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Education Series

Hepatopancreatic parvovirus (HPV)

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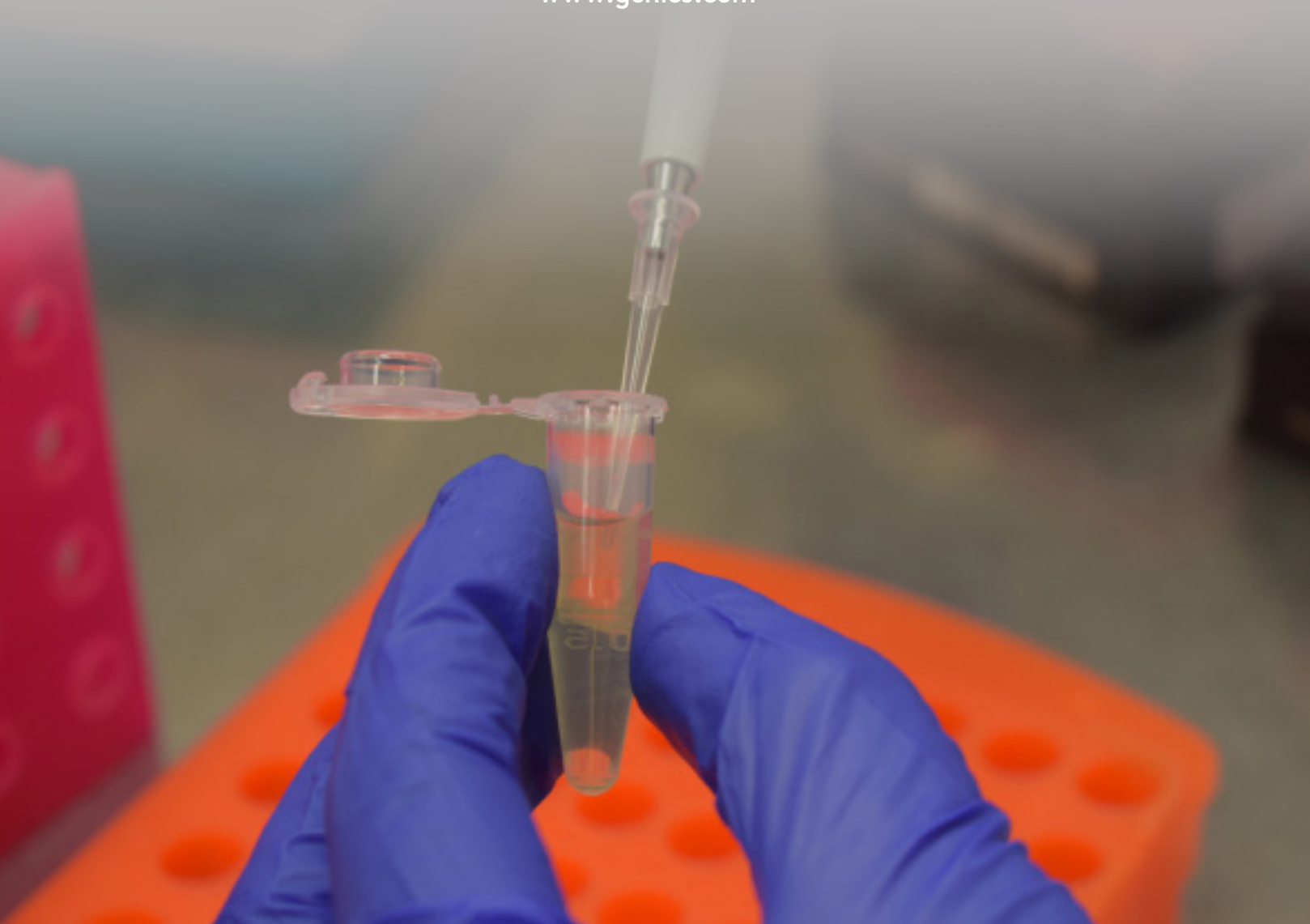

Shrimp get sick too. Hepatopancreatic parvovirus disease is an infectious shrimp disease caused by the virus HPV (Hepatopancreatic parvovirus). HPV infects tissues of digestive tract including hepatopancreas, anterior midgut caeca and midgut epithelium. Hepatopancreatic parvovirus disease was first reported in marine farmed shrimp from Singapore in1984. There were also reports a similar disease in *P. chinensis* (China), *P. monodon* (Philippines), *P. semisulcatus* (Kuwait) and *P. merguiensis* (Singapore).

HPV consists of a small virion (22 nm) with a negative single-stranded DNA that replicates in the nucleus of the target cells. It is suspected that HPV could produce more often health problems in densely populated aquatic animal production environments. Hepatopancreatic parvovirus disease is known to occur as co-infection with other pathogens such as Laem-Singh virus (LSNV).

Importantly, in spite that HPV may not cause evident massive mortalities in grow out ponds, it may produce slow growth and reduced production in farmed *P. monodon*. HPV can be spread between shrimp populations through horizontal contamination both by contaminated water or cannibalism. In spite that vertical transmission is unlikely, eggs can be contaminated into spawning tanks coming into contact with infected female feces. HPV infection can be detected by PCR analysis in almost all shrimp life stages as post-larvae, juveniles and adults. HPV detection in eggs or larvae, may be possible when egg have suffered contamination during spawning.

Causative agents of Hepatopancreatic parvovirus disease. The pathogenic agent HPV also known as Penaeus monodon densovirus (*Pm*DNV), being a putative parvovirus (Brevidensovirus). Currently HPV disease has been reported in Asia, Africa, Australia and the Americas.

