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N Chandrakala
P.G & Research
Department of Zoology,
Kunthaavai Naachhiyar
Government Arts College for
Women (Autonomous)
Thanjavur, Tamil Nadu, India

R Mekala
P.G & Research
Department of Zoology,
Kunthaavai Naachhiyar
Government Arts College for
Women (Autonomous)
Thanjavur, Tamil Nadu, India

Correspondence
N Chandrakala
P.G & Research
Department of Zoology,
Kunthaavai Naachhiyar
Government Arts College for
Women (Autonomous)
Thanjavur, Tamil Nadu, India

Comparative study on the indicating factors and prevalence of WSSV outbreak in culture and wild *Penaeus monodon* (Fab) along the South East Coast of Tamil Nadu

N Chandrakala and R Mekala

Abstract

The shrimp industries make a remarkable economic development in the aquaculture industries in India. White spot syndrome virus is one of the most serious viral pathogen causing huge mortality and economic loss. Physico chemical parameters of cultured *Penaeus sp* play a vital role in disease induction. Major portion of the world shrimp culture production comes from South East Asia. The survey on indicating factors of white spot syndrome virus (wssv) in culture and wild *Penaeus sp* (Fab) of Tamil Nadu. Indicators factors such as Temperature, pH, Salinity, Dissolved oxygen High and low levels were recorded in four different seasons Premonsoon, Post monsoon, Summer and Monsoon were analyzed. The indicating factors higher rate of infection in during summer season both culture and wild areas. The prevalence of wssv outbreak (%) in higher rate of infection in culture ponds during premonsoon season (11.56±3.58). Similarly prevalence of wssv outbreak (%) in higher rate of infection in wild during premonsoon season (12.56±1.45) when compared to the other season. The observation may be due to inference of environmental factors and climatic change.

Keywords: Indicating factors, White spot syndrome virus, Prevalence Shrimp, *Penaeus sp*, Temperature, Salinity

Introduction

Aquaculture has grown tremendously during the last years becoming more economically important industry (Suba singhe *et al.*, 2009) [13]. Today it is the fastest growing food-producing sector in the world with the greatest potential to meet the growing demand for aquatic food. Shrimp culture has become most profitable industry in many parts of the world has developed rapidly over the last four decades to become an important economic activity worldwide. The importance of Asia's contribution to global shrimp production is Indisputable in 2013, the continent accounted for 85% shrimp aquaculture production. Shrimps are exposed to stressful a condition, which causes environmental deterioration and blooms diseases, result in serious economic losses. Diseases are primary constraint to the growth of many shrimp which are exposed to stressful conditions, adverse environmental conditions. Global shrimp production volumes have grown in general significantly in the major shrimp producing countries like China, Indonesia, India, and Thailand especially in *Penaeus monodon* (Laximinarayana 2009) [7]. The world's largest species of *Penaeus monodon* is the most widely culture prawn species in the world, although it is gradually losing ground to the white shrimp. Water quality is critical for survival, health and growth of prawns, especially in semi intensive and intensive culture. To maintain good water quality the physical and chemical properties of water should be kept with certain safe levels. Physico- chemical parameters of water plays a vital role that determines the fate of culture. Among the factors, salinity is one of the most important abiotic factors in aquaculture, though many crustacean species exhibit some degree of euryhalinity. Salintiy is masking factor that modifies numerous physiological responses such as metabolism, growth, life cycle, nutrition and intra- and inter specific relationships.

