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Prevalence and intensity of ectoparasites in Pacific white shrimp (*Litopenaeus vannamei)* seeds from a pond and hatchery

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Abstract. This study aimed to determine the prevalence and intensity of ectoparasites in pacific white shrimp (*Litopenaeus vannamei*) seeds in ponds and hatcheries. This research was carried out from May to June 2018. The examination of ectoparasites in the samples of pacific white shrimp seeds was carried out in the Laboratory of the Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya. The research methods used included a survey and descriptive method. The results of the study were that there was the presence of the same two types of ectoparasites in the pacific white shrimp seeds in both locations, namely *Zoothamnium* sp. and *Vorticella* sp. The highest intensity and prevalence of ectoparasites found in the shrimp seeds from ponds was 100%, while the prevalence of pacific white shrimp ectoparasites from the hatchery was only 15%. The intensity of the ectoparasites that attacked the shrimp seeds in the pond was 81.9 ind/fish, while the intensity of the ectoparasite that attacked the shrimp seed from the hatchery was 2 ind/fish.

1. Introduction

Pacific white shrimp (*Litopenaeus vannamei*) are one of the shrimp species that has a high economic value and is a national superior commodity [1]. Pacific white shrimp comes from the waters of Central and South America [2]. The number of shrimp produced by Asian countries in the world is currently around 77%, Indonesia is one of the largest shrimp producers [3].

Pacific white shrimp are excellent when compared to tiger shrimp, as they can live with a range of salinity ranging from 0.5 to 45 ppt, have a high stocking density of more than 150 heads / m^2, have resistance to a low environmental quality, and need more maintenance time per cycle at around 90 - 100 days [4].

The success rate of pacific white shrimp cultivation is determined by the success of the hatchery in producing quality seeds that are free of disease [5]. This shows that the success of producing seed hatcheries will ultimately support the provision of quality pacific white shrimp seeds. According to a previous study [6], the success of a hatchery business must be demonstrated by the rapid growth rate and / or low mortality, which ultimately affects the production process. The main problem faced today is the low survival rate of post-larvae (PL1-30) pacific white shrimp [7].

Generally, seed production can be done in hatcheries and the result of enlargement in ponds is referred to as weaving. A hatchery starts from the parent producing the eggs to the post-larval stage.

Maintenance at the hatchery usually uses a concrete tub. Logging ponds are a chain of cultivation businesses that aim to produce larger seeds (PL20-30) so then they can be directly distributed in ponds or enlargement ponds. For maintenance logging ponds, fishponds are used on the ground. Constraints in hatchery activities include a lack of quality shrimp stock, poor food, poor larval maintenance techniques and inadequate management, which results in low quality seeds [8].

High ectoparasite infestation can cause an increase in mortality and have an impact on the organisms [5]. Ectoparasites are tiny animals that live on the surface of the host body that can reduce the host's productivity, reduce growth, and lower the quality of the meat [9]. The clinical symptoms caused by parasitic infestations can be different, according to the level of infestation and the type of parasite. Ectoparasite infestation can also cause death, caused by secondary attacks by bacteria [10]. Several genera from the *Ciliate* class that often infect pacific white shrimp are *Epistylis*, *Zoothamnium*, and *Vorticella* [3].

2. Research method

2.1 Materials and tools

The research equipment used was a ruler to measure the sample length, surgical scissors to obtain the surgical samples, tweezers for organ harvesting, a scalpel, binocular microscope, object glass, glass cover, petri dish, pipette, analytical scales for measuring the sample weight, label paper, napkins / network, and a camera for documentation. The material used in this study was a sample of white shrimp seed (*Litopenaeus vannamei*) with a size of PL11 - PL15 post-larvae from a hatchery and if a PL20 - PL30 size in ponds. Both were from 40 tails, aquades, and lugol to deactivate any parasites to make the calculations easier.

2.2 Sampling

Sampling from the plots in ponds and hatcheries was used to take 5% of the total plot [11]. The dredging ponds in Karangrejo Village totaled 8 while the hatchery, the Brackish Water Cultivation Development Technical Implementation Unit (UPT PBAP), totaled 4 plots. The samples taken from the total plot in the hatchery and in the pond made up as much as 1 plot. Samples were taken up to as many as 40 shrimp both from the hatchery and from the pond. The seeds were taken randomly so then the data obtained representatively represented the population and provided an equal opportunity to all members of the population [12]. The samples of the white shrimp seeds were packed and put into Styrofoam boxes to be taken to the Education Laboratory of the Faculty of Fisheries and Marine, Universitas Airlangga.

