**PATHOGEN INFORMATION**

1. **CAUSATIVE AGENT**

   1.1. Pathogen type
   
   Virus.

   1.2. Disease name and synonyms
   
   No specific disease name but acute virus infection can be found in *Penaeus monodon* displaying characteristic gross signs of mid-crop mortality syndrome and in *Penaeus japonicus* suffering idiopathic mortalities.

   1.3. Pathogen common name and synonyms
   
   Mourilyan virus.

   1.4. Taxonomic affiliation
   
   1.4.1. Pathogen scientific name (Genus, species, sub-species or type)
   
   Currently unclassified.

   1.4.2. Phylum, class, family, etc.
   
   Possible member of the Bunyaviridae.

   1.5. Description of the pathogen
   
   Spherical to ovoid-shaped, enveloped virus (85–100 nm in diameter) with a diffuse surface structure; replicates in the cytoplasm; virion maturation occurs at endoplasmic membranes.

   1.6. Authority (first scientific description, reference)
   

   1.7. Pathogen environment (fresh, brackish, marine waters)
   
   Marine and brackish water.

2. **MODES OF TRANSMISSION**

   2.1. Routes of transmission (horizontal, vertical, direct, indirect)
   
   Horizontal transmission via injection and likely via ingestion of infected tissue; vertical transmission has not been reported but cannot be excluded.

   2.2. Life cycle
   
   No data.

   2.3. Associated factors (temperature salinity, etc.)
   
   No data.

2.4. **Additional comments**

   None.

3. **HOST RANGE**

   3.1. Host type
   
   Shrimp.

   3.2. Host scientific names
   
   *Penaeus monodon, Penaeus japonicus*.

   3.3. Other known or suspected hosts
   
   No data.

   3.4. Affected or suspected life stages
   
   Young to adult shrimp.

   3.5. **Additional comments**
   
   Mourilyan virus has been detected at very low levels in *Penaeus merguiensis* using RT-nested PCR but a productive infection state has not been demonstrated. Minor nucleotide sequence variations (< 5%) occur between Mourilyan virus isolates from Australia, Malaysia and Thailand, indicating that strain variants exist in divergent populations of *P. monodon*. No significant sequence variation has been detected between virus isolates infecting eastern Australian *P. monodon* and *P. japonicus*, or among *P. monodon* sampled from various locations in north and eastern Australia and in Fiji, suggesting a single genetic lineage might exists in the shrimp populations in these regions.

4. **GEOGRAPHICAL DISTRIBUTION**

   4.1. Region
   
   Asia and Pacific.

   4.2. Countries
   
   Known presence in Australia, Fiji, Malaysia, Thailand and Vietnam.

5. **CLINICAL SIGNS AND CASE DESCRIPTION**

   5.1. Host tissues and infected organs
   
   Lymphoid organ spheroids and stromal matrix cells of tubules, cuticular epithelium and underlying connective tissues of the stomach and of the cephalothoracic exoskeleton, antennal gland tubules, primary and secondary gill filaments, epithelial pillar cells, hepatopancreas connective tissues, the pericardial septum, epicardium and fixed phagocytes within the myocardium, haemocytes within haematoipoietic tissues, glial, neurosecretory and giant cells associated with the segmental nerve ganglia, nerve cell bodies.
5.2. Gross observations and macroscopic lesions
No data.

5.3. Microscopic lesions and tissue abnormality
In haematoxylin and eosin stained sections of cephalothorax tissues, the presence of aggregates of cells with hypertrophied nuclei, known as spheroids, in the lymphoid organ is the most obvious pathology caused by Mourilyan virus. Spheroids numbers, the extent of cytoplasmic vacuolization within spheroid cells, and the amount of necrotic cell debris within spheroids, increase in relation to infection severity. In severe infections, ectopic spheroids may also be detected in gill and in connective tissue associated with various cephalothorax organs.

5.4. OIE status
Listed (under study) under Article 1.2.3. of the Aquatic Code

6. SOCIAL AND ECONOMIC SIGNIFICANCE
Considered to be of some economic importance due to its association with disease and mortalities in *P. monodon* and *P. japonicus*.

7. ZOONOTIC IMPORTANCE
No data.

8. DIAGNOSTIC METHODS
Procedures leading to definitive diagnosis can include: (i) basic surveillance methods; (ii) preliminary presumptive methods when infection is suspected or abnormal mortalities occur; and (iii) confirmatory methods for suspected low-level of chronic infections and for suspected involvement in mortality outbreaks.

8.1. Surveillance methods
RT-nested PCR as described in Cowley et al. (2005) (*Diseases of Aquatic Organisms*, 66, 91–104) or real-time PCR as described in Rajendran et al. (2006) (*Journal of Virological Methods*, 137, 265–271) on RNA extracted from lymphoid organ, hemocytes gill tissue of juvenile or adult shrimp, on whole post-larvae.

8.2. Presumptive methods
Enlarged lymphoid organ indicating the existence of viral-induced spheroids, idiopathic mortalities in *Penaeus japonicus* and gross disease signs consistent with mid-crop mortality syndrome in *Penaeus monodon* are potential indicators of acute infection. In haematoxylin and eosin stained histological sections: the presence of Type 1 spheroids (comprising small tubule occlusions of densely packed cells) and/or Type 2 spheroids (comprising larger aggregates of cells with enlarged nuclei and variably vacuolated cytoplasm, as well as debris due to cell necrosis) in the lymphoid organ as well as ectopic spheroids in other tissues.

8.3. Confirmatory methods
In severe infections, examination of lymphoid organ and gill tissue by electron microscopy for evidence of mature enveloped virions in the cytoplasm of infected cells can assist confirmatory diagnosis. However, as mature virions only appear to occur in circumstances where infection levels are extremely high, lower-level infection may not be detected. It is recommended that *in situ* hybridization on tissue sections be used for diagnosis of moderate to high-level infection and that either RT-nested PCR or real-time RT-PCR employing RNA isolated from lymphoid organ, gill or haemocytes be used for confirmatory diagnosis irrespective of predicted infection level. Methods for electron microscopy, *in situ* hybridization and RT-nested PCR are described in Cowley et al. (2005) (*Diseases of Aquatic Organisms*, 66, 91–104). The method for real-time PCR is described in Rajendran et al. (2006) (*Journal of Virological Methods*, 137, 265–271).

9. CONTROL METHODS
No known methods of prevention or control. Infected shrimp should not be transported into areas known to be free of the virus.

SELECTED REFERENCES


