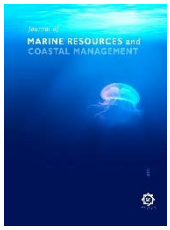
JOURNAL OF MARINE RESOURCES AND COASTAL MANAGEMENT
INDONESIAN JOURNAL OF MARINE LIFE AND UTILIZATION

e-ISSN : 2722-0966
Vol. 2 Issue 1



STUDY OF ECTOPARASITE PREVALENCE AND INTENSITY ON MUD CRAB (*Scylla serrata*) IN MANGROVE AREA OF WONOREJO, SURABAYA

Selobing Purna Agung Indarto, Misbakhul Munir, Dian Sari Maisaroh
Marine Science Department, UIN Sunan Ampel Surabaya
E-mail : purnaobing@gmail.com

ABSTRACT

This study aims to know various types, prevalence, and intensity of ectoparasite on mud crab (*Scylla serrata*) in Mangrove Forest Wonorejo, Surabaya. This study used survey method with random sampling to collect the data. This study was conducted in July-December 2020. Ectoparasite in this study collected by smear method. In-situ water quality measurement were applied in this study. Mud crab in this study was obtained from local fisherman that consist of 30 crabs. There are 3 types of ectoparasite was infected mud crab there are *Octolasmis* sp. (208 ind), *Zoothamnium* sp. (93 ind), dan *Epistylis* sp. (116 ind). Those ectoparasite was found in mud crabs gills. The highest prevalence was *Octolasmis* sp. (70%), *Epistylis* sp. (30%), *Zoothamnium* sp. (23%). The highest intensity was *Zoothamnium* sp (13,29 ind/crab), *Epistylis* sp. (12,89 ind/crab), dan Octolasmis sp. (9,90 ind/crab). Based on Ministerial Decree of Ministry Environment and Forestry No. 1 of 2004 water quality in Wonorejo Mangrove Forest was still optimal for life cycle of mud crab with average of temperature is 31,20°C, Dissolved Oxygen 5,53 mg/l, salinity 11 ppt, and pH 7,40.

Keywords*:* Mud crab, ectoparasite, prevalence, intensity

INTRODUCTION

Mud crab (*Scylla* sp.) is a crab that spread in tropical and subtropical areas in the Indo-West Pacific region. There are four species of mud crab can be found in Indo-West Pacific, there are *Scylla serrata*, *Scylla tranquebarica*, *Scylla olivacea* and *Scylla paramamosain*. *Scylla serrata is* mostly found in the Indo Pacific region while *Scylla tranquebarica* can generally be found in the South China Sea region and lives in association with *Scylla olivacea*. *Scylla paramamosain is* very often found in continental regions of the South China Sea to the South Java Sea. The four mangrove crab species are associated with another species in the same geographic area [1]

To fulfill the supply of mangrove crab commodities in Indonesia generally rely on catches in nature. According to Indonesia Central Bureau of Statistics (BPS) [2] the composition of crab exports which rely on catches in nature is 65.3%, while for cultivation products it has a lower value with percentage 34.7%. Mangrove ecosystem is one of the main habitats for mud crab. Surabaya has several mangrove ecosystems that are still use as fisihng ground to catch mud crab by local fisherman. One of the mangrove ecosystems used to catch mud crab is Wonorejo Mangrove Forest. The Wonorejo Mangrove Forest area has a good quality habitat for the growth of mud crab [3]. Food and Agricultural Security Service (DKPP) of Surabaya recorded total crab production in Surabaya in 2016 has reached 526.90 tons.

Disease on *Scylla serrata* were generally caused by the interaction of several factors with the host, including physiological conditions, host reproduction, environmental quality in water, growth rates, and pathogens. Pathogens that commonly infect mud crabs are bacteria, fungi, and parasites [4]. Water quality greatly affects the life cycle of mud crab. Change on water quality can cause the interaction between the host, environment and pathogen to be unbalanced. In unbalance situation the host will be easily infected by pathogen, common pathogens can be found on mud crabs is parasite [5].

