walk and swim leg and gill. Results showed that there were five parasites found from three family such as Zoothamnium sp., Vorticella sp., and Epistylis sp., Octolasmis sp., and Copepoda sp. The highest prevalence rate was Epistylis sp. with value of 50-60% whereas the lowest prevalence was Zoothamnium sp. and Octolasmis sp. with its value of 20%. The highest intensity level was Octolasmis sp., and Zoothamnium sp. with value of 8-11.3 ind/species, whereas the lowest intensity was Copepoda sp. with value of 2 ind/species.

1. Introduction

Aceh Province is one of the provinces that has abundant of fish diversity in Indonesia [1, 2]. There have been many reports related to fish and shrimp resources in this province such as fish and shrimp that are related to live feed [3-9] as well as several aspects of shrimp and fish biology [10, 11]. Apart from fish and shrimp, other crustacean resources such as mud crabs are also a promising opportunity for farmers. Mud crab (Scylla sp.) has become an important fishery commodity in Indonesia since the early 1980's. Mangrove crab fisheries are commonly obtained from capture of natural stocks in coastal waters, especially in mangrove or estuary areas and the results of culture in brackish water ponds. Recently, more and more increasing economic value of crab fisheries, the exploitation of mangrove crabs is increasing. But at the same time, the average growth in production mud crab in some of the main producing provinces of mud crab is actually quite a bit slow and tends to decline [12]. However, Mud crab culture technology in producing soca crab (Soft Shell Crab) is rapidly growing in Indonesia, including in Aceh province.

Soft Shell Crab product has a much higher price, can be up to twice as high as hard shell crab of the same size, so that many fish and shrimp farmers have switched to culture soca crab [13]. Soca crab is a mangrove crab in the molting phase or moist crab. Crab in this phase has the advantage of having a soft shell (soft carapace) so that it can be consumed easily [14]. The demand for soca crab is very high, so the increasing demand must be balanced with an increase in the culture of mud crab. However, efforts to develop mangrove crab culture face obstacles in the form of ectoparasite attacks. According to [15, 16] the biggest problem of mangrove crab culture is mortality. Disease and ectoparasites infection contribute a major cause of mangrove crab failure.
Some types of ectoparasites may cause damage to body organs in the host organism. The damage includes damage to the body surface and damage to the arrangement of the gills on the host. This damage can disrupt the growth of the host and decrease the body's defense system so that the fish are likely to be easily attacked by bacteria and viruses [17]. The triggers for ectoparasites attacks include stress, poor water quality, stocking density and an imbalance between environmental carrying capacity and the quantity of production in one culture area. However the immunity of mangrove crab has decreased due to poor water quality and polluted water conditions so that it is easy to attack by parasites. Therefore, it is necessary to investigate the intensity and prevalence rate of in soft shell crab in order to prevent future parasite attack in soca crab site culture, Banda Aceh, Indonesia.

2. Methodology

2.1. Time and place
This research was conducted in November 2018 in the soft shell crab aquaculture area in Banda Aceh. The identification of ectoparasites was carried out at the Parasite Laboratory, BKIPM Aceh. Crab sampling was carried out directly in the soca pond area in Banda Aceh in the villages of Cot Langkeuweh, Giampoeng Blang, and Lamjabat, using a purposive sampling method.

2.2. Procedures

2.2.1. Sampling
Sampling of Soca crab was carried out on the fourteenth day (D14) after stocking in a soca crab culture container. A 10% of the Scylla serrata sample was taken [18] of the total population that was considered representative from the entire population of soca crab in pond plots. The sample used in this study was young and healthy Scylla sp. It was taken using gloves to reduce scratches on the carapace and organs of Scylla sp. and brought to the laboratory for observation and the results were documented microscopically.

2.2.2. Ectoparasite observation
Examination of ectoparasites was carried out on the carapaceous organs, walking legs, swimming feet and gills with the procedure of cutting the target organs using scissors, tweezers and placed on a glass object, then dripped with physiological NaCl, and observed using a microscope and identified using parasite identification book [19].

2.2.3. Water Quality
Water quality examination was carried out in this study since poor water quality conditions were known to be the trigger for parasite attack on Scylla sp. Water quality observation included temperature, salinity and pH.

