



A Case Study on Current Disease Threats Faced by Vannamei Shrimp Farmers in South-East India

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ABSTRACT:

India is one of the most leading seafood producer and exporter all over the world and is in 3rd position after China and Indonesia. Total 129 countries tested the Indian seafood, China and USA are the major Indian seafood importer. India mainly exports Frozen shrimp, Fish, Cuttle fish or squids, dried items and some live (eg-Crabs, Ornamental fishes) and chill items also. Among them shrimp is one of the major export items that contribute more than 50% of the total exported items and also contribute near about 75% of the total export value. South East Indian states viz. West Bengal, Odisha, Andhra Pradesh, Tamil Nadu are the major Shrimp producer in India. A case study was done to evaluate the diseases that are cause main problem to the *Litopenaeus vannamei* shrimp farmers in South East Indian states, i.e. West Bengal, Odisha, Andhra Pradesh and Tamil Nadu. Total seven diseases cause headaches to the shrimp farmers and responsible for huge losses of vannamei farming that seven diseases are Vibriosis, Black Gill disease (BGD), Running Mortality syndrome (RMS), White faeces syndrome (WFS), White spot disease (WSD), Enterocytozoon Hepatopenaei (EHP) and Acute hepatopancreatic Necrosis Disease (AHPND). According to farmers and technicians most of the diseases occurs during summer crop. It was observed that those farmers are implement Biosecurity measures, use proper sanitization that farms are free from some diseases. Therefore, it is suggested that by employed Better management Practices (BMPs) with proper Biosecurity and by maintaining optimum probiotics load in the pond farmers can prevent these diseases.

Keywords: *Litopenaeus vannamei*, shrimp disease, shrimp disease management, WSSV, EHP, WFS, Vibriosis, AHPND.

Introduction:

In the financial year of 2024-25 Budget, the government of India claims that in last nine years seafood export has doubled from 30 thousand Crore rupees to 64 thousand crore rupees and also take a challenge that India will export over 1 lakh crore rupees in this FY 2024-25. In this scenario we have to double the productivity by using more advanced technology and also by expand the area of culture. Two species of shrimp i.e. *Litopenaeus vannamei* and *Penaeus monodon* are play major role in our Indian aquaculture. Due to high production cost and low market demand, the Indian shrimp farmers are faced significant economic loss and many farmers stop the culture. The main reason of high production cost is due to management of various diseases. Now a days the main challenge for any shrimp farmers is struggle with Various diseases that can crash any culture system.

However, as happened in the case of *P. monodon*, *P. vannamei* farming also has been experiencing largescale production losses due to a variety of diseases. These diseases have been either due to infectious pathogens, poor management practices, unhealthy seed, poor water and soil quality management. Diseases are the outcome of imbalance between environment, host and pathogen. This article gives a comprehensive idea about disease threatening to the Indian shrimp farmers.

The study delivers the knowledge about impact of diseases affecting *L. vannamei*. By synthesizing existing knowledge and empirical research, it identifies key pathogens and their interactions with shrimp physiology. Furthermore, the paper investigates disease prevention and management strategies.

Methodology:

The present study was conducted in four states of India viz, West Bengal, Odisha, Andhra Pradesh and Tamil Nadu based on the culture practices of the Shrimp *Litopenaeus vannamei*. The primary data was collected by survey method. Random data collected by talking with many farmers and technicians of these four different states to take information about the diseases and their impact on culture.



Figure 1: Study Area

Result and Discussion

Seven major diseases viz. Vibriosis, running mortality syndrome (RMS), Black Gill Disease (BGD), White Faeces Syndrome (WFS), White spot disease (WSD), Enterocytozoon Hepatopenaei (EHP) and Acute hepatopancreatic Necrosis Disease (AHPND) were mostly found in *Litopenaeus vannamei* culture pond of four states of South-East India i.e. West Bengal, Odisha, Andhra Pradesh and Tamil Nadu.

1. Vibriosis

Vibriosis is a common problem in most of the *L. vannamei* shrimp farm of all the four states. Vibriosis is a bacterial disease mostly caused by gram negative pathogenic bacteria including: *V. harveyi*, *V. parahaemolyticus*, *V. vulnificus*, *V. penaeicida*, *V. alginolyticus*, (Brock and Lightner, 1990; Ishimaru et al., 1995). According to Lightner (1996), *V. damsela*, *V. fluvialis* and other undefined *Vibrio* species also responsible for vibriosis.

