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Intensity and Ectoparasites in Vaname Shrimp (*Litopenaeus vannamei*) Cultivated in Intensive Ponds

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ABSTRACT

Whiteleg shrimp (*Litopenaeus vannamei*) is a widely cultivated commodity in Indonesia. The high demand of white leg shrimp requires increased production. High stocking density in intensive cultivation and excessive amounts of feed are obstacles in white leg shrimp productiom. It will cause the shrimp to become stressed and susceptible to pathogen infection, one of them is ectoparasite. This research was conducted from August to September 2023 with the aim of determining the intensity and infestation degree of ectoparasite on white leg shrimp that cultivated in intensive ponds. The samples of white leg shrimp in this study were 50 individuals by purposive random sampling method. Observations were carried out by native method in the Cultivation and Anatomy Laboratory, Faculty of Fisheries and Marine, Airlangga University. The results showed that white leg shrimp cultivated in intensive ponds were infested by *Zoothamnium* sp. with intensity 184 individuals/tail, *Vorticella* sp. with intensity 268 individuals/tail and *Epistylis* sp. with intensity 235 individuals/tail. Each ectoparasite has a very severe infestation degree, but the most severe infestation was carried out by *Vorticella* sp.
Keywords: White leg shrimp, infestation degree, intensity, ectoparasites.

INTRODUCTION

Vaname shrimp (*Litopenaeus vannamei*) is one of the introduced species that is widely cultivated in Indonesia (Rahayuni et al., 2022). This species has several advantages, namely more resistant to disease attack, high stocking density, lower feed conversion ratio, higher survival rate, and easy to cultivate (Ariadi et al., 2021). The high demand for vaname shrimp from various countries such as Japan, the United States, and European Union countries requires vaname shrimp production to continue to increase (Asnawi et al., 2021; Mufaidah et al., 2023).

However, the export value of Indonesian vaname shrimp is still below other world shrimp producing countries, such as India, Vietnam, Ecuador, China, and Thailand. India is recorded as the country with the highest shrimp export value in the world, reaching US$3.70 billion, followed by export values from Vietnam, Ecuador, China, Thailand, and Indonesia, which have export values in US dollars of 2.71 billion; 2.60 billion; 2.16 billion; 1.98 billion; and 1.67 billion, respectively (Suriawan et al., 2019).

The Indonesian Ministry of Marine Affairs and Fisheries (KKP) in 2023, reported that vannamei shrimp production in Indonesia reached 31,091.5 tonnes in 2021 and then increased to 38,344.9 tonnes in 2022. The increase in production continues to be carried out with various efforts, one of which is the development of a cultivation system from traditional cultivation to intensive cultivation in the majority of vaname shrimp ponds. This has the potential to reduce water quality (Jarir

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et al., 2020). The increase in stocking density and excessive feed in intensive cultivation increases the accumulation of organic matter. Where, the process of decomposition requires oxygen. Thus, the availability of oxygen for vaname shrimp is reduced. If this happens continuously, it will be detrimental to the condition of vaname shrimp and other biota.

Decreased water quality due to high organic matter is the main factor for vaname shrimp to experience a decrease in body resistance, making vaname shrimp susceptible to disease. Diseases that often occur in vaname shrimp are usually caused by ectoparasites. Ectoparasite infestation has been raised as one of the most important problems in aquaculture that can suppress growth, reduce resistance to bacterial and fungal attacks, and even result in death (Radkhah, 2017; Radkhah and Eagderi, 2022).

Ectoparasites that are usually found in vaname shrimp farming are protozoa, namely *Epistylis sp. Zoothamnium sp*., and *Vorticella sp.* with a prevalence of 79% for *Zoothamnium sp*., 76% for *Epistylis sp*., and 71% for *Vorticella sp*. from cultured PL 20 vaname shrimp (Dinisa et al., 2022). The three types of ectoparasites were found to be abundant in rearing media with high organic matter content and found in several parts of the shrimp body, namely gills, skin, carapace, periopod, pleopod, and uropod (Widiani and Ambarwati, 2018).

Epistylis sp. Zoothamnium sp., and Vorticella sp. can infest all vaname shrimp stadia, but are more commonly found in the post larval stadia where this stadia is the determining stadia for the success of vaname shrimp production. Furthermore, vaname shrimp fry are very susceptible to disease and are referred to as crisis stadia (Sari and Ikbal, 2020). On the other hand, ectoparasite infestation of vaname shrimp seeds causes movement disorders, respiration disorders, changes in body and gill colour, white spots on the body surface and results in the death of vaname shrimp (Firdaus and Ambarwati, 2019). This also occurs in vaname shrimp cultivated in intensive ponds. However, information on ectoparasite infestation in vaname shrimp cultured in intensive ponds is still rare.

Based on these problems, it is necessary to conduct research on the intensity and degree of ectoparasites attacking vaname shrimp cultivated in intensive ponds. By knowing the types of ectoparasites along with the intensity and degree of infestation, it is expected that farmers can determine actions as an effort to control ectoparasites, so that vaname shrimp production failure does not occur.

