

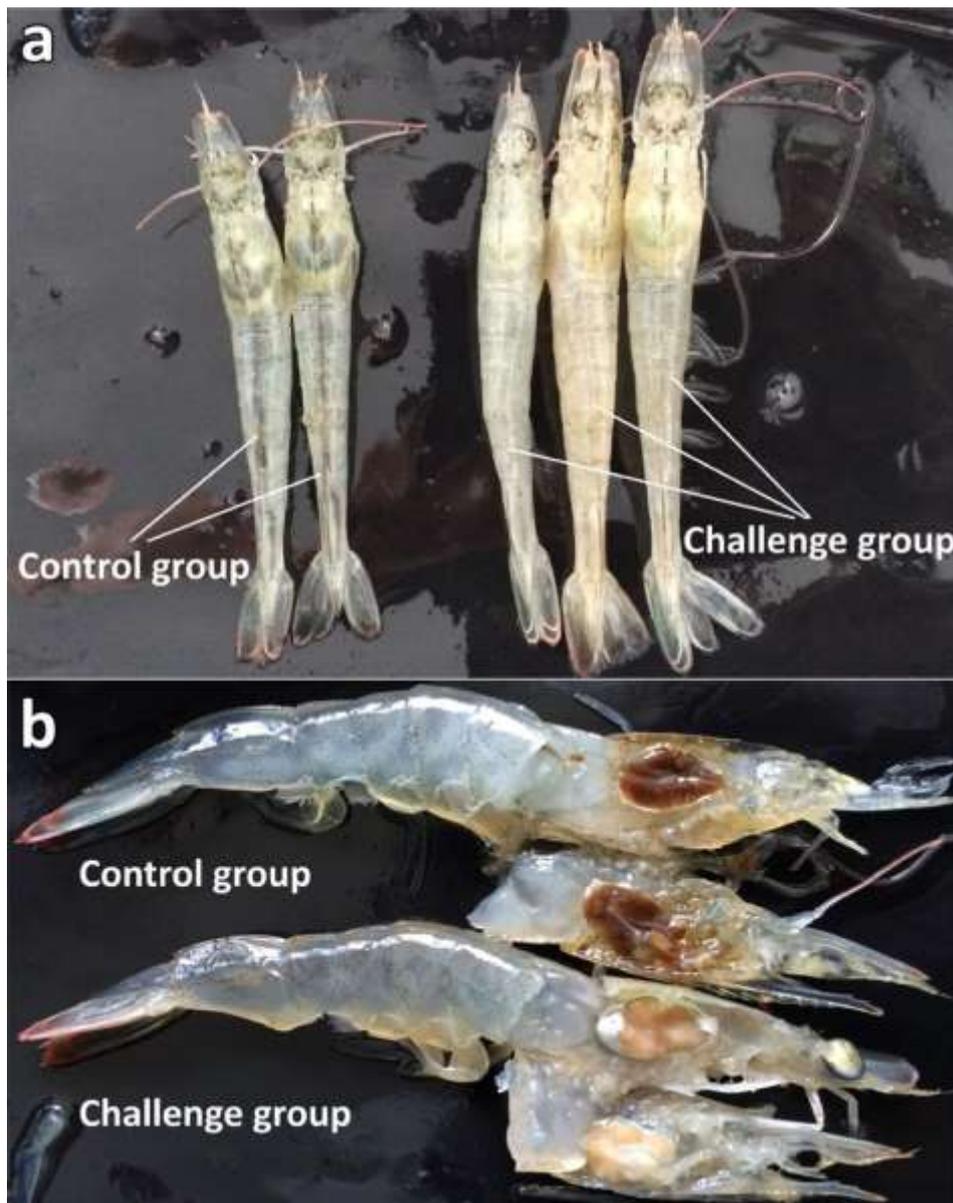


## Infection with shrimp haemocyte iridescent virus (SHIV)

Also known as white head disease (WHD), Decapod iridescent virus 1 (DIV1) and *Cherax quadricarinatus* iridovirus (CQIV)

From *Aquatic animal diseases significant to Australia: identification field guide*, 5th edition

Figure 1 Gross signs of Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) infected with SHIV



Note: When compared with healthy shrimp (control group), shrimp infected with SHIV (challenge group) have a whitish to yellowish head (a) caused by the pale necrotic hepatopancreas (b) and a slightly iridescent appearance of the carapace.

Source: Qiu et al. 2017

## Signs of disease

Important: Animals with this disease may show one or more of these signs, but the pathogen may still be present in the absence of any signs.

Disease signs at the farm, tank or pond level are:

- lethargy
- cessation of feeding
- diseased shrimp sinking to the bottom of the pond
- sudden onset of high mortalities in late-postlarvae, juvenile or subadult prawns.

