WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES
SJIF Impact Factor 7.421
Volume 7, Issue 10, 1293-1299 Research Article ISSN 2278 – 4357

IMPACT OF WHITE SPOT SYNDROME VIRUS DISEASE ON ABDOMINAL MUSCLES AND GILLS IN SHRIMP, PENAEUS MONODON

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Article Received on
04 August 2018,

Revised on 25 August 2018,
Accepted on 14 Sept. 2018,

DOI: 10.20959/wjpps201810-12465

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ABSTRACT

Disease has always a critical role in aquaculture industries which determine the success of shrimp culture and its efficient management. Farms and hatcheries have few defenses against ramping protozoan, fungal and bacteria, viral disease. Several protozoan parasites cause problems in Penaeid shrimp culture and major impact on the shrimp farming industry. White spot syndrome virus (WSSV) is a major shrimp pathogen that also infects Penaeus monodon species is selected. Histological changes in abdominal muscles and gill cells were studied. Histological techniques using paraffin embedded tissue as well as frozen tissues were used to identification of WSSV infection. Histological manifestation such as abdominal muscles and gill cells could be detected. The abdominal muscles and gill cells was marked and characteristic of WSSV infection were observed. The present investigation was focusing on the virus infecting shrimp. The microscopic examinations of the histological preparation are presently used to detect WSSV zoothamnium or ectoparasites.

KEYWORDS: Penaeus monodon, WSSV, Gills and Abdominal muscles.

INTRODUCTION

In world, Asia region is the center of fishing and aquaculture activities with top fish producing countries like Japan, China, Thailand, Philippines. Malaysia and Vietnam are from this region (Flegel, 2006). India was the second largest aquaculture producer in the world with a production of 1.6 metric tons in 1994 (FAO, 1996). Disease is one of the limiting

factors for the aquaculture industry throughout the world. According to Lightner (1996) the disease among Penaeid are somewhat dependent upon the system of culture followed. In the case of high density culture as intensive and semi-intensive, pond encourage the development and transmission of many diseases (East, et.al, 2004).

The zoothamnium infection in the gills of *Penaeus setifeus* and the brown shrimp *P. aztecus* throughout Mississipi coastal and adjacent coastal water, the infection was triggered by the water quality. The infection of wild crustaceans is due to the release of untreated liquid and solid waste from shrimp importing and processing plant directly into the coastal water (Lightner, et. al., 1996). According to Kautsky, et.al, (2000) confirmed that higher shrimp densities lead to the spread to pathogens and in the case of polyculture the disease spread is limited. White Spot Syndrome was detected from the crab *Parasesarma pictum*. It is one of the most common residents of shrimp farms and it might transmit virus to shrimp by acting as a vector. Rajendran, et.al, (2006) has studied the *P. monodon* of WSSV in both hemolymph and tissues and it corresponded to the severity of infection determined by histological evaluation. The histological studied demonstrated that a viral agent infected the epidermis of the diseased shrimp and the tissue degradation characterized by hypertrophid nucli with inclusion (Wang, et.al., 1997). WSSV was particularly prevalent in gills, followed in order of decreasing prevalence by hemolymph, stomach, pleopods, heart, integument, periopods, eyestalks and hepatopancrease (Lo, et.al., 1997). The present study was effects of white spot syndrome virus disease on abdominal muscles and gills of shrimp *P. monodon*.

MATERIALS AND METHODS

Infected White Spot Syndrome disease shrimp *Penaeus monodon* was used in the present investigation. The samples were collected from various aquacultures in Sindhudurg district in Maharashtra, India. The *P. monodon* is imported shrimp were aquaculture farm and hatcheries through different semi Government as well as registered private sectors in Sindhudurg district. Collected shrimp were properly preserved on the spot. The specimen animals were came in the laboratory. The shrimp were then further processing for study. The infected portion also dissected and infected portion of gills and abdominal muscles tissues were fixed with Davidson's fixative for 24 to 48 hrs. Then it was transferred and preserved to 50% ethyl alcohol for subsequent histological reparation and analysis. These samples were processed and sectioned following paraffin embedding using the methods by Bell and Lightner, 1988. The histological techniques were used.

The tissue of the gills and abdominal muscles of *P. monodon* were sectioned at 4-5 µm in thickness. Sections were stained with haematoxylin and eosin. The slide were further dehydrated in ascending grades of alcohol and finally given two changes of absolute alcohol. Slides were then cleared in xylene and mounted using DPX. Subsequent gross significance examined by light microscopy for histological typical studies of White Spot Syndrome Virus (WSSV) infections was evaluated.

Table 1: Light microscopic detection of White Spot Syndrome Virus infection in abdominal muscle and gills of shrimp, P. monodon.

Name of the shrimp species	Organs of P. monodon Shrimps	Natures of culture	Investigation for tissue
Penaeus monodon	Gills	Aquaculture (Pond)	Positive
	Abdominal muscles	Aquaculture (Pond)	Positive

RESULTS AND DISCUSSION

In the present study infected shrimp *Penaeus monodon* was observed and selected (Fig.1). The *P. monodon* shrimps of the body part abdominal muscles and gills were observation through light microscopic analysis (Fig. 2 and 3). The body parts of the *P.monodon* are showed positive for White Spot Syndrome Virus (WSSV) (Table 1). *P. monodon* shrimp during the monsoon period WSSV infection was recorded. The *P. monodon* shrimps signs and symptoms were observed. The WSSV disease spread very rapidly and affected almost all the shrimp in the culture. The infected shrimp died within 5 to 15 day spot were very clearly in both body parts gills and abdominal muscles of the infected shrimps.