MATERIAL AND METHOD

Time and place

This study was conducted from August to September 2023 in the laboratory of aquaculture and anatomy, Faculty of Fisheries and Marine Sciences, Universitas Airlangga.

Sample origin

Samples were collected from vaname shrimp farmers in Situbondo, East Java, who have one intensive pond for post larvae 25 vaname shrimp culture with a stocking density of 1000 shrimp/pond. Determination of the number of samples refers to (Cameron, 2002) which states that it takes 5% of the total number of vaname shrimp as a representative sample of the population on one intensive pond that has a stocking density of 1000 fish/pond. Therefore, this study used a sample of 50 post larvae 25 vaname shrimp.

Parasite examination

Examination of ectoparasites was carried out using the native method. The organs examined included the body surface, gills, periopod (walking legs), pleopod (swimming legs) and uropod (tail). The organs to be

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observed were taken and placed on an object glass then added 2% NaCl and covered with a cover glass. Observations were made under a microscope with 100 times magnification (Dang et al., 2021; Ilmiah et al., 2022).

Parameters observed

The ectoparasites found were observed for their morphology and identified based on (Kabata,1985). Determination of the degree of infestation and intensity of ectoparasites refers to (Williams and Williams, 1996) shown in Table 1.

Table 1. Determination of the Degree of Ectoparasite Infestation

Infestation Rate	Ectoparasite Intensity (Individual/Tail)
Very low	<1
Low	1-5
Middle	6-55
Heavy	51-100
Very heavy	>100
Extreme infestation	>1000

The calculation of ectoparasite intensity of vaname shrimp refers to the formula of Kabata (1985), as follows:

$$Intensity = \frac{number\ of\ ektoparasite\ found}{number\ of\ infested\ samples}$$

Data analysis

All data obtained were then analysed descriptively based on data tabulation and classification of intensity and degree of infestation according to the above categories. Furthermore, the results were discussed based on relevant references to obtain accurate conclusions.

RESULT AND DISCUSSION

A total of 50 samples of vaname shrimp cultured in intensive ponds were found infested with ectoparasites from the Protozoa phylum, including *Zoothamnium sp.*, *Vorticella sp.*, and *Epistylis sp.* The results of the examination of the three ectoparasites are shown in Table 2**.**

Table 2. Results of Ectoparasite Examination in Vaname Shrimp

Type of Ektoparasit	Number of sample (tail)	Samples infested (tail)	Number of Ectoparasites (tail)	Ectoparasite Intensity (Individu/tail)	Degree of Infestation Category (Williams and Williams, 1996)
Zoothamnium sp.	50	50	9211	184	Very heavy
Vorticella sp.	50	50	13406	268	Very heavy
Epistylis sp.	50	50	11750	235	Very heavy

Based on the table above, *Zoothamnium sp*. was found with an intensity of 184 individuals/tail, *Vorticella sp*. with an intensity of 268 individuals/tail, *Epistylis sp*. with an intensity of 235 individuals/tail. The

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three ectoparasites have an intensity of more than 100 individuals/tail, so it can be categorised as a very heavy infestation (>100 individuals/tail) (Williams and Wiliams, 1996). The results of the examination of ectoparasites in this study are in accordance with the results of research by Farras et al (2017), which stated that three ectoparasites were found to infest vaname shrimp, namely *Zoothamnium sp.*, *Vorticella sp.*, and *Epistylis sp*., but in the category of heavy infestation (51-100 individuals/tail).

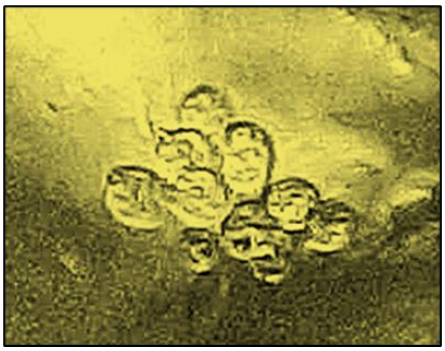

Figure 1. *Zoothamnium* sp.

Zoothamnium sp. found in this study has a zooid shape that resembles an inverted bell, whitish in colour, has cilia, and lives in colonies with dichotomously branched contractile stalks (Figure 1). These morphological characteristics are in accordance with the results of research by Muttaqin et al (2018), which state that *Zoothamnium sp.* has a body shape like an inverted bell, contractile, transparent in colour, and lives in colonies with many branches on each stalk. *Zoothamnium sp*. is divided into several parts, namely macronucleus, cilia, zooid, and stalk.

Zoothamnium sp is an ectoparasite that often infests vaname shrimp, both larvae and adults (Hardi, 2015). This ectoparasite is most often found as the cause of death in shrimp. *Zoothamnium sp*. is able to penetrate the carapace of vaname shrimp, causing damage to the inner skin surface and death (Widiani and Ambarwati, 2018). In addition, *Zoothamnium sp.* infest the gills, walking legs, and swimming legs of shrimp. *Zoothamnium sp.* infests its host by attaching a myoneme and then the myoneme will bifurcate. Each branch then grows two more branches and so on until it forms a colony.

