KOI VIRUS ALERT August, 2002

Two viruses that attack and kill koi: Spring Viremia of Carp (SVC) and Koi Herpes Virus (KHV) are creating panic in some koi owners, especially those who communicate on the internet. SVC has been confirmed in one case in koi the United States. KHV, although more common than SVC, has been confirmed by laboratory analysis in only a handful of cases, but has been suspected in others. So what is all the fuss about anyway? To understand, you need to understand a little bit about viruses.

Viruses are microscopic entities that usually contain protein and one type of nucleic acid. Viruses require a living cell to reproduce, but some viruses are very stable in the environment until they find a suitable host. Some viruses are host specific (i.e. Feline Leukemia Virus only affects cats) and others are not very host specific (i.e. Rabies virus attacks many species of mammals). Viruses cannot be cured or treated with antibiotics. There is no effective treatment for most viruses, although some viral diseases can be prevented by vaccination prior to exposure (i.e. Polio, Rabies, Hepatitis, etc.). Viral exposure can lead to five possible outcomes: 1. no effect 2. transient disease which leads to a complete cure or elimination of the virus by the immune system 3. death 4. transient disease which leads to chronic debilitation or permanent damage 5. transient disease that leads to health (no symptoms of disease), but the virus is present and under the correct circumstances, will cause disease. Individuals that fall into the last category are called *asymptomatic carriers,* which mean that they are capable of infecting other koi even though they show no outward signs of disease (asymptomatic). The "hiding place" of a virus in asymptomatic carriers is not always known.

SVC, a viral disease commonly found in koi, and other carp in Europe, is caused by a rhabdovirus, which is the same class as rabies, but it is a *fish* (not mammalian) virus. Goldfish are also thought to be susceptible. Mortality in an exposed population of koi ranges from 30% to greater than 90%. It is believed to be transmitted directly by fish to fish contact, by contact with mud, parasites, and water that has been in contact with infected fish. This would suggest that transmission by plants, nets, buckets and other objects commonly used with fish is also a risk. SVC viruses that settle in pond mud can remain infective for 2-3 months. Appearance of disease caused by SVC virus is temperature dependent. Disease caused by SVC has been reported at temperatures between 40 and 60º F, and may be seen in as little as 8-11 days after exposure. However, the incubation period (time between exposure and appearance of disease) is not known for all temperatures and conditions. Even less is known about its stability at temperatures over 70º F, but *disease* is not seen in koi at higher temperatures. This disease is the first reportable disease of ornamental fish in the United States, which means that, by law, a confirmed case of SVC must be reported to a qualified state and federal USDA (United States Department of Agriculture) veterinarian. The USDA *will* quarantine facilities in which the presence of the virus is confirmed by laboratory tests. Fish that have been exposed to the virus may survive, but may be *considered* to be carriers, and the USDA reserves the right to order them to be destroyed in order to prevent spread of the virus in this country. Suspected cases should be referred to a USDA certified veterinarian. A list of qualified veterinarians is available in the koi health section of the KHA (Koi Health Advisor) program of the AKCA (Associated Koi Clubs of America) on their web site: www.akca.org. Do not attempt to diagnose this problem yourself. The USDA is working with aquatic animal veterinarians to contain the virus, so that koi owned by dealers and hobbyists will be protected from it. More information about the virus, the symptoms, mode of transmission and prevention are available in a US government alert (http://www.aphis.usda.gov/vs/ceah/cei/sv_us0702.htm), and in a new publication by the University of Florida. (http://edis.ifas.ufl.edu/VM106).