This has confirmed in the report that WSSV infection was environment factors like rain by (Anonymous, 1995). In the case *P. indicus*, *Metapenaeus* species important, species being cultured by Indian shrimp farmer but *P. monodon* the lowest infection rate observed was 14% in male and 25% female for being cultured world wise (Sudha, et.al., 1998; citarasu, et.al., 2006; Primavera, 1998). WSSV was detected in *P.joponicus* in the culture facilities, wild and experimentally infected shrimp (Namikoshi, et.al., 2004; Takahashi, et.al, 1994; Lo, et.al., 1997). The tiger shrimp *P. monodon* and *P. indicus* from three systems (culture, wild and experiments) showed infection (microscopic white spot). It was detected in culture facilities, wild and auto entry in the *P. monodon* culture ponds (Peinado-Guevara and Lopez-Meyer, 2006). On the other infected *P.monodon* was also found in the crab fattening Scylla

tranquebarica pond and in *P. indicus* culture ponds. WSSV infection of *Metapenaeus* was reported by Wang, et.al (1997) and Lo, et.al, (1997). According to Karunasagar, et.al, (1997) during heavy rains the extensive outbreaks of WSSV in grow out ponds was recorded. The other environmental parameters like pH, Temperature, and Salinity etc. however, do not significantly influence the rate of infection.

In the present study brooder of *P.monodon* were selected for monitoring. Lo, et.al (1997) studied the infection of the wild *P.monodon* brooders in Southern Taiwan and reported that the percentage of infection (PCR confirmation) among male was 40% and female 12.5%. In the present study also the female were found more infected than the males, the highest percentage of infection recorded in the study being 14% in male and 25% in female. Both in the brood stock bank and hatchery (maturation phase) the shrimp were fed with crab, bivalve, polychaete worm and shrimp for the growth and fast maturation of brooder (Bayd, 1989; Primavera, 1998). During this period, there is a chance of WSSV infection through shrimp and crabs. Recent study showed that WSSV infects almost all the crustaceans both in captivity and in the wild. Polychaetes are the best brood stock feed. WSSV infection through food could be avoided through the exclusive use of non-crustaceans (Boyd and Fast, 1992).

Histological studies of the present study showed that the gill cell and abdominal muscles cell characterized by hypertrophied nuclei and eosinophilic to basophilic inclusions and cellular necrosis (Durand, et.al., 1996; Lightner, 1996; Nunan, et.al., 1998). Protozoan fouling in the gills of the infected shrimp was reported. In the present study protozoan fouling was detected in almost all the viral infected shrimps. Algal fouling was also observed in the gills of *P.monodon* (OIE, 2009).

The water quality is not maintained properly, shrimps become susceptible to disease. According to Boyed (1989) shrimps respond to changes in every water quality parameters. Temperature plays an important role in the metabolism of shrimps. The optimum temperature for grow-out pond is 25 to 30°c, but temperature increased 33 to 37°c to the summer season (Boyd and Fast, 1992). P. mondon is a euryhaline animal, which can tolerate wide range of salinity. The salinity plays a major role in the growth of shrimps. The optimum salinity in all the ponds ranged between 24 to 35.7 ppt and salinity is also low 15 to 22ppt. the pH fluctuation is not a major threat to the culture animals because the buffering capacity of the brackish water maintained the pH equilibrium. Low pH increase the toxicity of nitrite to culture organism and higher pH leads to increase in unionized ammonia, another toxic

material to the shrimps (Hai, 2015). According to Bayd, et.al (1978) and Madenjian, et.al (1988) the dissolve oxygen level less than 3ppm is detrimental t the shrimp. Low dissolved oxygen content increase the ammonia concentration. The water transparency was monitored by secchi disc and it was optimum level of transparency is from 25 to 45 cm was reported. The nutrients, nitrate and phosphate are the limiting factors for the phytoplankton production (Boyed and Fast, 1992). It is concluded that the impact of WSSV infection affects the *P.monodon* internal tissues and different part of organs appearance gill lamellae, gill racker, gill filaments and abdominal various segments muscles are affects. The aquaculture industries which determine the success of shrimp *P. monodon* culture and its efficient management are essential for aqua culturing farms and hatcheries.

Fig.1: WSSV infected disease P. monodon.

Fig.2: WSSV infected Gills in P. monodon.

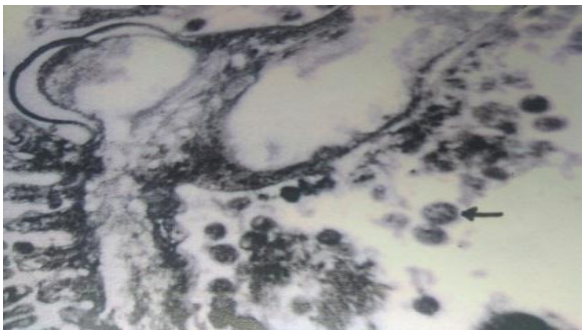

Fig.3: WSSV disease infected in the gills of P. monodon.

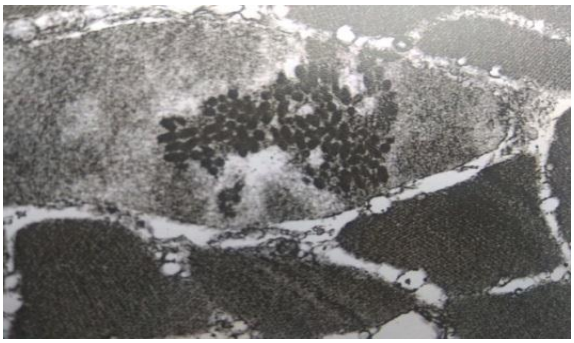

Fig.4: WSSV disease infected in the abdominal muscles of P. monodon.

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