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Prevalence of disease problems affecting shrimp *Litopenaeus vannamei* farming in Andhra Pradesh, India

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Abstract
Andhra Pradesh stands top in the aquaculture production in India and shrimp farming is one of the major sources of income. Now-a-days shrimp culture is facing many problems among them disease mitigation became major hurdle for the shrimp farmers. A study was done to evaluate the diseases affecting *L. vannamei* farming in coastal districts of Andhra Pradesh, i.e., Nellore, Guntur, Krishna, West Godavari and East Godavari. The summer crop was considered for the study during summer crop 2019. The diseases that are responsible for huge losses in *L. vannamei* culture was found to be White Spot Syndrome Virus (WSSV), White Faecal Syndrome (WFS), Black Gill Disease (BGD), Loose Shell Syndrome (LSS), Running Mortality Syndrome (RMS), and Enterocytozoon Hepatopenaei (EHP) of all the selected 5 districts of the Andhra Pradesh. About 70% culture ponds of Nellore, 65% of Guntur district, 69% in Krishna and 40% in West Godavari and 50% in East Godavari districts were affected by diseases. It was observed that, more disease related problems observed during the summer crop in all selected areas. The farms which implemented biosecurity measures, and maintained without any Dissolved Oxygen (DO) problems, were found to contain less diseases. Therefore it is suggested that by practicing better management practices (BMP) by following biosecurity measures, diseases can be prevented.

Keywords: Andhra Pradesh, BMP practices, diseases, *L. vannamei*, shrimp farming

Introduction
Shrimp farming become fast growing small scale business in south East Asia as a global industry than other aquaculture farming systems [1]. The impressive growth of shrimp farming bed a major player on global shrimp Industry, it play a virtual role on offering quality nutrition, employment and rural development. Andhra Pradesh has the second largest brackish water area in India after West Bengal, covering an area of about 37,560 ha. Andhra Pradesh has the coastline of 972 km, spreading over nine districts namely Srikakulam, Vijayanagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Sri Potti Sri Ramulu Nellore. Development of coastal aquaculture in Andhra Pradesh is centered on shrimp (*L. vannamei*) farming. The culture area increased from 264 Ha to 37,560 Ha during the period from 2009-10 to 2014-15. Andhra Pradesh (2, 76,077 MT) is the leading farmed shrimp producer with 78% and the rest of India production was 77, 336 MT (MPEDA, 2015). The exports production of *Litopenaeus vannamei* increased from 18247 to over 400000 MT in the country during 2010-11 to 2017-18 (MPEDA.2015) [2]. The shrimp aquaculture in India suffered significantly due to disease infections. In India, the gross economic losses due to shrimp diseases were estimated at more than Rs.1,000 crores in 2006-2008 and loss continues even now [3]. The threat of the diseases continued due to poor practicing of biosecurity measures like Pond preparations, water filtration and disinfection before and after pumping water in to the pond, not arranging bird and crab fencing, procuring the seed from unregistered hatcheries which supply non SPF seed. The diseases may be caused by various etiological agents such as viruses, bacteria, fungi, parasites, algal toxins, nutritional deficiency or the adverse environment. The frequent outbreaks of diseases such as White Spot Syndrome Virus (WSSV), Black Gill Disease (BGD), Running Mortality Syndrome (RMS), Loose Shell Syndrome (LSS), White Faecal Syndrome (WFS), White Muscle Disease (WMD) and Infectious Hypodermal and Haematopoietic Necrosis (IHHN) in shrimps causing economic loss to the aquaculture industry [4]. The present work was under taken to evaluate the disease out breaks in *L. vannamei* farming in Andhra Pradesh.