Ectoparasite is very dangerous for mud crab because it can cause damage to body organs in mud crab, including body surface and disruptions on mud crab gills. This damage can cause secondary infection to the host like disruption of the growth of the host and causing the host's defense system to be decreased so the host can be easily attacked by bacteria and viruses and eventually cause death in the host [6,7]

Thus, this present study was conducted to investigate the occurrence of ectoparasites infection, prevalence, and intesity on mud crab (*Scylla* sp.) in Mangrove Forest Areas of Wonorejo, Surabaya.

RESEARCH METHODS

Sample Collection

This research was conducted in July-December 2020 at Wonorejo Mangrove Forest, Surabaya. This study used a descriptive survey method with random sampling for collecting data. The parameter of this study was divided into two parameters, which are main parameters and secondary parameters. The main parameters are

ectoparasite type, prevalence, and intensity. Secondary parameters are water quality which includes physical and chemical parameters such as temperature, pH, DO, and salinity. In-situ water quality measurement also measured. The water quality measurement stations were at coordinates 7°30'9.162 "S and 112°83'4.693" T (**Fig. 1**). Water quality measurement were measured in triplicate to get the average of measurement. The sampling areas are the fishing ground for the local fisherman to catch mud crabs.

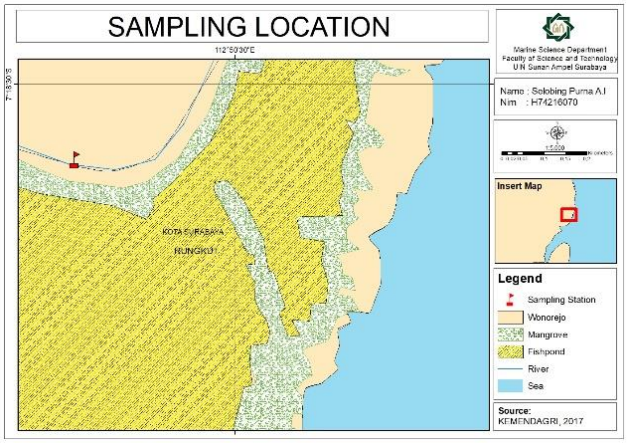


Figure 1. Wonorejo's mangrove area

Mud crab samples were taken from 10% of total daily fishermen's catch [8]. Thirty wild mud crabs were collected from Wonorejo Mangrove Forest. All crabs were examined in Basic Biology Laboratory, UIN Sunan Ampel and maintained in ice box which is filled with brackish water. The carapace width (CW) and crabs body weight (BW) were measured using calipers and digital balance.

To examine ectoparasites from phylum Protozoa on *Scylla serrata*, smear method was apllied on the external parts of crabs; such as carapace, walking legs, swimming legs, and gills. The smeared organ then was placed on the object glass, dripped with distilled water, and observed under a microscope. To examine parasites on the gills, the carapace was opened using sectio set and the gills and crab's internal organs were separated into a petri dish. Furthermore, the gills also observed under a microscope with the same method [9]. The results of ectoparasites documentation from observations then were identified based on the identification key [10], [11], [12] and [13].

Data Analysis

The data that had been processed were analyzed descriptively. The data had been obtained in this study were divided into two types of data the primary data (prevalence and ectoparasite intensity) and secondary data namely supporting data (water parameters).

• Prevalence of Ectoparasite

Prevalence is the percentage of parasitic infections that infected the entire host. The parasite prevalence was calculated from the total number of infected samples divided by the number of samples examined. The prevalence of parasites was calculated using an equation that refers to [1]:

$$P(\%) = \frac{number\ of\ infected\ host}{total\ sample}\ x\ 100\% \qquad (1)$$

To find out the prevalence rate of infection was referred to [14] criteria (**Table 1**).

