

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)

COWLEY J.A., McCULLOCH R.J., RAJENDRAN K.V., CADOGAN L.C., SPANN K.M. & WALKER P.J. (2005). RT-nested PCR detection of Mourilyan virus in Australian *Penaeus monodon* and its tissue distribution in healthy and moribund prawns. *Diseases of Aquatic Organisms*, **66**, 91–104.

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 life stage

Young to adult shrimp.

3.5. Additional comments

Mourilyan virus has been detected at very low levels in *Penaeus merguensis* 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 exist 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.

DISEASE INFORMATION

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 haematopoietic 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. ZONOTIC 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 cy-

toplasm, 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

COWLEY J.A., MCCULLOCH R.J., RAJENDRAN K.V., CADOGAN L.C., SPANN K.M. & WALKER P.J. (2005). RT-nested PCR detection of Mourilyan virus in Australian *Penaeus monodon* and its tissue distribution in healthy and moribund prawns. *Diseases of Aquatic Organisms*, **66**, 91–104.

COWLEY J.A., MCCULLOCH R.J., SPANN K.M., CADOGAN L.C. & WALKER P.J. (2005). Preliminary molecular and biological characterisation of Mourilyan virus (MoV): A new bunya-related virus of penaeid prawns. *In: Diseases in Asian Aquaculture V. Proceedings of the 5th Symposium on Diseases in Asian Aquaculture*, Walker P.J., Lester R.G. & Bondad-Reantaso M.G., eds. Fish Health Section, Asian Fisheries Society, Manila, pp. 113–124.

RAJENDRAN K.V., COWLEY J.A., MCCULLOCH R.J. & WALKER P.J. (2006). A TaqMan real-time RT-PCR for quantifying Mourilyan virus infection levels in shrimp tissues. *Journal of Virological Methods*, **137**, 265–271.

SELLARS M.J., KEYS S.J., COWLEY J.A., MCCULLOCH R.J. & PRESTON N.P. (2005). Association of Mourilyan virus with mortalities in farm-reared *Penaeus (Marsupenaeus) japonicus* transferred to maturation tank systems. *Aquaculture*, **252**, 242–247.

OIE Reference Experts and Laboratories	