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Education Series

Gill Associated Virus (GAV)

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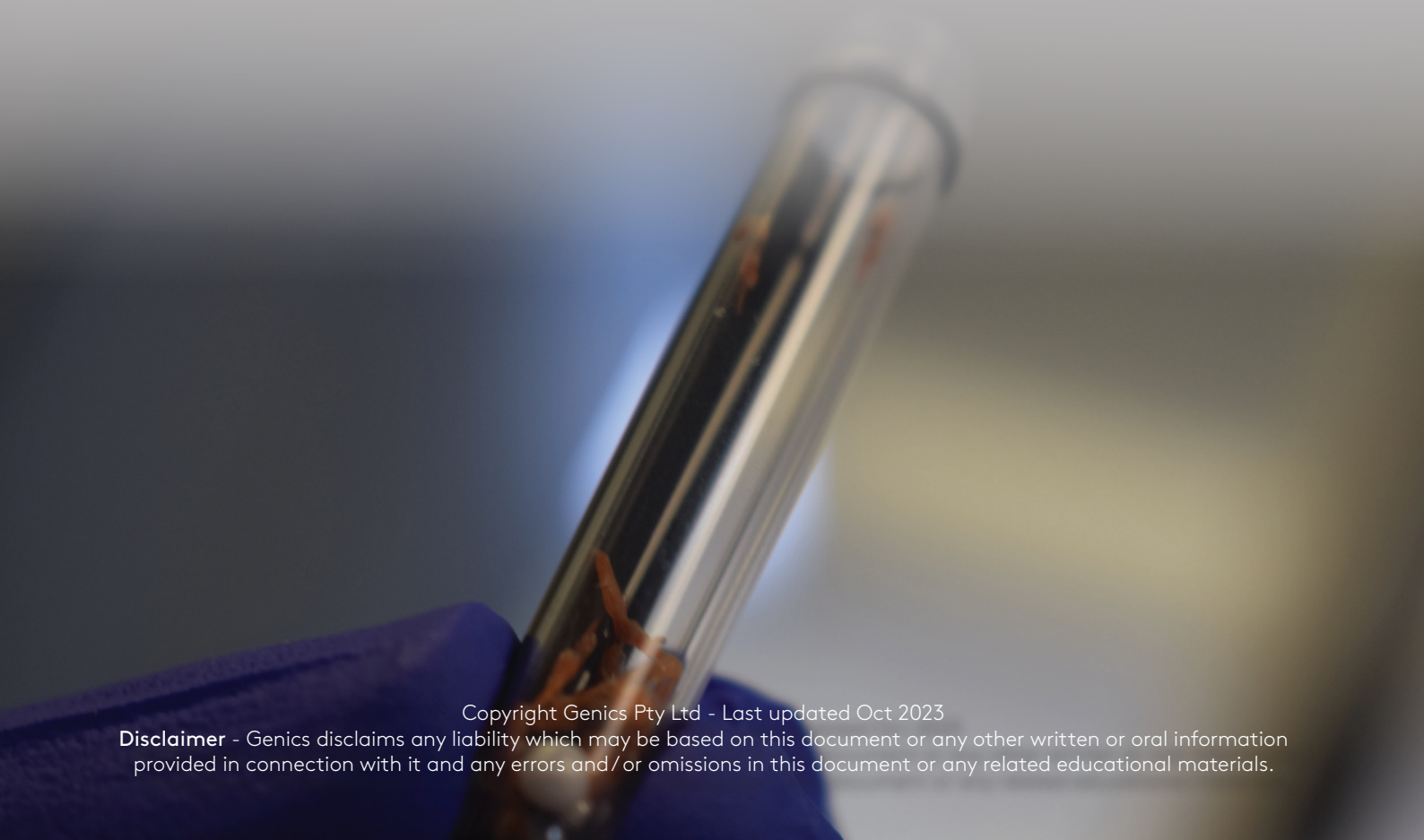

Shrimp get sick too. Gill Associated Virus (GAV) is also known as Yellow Head Virus variant 2 (YHV2). GAV causes similar histopathological and cytopathologic findings to YHV1, but it is less virulent. GAV is also known to be associated with mid-crop mortality syndrome (MCMS).

GAV has been detected in *Penaeus monodon* from Australia, Vietnam and Thailand. GAV has also been documented in Kuruma shrimp (*Penaeus japonicus*) from Australia and notably commonly found as a co-infection with Mourilyan Virus (MoV). GAV is associated with MCMS where mortalities progressively accumulate from the mid-late juvenile stage onwards. The disease onset is dose-related, and it involves the systemic distribution of virus in connective tissues throughout the cephalothorax or head region.

