SUMMARY
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Shrimp aquaculture is one of the most rapidly growing food producing sectors in the world. Fast expansion together with the intensification of farming practices in the last two decades has created several problems which are threatening the sustainability of shrimp industry. Of these, disease outbreaks in cultured animals are of major concern which results in severe economic losses. In addition to existing disease problems, several new diseases of unknown etiology remain to be studied to determine the causative agent and route of infection. Diseases spread across continents as a result of trafficking of farmed species leading to sudden emergence of a disease in a geographical region where such a disease problem was previously unknown. In India, though many diseases of unknown etiology have been frequently observed in hatcheries and grow out systems, no studies have been conducted to determine the possible association of viral/bacterial pathogens.

A new disease called the white tail disease has been observed in hatcheries and nursery ponds in India, threatening the success of the culture of *Macrobrachium rosenbergii*. Even though the causative agents [*Macrobrachium rosenbergii* nodavirus (MrNV) and extra small virus (XSV)] have been identified, there are no reports on the healthy carriers or natural reservoirs for these viruses. With this background information, the present study was conducted to understand the prevalence and causative agents of some new diseases affecting the culture of *Penaeus monodon* and *Macrobrachium rosenbergii*.

Majority of shrimp (*Penaeus monodon*) samples (healthy and moribund shrimps) analyzed in this study were collected during the disease outbreak. Of the 135 shrimp samples analyzed, 49% (67) were positive for White spot syndrome virus (WSSV) (37 in single step PCR and 30 in nested PCR). Monodon baculovirus (MBV) was detected in 29% (40) of the samples of which 21 were found positive in single step PCR and 19 were positive in nested PCR. Hepatopancreatic parovirus (HPV) was detected in 34% (47) of the samples (23 were found positive in first step PCR and 24 in nested PCR).

Presence of multiple viral infections was observed in many samples. Twenty-one samples (15%) showed the presence of triple viral infections (WSSV, MBV and HPV). Dual viral infection with WSSV and HPV were seen in 17 (12.5%) samples. Dual viral infection with WSSV and MBV were found in 6 and with MBV and HPV in 2 samples.
**Loose shell syndrome (LSS)** was one of the emerging diseases that were noticed during this study. The LSS affected shrimps show hard or leathery shell but not soft; and shrunken tail meat with gap between the shell and the muscle tissue (causing the “loose shell”). The moribund shrimp exhibited bacterial, fungal and algal parasite infections on the exterior. In many of the farms, the water colour was dark-greenish and in some farms LSS was also noticed in normal bluish-grey colour ponds. The histopathological studies revealed extensive degenerative changes in hepatopancreas including sloughing of the hepatopancreatic tubules from the basement membrane. Necrotized areas showed deep basophilia, karyorhexis and pyknosis. Deeply basophilic, inclusion-like bodies were observed in the cells of tubular epithelium as well as in the inter-tubular space. Secondary bacterial infections were also observed but not consistent. The bacteriological analysis also showed the presence of *Vibrio fluvialis*, *V. cincinnatiensis*, *V. fischeri*, *V. harveyii* and *V. natriegens*. Six samples (three from LSS and three from slow growth syndrome) were positive for an RNA virus called Laem-Singh virus (LSNV) by RT-PCR. None of the samples showed positive for necrotizing hepatopancreatitis (NHP) bacteria by PCR. Still the causative agent is not yet clear and more studies have to be conducted.

Another new disease, the **whitegut syndrome or swollen hindgut syndrome** of adults was also studied. The analysis of the affected shrimp showed multiple viral infections with WSSV, MBV and HPV but is not consistent. The histopathological studies revealed mild vacuolar degenerations in the tegmental gland of the hind gut but the chitin lining of the hindgut remained unaffected. Hepatopancreas showed degenerative changes. The bacteriological analysis showed the presence of *V. fluvialis*, *V. proteolyticus*, *V. carchariae*, *V. logei*, *V. metschnikovii* and *Bacillus* sp.

Another important emerging disease in focus of this study was the **swollen hindgut (SHG)** in postlarvae. Post larvae with SHG showed enlargement and distention of the hindgut folds and its junction with the midgut, although in some cases swelling also occurred in the midgut of the sixth abdominal segment in contrast to healthy PL. The abnormality caused cessation of the rhythmic movements of the hindgut–midgut junction resulting to failure of affected post-larvae to excrete fecal pellets. Hindgut appeared normal histologically but slight degenerations were seen in midgut epithelium anterior to the midgut-hindgut junction. Nevertheless, the significant pathology observed was in hepatopancreas, where severely necrotized tubules were evident with occasional deeply basophilic inclusion-like bodies. Only dual viral infections (WSSV/HPV or
WSSV/MBV) were noticed in the samples but not consistent. Bacteriological analysis of post larval samples showed the presence of *V. alginolyticus*.

Berried Freshwater prawns (*M. rosenbergii*) from Netravathi estuary, juveniles from a farm in Hasson (Karnataka) and Nellore (Andra Pradesh) were analyzed for *M. rosenbergii* nodavirus (MrNV) and extra small virus (XSV) by RT-PCR and were found to be negative. *Artemia* nauplii and Artemia flakes investigated in this study did not carry MrNV.

Prevalence of viruses in post larval samples from West Coast of India was analyzed by PCR. The year-wise analysis revealed an increasing trend in the level of WSSV infection over the years but a decreasing trend in the level of individual infections with MBV and HPV. Analysis of data on multiple virus infections revealed fluctuations in the dual and triple viral infections during the study period.