Table 1. Prevalence rate classification

No	Infection Rate	Note	Prevalence
1	Always	Very Severe Infection	100-99%
2	Almost Always	Severe Infection	98-90 %
3	Usualy	Moderate Infection	89-70 %
4	Very Often	Very Often Infection	69-50 %
5	Generaly	Common infection	49-30 %
6	Frequent	Often Infection	29-10 %
7	Sometimes	Sometimes Infection	9-1 %
8	Rarely	Rare Infection	>1-0,1 %
9	Very Rare	Very Rare Infection	>0,1-0,01 %
10	Never	Never	>P 0,1 %

• Intensity of Ectoparasite

Intensity were defined as the mean number of parasites in all infected hosts. The value of parasite intensity was calculated from number of parasites divided by number of infected crabs. To find out the parasite intensity value calculated using formula refers to [8]:

$$I = \frac{number\ of\ parasite}{number\ of\ infected\ crab} \qquad (2)$$

To find out the intesity criteria of ectoparasite were refers to [15] criteria (**Table 2**).

Table 2. Criteria of intensity

Intensity	Criteria
<1	Very low
1-5	Low
6-55	Medium
51-100	Severe
>100	Awfully
>1000	Super Infection

RESULTS AND DISCUSSIONS

Clinical Signs

Obsevation of clinical sign were started from outside the crab's body and gills. Observation shown that there was a small object's sprouts-shaped attached on crab gills and there were discolouration of the gills, the gills becomes blackish-brown (**Fig. 2**). Those clinical signs are generally seen on infected mud crab's [16]. There were

some crab's samples that showed no clinical signs but infected by ectoparasites.

Clinical sign of *Octolasmis* sp. can be seen immediately when looking at the gills. *Octolasmis* sp. shaped like white and orange sprouts attached to gills of *Scylla serrata*. Protozoan parasite did not show any clinical sign in mud crabs.

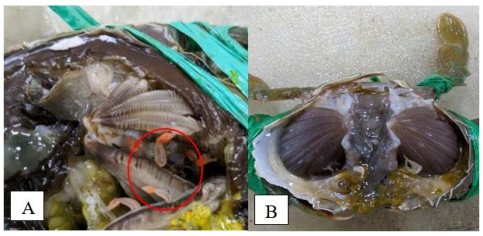


Figure 2. Clinical Sign on Mud Crab, individu like sprout shaped (A) and discolouration of gills (B).

Types of Ectoparasite

There were two phylums of mud crab's ectoparasites infection in Wonorejo Mangrove Forest, they are *Octolasmis* sp. (Arthropoda), *Zoothamnium* sp. (Protozoa), and *Epistylis* sp. (Protozoa). The number of ectoparasite were found in gills of mud crabs (**Fig. 3**)

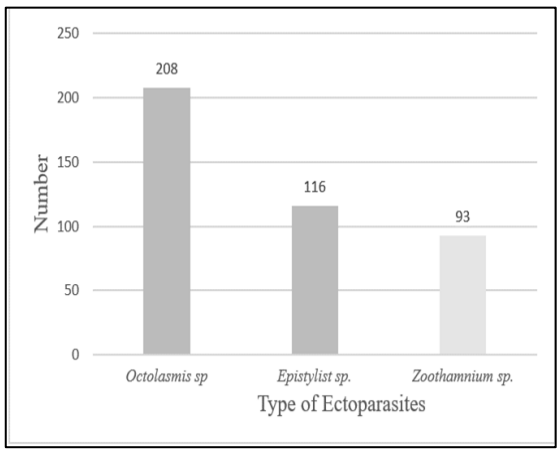


Figure 3. Number of ectoparasite was found on mud crabs

- *Octolasmis* sp.

Octolasmis sp. is an ectoparasite which has a sprout-like shape usually found attached on the gill's crabs. Morphological observations of *Octolasmis* sp. shown it has peduncel, carina, scutum, legs, and tergum. In this study has found two species of *Octolasmis* sp., they are *Octolasmis cor* and *Octolamsis angulata*. [13] described *Octolasmis angulata* have a thin scutum and and L-shape and its carina is narrow, while *Octolasmis cor* has a carina which has a shape like the letter T and wide. Morphological observation of *Octolasmis* sp. shown in **Fig. 4**.