Gross pathological signs are:

- empty stomach and gut
- soft shell
- mutilated antennae
- whitish to yellowish coloured head caused by a pale atrophied hepatopancreas
- white triangle under the carapace at the base of the rostrum in *Macrobrachium rosenbergii*
- slightly reddish body colour in around one third of affected shrimp.

Microscopic pathological signs are:

- many necrotic cells with pyknotic nuclei in the haematopoietic tissue and circulating haemocytes in the gills, hepatopancreas and haemolymph sinuses
- dark eosinophilic inclusions and karyopyknosis in haematopoietic tissue
- basophilic intracytoplasmic inclusions in haemocytes and other affected cells
- TEM shows many icosahedral non-enveloped virions in arrays within the cytoplasm of haemocytes found in the haemal sinuses, haematopoietic tissue, hepatopancreas and muscle.

## Disease agent

SHIV, also known as Decapod iridescent virus 1 (DIV1), is an iridescent virus with a double stranded DNA genome, classified within the proposed genus *Decapodiridovirus* within the family *Iridoviridae*. SHIV emerged in China around 2014, causing high mortalities and significant economic losses in cultured *Penaeus (Litopenaeus) vannamei* and *Macrobrachium rosenbergii*. Genome sequencing has revealed that SHIV and *Cherax quadricarinatus* iridovirus (CQIV), identified from freshwater red claw crayfish *Cherax quadricarinatus*, are likely to be different strains of the same virus species.

## Host range

**Table 1 Species known to be susceptible to SHIV**

Common name	Scientific name
Pacific white shrimp	<i>Penaeus (Litopenaeus) vannamei</i>

**Table 2 Non-penaeids known to be susceptible to SHIV**

Common name	Scientific name
Giant freshwater prawn <sup>a</sup>	<i>Macrobrachium rosenbergii</i>
Louisiana swamp crayfish <sup>a</sup>	<i>Procambarus clarkii</i>
Oriental freshwater shrimp <sup>a</sup>	<i>Macrobrachium nipponense</i>
Oriental prawn	<i>Exopalaemon carinicauda</i>
Redclaw crayfish <sup>a</sup>	<i>Cherax quadricarinatus</i>

a Naturally susceptible.

**Table 3 Potential carriers of SHIV**

Common name	Scientific name
Chinese white shrimp	<i>Penaeus (Fenneropenaeus) chinensis</i>
Superb freshwater shrimp	<i>Macrobrachium superbum</i>
Cladocerans (water fleas)	Order Cladocera

## Presence in Australia

Exotic disease—not recorded in Australia.

**Map 1 Presence of SHIV, by jurisdiction**



## Epidemiology

- Infection with SHIV has been responsible for high mortalities (over 80%) in farmed *P. vannamei* and *M. rosenbergii* populations in China since 2014.
- Infection is horizontal via cannibalism of infected shrimp or through contact with infected faeces. Per os and reverse gavage infection experiments in *P. vannamei* resulted in 100% cumulative mortality within 2 weeks.
- Injection challenges exposing *P. vannamei*, *C. quadricarinatus*, and *Procambarus clarkii* to SHIV also resulted in 100% cumulative mortalities.
- Infected *M. rosenbergii* exhibit distinctive clinical signs called white head disease, characterised by a distinct white triangle area under the carapace at the base of the rostrum. This effect is a result of the pale colouration of diseased haematopoietic tissue.
- The virus is found mainly in haematopoietic tissue located above the stomach and at the base of antennae, pereopods and other appendages. However, SHIV infection is systemic and the virus is also found in the haemocytes, gills, hepatopancreas, pereopods, and muscle.
- qPCR tests show that the highest levels of virus in infected crustaceans are found in the haematopoietic tissue and haemocytes. The lowest viral levels are in the muscle.

## Differential diagnosis

The list of [similar diseases](#) in the next section refers only to the diseases covered by this field guide. Gross pathological signs may also be representative of diseases not included in this guide. Do not rely on gross signs to provide a definitive diagnosis. Use them as a tool to help identify the listed diseases that most closely account for the observed signs.

## Similar diseases

Acute hepatopancreatic necrosis disease (AHPND), gill associated virus disease (GAV), infection with infectious myonecrosis virus (MrNV), infection with *Macrobrachium rosenbergii* nodavirus, infection with white spot syndrome virus (WSSV) and infection with yellowhead virus genotype 1 (YHV1).

## Sample collection

Perinuclear pale basophilic to dark basophilic inclusion bodies are evident in this group of muscle cells (arrows point at some examples).

