

Transboundary Shrimp Viral Diseases with Emphasis on White Spot Syndrome Virus (WSSV) and Taura Syndrome Virus (TSV)

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Crustaceans, specifically the cultured penaeid shrimp, are adversely affected by a number of diseases. Crustacean diseases that have significant social or economic impact on culture are mostly infectious in nature and many of them have no therapeutic remedies or treatments. There are currently 8 diseases of crustaceans listed by the OIE, seven of which are viral diseases of penaeid shrimp. This summary discusses two of the most important viral diseases in penaeid shrimp, white spot syndrome virus (WSSV) and Taura syndrome virus (TSV).

White Spot Syndrome Virus (WSSV)

WSSV was first described in Japan where an initial outbreak occurred in *Penaeus japonicus* in 1993 and was thought to have originated from imported stocks from China. This epizootic probably began in China around 1992 then subsequently spread to Taiwan, Japan and the rest of Asia. Infection with WSSV is characterized by white spots in the cuticle of heavily-infected shrimp and a high and rapid mortality which may reach 100% within 10 days from the onset of clinical signs. All shrimp species examined have been found to be susceptible to the virus and the host range extends widely into other marine and freshwater crustacean species, including copepods and even aquatic insect larvae. Several species of crabs and shrimp in the wild have been found infected with the virus without displaying any of the clinical signs and may act as a continual reservoir of infection. This persistence in wild crustacean species in the vicinity of shrimp farms may make the disease difficult, if not impossible, to eradicate from affected aquaculture areas. The causative agent is a double-stranded DNA virus and a member of the genus *Whispovirus* within the family *Nimaviridae*. Virions are rod-shaped to elliptical with a

trilaminar envelope and the size ranges from 80-120 × 250-380 nm. The virus was named after the gross signs of the disease which included white inclusions of various sizes embedded in the carapace at the late stages of infection. These white spots apparently represent abnormal deposits of calcium salts.

WSSV is considered as one of the most devastating viral diseases of cultured penaeid shrimp and is now widespread in Asia. Previous efforts by two research groups reported the absence of WSSV from cultured or wild *P. monodon* in the Philippines up to the late 1990s. Although WSSV came to the Philippines much later than the rest of Asia, the disease can now be easily diagnosed from samples obtained from various parts of the Philippines using polymerase chain reaction (PCR) assay. Since 1999 to early 2002, there were only few documented cases about mass mortalities associated with WSSV. However, starting in the last quarter of 2002 up to the present, mass mortalities have been frequently reported in all major shrimp producing regions in the Philippines. The outbreaks usually occurred between 60-90 days of culture. Mortality ranges from 80 to 95% in intensive culture system and 30 to 70% in extensive culture system. Also, WSSV has been detected by using PCR in 10% (dry season) and 0.3% (wet season) of the wild *P. monodon* collected from 7 sampling sites which are considered as primary sources of spawners or broodstocks in the Philippines.

Strategies that have been developed or adapted to limit the losses from this viral disease include the stocking of WSSV-free fry, use of reservoir to hold water and allow settling for at least 5 days, exclusion of potential WSSV carriers from the culture area, use of green-water culture system, nutritional supplementation with vitamins, regular application of probiotics in the rearing water, good cooperation among shrimp farmers who share the same waterways, and implementation of proactive monitoring scheme. The government, through the Bureau of Fisheries and Aquatic Resources (BFAR), strengthened existing regulations covering in-country movement of live shrimps, especially postlarvae. This includes issuance of health certificate at ports of entry and origin.

Taura Syndrome Virus (TSV)

Taura syndrome, caused by Taura syndrome virus, was first recognized in shrimp farms in Ecuador in 1992 where the disease caused catastrophic losses with a very high cumulative mortality rate of affected pond-cultured *Litopenaeus vannamei*. After its recognition as a distinct disease of cultured *L. vannamei* in Ecuador, TSV spread rapidly to virtually all of the shrimp growing regions of the Americas through shipments of infected postlarvae and broodstocks. The principal host for TSV is *L. vannamei*, although other shrimp species can be infected. Eastern hemisphere penaeids like *P. chinensis*, *P. monodon* and *P. japonicus* have been experimentally infected with TSV. Cumulative mortalities due to TSV outbreak ranged from 40% to more than 90% in cultured *L. vannamei*. Survivors of TSV infections may carry the virus for life. The virus has been demonstrated to remain infectious in the

feces of sea gulls that have ingested infected shrimp. This implicates birds as an important route of horizontal transmission of the virus. The characteristic gross pathology in *L. vannamei* include reddening of the tail fan and visible necrosis in the cuticle. The outbreak usually occurs during the first 60 days of culture. TSV was tentatively assigned under the family Picornaviridae. According to structure, the virion is 32 nm, non-enveloped, icosahedron and a single stranded RNA genome.

TSV was introduced into Asia through the importation of infected *L. vannamei* from Central and South American sources. TSV outbreaks were first reported in Taiwan where *L. vannamei* had been imported live to be used in commercial aquaculture ponds. Recently, there were confirmed reports of TSV infections in Thailand and Indonesia which also import their fry and breeders. In the Philippines, *L. vannamei* is already being cultured in Luzon area using imported postlarvae. However, due to the existence of a regulation promulgated in 1993 by BFAR under the Fisheries Administrative Order No. 189 Series of 1993, prohibiting the import of all species of live shrimp and prawns of all stages except for scientific purposes, importation of *L. vannamei* into the Philippines is considered illegal. A sample from a batch of fry that was confiscated on 8 May 2003 was tested at the National Taiwan University for the presence of TSV using the IQ2000 TSV Detection and Prevention System and was found negative for the virus. However, there is always the possibility of contamination with TSV if the illegal shipments of *L. vannamei* remain uncontrolled.

Methods to prevent and control TSV infection include total de-population of infected stocks, disinfection of the affected culture facility, and restocking with TSV-free fry that have been produced from TSV-free broodstock. In addition, active national quarantine, monitoring and surveillance systems are very valuable to help combat the spread of the virus.