USDA has not yet taken an interest in Koi Herpes Virus (KHV), but this virus has been *confirmed* in several koi ponds in the United States, and has been *suspected* in many others since 1998. It is currently classified as a Herpes virus, which is the same class of virus that causes koi pox. However, new studies at the molecular level may lead to eventual reclassification of the virus. Mortality due to KHV is usually greater than 90% in most populations in which KHV has been confirmed by laboratory analysis. Laboratory confirmation of the virus appears to be very accurate, but unfortunately is not widely available and may be subject to false negatives if the samples are not fresh. Presumably, survivors become *asymptomatic carriers*. The incubation period and details about transmission are not yet available, but like SVC virus, KHV appears to be a temperature dependent disease, and like SVC, transmission by direct fish to fish contact or from mud, nets, buckets, parasites, plants or water in contact with infected fish should be considered likely until proven otherwise. KHV, unlike SVC, does not appear to infect goldfish. KHV seems

to cause disease in koi in the spring and fall when the temperature is between 70º-80ºF, which is a slightly higher temperature than SVC. There have been previous reports on this virus in Koi USA (Jan/Feb, 2001), in the (AKCA) publication, *the Guide to Koi Health* and in the koi health section of the Koi Health Advisor (KHA) Program of the Associated Koi Clubs of America (AKCA) see www.akca.org Koi that have been exposed to the virus and then kept at temperatures above 86º F may survive, and survivors reportedly remain healthy even when the temperature is subsequently reduced to 70-75º F. Chloramine T, which is used in the treatment of bacterial gill disease, has been credited with saving infected fish by removing cellular debris, bacteria and fungus from the surface of the damaged gills. However, even if recovery is *possible*, it is not necessarily *wise* to save exposed or infected fish. *Current clinical cases suggest that recovered koi may be asymptomatic carriers*. Caution should be exercised until more is known about asymptomatic carrier koi. No one wants to spread this virus.

Table I. Clinical signs often associated with SVC and KHV.

Spring Viremia of Carp (SVC)	Koi Herpes Virus (KHV)
Behavioral signs • Fish congregate in areas of low flow or lie on bottom or in abnormal positions • Incoordinated swimming • Rate of respiration, response to stimuli, and swimming are progressively reduced. **External signs** • Darkening of the skin • Fluid accumulation in the abdomen (dropsy) • Exophthalmos (pop-eye) • Hemorrhages-skin, gills, eye • Pale gills • Protrusion/reddening of the vent • Feces- long, white/yellow, mucoid	**Behavioral signs** • Fish are lethargic and swim close to the water surface. • Gather at water inlets or waterfalls. • Exhibit an respiratory distress (increased respiratory rate, gasping at surface) • Sudden hyperactivity, incoordination • Off feed, only when near death **External signs** • Skin and gills exhibit decreased mucous production and hemorrhages in fins and body • Severe gill necrosis: white, grey or black, eroded gills; damaged gills might remain red; cartilage is often exposed • Often associated with secondary gill disease • Eyes may be sunken

There is no cure or treatment for SVC or KHV that is known to eliminate these viruses from koi. There is no routine pond-side diagnostic test. Only a few very specialized laboratories can confirm SVC or KHV. Owners would be wise to fear the effects of these viruses on their koi, but the time of this writing, there has been only one documented case of SVC in koi in the United States, and the USDA is working to contain SVC from spreading. There have only been a handful of *confirmed* cases of KHV, however, there have been many more suspected cases of KHV associated with substantial losses, and the numbers may increase substantially when more suspected cases are referred to qualified laboratories. Since both viruses are known to cause such high mortalities rapidly, and since there is no available rapid screening test for either virus, there are some reasonable precautions that are recommended to both koi owners and koi dealers.

Don't Panic.-Most diseases of koi are caused by poor water quality, common parasites, or common strains of bacteria. Many of these are preventable and/or treatable. Regardless of cause, quarantine will contain diseases to a small number of fish in the quarantine system, which can protect the fish in the pond. Dealers who practice proper disinfection and quarantine will have healthier koi for the hobbyist, and the hobbyist who quarantines will protect other koi already in their pond.