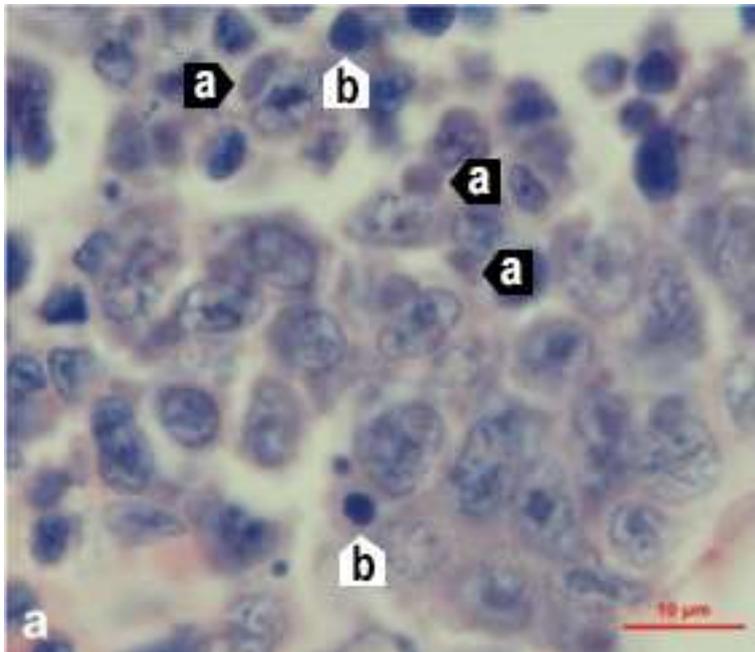
## Emergency disease hotline

See something you think is this disease? Report it. Even if you're not sure.

Call the Emergency Animal Disease Watch Hotline on **1800 675 888**. They will refer you to the right state or territory agency.

## Microscope images

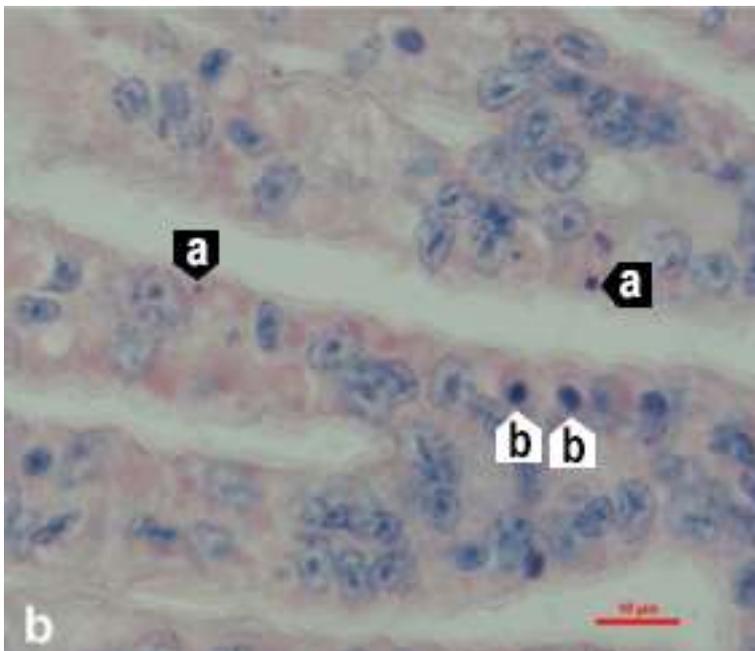
**Figure 2** Haematopoietic tissue of Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) infected with SHIV



Note: Haemocytes and hepatopancreas cells with dark basophilic cytoplasmic inclusions (a) and numerous necrotic cells with pyknotic nuclei (b). Histological section with haematoxylin and eosin stain. Scale bar = 10 μm.

Source: Qiu et al. 2017

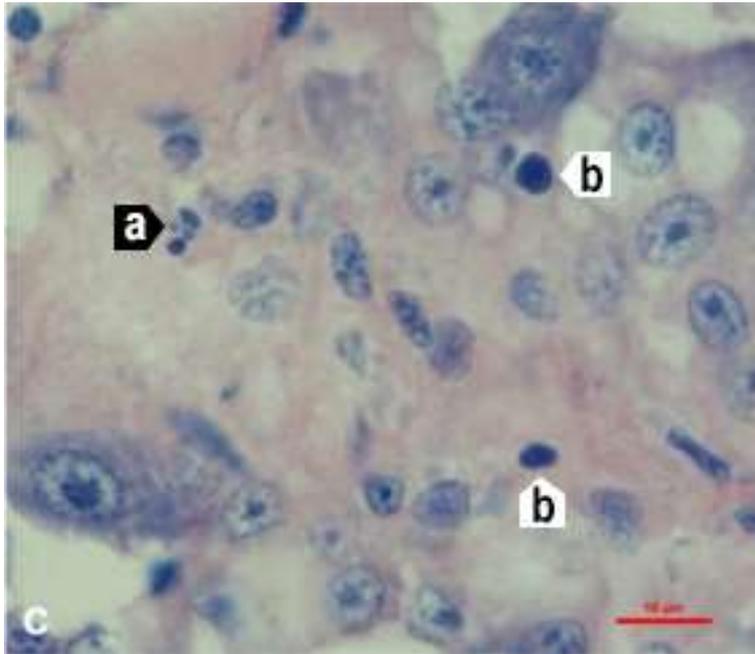
**Figure 3** Gills of Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) infected with SHIV



