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Education Series

Infectious Myonecrosis Virus (IMNV)

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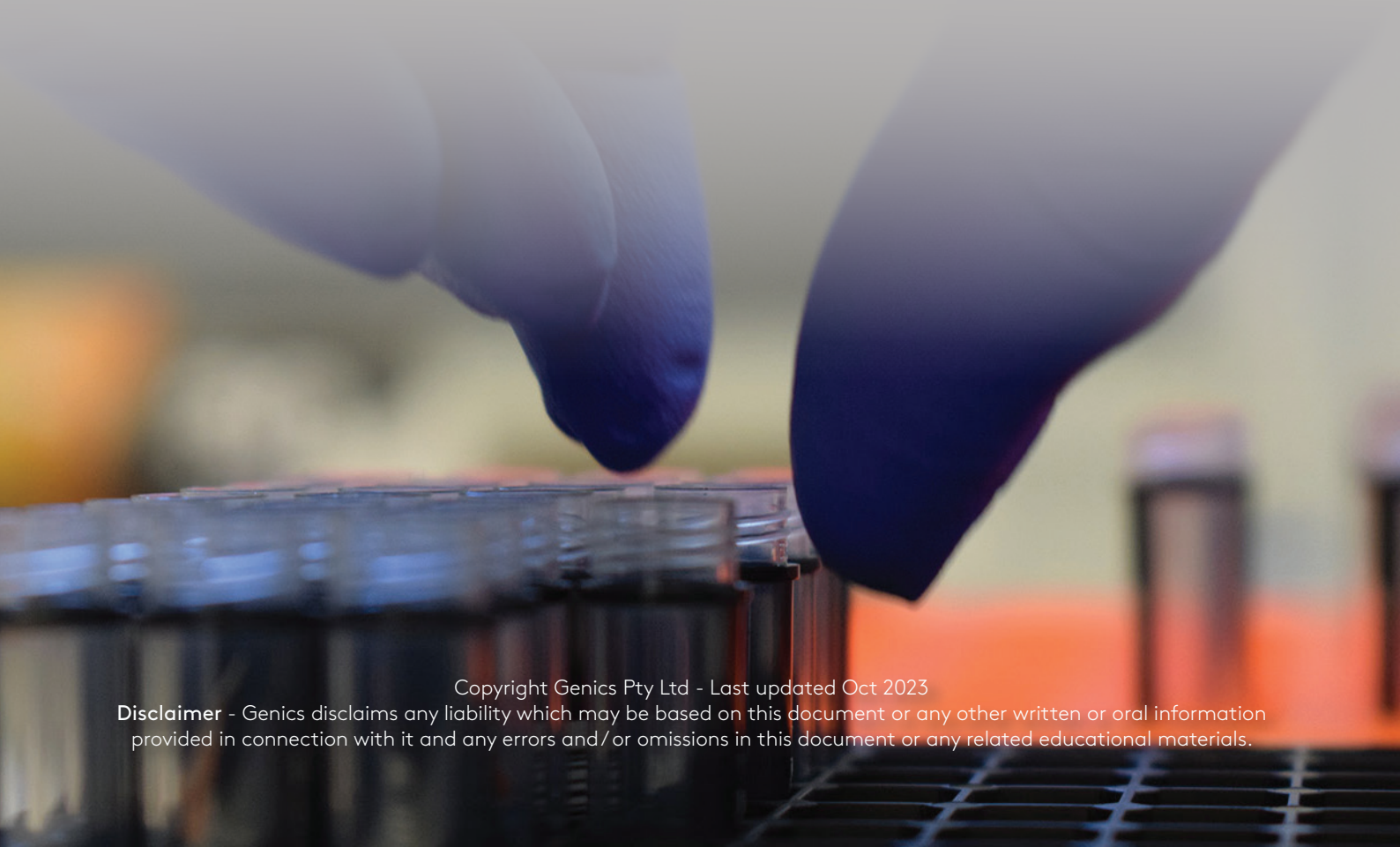

Shrimp get sick too. Infectious Myonecrosis disease, caused by the virus IMNV (Infectious Myonecrosis Virus), leads to the destruction of muscular tissue due to a viral infection. IMNV infects mainly striated muscle (skeletal and sometimes cardiac muscle), haemocytes, lymphoid organ and generalized connective tissues. Infectious Myonecrosis Virus was first reported in *Penaeus vannamei* from Brazil in 2002, Indonesia in 2006, then Malaysia in 2018. Recent studies revealed wild *P. monodon* from the Indian Ocean tested positive to IMNV.