Salinity is said to be a prime factor that plays a very vital role in the physiology and growth of shrimps that ultimately decides the fate of culture. The physiological responses are believed to be essential to assess the animal performance at different environmental conditions (Menezes *et al.*, 2006)^[10]. The physico chemical parameters like Temperature, Salinity, and Dissolved oxygen, Free CO₂, Alkalinity, Hardness and Transparency influence the water quality directly or indirectly, which ultimately govern the healthy survival of aquatic ecosystems. The salinity affects the nutrient availability by modifying the retention, fixation and transformation of the nutrients in soils and water. To maintain good water quality the physical and chemical properties of water should be kept with certain safe levels. The production is regularly and seriously affected by problems linked to environmental degradation and infectious and non-infectious diseases. Of the infectious diseases bacterial and viral infections, either as single or multiple pathogen conditions, caused most of the production losses. Viral diseases have recently become an important limiting factor for the shrimp aquaculture industry throughout the world (Leung and Tran 2000). White spot syndrome virus (wssv) continues to be the most serious cause of shrimp caused most of the production losses. WSSV resulted in high mortality in many culture *Penaeid* shrimp species and huge shrimp production losses. (WSSV) is the most major serious shrimp pathogen. Which cause up to 100% mortality of shrimp with in 7 to 10 days. To date, more than twenty viral diseases have been reported to affect shrimp and prawns and five viral pathogens of *Penaeid* shrimp are currently listed by the World Organization for Animal Health (OIE, 2009)^[12]. White spot syndrome virus (WSSV) is the causative agent of shrimp viral disease. Which presently over shadows all other disease agents as the leading cause of production losses in Asia (Flegel, 1997; Flegel *et al.*, 1997)^[14]. And posing a major threat to the shrimp farming industry. White spot syndrome virus (WSSV) a circular double standard DNA virus in family *Nimaviridae* (Van Hulten *et al.*, 2001)^[15]. Mortality rate can reach 100% within 3 to 10 days of appearance of symptom (Hossain *et al.*, 2015). WSSV infection has been positively correlated with proximity of the pond to the sea and negatively to ponds closely located within a given cluster (Mohan *et al.*, 2008). WSSV infection is characterized by gross signs of rapid reduction in food consumption and loss cuticle with white spots on the inner surface. WSSV has been found in association with other shrimp viruses such as *Monodon baculo virus* and *Hepato pancreatic virus* (Otta *et al* 2003; Umesha *et al.*, 2003)^[14]. Hence we made an attempt to survey on the Indicating factors and Prevalence of WSSV outbreak in culture *Penaeus monodon* (fab) along the South East Coast of Tamil Nadu.

Materials and Methods

The study area was selected from Rameshwaram to Chennai (9.17 N⁰ 79.22⁰ E, 79.22 E, 28 13.04⁰ N 80.17⁰ E) the rearing water samples and WSSV suspected on infected culture and wild *P. monodon* were the shrimp showing characteristics white spots were aseptically collected from culture ponds and wild from South East Coast of Tamil Nadu. In coastal system of samples were collected

throughout the year (Jan- 2015 to Dec-2015). But in the culture ponds the samples were collected from every month variation in throughout the year and recorded in terms of season. For the determination of dissolved oxygen water samples were collected from different Dissolved oxygen bottles each has 300 ml capacity. In case of the other parameters one liter capacity clean plastic bottle was used for collected from normal and outbreak pond. The water samples were taken to the laboratory immediately. The temperatures of the samples were recorded using thermometer. The pH was recorded using digital pH meter. The salinity and Dissolved Oxygen were estimated by standard procedure (Eaton *et al.*, 1994)^[3]. The origin of the collected WSSV suspected on infected culture shrimp *P. monodon* samples were collected no. of infected shrimp samples collected month wise. The samples were subjected to PCR using (Single Step PCR) virus detection.

Results

The present study survey on Indicating factors and prevalence of white spot syndrome virus (WSSV) outbreak in shrimp culture ponds and coastal areas of Tamil Nadu revealed following observation. Factors such as pH, Temperature, Salinity and Dissolved oxygen culture ponds were recorded in four different seasons Premonsoon, Post monsoon, Summer and Monsoon. During premonsoon *Penaeus* sp grow out ponds, Temperature (31.96±4.94) Salinity (32.6±4.0), pH (7.95±0.33), Do (6.93±1.02) were recorded when compared to other season. During post monsoon particularly showed Temperature (30.98±4.28), Salinity (33.88±3.64), pH (8.06 ±0.26) Do (5.76±1.74) were found to be high. During summer season high Temperature (33.8±3.79), Salinity (35.33±3.20), pH (8.21±0.35), Do (6.16 ±0.86) were recorded. During monsoon season Temperature (28.31± 5.59), Salinity (27.58± 1.41), pH (7.48± 0.18) and Do (7.85± 0.43) were observed (Table 1). Factors such as pH, Temperature, Salinity and Dissolved oxygen culture ponds were recorded in four different seasons during Premonsoon *Penaeus* sp wild areas Temperature (31.88±4.13), Salinity (33.31±3.60), pH (7.98 ± 0.34), Do (6.97±1.01) were recorded when compared to the other season. During post monsoon particularly showed Temperature (30.86±3.89), Salinity (33.86±3.61), pH (8.1±0.29), Do (6.50±1.51) were found to be high. During summer season high Temperature (33.46±3.39), Salinity (34.48±4.41), pH (8.11±0.35), Do (6.0±0.81) were recorded. During monsoon season Temperature (28.53±5.38), Salinity (26.16±0.78), pH (7.53±0.25) and Do (7.82±0.67) were observed (Table 2).

