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Fish Diseases: Spring Viremia of Carp (SVC)

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Introduction

Spring Viremia of Carp (SVC) is a disease caused by a member of the virus family *Rhabdoviridae*. Spring Viremia of Carp Virus (SVCV), as a Rhabdovirus, is a bullet-shaped virus that contains an RNA genome. This is the same family of viruses that contains a distant relative, the Rabies Virus. However, it is extremely important to realize that SVCV is a pathogen of fish and poses no health risk to humans. Historically, SVC has been known as a devastating disease of freshwater-reared common carp and related species in Europe. Prior to the early 1960's, when the research tools to study viral diseases of fish were not available, there were many unexplained losses in carp culture in central and Eastern Europe. These losses were thought to be caused by nutrition, water quality, parasites, bacteria or viruses. These disease events were described in the early literature by names such as: infectious dropsy, rubella, infectious ascites, hemorrhagic septicemia, and red contagious disease. It was not until the mid 1960's that the Spring Viremia of Carp virus was isolated in cell culture. The current known geographic range of SVC includes: Europe, the Middle East, China, the United States, Canada, and Brazil.

Spring Viremia of Carp was not known in North America until relatively recently. In 2002, SVC was found for the first time in the United States in cultivated koi in North Carolina and in wild common carp in Wisconsin and Illinois. Additional outbreaks of SVC were reported for cultured koi in Washington and Missouri in 2004. In 2006 SVCV was isolated from apparently healthy common carp from Hamilton Harbor, Lake Ontario, Canada. The virus was isolated from wild fish in Wisconsin and Minnesota in the Upper Mississippi River in 2007.

The Disease: Spring Viremia of Carp

Susceptible Species

While the common carp appears to be the most susceptible fish species to infection by SVCV, infections have also bee reported in grass carp (white amur), bighead carp, silver carp, crucian carp, goldfish, tench, orfe, and sheatfish/European catfish/wels. In addition, research efforts have shown that roach, zebrafish, guppies, northern pike, golden shiners and pumpkinseed can be infected under experimental conditions. The commercial aquaculture community should view SVCV

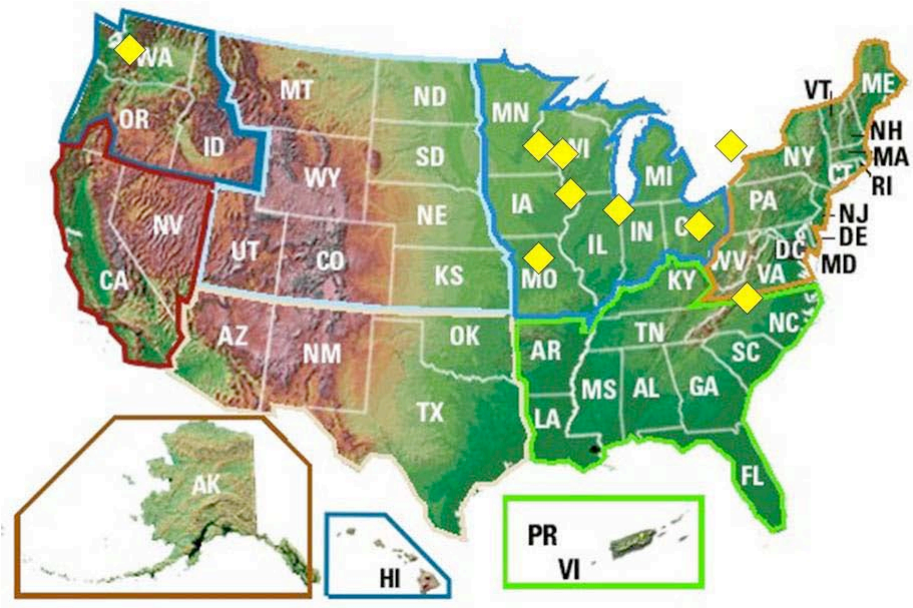

Figure 1. Locations in North America were evidence of Spring Viremia of Carp Virus has been found (basic map source: www.fws.gov/coastal/coastalgrants/contactUs.htm).

as a viral pathogen that might infect a variety of fish species beyond those reported above.

Clinical Signs

While SVC is typically most serious in young-of-the-year fish, it can also adversely affect older animals. The signs of the disease are nonspecific. They may include: petechial (pin-point) hemorrhages on the skin, eyes and gills, abdominal distension, exophthalmia ("pop-eye"), inflammation and swelling around the vent (Figure 2). Internal lesions may include hemorrhage on the internal organs as well as in the musculature. The body cavity may contain ascites (fluid) that may appear red due to the presence of blood and necrotic tissue. Behaviorally, infected animals may appear sluggish and lose equilibrium. The severity of a mortality event will depend upon other concurrent factors such as environmental stressors, bacterial or parasitic infections, and population density. Mortality may range from 30 – 40% but up to 90% in some outbreaks which are most common in the spring when the water temperatures are between 11 and 17°C (52 - 63°F).