Shrimp infected in laboratory trials with a high dose of GAV progress rapidly to disease with high viral loads and typical pathology leading to mortalities. Those infected with a low dose, do not develop disease and the virus remains as a low-level infection for at least 60 days. There is evidence that stress can lead to rapid increases in viral load.

In chronic infections, there are no discernible clinical signs, and it is restricted primarily to spheroid bodies in the lymphoid organ. Chronic GAV infections occur at high prevalence in wild and farmed *P. monodon* in eastern Australia and can cause disease in farms, particularly when culture conditions become less favourable. It has been associated with mortalities of up to 80% in Australia.

The causative agents of GAV is a rod-shaped, positive single-stranded RNA virus, of the genus *Okavirus* and family *Roniviridae* within the Nidovirales.

Transmission can occur horizontally, directly from the water column and through ingestion of infected material. There is evidence that horizontal transmission can also happen from chronically infected shrimp in absence of disease. Vertical transmission occurs through surface contamination or infected tissue surrounding the fertilized eggs.

The appearance of disease and the viral multiplication is induced by environmental and handling stress. Mortality generally occurs in early to late juvenile stages in rearing ponds.

Experimental infections with GAV indicate that larger (approximately 20g) Kuruma shrimp are less susceptible to disease than smaller (approximately 6 to 13g) shrimp of the same species.

Shrimp species susceptible to GAV are *Penaeus monodon* which is naturally susceptible, and *Penaeus esculentus*, *Penaeus merguiensis*, and *Penaeus japonicus* which have been proven to be experimentally susceptible.

There are reports that small shrimp such as *Palaemon styliferus*, and krill and crabs may carry this virus.

Clinical signs of GAV. Gross signs of acute infection include reddening of body, appendages, tail fan and mouth parts, pink to yellow coloration of the gills, and biofouling with exoparasites. GAV unlike YHV variant 1 does not induce the pale-yellow coloration, and mortality is usually preceded by a pink to red body color. As for histopathologic changes, it is characterized by the expansion of spheroid numbers and extensive necrosis in the lymphoid organ.

At the farm level, a high mortality (up to 80%) can be seen, moribund shrimp aggregating near the surface at pond edges, and an initial increase in feeding at an abnormally high rate followed by a sudden decline.

Shrimp who are chronically infected, show normal appearance and behavior.

Early detection using Shrimp Multipath™ can give farmers time to mitigate disease spread and maximize production outputs. It is important to establish early GAV disease mitigation strategies. They may include viral exclusion programs, in order to confirm when broodstock or postlarvae are positive to GAV. It can be used for early rejection of infected shrimp batches before stocking in maturation or grow-out ponds. If GAV is detected in commercial farms, disease expression risk may be reduced by avoiding physico-chemical parameter abrupt changes that stress shrimp population, and also keeping environmental conditions as stable as possible. Shrimp **Multi**Path™ can also be used to develop genetic lines that are tolerant of GAV which has been achieved commercially in *P. monodon*.

Target life-history stages for accurate early detection include postlarvae, juveniles, subadults and adults. Moribund shrimp from pond edges are the preferred source of samples for diagnosis during disease outbreaks. When juveniles or subadults are obtained from ponds suspicious of GAV infection, it is desirable to sample sick shrimp for further PCR tests. Nevertheless, it has been suggested that healthy shrimp from suspicious ponds may also give positive results for GAV detection tests, which is favourable for confirmatory disease diagnosis. It is worth noting that GAV has been detected in spermatophores and mature ovarian tissue of broodstock, and in fertilized eggs and nauplii spawned from infected females.

Target organs for sensitive Shrimp **Multi**Path™ detection are lymphoid organ, gills and haemolymph. In surveillance of juvenile or adult shrimp that look normal, lymphoid organ is the selected tissue.

Sampling and preservation of tissues for Shrimp **Multi**Path™ should be done in labelled vials or tubes with screw cap seals and fixative should be 70% laboratory grade ethanol. Tissue size can be 2-5 mm^2 in size. Sample equipment must be sterilized using appropriate methods between sample tubes.

Sampling numbers and Health Management Plans should be established with your health expert who will take into account factors such as postlarvae source, climate, farm size and location, company structure, market channels for sale of product, etc. There is also the option to pool samples for Shrimp **Multi**Path™ testing to maximize value for money with PCR testing.

Longer term solutions to GAV include breeding for tolerance and resistance and use of Shrimp **Multi**Path™ exclusion programs. Early pathogen detection and risk mitigation through the use of **Shrimp Multi**Path™ is also a foundational approach to solving GAV pond consequences.

Contact Genics at info@genics.com if you would like to discuss shrimp health management 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
- Identifying and sampling shrimp target organs for Shrimp **Multi**Path™ testing

Questions?

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GAV

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.