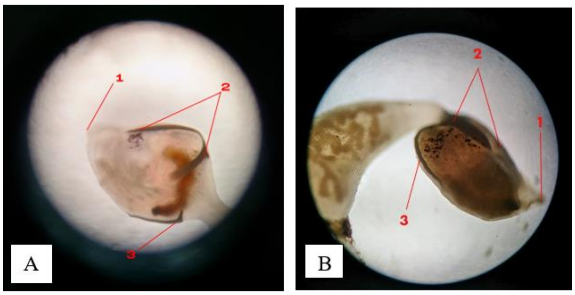


Figure 4. *Octolasmis angulata* (A) and *Octolasmis cor* (B) with Tergum (1), Carina (2), Scutum (3).

Octolasmis sp. has a body size of 0.01-0.15 cm with the morphology that colonizes the gills, has a capitulum, bergum, carina, scutum, and legs. Carina serves as a protector of the internal organs. Capitulum on *Octolasmis* sp. functionate as a stomach that can destroy food so that nutrients can be digested properly. Tergum functionate as the mouth, the scutum functionate as the intestine which is used to absorb food juices, and the feet are used to attach to the host [8].

- *Epistylis* sp.

The characteristics of *Epistylis* sp. is branching on the stalk, zooid shaped like an inverted bell, and colonize. This parasite is not contractile on the stem because it does not have myoneme. Morphological observations shown that *Epistylis* sp. has a zooid, stalk, macronucleus, peristomial lips, and peristomial disk. Observations of *Epistylis* sp. shown in **Fig. 5**. Based on [17] *Epistylis* sp. caused hemmorhagic uclear disesae on the host. *Epistylis* sp. associtaed with microfloral bacteria. The changes of phatological caused by bacterial protelyotic enzymes.

The protozoan ectoparasites, such as: *Zoothamnium* sp., *Epistylis* sp., *Vorticella* sp., and *Acineta* sp. were usually found in crab gills. These parasites can lead problems in the hatching phase, especially the egg and larval stage in aquaculture activities. Those problems are generally closely related to water quality. *Epistylis* sp. is easily found in water with low dissolved oxygen, according to previous research [18].

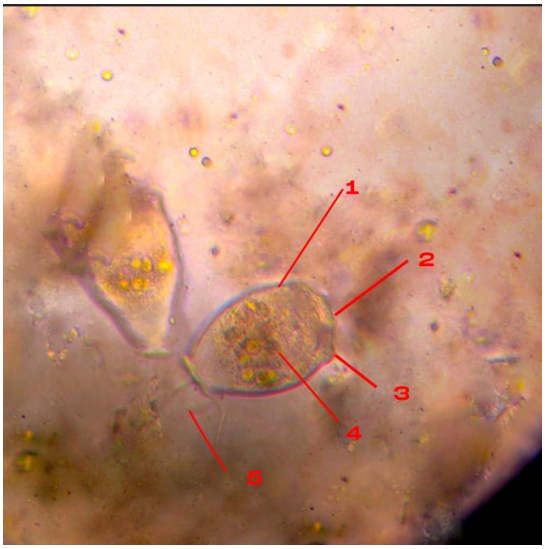


Figure 5. *Epistylis* sp. with zooid (1), peristomial disk (2), peristomial lips (3), nucleus (4), stalk (5) (record at 40x Magnification)

- *Zoothamnium* sp.