Diagnosis

Diagnosis of SVC is based on isolation of the virus in cell culture, followed by a second test to confirm the identity of the virus as SVCV (ie. is the virus SVCV or some other fish virus). The second test may be a test based on serology (e.g. virus neutralization) or a molecular-based test (RT-PCR). The samples to be processed may be whole fish (for fish less than 4 cm TL) or kidney, liver, spleen and brain. There are two documents that are generally accepted as providing the specific details of these procedures. These documents are the OIE (World Organization for Animal Health) Aquatic Manual and the American Fisheries Society, Fish Health Section "Blue Book." Due to the seriousness of SVCV, collection, handling and shipping of such specimens should only be performed after contacting the proper authorities. Because SVCV is a regulated pathogen, all appropriate means should be exercised to prevent the spread of the virus. It is for this reason that handling of diagnostic specimens should only be performed by personnel with the proper training.

Preventing Further Spread of SVC

There have been no additional isolations of SVCV in North America since 2007. Preventing the movement of

Figure 2. Common carp infected with Spring Viremia of Carp Virus (SVCV). Note petechial (pinpoint) hemorrhages on the body as well as exophthalmia (pop-eye). Photo: Dr. Andrew Goodwin, University of Arkansas at Pine Bluff.

SVCV to locations where it is not currently found can only be accomplished by a multi-faceted effort. That effort must include an understanding of the disease and how the virus can be transmitted. The virus can be carried by fish that show signs of disease as well as fish that are asymptomatic. Infected fish can shed the virus in the feces, urine and mucus. There is also some evidence that the virus may be found in ovarian fluid and therefore "egg-associated" transmission may occur. The virus may also be transmitted by fomites (i.e., equipment) and by other animals such as fish parasites (the fish louse *Argulus* and leeches of fish) and fish-eating birds.

The most effective way to avoid losses due to SVC is to practice effective biosecurity measures. Commercial aquaculturists, who have not already done so, should investigate opportunities to receive formal training in biosecurity measures for aquaculture and implement a biosecurity program on their facility.

An effective biosecurity program will include the establishment of the following:

- Training of all personnel on the aspects of the facility biosecurity program.
- Maintenance of training records for all personnel.
- Development of written Standard Operating Procedures (SOPs) for fish health and biosecurity practices.
- Limit the movement of new fish onto the facility property.
- Only allow the entrance of new fish or preferably only disinfected fish eggs onto the facility after they have undergone a fish health inspection and were found to be free of SVCV (and other important fish pathogens).
- Evaluation of water used on the facility and only use well water or spring water (water devoid of other fish and fish pathogens).
- Establishment of a professional relationship with a fish health program that can provide fish disease diagnostic expertise to the facility.
- The maintenance of records for all disease events, corrective action(s) taken and success of those actions.
- Evaluation of the various facility systems, the need for back-up electricity, water and back-up equipment.

Regulatory Considerations

SVCV is an OIE reportable pathogen. Due to this status, the scientific community as well as fisheries managers and aquaculturists must be aware of some special regulatory requirements associated with this pathogen. If a USDA Animal and Plant Health Inspection Service (USDA APHIS) accredited veterinarian or a laboratory official from an APHIS approved laboratory suspects that they have a diagnostic case in which SVCV will be found, they are legally obligated to report to their USDA APHIS Area Veterinarian-in-Charge. From that point, depending on the circumstances of the case (such as a new fish species being identified as a potential host), arrangements may be made to ship appropriate diagnostic materials to the USDA APHIS National Veterinary Services Laboratories, Ames, Iowa, for confirmation of the finding. Requirements for veterinarians to report to State authorities will be based on legislation in the State where the veterinarian has a license to practice. Reporting may also occur to the Competent Regulatory Authority in the state where the finding occurs as well as the State Veterinarian and the State natural resource agency, depending on whether the identification occurred in a wild or farmed fish and which state agency has authority within the State. Individuals with suspect cases of SVC and who are not veterinarians, will typical report in a similar manner as a professional courtesy to USDA APHIS as well as other entities and cooperate in efforts that will limit the adverse impact of important OIE notifiable pathogens, such as SVCV. Upon receipt of a SVCV report, APHIS and state authorities may take regulatory action to eradicate or prevent further spread of the virus. The action taken will depend on circumstances and may include anything from no action to quarantine and eradication of affected fish populations.

Summary

Spring Viremia of Carp Virus was first detected in North America in 2002. To date, its spread appears to be somewhat limited in terms of number of reports. On the other hand, those few findings of the virus have occurred as a wide geographic distribution. The knowledge that this devastating pathogen is present on the North American continent should serve as cause for the commercial aquaculture community to practice effective biosecurity measures on their facilities. Since there are no treatments for viral pathogens of fish, the only practical way to avoid losses due to SVC is through avoidance. The

commercial aquaculturist is strongly urged to avail themselves of any opportunity to obtain training on the principles of effective biosecurity for aquaculture facilities and implement a biosecurity program on his/her facility.

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General Web Sites of Interest

Center for Food Security and Public Health:
http://www.cfsph.iastate.edu/

USDA APHIS Newsroom.
http://www.aphis.usda.gov/newsroom/

Biosecurity for Aquaculture Facilities in the North Central Region:
http://www.ncrac.org/Topics/biosecurityfactsheet.htm