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## A preliminary study of White Spot Syndrome Virus (WSSV) infection on vannamei shrimp (*Litopenaeus vannamei*) cultured in semiintensive ponds in Bireuen District of Aceh Province, Indonesia

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Abstract. The objective of the present study was to evaluate the prevalence of White Spot Syndrome Virus (WSSV) infection in vannamei shrimp (Litopenaues vannamel) farmed in semi-intensive ponds in several villages in the Peudada subdistrict of Bireun District of Aceh Province, Indonesia. This crosssectional study was conducted using a simple random sampling approach. The 5 villages with the highest populations of vannamei shrimp ponds in the Peudada subdistrict were selected purposefully as sampling locations. One hundred (100) semi-intensive ponds were selected as sampling units from a total of 283 in the five villages. The number of ponds used as sampling units in each village was proportional to the total number of ponds in each village. The ponds used as sampling units were selected randomly. A pond was considered infected if one infected vannamei shrimp was found in the pond. A positive infection of WSSV was identified if the vannamaei shrimp had the clinical sign of a white spot on the carapace. Data obtained in this study were analyzed descriptively. The results showed that 6 semi-intensive vannamei shrimp ponds in 3 of 5 villages, among 100 semi-intensive farms (6%), were infected. The prevalence of the infection was not similar between different villages. The highest prevalence was in Kukue Village (11.11%), followed by Meunasah Blang Village (10.53%), and Kampong Baro Village (6.7%). In each of those villages 2 infected ponds were observed. In conclusion, our study has observed the existence and spread of WSSV disease at a low prevalence in vannamei shrimp semi-intensive ponds in the Peudada subdistrict.

Key Words: prevalence, shrimp farms, aquaculture, cross-sectional, virus.

**Introduction**. Currently, the White Spot Syndrome Virus (WSSV) disease is a global threat for the health of crustaceans. Since its first time of occurrence in Asia, in Taiwan in 1992 (Chou et al 1995), followed by Japan in 1993 (Nakano et al 1994), the disease has spread worldwide (Balakrishnan et al 2011; Cavalli et al 2011; Sunarto et al 2004). The etiological agent of the disease was identified as an enveloped and double stranded DNA virus (Inouye et al 1994; Wongteerasupaya et al 1995; Van Hulten et al 2001; Mayo 2002). This virus infection in shrimp could result in a fatal impact because the mortality rate increases dramatically within a few days of the first infection, with an interval from 80% to 100% (Nakano et al 1994; Chou et al 1995; Sunarto et al 2004). Therefore, most of the reported cases led to serious economic problems for shrimp farmers as they lost production and had to close the infected farms (Flegel 1997; McClenen 2004; Sunarto et al 2004). Many efforts have been made to control the spread of the disease,

from clinical to epidemiological strategies. However, the results are still unsatisfactory. Indonesia, known as one of the important areas for shrimp culture in Southeast Asia, has also faced a problem with WSSV infection. The occurrence of this disease was first reported in 1994 in the northern coast of East, Central and West Java. The disease then spread to many shrimp farms across the country (Sunarto et al 2004). Among those areas is the Province of Aceh, especially in the South Aceh area, which is known as one of the best potential locations for shrimp farming (Goetz 2000; Muchlisin et al 2012). The prevalence of WSSV disease in Indonesia is estimated at 15% to 90%, with both infected black tiger shrimp (Penaeus monodon) and infected vannamei shrimp (Litopenaeus vannamei) ponds (Muliani et al 2007; Haryadi et al 2015; Kilawati & Maimunah 2014; Taslihan et al 2014). This issue has decreased national shrimp production. So far, many cases of WSSV infection in shrimp in Indonesia have been reported in Java, Sulawesi, and Kalimantan (Muliani et al 2007; Haryadi et al 2015; Kilawati & Maimunah 2014; Taslihan et al 2014). However, very limited amounts of epidemiological studies have been conducted, especially in the semi-intensive ponds of L. vannamei farming in Sumatra. L. vannamei is a new introduced shrimp in Aceh Province, Indonesia (Callinan et al 2012). It is any controversy on impact of introduced species on native species, however, most of the scientists agreed that the introduction of exotic species has an impact on biodiversity (Muchlisin 2012), one of the serious impact is introducing new pathogens or diseases (Zenetos et al 2009) which can have a negative consequences on fisheries and other related resources. Therefore, to understand the extent of WSSV infection in this area we conducted the present preliminary study. The cross sectional approach was used to gain information on the existence and spread of WSSV infection in L. vannamei farmed in semi-intensive ponds in several villages in the Peudada subdistrict of Bireun District of Aceh Province, Indonesia.

## Material and Method

*Study location*. The study was conducted in the Peudada subdistrict of Bireuen District of Aceh Province, Indonesia in October 2014. This district was recommended as a potential area for an intensive aquaculture sector development program (Muchlisin et al 2012) (Figure 1).

**Sampling technique**. This cross sectional study was conducted using a simple random sampling approach. The 5 villages with the highest populations of *L. vannamei* ponds in the Peudada subdistrict were selected purposefully as sampling locations. Those villages are Paya, Blang Kubu, Kukue, Meunasah Blang, and Kampong Baro. The WSSV prevalence in this area was assumed to be 50%. This assumption was based on the average results from several related studies in other areas of Indonesia as there was no information available from the location of this study. Based on the calculation of the sample size, a total of 96 semi-intensive ponds were needed as sampling units. This number was rounded up to 100 semi-intensive ponds to be selected as sampling units from a total of 283 in the five villages. The number of ponds used as sampling units in each village was proportional to the size of the total number of ponds in each village. The ponds used as sampling units were selected randomly. A pond was considered infected if one infected vannamei shrimp was found in the pond because WSSV is known as a highly pathogenic and contagious as well as lethal disease (Sangamaheswaran & Jeyaseelan 2001; Lightner et al 2012).