Zoothamnium sp. shaped like inverted bell-shaped zooid, contractile stalk, zooid capable to contracting, colonizing, and having many branches on each stalk. Morphological observations shown that *Zoothamnium* sp. have cilia, zooid, myoneme, stalk, and nucleus. Observations of *Zoothamnium* sp. shown in **Fig. 6**. *Zoothamnium* sp. colony attach on the the host using a pedicel or stalk. When *Zoothamnium* sp. has attached to the host, *Zoothamnium* sp. will injected a specific substance or can be called a specific mucus which can cause damage to the host organ especially gills [19].

Zoothamnium sp. infected crab and shrimp larvae. *Zoothamnium* sp. infected mud crab at zoea 5 stage and megalopa phase. Infection of *Zoothamnium* sp. in the larval phase it can lead the larvae to mass death in crab cultivation. This parasite can lead to abnormal shape of crab larvae, leading to the increase of mortality [20].

Figure 6. *Zoothamnium* sp. with silia (1), zooid (2), myoneme (3), stalk (4), nucleus (5) (record at 40x Magnification)

PREVALENCE AND INTENSITY

Prevalence is the percentage ratio between the number of samples infected with ectoparasites and the total number of samples was examined. Based on **Table 3**, the highest prevalence of ectoparasites is *Octolasmis* sp. with prevalence value 70% followed by *Epistylis* sp. with a prevalence value of 30% and the lowest prevalence value is *Zoothamnium* sp. with a value of prevalence 23%. Based on the category of parasite prevalence values [14] the prevalence of *Octolasmis* sp. is moderate prevalence level where the prevalence rate of *Octolasmis* sp. can cause stress to the host but not lead death of the host. Prevalence of *Epistylis* sp. is the usual prevalence level where this infection is common in mud crab. The prevalence of *Zoothamnium* sp. categorized into frequent prevalence, this illustrated that *Zoothamnium* sp. often found infected mud crab in the Wonorejo Mangrove Forest area.

Intensity is the ratio between the number of individual parasites and the total number of infected crabs. The result of the intensity calculation shows that the highest parasite intensity value is *Zoothamnium* sp. with intensity 13.29 ind/crab, *Epistylis* sp. with intensity value 12.89, and *Octolasmis* sp. with intensity value 9.90 ind/crab. Based on intensity category by [15] had shown that all parasite intensity in mud crab is at moderate intensity. Moderate intensity can indicate those parasites can causes stress on the host but does not lead death of the host [8]. The calculation of the prevalence value and ectoparasite intensity were also calculated based on weight of the crab (BW) and width of the carapace (CW). The results of calculation based on the weight of the crab can be seen in **Table 4** and the calculation results based on the width of the carapace can be seen in **Table 5**.

The prevalence and intensity values based on the weight of the crabs, there are increasing value in the intensity and prevalence values in the 78-85 gram - 103-110 gram. The highest prevalence and intensity values based on the width of the carapace are in the 65-68 mm, 69-72 mm, and 85-88 mm where the prevalence value reaches 100%, because in those classes were found ectoparasites infected on those class. In the 73-76 mm to 81-84 mm there is an increasing value in the prevalence value and the number of ectoparasites. The increasing age of the host, the morphological and physiological changes will affect the surface area of the host body to become wider. Host size will also affect the fluctuation of ectoparasite intensity on the host [21].

Wider surface area of ectoparasite would increase it intensity value [22]. Also, there was positive correlation between the width of carapace and percentage of parasite intensity in *Callinectes ornatus* [23]. Prevalence and intensity of parasites has different values on the host in the juvenile phase and the adult host, also on the male and female hosts. Longer exposure of parasites to the host will lead to the increase of its intensity and prevalence value [21].