2.3 Ectoparasite examination

The method used in the examination of the ectoparasites was the native method [13]. The body part that was observed in the shrimp seed (*Litopenaeus vannamei*) was the surface of the body, the foot of the swimming keg, the foot of the road leg, and the tail. All parts of the shrimp body were placed on a glass object, dripped with distilled water, covered with the cover glass and then observed using a microscope with a magnification of 40x and 100x [14]. Identification was carried out according to the identification keys [13]. The parasitic examination aimed to find out the parasites that were infesting the sample shrimp. The lugol drops were given when there was a parasite that was still alive.

2.4 Research design

The ponds in fisheries are artificial ponds, usually found in coastal areas filled with water and used as aquaculture facilities. This is different from tmining pond hatcheries that are still affected by environmental conditions, as they are ponds with a soil base and consist of open spaces. Maintenance in the sloping ponds rarely involves siphoning. Seeds stocked in white shrimp ponds are usually PL12 sizes or more [15]. The cutting of white shrimp seeds (*Litopenaeus vannamei*) in ponds with a stocking density of 500 fish / m^2 produces optimal growth. The density of 2000 head / m^2 does not affect the survival rate in shrimp seed ponds [16]. In this study, we used sample seeds that were size PL20-PL30 from the pond.

2.5 Data analysis

The data obtained has been presented through graphs and images of the parasites (*Epistylis*, *Zoothamnium*, and *Vorticella*) that infested each individual pacific white shrimp seed (*Litopenaeus vannamei*). The data analysts used the Statistical Package for Social Science (SPPS). The statistical calculation of the difference in the prevalence of pacific white shrimp seeds infested with ectoparasites was done using SPSS Chi-Square. The statistical calculation of the differences in the ectoparasite intensity of the infested white shrimp seeds was done using SPSS Mann-Withney, in order to determine the difference between the prevalence and intensity of ectoparasites in white shrimp seeds in ponds and hatcheries respectively.

3. Results and discussion

3.1 Results

3.1.1 Examination of the ectoparasites on pacific white shrimp seeds in ponds and hatcheries

The results of the ectoparasite examination of the pacific white shrimp seed (*Litopenaeus vannamei*) included all of the 40 samples taken from the hatchery and ponds. Based on the calculations, the parasites found were from the genus Z*ooothamnium* and *Vorticella*. The results were compared with that of previous studies [17].

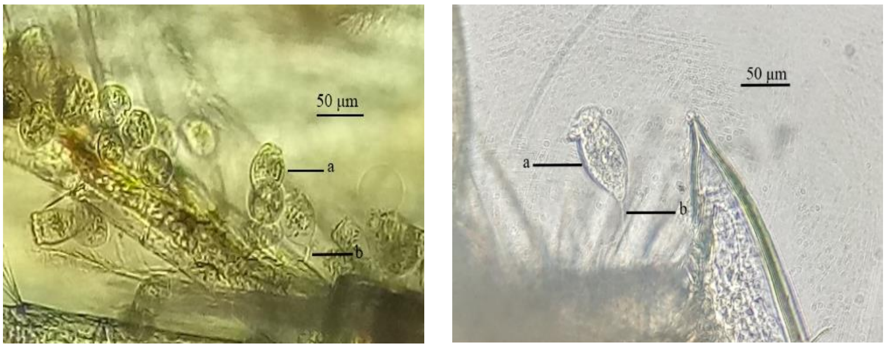

Figure 1. Illustration of the ectoparasite infestation in a few organs.

a: *Zoothamnium* b: *Vorticella* (100x magnification)

Table 1. The results of the calculation of the prevalence of the pacific shrimp seeds infested with ectoparasites in ponds

Ectoparasites	Number of Samples (tail)	Positive (tail)	Negative (piece)	Prevalence (%)	Category (Williams and Williams, 1996)
Ectoparasites	40	40	0	100	(*Always*)
Zoothamnium	40	40	0	100	(*Always*)
Vorticella	40	40	0	100	(*Always*)

Table 2. The results of the calculation of the prevalence of pacific shrimp seeds infested with ectoparasites in the hatchery

Ectoparasites	Number of Samples (tail)	Positive (tail)	Negative (piece)	Prevalence (%)	Category (Williams and Williams, 1996)
Ectoparasites	40	6	34	15	(*Often*)
Zoothamnium	40	2	38	5	(*Occasional*)
Vorticella	40	4	36	12,5	(*Often*)

Table 3. The results of the calculation of the intensity of the ectoparasites infesting the white shrimp seeds in the pond

Ectoparasites	Infested Samples (tail)	Amount of ectoparasites	Intensity (Ind/tail)	Category (Williams and Williams, 1996)
Ectoparasites	40	3276	81,9	Severe
Zoothamnium	40	2054	51,35	Severe
Vorticella	40	1227	30,675	Medium

Table 4. The results of the calculation of the intensity of the ectoparasites infesting the white shrimp seeds in the hatchery

Ectoparasites	Infested Samples (tail)	Amount of ectoparasites	Intensity (Ind/tail)	Category (Williams and Williams, 1996)
Ectoparasites	6	12	2	Low
Zoothamnium	2	6	3	Low
Vorticella	4	6	1,2	Low

3.1.2 Water quality in ponds and hatcheries

The water quality measurements were carried out as a supporting parameter in this study. The measurement of the water quality parameters was carried out when sampling the white shrimp seeds in the ponds and hatcheries. The water quality parameters measured included temperature, dissolved oxygen (DO), acidity (pH) and salinity. The water quality measurement results from each sampling place have been presented in the following table.