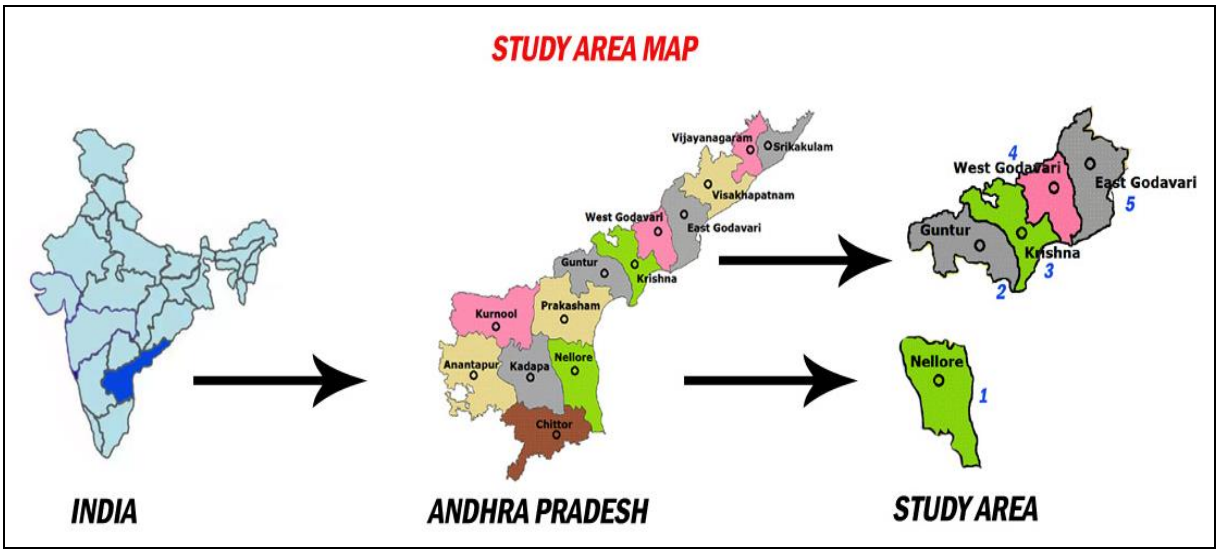

Fig 1: Andhra Pradesh map (Study area districts)

Methodology

The present study was conducted in five districts, viz, Nellore, Guntur, Krishna, West Godavari and East Godavari of Andhra Pradesh during summer season 2019. The five districts were selected based on the farming practices of the shrimp *L. vannamei.* Stratified random data sampling procedures was adopted for the selection of farms and shrimp farmers. A total of 80 farms in each district were considered for the study.

Table 1: Study area in five districts of Andhra Pradesh

S. No	Name of the Study area	No. of Villages covered	No. of Farms covered	Total culture area covered (Ha)
1	Nellore	7	70	154
2	Guntur	8	70	168
3	Krishna	8	70	199
4	West Godavari	8	70	176
5	East Godavari	8	70	165

The primary data were collected by survey method with the help of pre-tested schedule through personal interview to assess the disease impact of the shrimp farming in the selected study area.

Table 2: Impact assessment methods adopted by the study

Survey Method	Description of the Units Covered
Sample Survey	Farms registered with CAA/DoF Farmers in the 39 villages 350 farms.

Results and Discussion

Six major diseases viz. White Spot Syndrome Virus (WSSV), White Faecal Syndrome (WFS), Black Gill Disease (BGD), Loose Shell Syndrome (LSS), Running Mortality Syndrome (RMS), and Enterocytozoon Hepatopenaei (EHP) were found in *L. vannamei* culture ponds of all the 4 divisions of the Andhra Pradesh. About 60% culture ponds of Nellore, 50% in Guntur district, 62% in Krishna and 45% in West Godavari and 44% in East Godavari districts were affected by diseases. It was observed that, more disease related problems observed during the summer crop in all selected areas. It was observed that, only 15-25% of farms implemented bio-security measures in Nellore, Guntur and Krishna districts and more diseases were observed in those districts. Where as in West and East Godavari districts 30-40 % of farms implemented biosecurity measures, and maintained their farms without any Dissolved Oxygen (DO) problems, therefore less infections were observed in those districts.

All farmed brackish water and marine (penaeid) shrimp species are highly susceptible to white spot virus disease, with mass mortalities commonly reaching 80–100% in ponds within a period of 3–10 days [5,6]. White Spot Syndrome Virus (WSSV) has a wide host range in crustaceans [7, 8, and 9] and is potentially becoming cause to most of the commercially cultivating shrimp species (OIE 2003). Bright milky colour White spots appear on the carapace and other parts of the body. Due to lack of bio-security at the farm, pumping water without disinfection and filtration, cross contamination were observed to be main reasons for the outbreak of WSSV (Fig. 2).

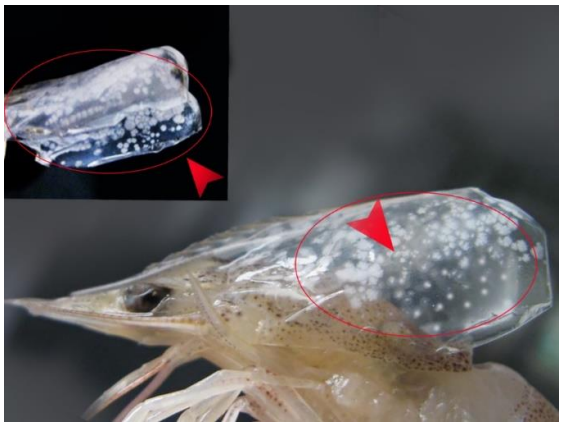

Fig 2: White Spots on carapace of the *L. vannamei*

White Faeces Syndrome (WFS) is observed in all the districts of *L. vannamei* culture ponds (Fig. 3). Incidences of WFS were observed after 20 days of stocking of the PLs in culture ponds. WFS in shrimp arises with protozoan Gregarines and Hepatopancreas infection caused by the high vibrio sps.

Bacteria the Lipid cells leaching into the gut. White faecal material float on the water surface in the culture ponds. Observed Vibrio species have been found in the pond water and fecal analysis from infected shrimps [11, 12].