The shrimp affected by vibriosis show abnormal swimming behaviour, float on the water surface. The reduce feeding or sometimes entirely stop feeding. Cutting antenna, red colouration of appendages and uropod are common symptoms (fig-2) as well as we can observe roughness of antenna by loosely touch the antenna from upper portion to lower portion. At the initial stage of infection, affected shrimps hepatopancreas become cloudiness and latter it becomes red to brown colour (fig-2). Mortalities occur when shrimps are stressed by various factors like- poor water quality, high water temperature, high stocking density, low water exchange and low DO (Lewis, 1973; Lightner and Lewis, 1975; Brock and Lightner, 1990).

Figure 2: Vibriosis affected shrimp



Best management practice is most preventive way of vibriosis, need to maintain good water quality throughout the culture period, Proper sanitation, treatment of water before entering into culture pond, low stocking density is suggested. If vibriosis is occur in any culture pond then water exchange and reduce stocking density by partial harvesting is suggested. Use good quality probiotics.

2. Running mortality syndrome (RMS)

Running mortality syndrome (RMS) was maximum observed in West Bengal and Tamil Nadu. since 2011, Tamil Nadu and Andhra Pradesh's vannamei sector have suffered by this syndrome. Typically, the RMS began 35 to 40 days of culture (DOC) with relatively small mortalities. As the culture developed, the mortality rate jumped and the issue became more serious at about 90 DOC, forcing the farmers to harvest their crops early [4]. It is known as "Running Mortality Syndrome (RMS)" because the death rate keeps increasing every day throughout the rest of the culture period [4].

There is no connection between the peculiar signs and death pattern seen by the shrimp from the RMS suffering pond and any other known shrimp diseases. Shrimp from RMS affected ponds tested negative for all the major OIE listed and other pathogens such as [White Spot Syndrome Virus](#) (WSSV), Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV), [Monodon Baculovirus](#) (MBV), Hepatopancreatic Parvo Virus (HPV), Infectious Myonecrosis (IMNV), [Taura Syndrome Virus](#) (TSV), Yellow Head Virus (YHV), and *Penaeus vannamei* Noda Virus (PvNV) [4].

The majority of *Vibrio* species, including *Vibrio parahaemolyticus* and *Vibrio azureus*, were found in the haemolymph and hepatopancreas by histopathological and microbiological examination from shrimp infected by RMS [4].

In the early stages of RMS, the affected shrimp exhibit white spots on their second and fourth abdominal segments. This situation resulted in a daily death of shrimps in the affected pond.

Affected shrimps show broken antennae, red Uropod's and Presence of white or yellow fecal matter in the gut of affected shrimp. At the primary stage Hepatopancreas start to turn into reddish yellow colour and finally full body turn into dark red in colour. Dead shrimps are settled down at the pond bottom and do not come on the surface, farmers can understand only when dead shrimp observed in check tray (fig-5).

In primary stage, farmers control this disease by everyday removing the dead shrimp from the pond(fig-4). By reducing the stocking density through partial harvesting and reduce feeding for few days farmers can reduce the mortality. By employing Better management practices such as regularly monitor water quality, avoid over stocking, strict feed management, nursery management and partial harvest will reduce the chances of RMS.

Figure 3



Figure 4



Figure 5



Figure 3: RMS affected shrimp

Figure 4: RMS affected dead shrimp collected from the pond bottom

Figure 5: Dead shrimp found on check tray

3. Black Gill Disease (BGD)

Shrimp Black Gill Disease has been one of the most frequent shrimp farming problems in West Bengal and Tamil Nadu.

Poor pond preparation before stocking, low water exchange, lack of aeration, high amount of black soil at the pond bottom, irregular probiotic use etc. are the common reasons for black gill disease. Some fungal species such as [Aspergillus flavus](#), [Fusarium solani](#) and *A. awamori* are sometime responsible for this disease.