Table 5. Water quality measurement results in the ponds and hatcheries

Water Quality Parameter	Sampling Place		Literature (PERMEN-KP No. 75 of 2016)
	Ponds	Hatchery	
Temperature (^oC)	30	27	27-32
DO (mg/L)	2,9	5,1	>3
pH	7	8	7,5-8,5
Salinity (ppm)	10	15	5-40

3.2 Discussion

The prevalence and intensity of ectoparasites which infested the pacific white shrimp seeds from the ponds was higher than the pacific white shrimp seeds from the hatchery. The highest prevalence of shrimp seeds that had ectoparasites was from the ponds at 100%, with the prevalence of *Zoothamnium* and *Vorticella* included in the category of very severe infestation. The hatchery pacific white shrimp seed prevalence of 15% was included in the frequently infested category, with *Vorticella* at 12.5% in the frequently infested category, and with the 5% *Zoothamnium* in the infested category. The intensity of the ectoparasites that attacked the shrimp seedlings from ponds (81.9 individuals/tails) was in the severe category, *Zoothamnium* (51.35 individuals/tails) was included in the severe category, and *Vorticell*a (30.675 individuals/tails) was included in the moderate category. The ectoparasite intensity from the hatchery was included in the low category at 2 individuals/tails, with *Zoothamnium* at 2 individuals/tails, and *Vorticella* at 3 individuals/tails.

The highest prevalence and intensity of the ectoparasites which infested the white shrimp seeds from the ponds was from the genus *Zoothmanium* and *Voticella*, while *Episylis* was not found. This is because *Zoothamnium* have only definitive hosts in crustaceans, while *Vorticella* and *Epistylis* are more commonly found in freshwater fish culture [13]. In addition, *Zoothamnium* is more abundant than *Vorticella* because *Zoothamnium* lives in colonies; breeding is faster when compared to the solitary *Vorticella*. The pacific white shrimp seeds (PL20-30) from ponds are always infested with ectoparasites and were included in the severe category probably due to the environment supporting ectoparasites. The maintenance facilities in soil pools, that have many substrates, can lead to an increase in the prevalence and intensity of ectoparasites that require substrates in their lives. The environmental support for both ectoparasites was a preferred low DO of less than 3 mg/L; this is an ideal parameter to note when breeding ectoparasites from the genus *Zoothamnium* and *Vorticella*. Dissolved oxygen at 2.9 mg/L can cause high ectoparasite growth; this is consistent with the *Zoothamnium* and *Vorticella* life cycles, which are strongly influenced by low oxygen environments and transversal cleavage [18].

The highest prevalence and intensity of the ectoparasites that infested the pacific white shrimp seeds from the hatchery were from the genus *Voticella* and *Zoothmanium*, while *Episylis* was not found. The highest prevalence and intensity of ectoparasites was lower than what infested the white shrimp from the ponds. This is consistent with the research of a previous study [19], stating the prevalence of ectoparasites that infest white shrimp in intensive ponds using concrete and soil bases. The degree of infestation of *Zoothamnium* and *Vorticella* ectoparasites in intensive ponds was heavier than the parasitic infestation in traditional ponds. Controlling seed maintenance is easier in a hatchery than it is in a pond. According to a previous study [20], seed maintenance in the hatchery was done by cleaning the tub by using aeration, siphoning, and routine water replacement. Judging from the results of the DO measurements in the hatchery, the yield of 5.1 mg/L means that it is not an ideal environment for breeding ectoparasites.

4. Conclusion

The highest prevalence of infested pacific white shrimp was in the pond, which was where 100% were included in the category of very severe infestation (always), while the prevalence of ectoparasite-infested white shrimp seed from the hatchery was only 15% infested, included in the frequent infestation category. The ectoparasite intensity that attacked the shrimp seed from ponds was 81.9 individuals/tail and included in the severe category, while the intensity of the ectoparasites that attacked the white shrimp seed from the hatchery only totaled 2 individuals/tails, and thus was included in the low category. There is a significant difference between the prevalence and intensity of ectoparasites in white shrimp seeds (*Litopenaeus vannamei*) in ponds and in hatcheries.

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