Clinical signs of HPV. There is no one specific sign for HPV infection. With the pathogen generally causing atrophy of the hepatopancreas, anorexia, slow growth, reduced activity and gill fouling. It is suspected that HPV infected shrimp are also infected by other viral pathogens which frequently mask HPV infection effect. Heavy hepatopancreas infections cause no evidence of inflammatory response with haemocyte migration.

Chronic mortalities have been associated to HPV infection in farmed shrimp in early larval or postlarval populations. Hepatopancreatic parvovirus disease may produce slow growth in juvenile stages. HPV infection effect on adults is not clear. However, it may ensue mortality when severe infections are present simultaneously with high metabolic demands for example due to gonad maturation. Epizootics due to HPV infection have not been reported in shrimp farming facilities. Considerable losses to farmers can be incurred due to stunted growth as a result of HPV.

Early detection using Shrimp MultiPath™ (SMP). Early testing and detection with SMP can give hatchery and farm managers valuable time to notice the presence of pathogens before clinical signs appear and prior to mass mortalities. In commercial hatcheries, nursery ponds and growout ponds, HPV infection can be detected early, and farmers advised as soon as postlarvae become positive or juveniles are recently stocked in ponds. In maturation scenarios broodstock infected with HPV can be removed from the spawning cohort to minimize chance of transmission to progeny due to infected feces. This information is an early warning system preparing farmers for a critical period where slowing the spread of the disease and maximizing production outputs is still possible.

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

- PCR assays for pre-screening of broodstock before placing in production tanks
- PCR assays for pre-screening of spawned eggs and nauplii discarding tanks that test positive for HPV infection
- Suspending pond stocking with PLs from infected hatcheries
- Avoiding live and fresh feeds (especially for broodstock) from countries with historic status of HPV infections
- Not feeding female broodstock 6 hours before moving to spawning tanks to reduce eggs/embryos contamination with HPV infected feces, and reinforcing eggs and nauplii washing and disinfection before transferring to hatchery tanks to reduce possible HPV contamination from broodstock feces
- Use PLs from breeding programs focused on exclusion plans and production of HPV-Free or tolerant PLs
- Pond stocking only with HPV PCR (negative) tested PLs and, frequent pond surveillance for HPV using molecular tools in combination with statistically significant sample plans are procedures that will help control HPV infections.

Farming preventive strategies may reduce HPV transmission by:

- Fallowing and restocking of entire farming zones with HPV-free stocks
- Removing sick or dead shrimp to prevent transmission through cannibalism
- Reducing pond density (partial harvest)
- Organic debris and feces removal (syphoning and/or bacterial bioremediation when possible), must be considered as priority tasks
- Proper technical assistance for periodic monitoring with appropriate diagnostic tools will allow for discrimination between HPV and other disease with similar clinical signs
- Biosecurity around infected ponds must be increased, separating nets and equipment, physical barriers put in place, inform adjacent farmers of the infection, and first to harvest when commercial size be 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 HPV infective particles. This data can be used to eliminate infected broodstock and/or PL batches from production systems before stocking ponds with infected organisms.

Susceptible species for HPV infection in which viral presence has been demonstrated (natural infection) include *P. vannamei, P. monodon, P. stylirostris, P. indicus, P. esculentus, P. japonicus, P. merguiensis, P. penicillatus, P. semisulcatus, P. schmitti* and *P. chinensis*. Other species with histological positive lesions due to HPV is Malaysian freshwater prawn *Macrobrachium rosenbergii*.

Target life-history stages for accurate early detection include early PL stages (both at hatchery and/or at farm raceways and nursery ponds), juveniles and adults; HPV infection in eggs or larvae can occur by female fecal contamination during spawning.

Target organs for sensitive SMP detection are hepatopancreas, anterior midgut cecae, anterior midgut tissue and whole small shrimp or shrimp heads. Adequate tissue sampling is essential for accuracy of HPV molecular detection and quantitation. When PLs or small shrimp be PCR tested, it´s recommend making a homogenate (of the head) in order to take then an aliquot for DNA extraction and a subsequent PCR analysis for HPV genomic detection.

Sampling and preservation of tissues for PCR tests should be done in labelled vials and/or tubes that seal. The fixative should be 70-95% laboratory grade ethanol or RNALater. Tissue samples for HPV molecular detection should include hepatopancreas, midgut, or whole PLs or PL heads suppling 2 to 5 mm^2 in size. Sampling equipment must be sterilized between samples.

Sampling numbers and **Health Management Plans** should be established with your health expert who will consider factors such as nauplii/postlarvae source, climate, farm size and location, company structure, market channels for sale of product, etc. Pooling shrimp samples for HPV testing to maximize value for money with PCR testing is routinely done.

Longer term solutions to disease caused by HPV include breeding for tolerance and resistance and biosecurity measurement implementation as a preventative strategy. Good sanitary and good management farming practices may help to control the disease. These include, among other things, improvement of maturation and hatchery sanitary molecular controls, frequent broodstock and PL PCR-screening, adequate broodstock management (specially females prophylactic measurements), use of HPV-negative postlarvae and good shrimp farm management like strict feeding rate control, reduction of organic matter in tanks and ponds, and appropriate stocking density and weekly-based surveillance for clinical signs of HPV causing-disease. Early pathogen detection and risk mitigation through the use of Shrimp **Multi**Path™ is an important tool for lessening potential HPV infections.

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 SMP testing
- + Much more...

Questions?

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HPV

Did you know...

Shrimp rarely harbour only one pathogen and farmers often don't know which ones they are. This is a huge economic risk for farmers. Genics has solved this problem with Shrimp MultiPath™. It stacks up as the ultimate early warning system for farmers, detecting 13 pathogens in a single automated test that is unparalleled in today's industry for its sensitivity and accuracy.