At the primary stage of this disease, the gills turn into orange-yellow to light brown. The gills eventually turn darker until they become black (fig-6). They struggle with oxygen consumption and due to insufficient oxygen, they float on the water surface. Mortality observed in very severe cases.

Feeding management, water quality management by using probiotics is a very effective way to control this black gill. Use probiotics can help to reduce the accumulation of organic substances and toxins in pond throughout the culture season. If Black gill disease occur then it is suggested to change water frequently and to supply sufficient oxygen by provide more aerators. If shrimps struggle with insufficient oxygen and they float on water surface then apply oxygen powder until complete recovery.



Figure 6: Black gill Disease affected shrimp

4. White Faeces Syndrome (WFS)

White Faeces syndrome is one of the most serious problems in shrimp culture. Based on the given information by Farmers and technicians, WFS is occur all of these four states. It causes lower productivity in shrimp farming. White faeces syndrome generally occurs after 20 days of culture (DOC) and it may be caused high mortality of shrimp.

The causes of white faeces may include poor quality of feed (presence of anti-nutritional factors of mycotoxins), unhealthy seeds, bacteria (a number of species of *Vibrio* species have been found in the faecal analysis from infected shrimps) [20], algal toxin (cyanobacteria), EHP (*Enterocytozoon hepatopenaei*) and the presence of protozoa Gregarines-like organisms in the intestine and hepatopancreas are some of the reasons for causes of the disease [13,20]

All of these factors have been Show to damages the hepatopancreas. When the hepatopancreas (the large internal organ in shrimps) is compromised and damaged, we observe “white faeces.

Symptoms may include White faeces floating on the water surface (fig-7), white gut. Shrimp reduce feed intake which cause growth retardation and lead to reduces in average daily growth.High mortality will observe during moulting time.

Cause of white faeces syndrome and treatment is uncertain. However, better management practices with low stocking density, feed and water quality management may reduce the risk of WFS.



Figure 7: white faeces floating on the water surface



Figure 8: white faecal matter

5. WHITE SPOT DISEASE (WSD)

White spot disease (WSD) is one of the dangerous Viral Disease of all the Penaeid shrimp farm globally. Most crustaceans like all penaeid shrimps including *P. monodon*, *P. vannamei*, *P. indicus* etc. and crab also affected by this virus. Before 1992 Indian shrimp farmers only cultivate Tiger prawn but due to WSSV they face heavy economic loss during 1992 to 1995 and only that reason maximum shrimp farmers stop the shrimp farming during that time.

This disease first observed at Taiwan in 1992 and then it spread to all over the Asian countries within very less time. This virus can be transmitted by Horizontally or by Vertically from brood stock to larvae.

When farmers shift the species from monodon to vannamei, then Vannamei had WSSV resistance power and this virus can't affect the vannamei shrimp but recent few year Vannamei shrimp also affected by this Viral infection. Like White faeces disease, WSSV also creates serious issue of these four states. WSSV spread very rapidly, mortality starts after 2-3 days of infection and within 5 to 7 days the mortality reaches up to 80-90 %.

It is a viral disease caused by White spot syndrome virus (WSSV), it is a rod shaped double stranded DNA virus.

Clinical signs include Presence of white spots up to 2 mm diameter on Carapace (fig-9) and exoskeleton. Shell becomes loose. Body and appendages become reddish in color.

There has no treatment for viral infection, so "prevention is better than cure".SPF Seed stocked from CAA registered Hatchery which is WSSV free, testing by PCR.

Prevent the disease carrier by adopt better management practices by using proper biosecurity like Bird fencing and crab fencing. Maintain proper sanitization like use potassium Permanganate to disinfect the all instruments that are used in a farm and also for washing the cast net that is used for the sampling and hand or leg wash of farm employees. Keeps Potassium permanganate solution water in front of entry of farm gate.

Maintain good water quality, good feed management practices and also maintain good health of shrimp. Use probiotics to keep the shrimp healthy which give good immunity to the shrimp.

If any farm affected by WSSV then it is recommended to harvest the shrimp as early as possible.Do not release WSSV infected shrimp pond water into the wild before proper treatment.