A positive infection of WSSV was identified if the *L. vannamei* shrimp had the clinical sign of a white spot on the shrimp carapace (OIE 2012). The data obtained was analyzed descriptively. The prevalence of infection were calculated based on Kabata (1985) and Muchlisin et al (2014).



Figure 1. Map of Bireuen District, the Peudada subdistrict as study location and a potential area (marked with red arrow) for an intensive fisheries sector development program (source: Agency of Planning and Development of Bireuen District).

Results and Discussion. This study was undertaken to obtain preliminary information on the prevalence of WSSV infection in semi-intensive farmed shrimp ponds in 5 villages in the Peudada subdistrict of Bireuen District. The results of the study showed that 6 semi-intensive L. vannamei ponds in 3 of the 5 villages were infected by WSSV (Table 1). This result indicates that the WSSV disease exists in L. vannamei semi-intensive ponds in Bireuen District of Aceh Province, Indonesia. Among 100 semi-intensive farm samples in those 5 villages, approximately 6% of the farm samples were found infected. However, the prevalence of infection was lower than several previous reports of WSSV infection in P. monodon farmed in traditional ponds and L. vannamei raised in semi-intensive farms in other areas of Indonesia (Muliani et al 2007; Taslihan et al 2014; Haryadi et al 2015). The level was also lower than in parts of Latin America such as Brazil (Cavalli et al 2011), where infection levels were between 64.27%-90%. However, those studies were used the PCR technique to detect WSSV infection, while our study was based on the clinical signs of the disease. Thus, the diagnostic methods used in those studies were highly sensitive compared to this study. Therefore, the prevalence of WSSV in the L. vannamei culture in Bireuen District of Aceh Province, Indonesia could be higher than our findings in this study. Further study will need to be conducted using the PCR technique to analyze the status of WSSV infection in the L. vannamei culture in Bireuen District of Aceh Province.

Interestingly, this study revealed that the level of WSSV disease in *L. vannamei* farmed in semi-intensive ponds was not similar between different villages. The highest prevalence was obtained in Kukue Village (11.11%), followed by Meunasah Blang Village (10.53%), and Kampong Baro Village (6.7%). In each of these villages we observed 2 infected ponds. However, this infection did not seem to be transmitted from one pond to another since the locations were not close to each other. The WSSV disease was also not found in the ponds located close to the infected ponds. Therefore, other risk factors need to be considered. Perhaps the irregular prevalence of infection between ponds was caused by the dissimilarities in the majority of shrimp farms that raise adult shrimps in each village. According to Cheng et al (2013), the survival of brooder *L. vannamei* infected with WSSV is higher than juvenile *L. vannamei*. WSSV infection was lower in adult *L. vannamei* (5%) than juveniles (38%) in the *L. vannamei* farm industry in

Taiwan. This result might be caused by different immunity levels among shrimp of different sizes and ages, but there is a lack of information available related to this issue.

Table 1

The prevalence of WSSV infection (based on clinical sign) and distribution of location on *L. vannamei* semi-intensive ponds in 5 villages in Peudada subdistrict of Bireuen District, Aceh Province

Village/site	Total	Total WSSV	Total WSSV	Prevalence (%)	95% CI (%)
	ponds	positive	negative		
Kampong Baro	30	2	28	6.7	1.85-21.32
Meunasah Blang	19	2	17	10.53	2.94-31.39
Kukue	18	2	16	11.11	3.1-32-8
Paya	17	0	17	0	-
Blang Kubu	16	0	16	0	-
Total	100	6	94	6	2.78-12.48

Another possibility for a low prevalence of WSSV infection in *L. vannamei* ponds in this study is that most farmers used high quality larvae from recognized hatcheries. Several reports suggest that ponds that do not apply a good biosecurity, such as raising shrimp seed without concern for their health may increase the risk of a WSSV outbreak (Satoh et al 1999; Peng et al 2001; Corsin et al 2005; Corsin et al 2006; Responsible Aquaculture Foundation 2013). If farmers raise *L. vannamei* seed from a specific pathogen free (SPF) seedstock producer, then their ponds may be safe from a WSSV outbreak (Responsible Aquaculture Foundation 2013). Furthermore, water supply is an important factor in disease prevention in shrimp farming. Corsin et al (2005) has suggested that the spread of WSSV infection from infected ponds to WSSV-free ponds can occur when they exchange water supplies. The lower spread of WSSV disease between shrimp ponds in one village as well as in the Peudada sub-district as a whole might indicate that the farmers have applied good management practices in the water supplies for their ponds. It seems that they did not use the same water supply in different farms, an example of better management practices (Padiyar et al 2005; Walker et al 2011).

**Conclusions**. Our study has found a low level of WSSV disease in *L. vannamei* semiintensive farms in the Peudada subdistrict. Further study is needed to measure the risk factor for the introduction of the disease to *L. vannamei* semi-intensive farms in this area. This information will help in designing locally relevant better management practices.

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