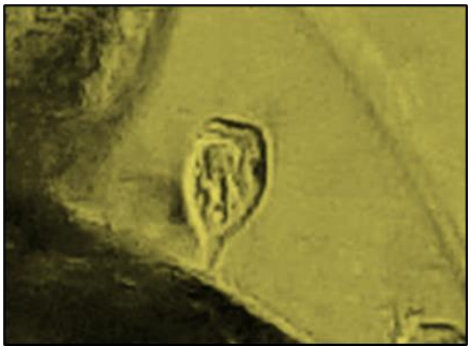

Figure 2. *Vorticella* sp.

Vorticella sp. found in this study has a body shape resembling an inverted bell, a transparent colour, a long and contractile stalk, ciliated, unbranched, and lives solitarily. This is in accordance with the statement of Dinisa et al (2022), that *Vorticella sp.* is shaped like an inverted bell with a transparent body colour, experiences movement on the stalk, has only one individual on each stalk, and is not colonised or solitary. *Vorticella sp.* can live in freshwater and marine waters (Abibuleva and Golva, 2021). This ectoparasite generally lives freely without causing disease in the host, but in stressful host conditions due to adverse environmental conditions, *Vorticella sp*. will become a fluctuating ectoparasite that causes death in its host (Baki et al., 2014). Widiani and Ambarwati (2018), reported that *Vorticella sp.* was found to infest the body of vaname shrimp by attaching its unbranched and contractile stalk to the host.

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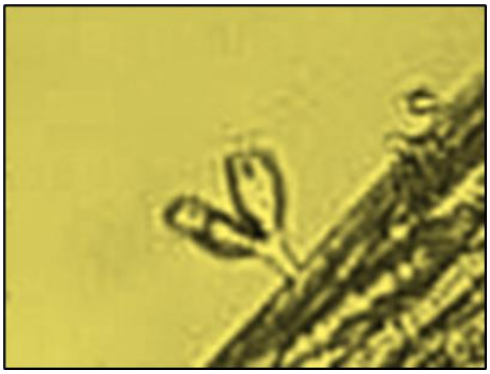

Figure 3. *Epistylis* sp

Epistylis sp. found on vaname shrimp in this study has a body shape resembling an inverted bell, transparent in colour, ciliated, living in colonies with non-contractile stalks and many branches on each stalk (Figure 3). The morphological characteristics of this ectoparasite are in accordance with the results of research by Widiani and Ambarwati (2021), which suggest that *Epitylis sp.* has an elongated flat zooid shape, there are cilia on the peristome, is sessile, has a dichotomously branched stalk, non-contractile stalk, lives in colonies arranged on branched stalks where one stalk has one individual. Firdaus and Ambarwati (2019), also suggested that *Epistylis sp*. has morphological characteristics with two zooids in one individual.

Epistylis sp. is an ectoparasitic protozoan that attacks shrimp and will develop well if the aquatic environment contains a lot of organic matter. Ectoparasites of this type are found in areas with substrate. Another factor that affects the number of these ectoparasites is the low concentration of dissolved oxygen because it can accelerate the growth of *Epistylis sp.* (Muttaqin et al., 2018). This ectoparasite is generally ectocommensal, which causes irritation to the host's gills and skin, and can even cause more severe damage if water conditions are favourable. *Epsitylis sp.* is usually found in small numbers on the surface of the gills and skin of healthy hosts, but due to certain factors such as high densities and malnutrition, there is a decrease in host health conditions, thus increasing the infestation of this ectoparasite. Irritation that occurs on the surface of the vaname shrimp body due to *Epistylis sp*. infestation can cause hyperplasia and epithelial destruction of the gills and skin, an increase in loose epithelial cells which results directly in death, infection with bacteria, fungi and other parasites (Hardi, 2015).

CONCLUSION

Based on the results of the study, it can be concluded that there are three types of ectoparasites that infest PL-25 vaname shrimp cultivated in intensive ponds. Ectoparasites are *Zoothamnium sp*. with an intensity of 184 individuals/head, *Vorticella sp*. with an intensity of 286 individuals/tail, and *Epistylis sp.* with an intensity of 235 individuals/tail. The intensity values of the three ectoparasites indicate that each has a very heavy degree of infestation on vaname shrimp, where *Vorticella sp*. is the most severe ectoparasite infestation among the three types of ectoparasites found. With the results of this study, it is hoped that farmers can pay more attention to pond water conditions to prevent the increase in ectoparasite infestation and immediately make appropriate ectoparasite control efforts.

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AUTHORS' CONTRIBUTIONS

The contribution of each author is as follows, YLU; collected the data, drafted the manuscript, and designed the table as well as the graph. GM and LS; devised the main conceptual ideas and conducted a critical revision of the article. All authors discussed

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the results and contributed to the final manuscript.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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