IMNV is a small virion (40 nm), and its genome consists of a single, double-stranded (ds) RNA molecule that replicates in the cytoplasm of the target cells. Anecdotal information suggests that IMNV causes health problems in densely populated aquatic animal production environments. IMNV from Indonesia has 99.6% identity to the Brazilian strain, which indicates that the disease was introduced in 2006 from Brazil to Indonesia possibly through *P. vannamei* stocks exported to Asia.

Observation from the field suggests that IMNV 'inactivation' is more difficult using routine pond disinfection methods like sun drying or chlorination, compared to other penaeid shrimp viruses like IHHNV, YHV1, WSSV and TSV. Additionally, it is probable that IMNV virions remain infectious in the gut and faeces of seabirds that have eaten sick or dead shrimp due to infection with Infectious Myonecrosis Virus.

IMNV infection is characterized by mass mortality (40 - >70%). This may be observed at the early stage of juveniles to subadults. Environmental stressors like sudden changes in water salinity and temperature may predispose susceptible populations to IMNV disease outbreaks. Sudden *P. vannamei* mortality due to infection with IMNV may be observed in regions where IMNV is enzootic and associated with other stressful events like sub-optimal water quality.

Causative agent of Infectious Myonecrosis. The pathogenic agent Infectious Myonecrosis Virus (IMNV) belongs to the family Totiviridae. IMNV can be transmitted to susceptible shrimp populations by infected faeces of marine birds similar to that of Taura Syndrome Virus (TSV), however there is no conclusive evidence.

Susceptible species for IMNV infection in which viral presence has been demonstrated and disease with clinical signs has been observed, include *P. vannamei, P. esculentus and P. merguiensis*. Other species with incomplete evidence of susceptibility include *P. monodon and P. stylirostris* with reduced survival of *P. monodon* infected with IMNV reported from Indonesia. In addition, *P. subtilis* have been reported to be PCR positive to IMNV but not having active infection.

Clinical signs of IMNV. Clinical signs can occur in juvenile or subadult stages in grow-out ponds. Affected shrimp have white muscle discoloration in tails (see image below). Many severely affected shrimps continue to feed and have full guts just before stressors trigger mortality. During IMNV infection outbreaks, affected shrimp become moribund and then mortality can overcome and continue during many days. Appearance of IMNV clinical signs usually onset just after stressors are present in pond water.

Macroscopic view right image. In this image subadults of farmed white shrimp, *Penaeus vannamei*, are severely sick due to IMNV infection. Whitish body discoloration can be observed. The main finding is red-orange muscle discoloration due to muscle fiber necrosis and tissue decomposition when shrimp are still alive. Lesions are visible at the end of the abdomen, affecting the last abdominal segments.

Early detection using Shrimp MultiPath™ can give farmers up to four weeks' notice before clinical signs appear and prior to mass mortalities. In commercial grow-out shrimp ponds, IMNV infection can be detected early, and farmers advised just a few days after juveniles are stocked in ponds. This information is an early warning system preparing farmers for a critical period when slowing the spread of the disease and maximizing production outputs is still possible. Importantly Shrimp **Multi**Path™ detects both Indo-pacific and eastern Latin American strains of IMNV (Genz et al., 2023 Aquaculture).