Table 3. Prevalence and Intensity of Ectoparasite

Ectoparasite	Number of Parasite	Examined Crab	Infected Crabs	Prevalence	Intensity
Octolasmis sp	208	30	21	70%	9,90
Epistylis sp.	116	30	9	30%	12,89
Zoothamnium sp.	93	30	7	23%	13,29

Table 4. Prevalence and Intensity of Ectoparasite Based on Body Weight

BW (gr)	Examined Crab	Infected Host	Number of Parasite	Prevalence	Intensity
70-77	2	2	39	100%	19,5
78-85	7	4	65	57%	16,25
86-93	9	7	95	78%	13,57

BW (gr)	Examined Crab	Infected Host	Number of Parasite	Prevalence	Intensity
94-102	5	4	93	80%	23,25
103-110	6	4	122	67%	30,5
111-118	1	1	3	100%	3

Table 5. Prevalence and Intensity of Ectoparasite Based on Carapace Width

CW (mm)	Examined Crab	Infected Host	Number of Parasite	Prevalence	Intensity
65-68	1	1	23	100%	23,00
69-72	2	2	51	100%	25,50
73-76	13	7	99	54%	14,14
77-80	5	4	106	80%	26,50
81-84	7	6	110	86%	18,33
85-88	2	2	28	100%	14,00

WATER QUALITY

The results of water quality measurements indicate that these environement are still optimal for mangrove crab life based on the quality standards that have been set in Ministerial Decree Ministry of Environment and Forestry No. 51 of 2004. The results of water quality condition are shown in **Table 6**. If water quality decreased from its natural conditions can cause mud crab immunity, so it can be easily attacked by pathogens. One of the pathogens that can cause disease is parasites [20]. The optimal water salinity for parasite development is 30-35%, pH is in the range of 7.63-8.80, temperature 28-31 °C [8].

Table 6. Water condition

Parameter	Average	Ministerial Decree Ministry of Environment and Forestry No 51 of 2004
DO (mg/l)	5,53	>5 mg/l
pH	7,40	7-8,5
Temperature (°C)	31,20	28-32°C
Salinity (ppt)	11,00	s/d 34 ppt

Distribution of *Octolasmis* sp. highly influenced by changes in seasons, high rainfall might indirect the water salinity, lower salinity could affect intensity and prevalence of *Octolasmis* sp. Mud crabs in environment with high salinity will have a high chance for *Octolasmis* sp. stick to the host. The high rainfall could affect the water salinity value, it will lead changes in eating habits, reproduction, metabolism, and the life cycle process of *Octolasmis* sp [24]. The results of research by [4] found that *Octolasmis* sp. as many as 201 individuals in waters with a temperature range of 28.1-31.4 °C, DO 4.7-7.7 mg /l, salinity 7-28 ppt, and pH 7.23-7.60.

High dissolved oxygen will affect the intensity and prevalence of *Epistylis* sp. in mud crab. *Epistylis* sp. is a parasite that can develop optimally in waters with low dissolved oxygen and have a substrate [20]. *Epistylis* sp. can develop optimally in waters with temperature 10-25 °C, salinity of 15-31 ppt, and pH 6.5-7.0 [16]. In another research *Epistylis* sp. were found in mud crab with water temperature 30-31 °C, pH 8, and the salinity is in the range of 31-35 ppt [8].

Zoothamnium sp. is one of the parasites whose life is not influenced by water quality. *Zoothamnium* sp. can live in waters with good or bad quality. Colony of *Zoothamnium* sp. will be found in waters with temperature range 22.25-24.11°C and salinity 34.9 ppt [25]. *Zoothamnium* sp. also found in waters with temperature 28.1-31.4 °C, DO 4.7-7.7 mg/l, salinity 7-28 ppt, and pH 7.23-7.60 [4].

CONCLUSIONS

There are three types of ectoparasites from phylum protozoa and arthropoda which infected mud crab (*Scylla serrata*) in Wonorejo Mangrove Forest, those ectoparasites are: *Octolasmis* sp., *Zothamnium* sp., and *Epistylis* sp. All parasites were only infected on the gills of mud crabs. The highest parasite prevalence is *Octolasmis* sp. (70%) categorized as moderate prevalence, *Epistylis* sp. (30%) categorized as the usual prevalence, *Zoothamnium* sp. (23%) categorized as frequent prevalence. The highest parasite intensity is *Zoothamnium* sp. (13.29 ind/crab), *Epistylis* sp. (12.89 ind/crab), and *Octolasmis* sp. (9.90 ind/crab) all ectoparasite intensities were categorized into the moderate category. Based on our study, the increase of crab's size would affect to ectoparasites prevalencies and intensity.

