

# Koi Herpes Virus (KHV)

## Clinical symptoms and diagnosis

Duncan Griffiths

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In order to fully understand the clinic symptoms of Koi Herpes Virus (here in referred to as KHV), the symptoms of which are very subtle and varied. It is, in my humble opinion; important to know a little of the history of the disease. When mentioning the former names given to this disease before the virus was isolated and named by Dr Ron Hedrick et al, all the former names will suggest symptoms that will give vital and therefore faster diagnosis of the disease as it presents itself in the typical garden pond. As the former names were a little more descriptive and relevant to what we were looking for than the current given name of KHV.

The speed with which KHV advances and kills carp has to be seen to be believed. From contracting KHV and the disease going active/live, mortalities can be experienced in 1 to 2 days and with a steady stream of mortalities thereafter, you could possibly be looking at a near 80- 100% wipe out of a pond inside three weeks if the diseased is left unchecked and/or untreated at the diseases preferred operating temperatures. Herein lies yet another problem of diagnosis.

I think it's true to say that even the advanced hobbyist when presented with KHV can be experiencing 30-50% mortalities; before he or she realizes they have or may have it. For the newcomer to the hobby this could be 60- 80% before they realize KHV, IF THEY EVER DO, such is the speed with which this virus kills

The virus was isolated and partially characterized in the year 2000 by Ron Hedrick et al. At this time KHV was photographed with an electron scanning microscope, THE name was given to the disease, that of "koi herpes virus", as it is indeed variant of a herpes virus.

Koi herpes virus is just one of three types of Herpes Viridae that infect cyprinid classification of fish.

**CyHV-3 (koi herpes virus) and the KHV virus is a double stranded DNA molecule effecting common and koi carp**

**CyHV-2 (Cyprinid herpes virus 2). "Haematopietic necrosis herpes virus". This affects goldfish and is closely related to "carp pox".**

**CyHV-1 "carp pox" virus, we see this as a waxy blister appearance on koi at certain times of the year and is generally non life threatening.**

The herpes virus is certainly one of the largest Viridae there are, but that does not make life for diagnosis any easier.

One of the problems with identifying the disease when it appears is, the name "KHV" does not give you any clues as to what you are looking for.

If we as humans get a cold or influenza, to certain extent an historic image of the symptom in our memory suggests a view of the symptom we can expect to see. Most of us know how the typical clinical symptoms for colds and flu present themselves, and then we can be pretty sure we have a cold or an attack of influenza and we are usually not wrong. With clinical symptoms of KHV, the "H" in the initials KHV stands for Herpes. While most of us may know how a typical herpes virus symptom presents itself in humans (typically as blisters on the lips or the genital area). When the piscine (fish version) variant of herpes virus presents itself, we see none of these known typical symptoms. Therefore apart from the fish looking sick and behaving in a non normal manner, we have nothing to identify with as with other disease.

KHV is a serious mover when it infects a fish population and deaths are extensive and swift but the clinical signs are both subtle and easy mistaken for other diseases. Also \*all\* the symptoms are not forced to be present in all fish at all times.

We have; as I see it, two immediate problems of diagnosis when this bug strikes. 1. Speed of mortalities or advancement of the disease. 2. So called subtle and easy mistakable external symptoms

If a cure or cessation of symptoms is to be effected with an outbreak of KHV, speed of diagnosis must be of utmost importance. But how can you diagnose something and take action to effect a cure, when the symptoms are that subtle and the disease advances that fast?

This is where the history of the disease becomes an important factor for us as koi keepers. The pervious numbers and array of names given to this disease before it was identified and officially named prior to 2000, gives us the best clues. The descriptive names for the disease prior to this time are probably more of an indicator to symptoms of the disease than that which the current name suggests.

In 1998 just as the internet age was dawning, the Israeli koi carp and common carp food fish industry reported a disease which rapidly moved through their fish stocks claiming almost 100% mass mortalities in both common Carp and Koi Carp. It was not long before fish keepers in the koi carp hobby; reported seeing a disease similar in Koi Carp just as devastating, with the very same mass mortalities. Or could it be perhaps, it may have been that the newly emerged internet was giving this disease a higher profile? High profile or not, the disease was serious and virulent enough to generate extensive debate. Acceptance that a new virus was with us and denial abated on the worlds the koi web site forums and some debates got quite angry and ugly. But this is all history now. But, what we can say to put a time scale to the disease is, KHV virus has since been isolated from fish samples taken in England back as far as 1996. So we are probably talking about mid 90's for the earliest recorded known emergence of the disease.