The prevalence of WSSV outbreak (%) in culture ponds higher rate of infection (%) in during premonsoon season (11.56±3.58) when compared to the other season (Table 3). Similarly prevalence of WSSV outbreak (%) in wild (%) higher rate of infection (%) in during premonsoon season (12.65±1.45) when compared to the other season. Among the cultured and wild, the rate of infection were found to be higher in wild compared to the grow out. The obser vation may be due to inference of environmental factors and climatic change. (Table-4). The PCR study revealed that PCR amplification product (650,296 bp) confirmed WSSV infection observed.

Table 1: Physico chemical parameters of grow out farm.

S. No	Seasons	Temperature °C	Salinity ppm	pH	Dissolved Oxygen mg l ⁻¹
1.	Pre monsoon	31.96±4.94	32.6±4.0	7.95±0.33	6.93±1.02
2.	Monsoon	28.31±5.59	27.58±1.41	7.48±0.18	7.85±0.43
3.	Post monsoon	30.98±4.28	33.88±3.64	8.06±0.26	5.76±1.74
4.	Summer	33.8±3.79	35.33±3.20	8.21±0.35	6.16±0.86

Table 2: Physico chemical parameters of wild.

S. No	Seasons	Temperature °C	Salinity ppm	pH	Dissolved Oxygen mg l ⁻¹
1.	Premonsoon	31.88±4.13	33.31±3.60	7.98±0.34	6.97±1.01
2.	Monsoon	28.53±5.38	26.16±0.78	7.53±0.25	7.82±0.67
3.	Postmonsoon	30.86±3.89	33.86±3.61	8.1±0.29	6.50±1.51
4.	Summer	33.46±3.39	34.48±4.41	8.11±0.35	6.01±0.81

Table 3: Prevalence of WSSV infection from shrimp Grow out ponds.

S. No	Seasons	Collected Grow out (%)	WSSV infected Growout (nos)	WSSV infected Growout (%)
1.	Pre monsoon	37.6±5.85	4.33±1.52	11.56±3.58
2.	Summer	67.3±35.90	4.66±2.08	6.74±0.66
3.	Post monsoon	99.6±0.57	6.66±3.21	6.69±3.24
4.	Monsoon	105.3±29.8	5.33±0.57	5.34±1.54

Table 4: Prevalence of WSSV infection from shrimp wild environment.

S. No	Seasons	Collect wild (%)	WSSV infected wild (nos)	WSSV infected wild (%)
1.	Pre monsoon	48 ±11.26	6±1	12.65±1.45
2.	Summer	78.6±28.29	6±2	7.85±0.59
3.	Post monsoon	144.6±8.14	8.66±1.52	6.01±1.36
4.	Monsoon	115±21.79	8.66±0.57	7.77±1.94

Discussion

The present study survey on the indicating factors and prevalence of white spot syndrome virus (WSSV) outbreak in shrimp culture ponds and wild *Penaeus monodon* (fab) along the South East Coast Rameshwaram to Chennai were WSSV outbreak in *Penaeus monodon* culture farms and coastal areas among the throughout the year and different seasons were shown to be significant variation among the physico chemical parameters lead to disease outbreak in culture ponds and coastal areas being considered as the major problem particularly the viruses cause more damage to the culture system. Most viruses transmit through water and climatic change. The poor conditions may have been attributable to sub-optimal temperature and salinity. The temperature and salinity affects the immune response of crustaceans (Vargas-Albores *et al.*, 1998; Le Moullac and Haffner, 2000) [16, 8]. Temperature changes are one of the factors that trigger WSSV infection in shrimp culture (Kautsky *et al.*, 2000) [6]. Climatic changes and water quality management are considered as the Indicating factors for disease outbreak.

The prevalence of WSSV outbreak in culture farms rest study sites wer shown negative results of the study sites were shown negative results for WSSV infection. The WSSV infection could be due to the location of shrimp farms cultivating species *Penaeus monodon* which is more susceptible to WSSV (Chakarabarty *et al.*, 2002) [2]. Comparable differences in seasonal changes affected the viral infections (Badhul Haq *et al.*, 2015) [1]. Since WSSV is a necessary cause for WSD, the most obvious way to prevent outbreaks is to keep the virus out of the following system. In order to evaluate the value of such a control strategy it is necessary to first examine the possible routes by which the virus can enter the farming system. White spot diseases cases were reported in many stages of shrimp post-larvae from 9 stages to 119 d culture. Despite the not- able

susceptibility to WSD in younger stages from juvenile to adult shrimp. Water quality management and molecular characterization of the virus helps the aquaculture to prevent the disease outbreak. The study revealed that the factors associated with Premonsoon and Post monsoon period along with the climatic change influence the disease outbreak in cultured farms and coastal areas.

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