FA29

Introduction to Viral Diseases of Fish [1]

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What Is a Virus?

Viruses are very small infectious agents that multiply only within the living cells of an animal or plant host. Other microorganisms, such as bacteria or fungi, have organelles for their own metabolism, but viruses do not. They must utilize the machinery of the infected host cell for growth and reproduction.

A virus has two parts. The internal part is the virion, or virus particle which is composed of nucleic acid, the same material that makes up genes. The virion is enclosed in an external protein coat called a capsid. Viruses are broadly categorized by the type of nucleic acid they contain; the two basic types of nucleic acid are RNA (ribonucleic acid) and DNA (deoxyribo-nucleic acid). Virologists also classify viruses by their shape, for example, "icosahedral" viruses have 20 sides, and "helical" particles are rod shaped.

Detection of Viral Diseases

Because they are so small, viruses are often difficult to detect. Parasites, bacteria, or fungi are easier to detect than viruses, so diagnosticians first check to see if these other organisms are the cause of a specific disease before considering the possibility that a virus is responsible. Three techniques are used for initial identification of a virus. First, electron microscopy (EM) is used to visualize virus particles within tissue cells. Second, an effort is made to grow the virus in the laboratory using established cell-lines, which are living cells grown in vitro, literally "in a glass," outside of a living organism by feeding them special nutrients. This technique is referred to as cell culture, and cells from specific fish are used for growth of specific viral agents. Finally, identification of the virus is confirmed using serology, in which serum (part of the blood) from animals known to be infected with the virus is tested for its ability to "recognize" the suspected virus; this confirms that the virus in the animal's body is the same as the virus that has been isolated in the laboratory.

Viruses are often both species-specific and tissue-specific. This means that they may only grow in certain types of cells from certain animals. This can make it difficult to isolate viral agents from many fish because there may not be a commercially available cell-line for an individual fish species. Many cell-lines which are commercially available originate from coldwater fish such as salmonids, and may be less suitable for warmwater species. It is impossible to develop serology as a tool until after the virus has been isolated in the laboratory using a

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suitable cell line. For these reasons, viral agents of many fish are often suspected based on visualization of viral particles in tissues taken from sick fish using EM. The problem with this tool, when used alone, is that it is possible for viral particles to be present in tissue without causing harm, or disease. Therefore, identification of viral particles in tissues of sick fish does not prove that the observed virus is the cause of the disease in progress.

Management and Control of Viral Diseases

Viral diseases cannot be controlled with medication because they use the host's own cells for reproduction and survival. It is therefore prudent to provide "good nursing care" for fish suspected of having a viral infection so that their own natural defense mechanisms can work to eliminate infected cells. This involves maintaining excellent water quality, feeding fish a high quality diet, maintaining clean facilities, and keeping sick or potentially infected stock separate from all other animals.

Equipment, boots, and hands should be washed with a disinfectant after either handling or being close to potentially infected stock. Chlorine bleach is an excellent virucidal agent and can be used to disinfect equipment. Concentrations of 10 mg/l for one hour will kill most infectious particles (See IFAS Extension Fact Sheet VM-87). When using bleach, however, it is imperative to keep in mind that it is extremely toxic to fish. Residual chemical or strong fumes are lethal to fish. An alternative to bleach is quaternary ammonium compounds. They are effective virucidal agents and can be used to disinfect equipment; they also are suitable for use as a foot bath. Although quaternary ammonium compounds are not as toxic to fish as chlorine, all items must be thoroughly rinsed before being placed in contact with live fish.

Before introducing new fish into established breeding populations, a three- to four-week quarantine period should be observed. It is not realistic to design the quarantine period to prevent introduction of viruses because so little is known about viral diseases of fish. Instead the quarantine period should be designed to prevent the introduction of bacterial and parasitic diseases. Methods to accurately identify specific viral diseases of fish are lacking. There is no means of screening fish which may be carrying suspected viral diseases, no way of determining whether or not they may serve as a source of infection to other fish, or how long they may remain infectious. Development of quarantine strategies that are effective against viruses will require answers to each of these questions before reasonable prevention or avoidance recommendations can be made.

For many infectious diseases of fish there is a temperature range where the level of sickness and death in a population is most severe. For example, channel catfish virus disease generally causes most severe losses when water temperatures reach or exceed 25°C (77°F). Under experimental conditions, mortality rate decreased dramatically when water temperature was lowered from 28°C (82°F) to 19°C (66°F). For species which are reared in temperature-controlled environments, manipulation of environmental temperature as a means of minimizing the impact of viral disease is worth pursuing.

Vaccination

Although vaccination is used routinely to prevent viral diseases in humans and domestic mammals, it is not widely used in fish medicine. Vaccine development is extremely expensive and there are only a few viral diseases of fish which have sufficient economic impact to warrant investment in vaccine development. Also, because fish are cold-blooded animals, their immune response to a vaccine is not as predictable as that of warm-blooded animals, and therefore more frequent vaccination may be needed. At present, vaccines used in aquaculture are primarily used in salmonid production and most commercial vaccines have been developed for protection of fish from common bacterial agents. Vaccines are administered by injection or by immersion bath. An oral vaccine has been developed for use in channel catfish to prevent bacterial disease, however, to date, its use has been limited.

Summary

Viruses are microorganisms which are extremely difficult to study because of their small size and inability to live outside their host tissue. Viruses are classified by the type of nucleic acid they possess, either RNA or DNA, as well as by their size and shape. Initial identification of viral agents which may be causing disease is often based on visualization of viral particles in tissue of dying fish using electron microscopy. Efforts are then made to isolate the virus in the laboratory using special living cells, called cell-lines, and finally serology is used to confirm that the virus in the animal's body is the same as the virus which has been isolated in the laboratory. Identification of viruses and investigation of viral diseases is highly specialized and requires special training and equipment. Once a viral disease is in progress, the course of the disease cannot be altered by medicating the fish. Prevention of secondary bacterial infections and maintenance of a clean environment and good nutrition will help give the fish the best opportunity to overcome the infection using their own natural defense mechanisms. Temperature manipulation provides a method for controlling some viral diseases of fish, and if fish are reared under temperature-controlled conditions, this may be a practical management strategy.