Fig 3: White faecal matter in *L. vannamei* culture pond

Black Gill Disease (BGD) was observed in Guntur and Krishna districts majority of the ponds, observed due to the soil nature in these districts and observed less in West Godavari and East Godavari districts, Poor pond management and Poor water quality is the main reason for Black Gill Disease (BGD) disease (Fig. 4). This disease is normal in shrimps. It is commonly caused by to abiotic factors in the pond like heavy organic load in pond bottom, presence of pollutants, low DO problems and high stocking densities. Observed that disease infected ponds was not managed properly it will affect the growth and survival of the shrimps in the ponds [13]. Black gill Disease. In the initial stages appear light yellow or brown in colour and finally it leads to change as black in color [14]. The black gill diseases of shrimp causes damage in grow out ponds during the end of the culture.

Fig 4: Shrimps infected with black gill disease.

Loose Shell Syndrome (LSS) was observed in majority of ponds in all the five districts where the farms infected with white faeces and poor management i.e., Nellore, Guntur, Krishna, West Godavari and East Godavari districts (Fig. 5). Previously studies also reported in the cultured *Penaeus monodon* since 1998 in India [15]. The affected shrimp are with soft and thin exoskeleton, lethargic in movement, spongy while touch, feed intake was poor and also observed a gap between the muscle and the shell. Moribund, weak shrimp with soft shell swim near dikes of the ponds appear in shiny light pink colour and results in progressive mortality. The mineral deficiency, poor Nutrition and water quality and high loads of pathogenic bacteria and other disease causes of WFS may cause the loose shell syndrome [16, 17].

Fig 5: Loose Shell Syndrome (LSS) in *L. vannamei.*

Running Mortality Syndrome (RMS) was observed more in Nellore, Guntur, Krishna districts where the culture period was prolonged and damaged pond bottom soils and observed less in West Godavari and East Godavari (Fig. 6). The farmed shrimp in the affected ponds show continuous mortality with no symptom to any other diseases. In the initial stages of the RMS conditions shrimp show antennae cut, uropod turn pink or red in colour and later the Hepatopancreas begins will turn reddish yellow; finally entire body turns into red colour. Continuous internal mortality was noticed in the pond. The dead shrimp settle at the bottom of the pond and sometimes observed in check tray and not observed near the dikes and pond surface.

Several farmers have lost survival and productivity in their crops. In the beginning, the farmers managed the situation by immediately removing the dead shrimps and following strict biosecurity as well as Better Management Practices (BMPs) by reducing the pond pollution. Farmers observed stocked low stocking densities were able to harvest the crop successfully without Running Mortality Syndrome RMS.

Fig 6: Running Mortality Syndrome in *L. vannamei.*

Enterocytozoon Hepatopenaei (EHP), observed in Mainly in Nellore, Krishna district, less in Guntur than Nellore, Krishna districs also observed few ponds in West Godavari and East Godavari district, EHP is a microsporidian caused by parasite to be associated with slow (retarded or stunted) growth and

also cause white feces syndrome (WFS) in cultured shrimp in many of the shrimp farms observed in the Nellore, Guntur, Krishna districts (Fig.7). That the EHP could be detected from slow growing as well as WFS-affected animals [18]**.** EHP is also reported from slow growing shrimp. Thus, EHP is an emerging problem that is under urgent need of control [19]. It is caused by Microsporidian fungi infected from the soil in hatcheries infected poly chaeates giving as a feed for brood stock. Farmers are focusing to select EHP free seed sources with taking personal interest to check the seed quality for EHP diagnosis.

Fig 7: EHP infected shrimp *L. vannamei* stock.

Conclusion

Rapid aquaculture farming systems, the disease problems are becoming serious threat to the sustainability of shrimp aquaculture in Andhra Pradesh coastal districts. Aquaculture farmers should be aware about these diseases prevention and management of the diseases of shrimp and Health management. Farmers have to follow the Better management Practices (BMPs) with strong Biosecurity measures in all stages of the culture from pond preparation to harvesting, then only *L. vannamei* culture can be achieved without and diseases problems. The Better Management Practices (BMPs) like proper pond preparation, water and soil treatment with adopted reservoir system for water filling and also should purchase Specific Pathogen Free (SPF) quality shrimp seed from Coastal Aquaculture Authority registered hatcheries. During culture should follow the biosecurity measures viz., Farm materials disinfection, Foot and Hand dips, Shrimp toilets or sludge drains mainly Bird fencing and crab fencing to avoid disease transmission. If disease is found in pond that should be treat properly like water, Pond bottom, Animals with CAA registered Aquaculture Farm and Animal care products also farmers can adopt the practice weekly testing of the pond water and animals in Aquaculture Water Quality and Disease diagnosis Laboratory for monitoring the water quality changes, diseases symptoms during the culture period. With this practice farmers can easily identify the changes in water and animals, disease also can be prevented and control the disease possibility and can reduce the risk or loss of the crop from diseases.

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