At this time as mentioned, the disease had not been isolated and sequenced, but certain clinical symptoms became apparent to the koi keeper and professional alike. These typically symptoms ran though the disease and this culminated in a Varsity of names that to some extent were more descriptive than what we currently now have for KHV

Listed below in no particular order

- **Bacterial Gill Disease (BGD)**
- **Viral Gill Disease (VGD)**
- **Fulminating Gill Rot (FGR)**

The first name given here, "bacterial gill disease" or (BGD) indicates or suggests that something is infecting or affecting the gill lamellae, indeed this one title spawned a treatment for a not at that time, very well understood disease which may have been bacterial but was in most cases probably viral in nature. This treatment, which was a very close variant of the compound called Chloramine T was a product produced by Argent labs called BGD<sub>X</sub> and the name stood for "Bacterial gill disease X" and is still in use today.

it was also called "viral gill disease" (VGD). Some hobbyists and professionals suspected back then that BGD could indeed be viral in nature, but this was pure guess work backed by local research then, by some pretty savvy fish geeks. But here again this name indicates some thing clinical is affecting the gill area on the koi.

Fulminating Gill Rot (FGR) is yet another name for the same thing, but now we have an indication as to what that clinical sign affecting the gill may be. Namely, gills rotting down to the core

All these titles give us vital clues as to what we are looking for, namely something that's affecting the gill areas of the fish, couple this to the speed and severity of the mortalities that take place we have our main clinical symptoms. The point of all this is, it culminates in the best two vital clues we have in our arsenal of clues, speed of kills and gill problems!

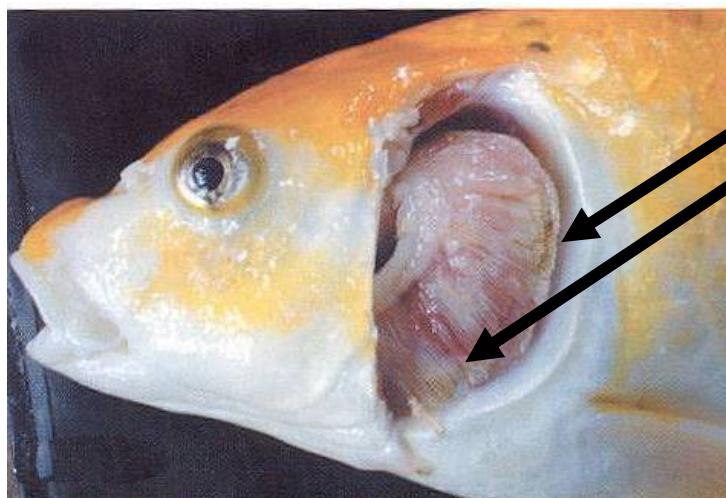
So apart from the speed of advancement of the disease and large numbers of deaths, "what the hell is affecting the gills"?

The colour and general tidiness of the typical gill should look like this picture below. This koi has lost part of its gill lamellae at some point in its life, but it is a good indicator of what we are looking for in a healthy koi. "Deep ruby red in colour and clean and tidy filaments with no excess mucus and no signs of necrosis (rot)



*Very tidy gill lamellae deep ruby red in colour not congested by mucus, very clean and tidy*

So what does a koi's gill look like that is suffering from the above title names, and as we now know it KHV.