2.3. Data analysis

2.3.1. Intensity
The equation for the intensity of ectoparasite species was calculated by the total number of certain infecting parasites divided by the number of Scylla sp. infected by ectoparasite. The ectoparasite intensity was calculated using a hand tally counter for each preparation from the scrapping results and plates. The calculation of ectoparasite intensity used the formula [19]:

\[
\text{Intensity (ind / head)} = \frac{\sum \text{ectoparasites found}}{\sum \text{infected fish}}
\]

The results of the ectoparasite intensity calculation were included in the parasite intensity category as presented in Table 1.

2.3.2. Prevalence
The research data in the form of the type and number of parasites were analyzed descriptively to calculate the prevalence level using the following formula [19]:

\[
\text{Prevalence (\%)} = \frac{\sum \text{ectoparasites}}{\sum \text{the examined fish}} \times 100\%
\]

The results of the calculation of the prevalence of ectoparasites were included in the parasite prevalence category as presented in table 2.

### Table 1. Category and intensity level of soca crab parasites

| Number | Intensity (ind/head) | Category       |
|--------|----------------------|----------------|
| 1      | <1                   | Very low       |
| 2      | 1-5                  | Low            |
| 3      | 6-55                 | Medium         |
| 4      | 51-100               | Severe         |
| 5      | >100                 | Awfully        |
| 6      | >1000                | Super infection|

### Table 2. Prevalence Categories

| No | Prevalence       | Category         | Note                        |
|----|------------------|------------------|-----------------------------|
| 1  | 100-99\%         | Always           | Very severe infection       |
| 2  | 98-90\%          | Almost always    | Severe infection            |
| 3  | 89-70\%          | Usually          | Moderate infection          |
| 4  | 69-50\%          | Very often       | Infections are very frequent|
| 5  | 49-30\%          | Generally        | Common infection            |
| 6  | 29-10\%          | Often            | Frequent infections         |
| 7  | 9-1\%            | Sometimes        | Infection sometimes         |
| 8  | <1-0.1\%         | Rarely           | Infection is rare           |
| 9  | <0.1-0.1\%       | Very rarely      | Infection very rare          |
| 10 | <0.01            | almost never     | Infection never             |

### 3. Results and Discussions

The results showed that there were 5 identified ectoparasites found in Soca crab culture area in Banda Aceh, Indonesia. The Protozoa group there were *Zoothamnium* sp., *Vorticella* sp., and *Epistyli* sp. whereas from the Arthropoda group, namely *Octolasmis* sp., and from the Copepoda group. This is in accordance with the report from [20] stated that the types of ectoparasites that often infect mangrove crabs are *Zoothamnium* sp., *Vorticella* sp., *Epistyli* sp. and *Octolasmis* sp. Table 3 shows that the level of intensity and prevalence of each soca crab culture was significantly different, the prevalence value showed that the mud crabs in the Gampong Blang and Cot Langkeuweh ponds were higher than in the Lamjabat pond, this was thought to be due to the ectoparasites being carried away during the mangrove crabs. It was taken in nature before being spread and there was a carrier for parasites both at the time of cutting process of walking leg which was used to speed up the process of producing soca crab.

Another aspect that causes these two ponds were having more infection compare to another pond since these ponds are adjacent to each other and connected in one water source, the ponds in the villages of Gampong Blang and Cot Langkeuweh are only separated by a small estuary that leads to the sea and makes the estuary water only a source of culture water. Ectoparasites move more easily from one host to another therefore it make the spread become very quick. In contrast to the ponds in Lamjbat Village which are located in different area from the estuary, so that the infection rate was quite low.

Referring to previous reports conducted by several researchers who examined ectoparasites in *Scylla* sp. Mangrove crabs in several places between the open and in controlled culture containers. It shows that crabs that live in wild environment are more susceptible to parasites than crabs that are raised in a
controlled aquaculture area. This can be seen and compared from research that has been carried out in open areas and in the aquaculture areas of mangrove crab culture [21]. This is presumably because the crabs that are kept in aquaculture are more controlled and maintained properly compared to conditions in the wild area, including parasite carriers and water quality. Poor water quality which is influenced by several environmental factors can cause a lack of nutritional requirements so that ectoparasites can attack [22, 23].