Education is the key to disease prevention in koi. Read, ask questions, attend seminars, work with fish health experts, and attend functions where educated speakers can inform and advise you. As with any internet communication, evaluate the information with respect to the source; not everything printed on the internet is accurate or current. Know the relative risks of various activities. Koi kept in the same stable pond for a long time are the *least* likely to have been exposed to either virus. Fish recently

purchased are greater risk, and koi recently purchased from dealers or at auctions in which fish from many sources have been put into in a common tank are at higher risk of exposure than those maintained in separate tanks. Fish recently imported are at risk of being carriers of SVC or KHV, although the risk varies with the region. Japan has not had a reported case of SVC in that country, but Japanese imports that have been mixed in this country with imports from other countries could have been subsequently exposed. Koi shown in "Japanese style koi shows", where koi are directly exposed to other koi in a show tank, are at higher risk than koi in "English style koi shows", where the fish remain in their own tanks and are handled less. In each situation, the risk is reduced where proper hygiene is routine (i.e. hand washing between tanks, separate nets, separate tanks, excellent water quality, proper handling, etc). The good news is that the SVC virus and KHV are relatively easy to kill on objects that are properly disinfected, and quarantine can help prevent spread of these viruses to unexposed fish. It is up to each koi owner, dealer and show committee to learn more about proper disinfection and quarantine so that the risk to koi is minimized. However, that is true for koi health in general, and not just for these two viruses.

Quarantine and disinfection are the best preventions of any koi diseases. It is wise for *all* koi handlers (dealers and private owners) to quarantine *all* fish prior to introducing or re-introducing koi into a pond or tank after purchasing new koi or attending a koi show. Quarantine, like all koi functions, will be temperature dependent. At this time, specific recommendations for quarantine are not available, but it will likely include at least 4 weeks covering a wide temperature range. Proper disinfection also reduces the risk of buying and showing fish. Hand washing between fish tanks or ponds is a must. Disinfection of equipment is essential for good health. Benzalkonium chloride is one of the most useful disinfectants. Chlorine is better, but is toxic to fish. Empty tanks, hoses and objects that can be treated with chlorine should be. However, when fish are in close proximity to the disinfectant, benzalkonium chloride is a little safer in case of accidental exposure to people or fish. If everyone is educated and practices hygiene and quarantine, the risk of all diseases including these two viruses will be reduced. The best disease prevention program includes education, quarantine by the owner and the dealer, and proper disinfection by everyone who handles the fish.

Do not add any native fish or aquascaping to your pond for "looks" and do not release any non-native fish into the wild. Objects like wood, plants, rocks, fish, water or anything that has been in contact with other fish (any species) should be avoided. Until more is known about viral carriers, it is better to be safe than sorry. In most states, releasing non-native fish (koi and some goldfish) or water from a fish pond into public waterways is prohibited or restricted.

Early detection of disease often improves outcome. When a rapid, accurate screening test for either of these viruses is developed, then carrier status and transmission will be studied and more precise advice will be available. Until then, however, *quarantine and limited exposure* will be the best defense against these viruses as well as most other infectious diseases of koi. **That does not mean that owners and dealers should not buy, sell or show koi. It means that owners and dealers should continue to educate themselves about disease prevention, good hygiene and early detection of problems.** Each owner, judge or show manager should then evaluate the risks and benefits of showing, buying and selling koi, and then to decide what level of risk each is prepared to take.

Koi are beautiful animals, wonderful pets, and the source of enjoyment for thousands of households. Koi shows have been the time honored method of displaying and enjoying koi, and are in large part responsible for the growing popularity of koi in this country today. The popularity of koi has in turn driven the veterinary community and fish health specialists to learn more about the health and medicine of these pets, so that they can remain healthy. Koi dealers, koi owners, koi clubs, koi show managers, and fish veterinarians are working together to ensure the health of koi and to improve the management of koi shows so that we can continue to enjoy koi the way that they have been seen for generations.

Note! Quarantine and disinfection are only two methods of keeping your koi healthy, but they represent two of the most powerful methods available. Look for specific quarantine and disinfection recommendations in the next issue of KOI USA.

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