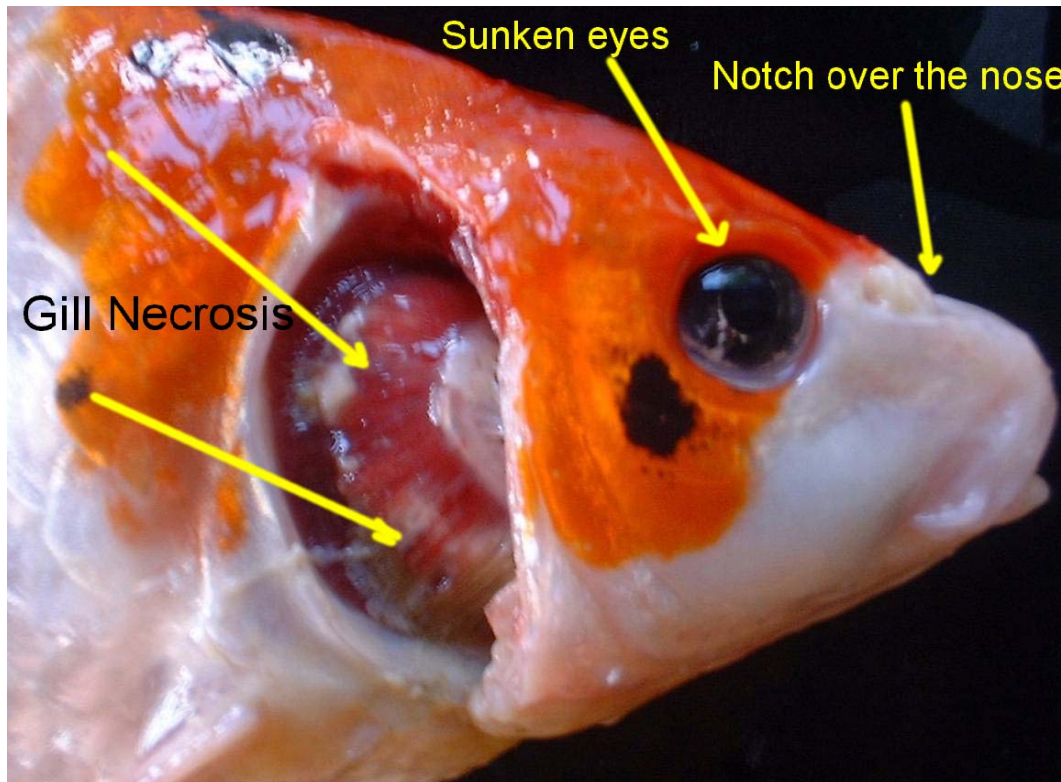
Necrosis of the gill lamellae

To date, this is still our best indicator of KHV when coupled with heavy fast losses. see the pale colouration, the necrosis taking place of the gill filaments( the area's predominantly at the edges tinged with grey /pale green/ white tissue) which indicates that the gill is dying and no longer capable of gas exchange for vital oxygen

### Are there any other symptoms?

Yes there are several more symptoms but these are indicative of both KHV and other diseases

One that seems to go hand in hand with KHV is the koi's eyes sink back into there sockets, at this time you are also likely to see the appearance of a shallow sunken notch in the facial profile of the fish right over the nose just ahead of the nares( nose)



*Here we see three of our KHV symptoms, gill necrosis, sunken eyes and the small notch over the nose*

There is one more major symptom to consider. Some people who have experienced the disease report initially at the start of the disease, heavy mucus production; that makes the mucus slough off the fish in layers, then the exact opposite no mucus as the disease progresses. In my experience I have yet to witness the former symptom, but I don't doubt it is a prominent part of the disease in some instances. But I do see or rather feel fish with no mucus and a texture to the skin when felt, that feels like sand paper.

Further fish will display extreme lethargy and sink to the bottom of the pond with pectoral fins spread out almost as though the fish is attempting to stay upright by deploying their fins in this way.

It's quite common to lose koi at the rate of two or three a day in the average stocked pond, such is the virulence of the disease and it seems to affect the more mono culture koi than the more diverse varieties. In other words if one were to keep a pond full of go-sanke and no other species it's highly likely that due to the way these three ( or four if you include shiro Utsuri) species have been selectively bred and honed to a specific pattern. These varieties are therefore inherently weaker than the more robust species. 100% mortalities are indeed more than possible with go-sanke. It's a bit like mongrel dogs verses pedigree for health robustness. If you work on the assumption that the koi that are more likely to survive KHV are the ones with the closest genetic links to the common carp this rules out go-sanke but may include koi like Chagoi, Ochiba, Ogons, maybe even shusui

One thing for is for sure, nothing is safe from KHV that belongs to the cyprinid carpio genus.

## The sting in the tale

It would not be prudent of me to leave this subject without telling it like it is.

We have waxed on and on about symptoms and what they look like but I said earlier KHV symptoms can present like many other diseases. So a **proper and correct diagnosis** is urgently required and preferred.

It is recommended to do your own diagnosis to rule out other root causes and possible diseases as early as possible. KHV confirmation cannot be done at home or at your local vets. All the symptoms above suggest KHV but as KHV is a viral infection, it must be assayed and confirmed at a marine/fish pathology laboratory no other diagnosis confirmation is possible and even then it must be a lab with experience in diagnosing KHV .

As KHV or any other virus is a very minute in size it cannot be seen under a compound light microscope. However, it does leave a foot print of its presence in the form of either a DNA sequence and/or antibody formation. The processes necessary to detect the presence of KHV takes dedicated equipment and dedicated materials, it cannot be done at your dealers or vets at this time. But the above symptoms will give you indicators as to what you are dealing with pending accurate diagnosis, you may even choose to start treatments pending your report back from your chosen lab, if confirmed this will give you a head start.

### What are the chances of your fish contracting KHV?

As KHV is now a global disease effecting every major koi carp breeding and exporting nation including, Japan, Israel, Malaysia, china and Is also affecting major carp food fish industries around the world up to an including angling fisheries. If you add koi to your collection year on year, the odds are stacking all the time against you **never** seeing KHV, unless you employ countermeasures to avoid contamination. Namely, strict quarantine protocols. But that's the subject of another article this is not being an alarmist it just a reality check for you

Thank you for taking the time to reads this section I hope it has been of help to you.

**If you take nothing else from this article commit this to memory.**

“If you start experiencing high rates of unexplained deaths in your fish stocks (with the emphasis on “**unexplained**”) and upon opening the gill cover you see areas of gill necrosis (rot)! **Alarm bells should be ringing and you should seek professional help!”** better safe than sorry

Quarantine is not a luxury it's essential