Note: Haemocytes and hepatopancreas cells with dark basophilic cytoplasmic inclusions (a) and numerous necrotic cells with pyknotic nuclei (b). Histological section with haematoxylin and eosin stain. Scale bar = 10 μm.

Source: Qiu et al. 2017

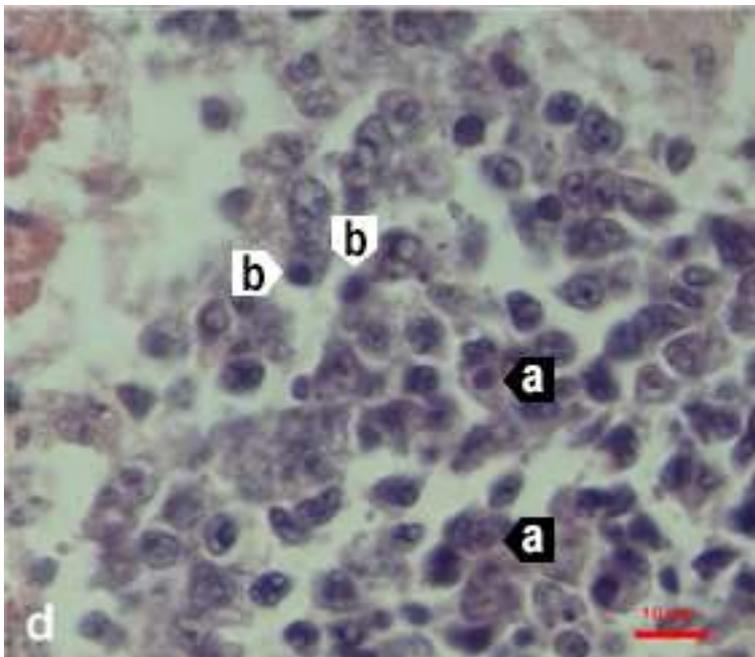
**Figure 4** Hepatopancreas of Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) infected with SHIV



Note: Haemocytes and hepatopancreas cells with dark basophilic cytoplasmic inclusions (a) and numerous necrotic cells with pyknotic nuclei (b). Histological section with haematoxylin and eosin stain. Scale bar = 10  $\mu$ m.

Source: Qiu et al. 2017

**Figure 5** Periopods of Pacific white shrimp (*Penaeus (Litopenaeus) vannamei*) infected with SHIV



Note: Haemocytes and hepatopancreas cells with dark basophilic cytoplasmic inclusions (a) and numerous necrotic cells with pyknotic nuclei (b). Histological section with haematoxylin and eosin stain. Scale bar = 10  $\mu$ m.

Source: Qiu et al. 2017

## Further reading

Qiu L, Chen MM, Wan XY, Li C, Zhang QL, Wang RY, Cheng DY, Dong X, Yang B, Wang XH, Xiang JH, and Huang J 2017, 'Characterization of a new member of *Iridoviridae*, Shrimp haemocyte iridescent virus (SHIV), found in white leg shrimp (*Litopenaeus vannamei*)', *Scientific Reports*.

Qiu L, Chen X, Zhao RH, Li C, Gao W, Zhang QL, Huang J 2019, 'Description of a natural infection with Decapod iridescent virus 1 in farmed giant freshwater prawn, *Macrobrachium rosenbergii*', *Viruses*.

Xu L, Wang T, Li F, Yang F 2016, 'Isolation and preliminary characterization of a new pathogenic iridovirus from redclaw crayfish *Cherax quadricarinatus*', *Diseases of Aquatic Organisms*.

## Contact details

Emergency Animal Disease Watch Hotline 1800 675 888

Email [AAH@agriculture.gov.au](mailto:AAH@agriculture.gov.au)

Website [agriculture.gov.au/pests-diseases-weeds/aquatic](http://agriculture.gov.au/pests-diseases-weeds/aquatic)

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