**USA COMMENTS IN RED FONT**

CHAPTER 2.3.7.

**infection with RED sea bream iridovirus**

**1. Scope**

Infection with red sea bream iridovirus is considered to be infection with the pathogenic agent red sea bream iridovirus (RSIV) of the genus *Megalocytivirus*, Family *Iridoviridae*.

**2. Disease information**

**2.1. Agent factors**

**2.1.1. Aetiological agent**

The pathogen is an icosahedral virion 140−200 nm in diameter consisting of a central electron-dense core (120 nm) and an electron translucent zone (Inouye *et al.,* 1992) with a double-stranded DNA genome approx. 110 kbp in length (Kawato *et al.,* 2017a). The viral genome has a G+V content of 53–55%, containing about 120 potential open reading frames (ORFs).

Phylogenetic analyses using major capsid protein (MCP) and ATPase genes shows that the viruses causing the similar clinical signs can be divided into three different genotypes: RISV, infectious spleen and kidney necrosis virus (ISKNV) (He *et al.,* 2000; 2001), and turbot reddish body iridovirus (TRBIV) genotype (Shi *et al.,* 2004; 2010).

The aetiological agent of infection with RSIV is RSIV (Inouye *et al.,* 1992; Jeong *et al.,* 2003) and other strains belonging in the RSIV genotype (Go *et al.,* 2016; Koda *et al.,* 2018; Kurita & Nakajima, 2012). Similar diseases with the characteristic, enlarged basophilic cells within infected organs, typical of infections with megagalocytiviruses, classified into ISKNV genotype and TRBIV genotypes are excluded in this chapter. RSIV genotypes are differentiated from ISKNV and TRBIV genotypes based on nucleotide sequence analysis which is required for confirmatory diagnosis. Scale drop disease virus is another virus in the genus *Megalocytivirus* causing different clinical signs in Asian seabass, *Lates calcarifer* (Groof *et al.,* 2015).

RSIV was first found in red sea bream, *Pagrus major,* from which the virus name (RSIV) is derived (Inouye *et al.,* 1992). As RSIV has a broad host range as shown in Section 2.2.1. *Susceptible host species*, many viruses that can be classified into RSIV genotype are synonyms of RSIV and defined to be the aetiological agents in this chapter, e.g. rock bream iridovirus (RBIV) (Do *et al.,* 2004; Jung & Oh 2000), Taiwan grouper iridovirus (TGIV) (Chou *et al.,* 1998), large yellow croaker iridovirus (LYCIV) (Chen *et al.,* 2003), orange-spotted grouper iridovirus (OSGIV) (Lu *et al.,* 2005), spotted knifejaw iridovirus (SKIV) (Dong *et al.,* 2010) and giant seaperch iridovirus (GSIV) (Wen & Hong, 2016).

**2.1.2. Survival and stability inside the host tissues**

Unknown

**2.1.3. Survival and stability outside the host**

Unknown

For inactivation methods, see Section 2.4.6.

**2.2. Host factors**

**2.2.1. Susceptible host species**

In the case of RSIV infection:

| **Family** | **Scientific name** | **Common name** |
| --- | --- | --- |
| Carangidae | *Pseudocaranx dentex*  | striped jack |
| *Seriola dumerili*  | greater amberjack |
| *Seriola lalandi*  | yellowtail amberjack |
| *Seriola lalandi* × *Seriola quinqueradiata*  | hybrid of yellowtail amberjack and Japanese amberjack |
| *Seriola quinqueradiata*  | Japanese amberjack |
| *Trachinotus blochii*  | snubnose pompano |
| Centrarchidae | *Micropterus salmoides*  | largemouth bass |
| Centropomidae | *Lates calcarifer*  | barramundi or sea bass |
| Haemulidae | *Parapristipoma trilineatum*  | chicken grunt |
| *Plectorhinchus cinctus*  | crescent sweetlips |
| *Trachurus japonicus*  | Japanese jack mackerel |
| Kyphosidae | *Girella punctata*  | largescale blackfish |
| Lateolabracidae | *Lateolabrax japonicas*  | Japanese sea perch |
| *Lateolabrax* sp.,  |  |
| Lethrinidae | *Lethrinus haematopterus*  | Chinese emperor |
| *Lethrinus nebulosus*  | spangled emperor |
| Moronidae | *Morone saxatilis* × *M. chrysops* | hybrid of striped sea bass and white bass |
| Oplegnathidae | *Oplegnathus fasciatus*  | Japanese parrotfish |
| Paralichthyidae | *Paralichthys olivaceus*  | bastard halibut |
| Pleuronectidae | *Verasper variegatus*  | spotted halibut |
| Rachycentridae | *Rachycentron canadum*  | cobia |
| Sciaenidae | *Pseudosciaena crocea*  | croceine croaker |
| Scombridae | *Scomber japonicus*  | chub mackerel |
| *Scomberomorus niphonius*  | Japanese Spanish mackerel |
| *Thunnus thynnus*  | northern bluefin tuna |
| Sebastidae | *Sebastes schlegeli*  | rockfish |
| Serranidae | *Epinephelus akaara*  | Hong Kong grouper |
| *Epinephelus awoara*  | yellow grouper |
| *Epinephelus bruneus*  | longtooth grouper |
| *Epinephelus coioides*  | orange-spotted grouper |
| *Epinephelus fuscoguttatus*  | brown-marbled grouper |
| *Epinephelus lanceolatus*  | giant grouper |
| *Epinephelus malabaricus*  | Malabar grouper |
| *Epinephelus septemfasciatus*  | convict grouper |
| *Epinephelus tauvina*  | greasy grouper |
| *Oplegnathus punctatus*  | spotted knifejaw |
| Sparidae | *Acanthopagrus latus*  | yellowfin sea bream |
| *Acanthopagrus schlegeli* | black porgy |
| *Evynnis japonica*  | crimson sea bream |
| *Pagrus major*  | red sea bream |
| Tetraodontidae | *Takifugu rubripes*  | torafugu |

**2.2.2. Species with incomplete evidence for susceptibility**

Species for which there is incomplete evidence to fulfil the criteria for listing as susceptible to infection with (RSIV) according to Chapter 1.5 of the *Aquatic Code* are: Under study.