REFERENCES

[1] Ihwan, M.Z., Wahidah, W., Ambak, M.A., Ikhwanuddin, M., Marina, H., 2015. *Investigation of Parasite and Ecto-Symbiont in Wild Mud-Crab Genus Scylla from Trengganu Coastal Water Malaysia: Prevelance and Mean Intensity*. International Journal of Zoological Research 11, 151–159.

[2] BPS. 2018. *Data Ekspor-Impor 2012-2017*. Jakarta: Badan Pusat Statistik

[3] Hanjani, A., 2019. Analisis Ekologi *Dan Morfometrik Kepiting Bakau (Scylla Serrata) Pada Kawasan Estuaria Di Pesisir Wonorejo, Rungkut, Surabaya (Skripsi)*. UIN Sunan Ampel, Surabaya.

[4] Muttaqin, I., Julyantoro, P.G., Sari, A.H., 2018. *Identifikasi dan Predileksi Ektoparasit Kepiting Bakau (Scylla spp.) dari Ekosistem Mangrove Taman Hutan Raya (TAHURA) Ngurah Rai Bali*. Aquatic Science I.

[5] Lerssutthichawal, T., Penrapai, N., 2013. *Seasonal Distribution and Host-Parasite Interaction of Pedunculate Barnacle, Octolasmis spp. on Orange Mud Crab, Scylla olivacea*. Walailak Journal 10, 113–119.

[6] Muchlisin, Z.A., A.M. Munazir, Z. Fuady, W. Winaruddin, S. Sugianto, M. Adlim, N. Fadli dan A. Hendri. 2014. *Prevalence of ectoparasites on*

mahseer fish (Tor tambra Valenciennes, 1842) from aquaculture ponds and wild population of Nagan Raya District, Indonesia. HVM Bioflux, 6(3):148-152

[7] Novita D., T. R. Ferasyi dan Z. A. Muchlisin. 2016. *Intensitas dan prevalensi ektoparasit pada udang pisang (Penaeus sp.) dari tambak budidaya di pantai barat Aceh*. Jurnal Ilmiah Mahasiswa Kelautan Perikanan Unsyiah, 1(3): 268-2

[8] Irvansyah, M.Y., Abdulgani, N., Mahasri, G., 2012. *Identifikasi dan Intensitas Ektoparasit Pada Kepiting Bakau (Scylla serrata) Stadia Kepiting Muda di Pertambakan Kepiting Kecamatan Sedati Kabupaten Sidoarjo*. Jurnal Sains dan Seni ITS 1, 5–11.

[9] Handayani, L., Rozikin, I., 2019. *Identifikasi Ektoparasit Pada Kepiting Bakau (Sylla serrata) Dari Hasil Tangkapan Nelayan Di Wilayah Pertambakan Desa Segintung Kuala Pembuang II*. SEBATIK 23, 72–76.

[10] Bick, H., 1972. *Cilliated Protozoa*. World Health Organization, Genva.

[11] Bierhof, M.J., Roos, P.J., 1977. *Sedentary Cilliates From Two Dutch Fresh Water Gammarus Species.* Bijdragen Tot De Dierkunde 46, 151–170.

[12] Jefferies, W., Voris, H., Naiyanetr, P., Panha, S., 2005. *Pedunculate Barnacles of The Symbiotic Genus Octolasmis (Cirripedia: Thoracica: Poecilasmatide) from The Northern Gulf Of Thailand*. The Natural History Journal of Chulalongkorn University 5, 9–13.

[13] Chan, B.K.K., Prabowo, R.E., Lee, K.-S., 2009. *Crustacean Fauna Of Taiwan Barnacles Volume I-Cirripedia: Thoracica Excluding The Pyrgomatidae And Castinae*. National Taiwan Ocean University, Taiwan.