Table 3. Ectoparasite Types, Prevalence and Intensity in mud crabs in Banda Aceh City

| Area          | Ectoparasite type | ∑ Attacke (Tail) | ∑ Parasite (ind) | Prevalence (%) | Intensity (ind / tail) |
|---------------|-------------------|------------------|------------------|----------------|------------------------|
| Village Blang | Epistylis sp.     | 5                | 24               | 50             | 4.8                    |
|               | Zoothamnium sp.   | 4                | 60               | 40             | 15                     |
|               | Octolasmis sp.    | 3                | 34               | 30             | 11.3                   |
|               | Vorticella sp.    | 4                | 15               | 40             | 3.7                    |
| Lamjabat      | Epistylis sp.     | 3                | 20               | 30             | 6.7                    |
|               | Zoothamnium sp.   | 4                | 43               | 20             | 10.7                   |
|               | Octolasmis sp.    | 2                | 32               | 20             | 18                     |
|               | Vorticella sp.    | 3                | 9                | 30             | 3                      |
| Cot Langkueweh| Epistylis sp.     | 6                | 28               | 60             | 4.7                    |
|               | Zoothamnium sp.   | 4                | 37               | 40             | 9.2                    |
|               | Octolasmis sp.    | 4                | 32               | 40             | 8                      |
|               | Vorticella sp.    | 3                | 13               | 30             | 4.3                    |
|               | Copepoda          | 3                | 8                | 30             | 2.7                    |

Table 3 shows that the highest prevalence value of *Epistylis sp.* found in ponds in the village of Cot Langkueweh, namely 60% and Gampong Blang 50%, based on the prevalence criteria according to [16] that included in the very frequent category which means the infection rate is very frequent, where the infection rate can be watched out for, and the lowest prevalence value *Epistylis sp.* that is, in a pond in Lamjabat village 30%, this criterion is included in the general category which means common infection where the infection rate is not dangerous for the life of *Scylla sp.* for the intensity value of ponds in Gampong Blang Village, which is 15 individuals / fish and in Cot Langkueweh Village 4.7 ind/fish, this criterion is in the low category. The intensity of *Epistylis* attacking *Scylla sp.* in ponds in Lamjabat village was 10.7 individuals / head which was included in the moderate category.

Figure 1. *Epistylis sp.* infection in mangrove crab

*Zoothamnium* was the highest parasite prevalence in aquaculture area in Gampong Blang village (40%) and Cot Langkueweh (40%) (Table 3). Based on the prevalence criteria according to [11] that included in the very general category which means the infection rate is common, the infection rate can
be watch out. The lowest prevalence value of *Epistylis sp.* that is, in a pond in Lamjabat village 20%, this criterion is included in the frequent category which means that it often infects or attacks the host, where the infection rate is not too dangerous for the life of *Scylla sp.* but must always be careful. For the intensity value in the ponds in the village of Gampong Blang, namely 4.8 individuals / fish and 9.2 individuals / fish in Cot Langkuweh village, this criterion is included in the moderate category, the *Epistylis* intensity that attacks *Scylla* in ponds in Lamjabat village is 6.7 ind / tail which is also included in the medium category.

*Octolasmis sp.* was the highest parasite prevalence in aquaculture area in Gampong Blang village 30% and Cot Langkuweh 40%, based on the prevalence criteria according to [24] that included in the general category which means the infection rate is normal, the infection rate is not dangerous for the life of *Scylla sp.* and the lowest prevalence value of *Epistylis sp.* namely in the ponds in Lamjabat village 20%, this criterion is included in the general category which means that the infection rate is not dangerous for the life of *Scylla sp.* for the intensity value in the pond in the village of Gampong Blang, namely 11, 3 fish / ind and the village of Cot Langkuweh 8 fish / ind, this criterion is in the medium category. The intensity of *Epistylis* attacking *Scylla* pada ponds in Lamjabat village is also in the moderate category, namely as many as 18 individuals / head.