**2.2.3. Likelihood of infection by species, host life stage, population or sub-populations**

Juvenile through to adult stages are susceptible; however, the susceptibility of juveniles is generally higher than adults. Fish belonging to the genus *Oplegnathus* may be more susceptible than others.

**2.2.4. Distribution of the pathogen in the host**

Infected cells are observed in the spleen, kidney, heart, liver, intestine and gill.

**2.2.5. Aquatic animal reservoirs of infection**

Unknown

**2.2.6. Vectors**

Unknown

**2.3. Disease pattern**

**2.3.1. Mortality, morbidity and prevalence**

Depending on host fish species, fish size, fish age, water temperature, and other culture conditions, mortality rates range between 0% and 100%. Morbidity is unknown.

**2.3.2. Clinical signs, including behavioural changes**

Affected fish become lethargic and show abnormal and conspicuous respiratory movements.

**2.3.3. Gross pathology**

Fish exhibit severe anaemia, petechiae in the gills, and enlargement of the spleen and kidney.

**2.3.4. Modes of transmission and life cycle**

The principal mode of transmission of RSIV is horizontal via the water. Vertical transmission of RSIV has not yet been investigated.

**2.3.5. Environmental factors**

Outbreaks have been seen mostly in the summer season at water temperatures of 25°C and above.

**2.3.6. Geographical distribution**

The first outbreak was recorded in marine cultured red sea bream in Japan in 1990. From then on, further outbreaks and infections have been reported in many marine fish and freshwater fish. The international trade of ornamental fish has contributed significantly to the spread of megalocytiviruses (Johan & Zainathan, 2020).

See WAHIS (<https://wahis.oie.int/#/home>) for recent information on distribution at the country level.

**2.4. Biosecurity and disease control strategies**

**2.4.1. Vaccination**

Effectiveness of a vaccine consisting of formalin-inactivated supernatant from RSIV-infected GF cell culture has been confirmed experimentally and in field trials (Nakajima *et al.,* 1997; 1999). Currently, the formalin-inactivated vaccine for infection with RSIV is commercially available for red sea bream (*Pagrus major*), striped jack (*Pseudocaranx dentex*), Malabar grouper (*Epinephelus malabaricus*), orange-spotted grouper (*Epinephelus coioides*) and other fish species belonging to the genus *Seriola* in Japan. Protection of fish belonging to the genus *Oplegnathus* by vaccination is difficult.

**2.4.2. Chemotherapy including blocking agents**

Not available.

**2.4.3. Immunostimulation**

Not applicable.

**2.4.4. Breeding resistant strains**

An RSIV-resistant strain of red sea bream (*Pagrus major*) has been developed using marker-assisted selection combined with DNA-based family selection (Sawayama *et al.*, 2019).

**2.4.5. Inactivation methods**

RSIV is inactivated at 56°C for 30 minutes and by treatment with either ether, chloroform or formalin (0.1%), and by exposure to pH 3.0. The virus is stable in tissue at –80°C and at pH 7.0 and pH 11.0 (Nakajima & Sorimachi, 1994).

**2.4.6. Disinfection of eggs and larvae**

Unknown

**2.4.7. General husbandry**

Not available.

**3. Specimen selection, sample collection, transportation and handling**

This section draws on information in 2.2, 2.3 and 2.4 to identify populations, individuals and samples which are most likely to be infected.

**3.1. Selection of populations and individual specimens**

Clinical inspections should be carried out during a period when water temperature is conducive to development of clinical disease (see Section 2.3.5). All production units (ponds, tanks, etc.) should be inspected for the presence of dead, weak or abnormally behaving fish. For the purposes of disease surveillance, fish to be sampled are selected as follows:

i) The most susceptible species should be sampled preferentially (see Section 2.2.3). Other susceptible species listed in Section 2.2.1 should be sampled proportionally.

ii) Risk-based criteria should be employed to preferentially sample lots or populations with a history of abnormal mortality, potential exposure events or where there is evidence of poor water quality or husbandry. If more than one water source is used for fish production, fish from all water sources should be included in the sample.

iii) If weak, abnormally behaving or freshly dead fish are present, such fish should be selected. If such fish are not present (e.g. during surveillance of apparently healthy populations), the fish selected should include normal appearing, healthy fish collected in such a way that all parts of the farm as well as all year classes are proportionally represented in the sample. Smaller fish may be more appropriate because infection with RSIV can cause higher mortality in juvenile or yearling fish. However, adult fish are also susceptible to RSIV infection as the viral genome has been detected from apparently healthy broodstock. Infection with RSIV has not been reported in hatchery fish.

For disease outbreak investigations, moribund fish or fish exhibiting clinical signs of infection with RSIV should be collected. Ideally fish should be collected while alive, however recently dead fish can also be selected for diagnostic testing. It should be noted, however, that there will be a significant risk of contamination with environmental bacteria if the animals have been dead for some time.

**RATIONALE:** Punctuation

**3.2. Selection of organs or tissues**

Although gill and visceral organs such as spleen, heart, kidney, liver and intestine can be used, it is recommended to sample spleen or kidney tissues; and spleen is the most appropriate organ for the preparation of imprints for use in the IFAT. For surveillance of apparently healthy populations, spleen or kidney should be sampled.

**RATIONALE:** Editorial. Use “and” between a comma splice.