Figure 9: White spots on Carapace

6. Hepatopancreatic microsporidiosis (HPM) or *Enterocytozoon hepatopenaei* (EHP)

Since the last few years, framers have faced lots of challenges in farming. Among the many challenges, one of the most threatening is Hepatopancreatic microsporidiosis (HPM) or *Enterocytozoon hepatopenaei* (EHP). Due to the EHP, farmers face million rupees of losses because it affected the growth of the species. Hepatopancreatic microsporidiosis (HPM) is caused by *Enterocytozoon hepatopenaei* (EHP), is basically a Microsporidian parasite that was first reported in the HP of *P. japonicus* from Australia in 2001, but it was first confirmed in the black tiger (*P monodon*) from Thiland in 2009.

It does not cause any mortality to the infected shrimp but it caused Growth retardation and Size variation (fig-10) among the cultured shrimps which is the main symptoms of this disease. EHP infected Shrimp reduce feed consumption, the gut of the shrimp found almost empty and white faecal visible above the water surface.

There is no medication to treat EHP infection. Therefore, the only way to prevent EHP from entering the culture system is to implement better management practices (BMPs) and adequate biosecurity measures. Use SPF brood stock. Ponds should be stocked with EHP-free seed. Properly prepare ponds in accordance with BMP protocols to guarantee that the pond is free of EHP spores.



Figure 10: Growth retardation and Size variation due to *Enterocytozoon hepatopenaei* (EHP)

7. Acute hepatopancreatic Necrosis Disease (AHPND) –Previously known as Early mortality syndrome (EMS)

Acute Hepatopancreatic Necrosis Disease (AHPND), is a bacterial disease of a different strain of *Vibrio* spp. Earlier, it was known as EMS or Early Mortality Syndrome. AHPND was first reported in China in 2009. One of the main characteristics of this disease is mass mortalities occur within the first 20–30 days of stocking for both black tiger shrimp and Pacific white shrimp. There had no documented evidence of EMS reported in India specially in our study area but as per the information given by few farmers, they experienced early mortality before 30 DOC but it is not confirmed that it is caused by EMS. Although, that farmers did not suffer with serious loss.

Acute Hepatopancreatic Necrosis Disease (AHPND) is mainly caused by different strain of *Vibrio* like *V. parahaemolyticus*, *V. punensis*, *V. harveyi*, *V. owensii*, *V. campbelli* and *Shewanella* sp.

At the initial stages damages are shown in hepatopancreas and at the acute stages hepatopancreas turn whitish in color. Shrimps in their terminal stages are anorexic, drowsy, and have an empty stomach. Lethargic and exhibits irregular swimming patterns and the most common symptoms is mortality starts as early as 10 days after stocking of the PL.

Practices better pond management like pond preparation and sludge management because *Vibrio parahaemolyticus* can persist within the organic matter for a long period of time so use proper disinfectants during pond preparation and disinfect the culture pond water before release into the wild is recommended to stop the Horizontal transmission. Use SPF broodstock and BMPs with strict biosecurity can minimize the risk of AHPND. EMS is mainly caused by bacterial pathogens so maintain beneficial bacteria in the pond water and Gastrointestinal tract by using Probiotics can be good preventive method of this diseases.

Conclusion:

The diseases causing serious threat to sustainability of *L. vannamei* culture. Farmers need to be alert and educated about these diseases and the preventive methods of these diseases, then only farmers can get disease free crop. All Farmers have to follow BMPs from the initial stages of culture like Pond preparation, inlet water treatment, Seed selection, Use of SPF seed, Feed management, water quality management, Regular health monitoring, Use biosecurity like crab fencing, bird fencing for the minimising the diseases contamination during the culture period. Low stocking density also helps to prevent the diseases. Stress is the major factors that can trigger the disease causing pathogens to attack to shrimp so if we give stress free healthy environment to the culture animals then they will show active against any disease causing pathogens. To give stress free environment, maintain optimum water quality parameters, don't give over feeding because excess feed will accumulate at bottom and produce toxins gases, use probiotics at weekly basis because the probiotic contains beneficial bacteria which will show dominance over pathogenic bacteria. The drawn water for culture should be filtered properly and should be disinfected. Once the disease is found in culture pond, the water should be properly treated, disinfected and then only the water should be released into the wild to stop contamination. By practicing above suggestions, farmers can easily prevent any diseases and can get good production without facing any losses.

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