Early detection empowers the implementation of prompt mitigation strategies. These include:

- Shrimp **Multi**Path™ for pre-screening of broodstock before placing in production tanks.
- Shrimp **Multi**Path™ for pre-screening of PLs discarding tanks that test positive for IMNV infection.
- Suspending pond stocking with PLs from infected hatcheries.
- Avoiding live and fresh feeds (especially for broodstock) from countries with historic status of IMNV infections.
- Not feeding female broodstock 6 hours before moving to spawning tanks to reduce possible offspring contamination with faeces, and reinforcing egg and nauplii washing and disinfection before transferring to hatchery tanks to reduce possible IMNV contamination from broodstock faeces.
- Use PLs from breeding programs focused on exclusion plans and production of IMNV-free or SPR/SPF-resistant or tolerant PLs.
- Pond stocking only with IMNV Shrimp **Multi**Path™ negative tested PLs and frequent pond surveillance for IMNV using molecular tools are procedures that will help reduce and control IMNV infections.

Farming preventive strategies may reduce IMNV transmission by:

- Fallowing and restocking of entire farming zones with IMNV-free stocks.
- Removing sick or dead shrimp to prevent transmission through cannibalism; capture procedures must not represent stress that trigger mortality.
- Reducing pond density (partial harvest - procedures must not represent stress that trigger mortality)
- Proper technical assistance for periodic monitoring with appropriate diagnostic tools will allow for discrimination between IMNV and other disease or external conditions with similar clinical signs.
- Biosecurity around infected ponds must be increased, for example separating nets and equipment, physical barriers put in place, inform adjacent farmers of the infection, and be the first to harvest when commercial size is reached. Disease mitigation plans should include pathogen exclusion programs.

The Shrimp **Multi**Path™ PCR is used to confirm when broodstock or PL are infected with IMNV infective particles. This data can be used to eliminate infected broodstock and/or PL batches from production systems before stocking maturation tanks and ponds with infected organisms.
Additionally, Shrimp **Multi**Path™ can be used for early pathogen detection during grow-out.

Target organs for sensitive Shrimp MultiPath™ detection are striated muscles, haemocytes, connective tissue and lymphoid organs. Post-larvae heads may also be used.

Sampling and preservation of tissues for PCR tests should be done in labelled vials and/or tubes that seal. The fixative should be 70% laboratory grade ethanol. Tissue samples should include striated muscle, haemolymph, connective tissue and/or lymphoid organ. **Sampling equipment must be sterilized between samples**. Non-destructive testing of high value broodstock can be done by collecting haemolymph or pleopods when necessary.

Sampling numbers and health management plans should be established with your health expert who will take into account factors such as climate, farm size and location, company structure and risk appetite, market channels for sale of product etc. There is also the option to pool samples for IMNV testing to maximize value for money with PCR testing.

It is worth noting that according to the WOAH (World Organisation of Animal Health), infected crustacean products can be treated at 75°C for 5 minutes to inactivate the pathogen.

Longer term solutions to disease caused by IMNV include:

- Early pathogen detection and risk mitigation through using Shrimp **Multi**Path™
- Breeding for tolerance, resistance and biosecurity measurements implementation as a preventative strategy
- Good sanitary management and farming practices may help to control the disease
- Improvement of maturation and hatchery sanitary molecular controls
- Frequent broodstock and PL PCR-screening
- Adequate broodstock management (especially females prophylactic measurements),
- Use of IMNV-negative postlarvae and good shrimp farm management like strict feeding rate control
- Appropriate stocking density
- Avoiding environmental stressors in infected ponds.

Contact Genics at info@genics.com if you would like to discuss these options for your operation or visit www.genics.com for further details.

Learn how to dissect your shrimp for testing

Visit our **NEW Educational page** here to learn how to:

- Sterilize your equipment before sampling
- Selecting the correct ethanol for tissue preservation
- Identify and sample shrimp target organs for Shrimp **Multi**Path™ testing

Questions?

info@genics.com

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IMNV

Did you know

Shrimp rarely harbour only one pathogen and farmers often don't know which ones they are. This is a significant economic risk for farmers. **Genics has solved this problem with** Shrimp **Multi**Path™. It's the ultimate early warning system for farmers, **detecting 16 pathogens in a single test** that is unparalleled in today's industry for its sensitivity and accuracy.