[14] William, E.H., and Bunkley, W.L. 1996. *Parasites of Offshore Big Game Fishes of Puerto Rico And The Western Atlantic*. Puerto Rico: University of Puerto Rico.

[15] Yusni, E., Haq, F.A., 2020. *Inventory and prevalence of ectoparasites Octolasmis sp. in the mangrove crab (Scylla tranquebarica) in Lubuk Kertang, Langkat*, in: 454. Presented at the IOP Conference Series: Earth and Environmental Science, pp. 1–8.

[16] Fitriyani, S., Desrina, Haditomo, A.H.C., 2016. *Ektoparasit Kepiting Bakau (Syclla serrata) Dari Perairan Desa Wonosari Kabupaten Kendal*. Prosiding Seminar Nasional Hasil Penelitian Perikanan dan Kelautan VI, 554–565.

[17] Padua, Santiago., Martin, Maurico., Vallado, Gustavo., Utz, Laura., Zara, Fernando., Ishikawa Marcia., and Belo, Marco. 2016. *Host-parasite relationship during Epistylis sp. (Ciliophora: Epistylididae) infestation in farmed cichlid and pimelodid fish*. Pesq Agropec Bras 51, 520-526

[18] Jithendran, K., P., Poornima, M., Balasubramanian, Kulasekarapandian, S., 2010. *Diseases of Mud Crabs (Syclla, spp.): An Overview*. Indian Journal Fishery 57, 55–6.

[19] Mahasri, G., Raya, L., Mubarak, S., Irawan, B., 2008. *Gambaran Patologi Insang Dan Kulit Udang Windu (Penaeus Monodon Fab.) Yang Terserang Ciliata Patogen Dari Famili Vorticellidae (Zoothamnium sp.).* Berkala Ilmiah Perikanan 3, 95–103.

[20] Linh, N.K., Khoa, T.N., Zainathan, S.C., Musa, Nadhirah, Musa, Najiah, Harrison, F., 2017. *Development Of Mud Crab Crablet, The Identification Of Ciliates And The Bioefficacy Of Leaf Extract Of Rhizophora Apiculata As Anti-Protozoal Agen*t. Journal of Sustainability Science and Management 12, 52–65.

[21] Alifudin, M., Hadiroseyani, I., Ohoiulun, I., 2003. *Parasit Pada Ikan Hias Air Tawar (Ikan Cupang, Gapi Dan Rainbow)*. Jurnal Akuakultur Indonesia 2, 93–100.

[22] Bawia, R.H., Tuiyo, R., Mulis, 2015. *Prevalensi dan Intensitas Ektoparasit Monogenea Cichlidogyrus sp pada Insang Ikan Nila dengan Ukuran yang Berbeda di Keramba Jaring Apung Danau Limboto*. Jurnal Ilmiah Perikanan dan Kelautan 2, 60–65.

[23] Santos, C., Bueno, S., 2002. *Infestation By Octolasmis Lowei (Cirripedia: Poecilasmatidae) In Callinectes Danae And Callinectes Ornatus (Decapoda: Portunidae) From São Sebastião, Brazil*. Journal Of Crustacean Biology 22, 241–248.

[24] Khotimah, A., Rokhmani, Riwidiharso, E., 2018. *Prevalensi dan Kelimpahan Vorticella sp. Pada Kepiting Bakau (Scylla serrata) yang Didaratkan di Tempat Pelelangan Ikan Sleko Kabupaten Cilacap Jawa Tengah*. Presented at the PROS SEM NAS MASY BIODIV INDON, pp. 87–91.

[25] Munir, S., Sun, J., 2018. *The first snapshot study on horizontal distribution and identification of five peritrich ciliates (Genus Vorticella Linnaeus and Zoothamnium Bory de St. Vincent) from the eastern Indian Ocean*. Acta Oceanol Sin 37, 79–85.