*Vorticella sp.* which is written in the table shows that the highest prevalence is in aquaculture in the village of Gampong Blang 40%, and the lowest prevalence value is *Epistylis sp.* namely in the ponds in the village of Lamjabat 30%, and 30% in Cot Langkuweh. This criterion is included in the general category which means the common infection attacks *Scylla* sp. where this level of infection can also be dangerous for the life of *Scylla* sp. For the intensity value of ponds in the village of Gampong Blang, namely 3.7 individuals / fish and 4.2 individuals / fish in the Cot Langkuweh village, this criterion is in the low category. The intensity of *Epistylis* attacking *Scylla* pada ponds in Lamjabat village was 3 individuals / fish which was also included in the low category.

*Copepods* were only found in the village of Cot Langkuweh, which showed that the prevalence was 30% with the general category and for the intensity in the pond was 2.7 individuals / head, which is included in the low category.

**Table 4.** Prevalence and Intensity in Organs

| Organs      | ∑ Attacked (Tail) | ∑ Parasite (ind) | Prevalence (%) | Intensity (ind/tail) |
|-------------|------------------|-----------------|----------------|---------------------|
| Walking leg | 6                | 51              | 20             | 8.5                 |
| Swimming leg| 12               | 104             | 40             | 8.6                 |
| Carapace    | 16               | 88              | 53             | 5.5                 |
| Gill        | 14               | 112             | 47             | 8                   |

3.1. Ectoparasites in Organs

Table 4 showed that the highest prevalence was in the carapace with a prevalence value of 53% and 47% gills, while the highest intensity is in the leg organ with an intensity of 8.6 individuals / tail in mangrove crabs. The high prevalence value in the carapace was thought due to the carapace was the widest part of the host's limb, and in the mangrove crab culture process to produce soft crab uses a box-shaped basket with a width of 20 cm, a length of 10 cm and a height of 10 cm. The gills infections were caused due to the direct contact with the surrounding environment which filters dissolved materials, filters feed particles and their life cycle requires more nutritional needs.

The similar finding by [20] stated that gills are one of the organs that is often flowed with blood, there are blood vessels and a thin layer of epithelial tissue that is protective, making it easy to attack ectoparasites. The high intensity that attacks the swimming legs is due to only the remaining swimming legs of the *Scylla sp* organs or not being cut during the crab leg cutting process, which functions to speed up the moulting process of the crab. The lowest prevalence is in the organ of walking foot because this organ is still very small, not yet its surface area and just growing so that the parasites do not infect many areas of the organs of the toes.
3.2. Water Quality Parameters
Water quality parameters that have been measured in the waters of the Soca Crab Aquaculture in Banda Aceh City in this study included pH, temperature and salinity. The test results showed that the water quality waters in the aquaculture pond were still suitable for the culture process [16, 25]. Data from the measurement of water parameters can be seen in Table 5.

| Area               | Parameters | Unit | Measurement results |
|--------------------|------------|------|---------------------|
| Gampong Blang      | pH         | -    | 8                   |
|                    | Salinity   | Ppt  | 30                  |
|                    | Temperature| ºC   | 29                  |
| Lamjabat           | pH         | -    | 8                   |
|                    | Salinity   | Ppt  | 28                  |
|                    | Temperature| ºC   | 30                  |
| Cot Langkueweh     | pH         | -    | 8                   |
|                    | Salinity   | Ppt  | 30                  |
|                    | Temperature| ºC   | 30                  |

4. Conclusion
Parasites that infect soca crab or Scylla sp or mud crab in the soft shell crab pond area, Banda Aceh city consisted of Epistylis sp., Zoothamnium sp., Octolasmis sp., Capepoda sp. and Vorticella sp. The highest prevalence rate was found in Epistylis sp., with a value of 50-60% included in the very frequent category, while the lowest prevalence rate was found in Zoothamnium sp. and Octolasmis sp. with a value of 20%, it is included in the category often. The highest intensity levels were found in Octolasmis sp. And Zoothamnium sp. with a value of 8 - 11.3 ind/tail included in the medium category, while the lowest intensity value was found in Capepoda sp. with a value of 2 is in the low category.

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