

## Introduction



- Koi Herpesvirus is a recently emerged viral disease of carp (*Cyprinus carpio*) in all of its varieties
- First officially identified in 1998.
- Examination of archive material indicates KHV presence as early as 1996
- Worldwide distribution
- **Poorly regulated international trade of ornamental carp (Koi)**

## Major impact on commercial food carp production

- Japan
- South East Asia
- United Kingdom
- KHV recently detected in confiscated illegal koi imports in the Philippines

## History

- In the past international movement of carp was governed by concerns over the spread of spring viraemia of carp (SVC)
- Health certification requirements applied to carp but not to koi.
- Spread of SVC in recent years has also been blamed on movement of koi



## Spring viraemia of carp (SVC)

- Rhabdovirus
- Can survive outside of the host in fresh water for up to 5 weeks at 10°C
- Disease of cyprinids (carp, goldfish and koi)
- Spread from the European continent
- 1988 – Brazil                      2002 – USA
- 2004 – China                      2006 - Canada

## KHV and other species

- Recent evidence indicates that gold fish (*Carassius auratus*) and grass carp (*Ctenopharyngodon idella*) may act as asymptomatic carriers of the koi herpes virus
- No information available on susceptibility of African cyprinids

### Introduction of exotic diseases threatens:-

- natural aquatic species diversity
- livelihood of subsistence and commercial fishermen
- aquaculture development and investment
- employment opportunities
- local economies



### Family Herpesviridae

- Cyprinid herpes virus 1 - carp pox herpes virus
- Cyprinid herpes virus 2 – herpes viral haematopoietic necrosis virus of goldfish
- Cyprinid herpes virus 3 - Koi herpes virus

CyHV-1, CyHV-2 and CyHV-3 have been shown to be closely related to each other and distantly related to channel catfish virus (IcHV-1)

### Carp pox lesions CyHV-1



### History of a typical outbreak

- Disease follows introduction of new fish or after contact with strange fish
- Clinical signs are not specific.
- Incubation period 7 days or less
- Rapid onset of mortality. Within 24 to 48 hours of onset of clinical signs. (82 % or more of exposed fish at 22°C can die within 15 days)
- 80 to 100 % mortality
- Optimal temperature range of the virus is from 18 – 25°C
- All ages, but fingerlings more susceptible than older fish

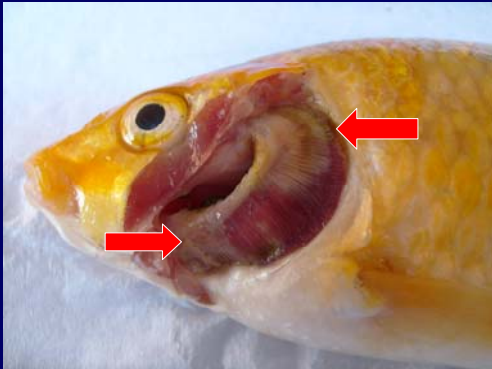
### Symptoms

- Affected fish remain near the surface
- Swim lethargically
- Respiratory distress
- Uncoordinated swimming movements
- Sick fish may still be attracted to feed

### External signs of disease

- reddening of the skin, dilation of superficial blood vessels, thickening of the surface mucus, often hanging from the fish in strands as if the fish were shedding skin. Dry feeling patches of skin.
- The gills appear mottled with characteristic pale white or brown streaks where gill filaments have died off. Haemorrhages may be evident in the gills.
- Eyes may be sunken.
- Changes in the internal organs are inconsistent and non-specific

## Gill necrosis (KHV)



## KHV - need for certified disease free fish

- Difficulty of identifying carrier fish
- Unquantifiable risk associated with:-
  - naturally resistant fish
  - survivor fish
  - 'vaccinated' fish
- Access to export markets



## Diagnosis

- Opportunistic infections may mislead a diagnosis of KHV
- PCR testing of gill and kidney swabs will reliably confirm active infection

## Diagnostic confirmation

- Direct diagnostic tests
  - (1. virus isolation on koi tissue culture)
  2. **polymerase chain reaction (PCR)**

## Diagnostic confirmation

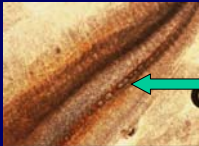
- Indirect diagnostic test
  - ELISA to detect antibody to KHV.
  - Limitations:
    - although a positive test indicates previous exposure, it gives no indication of whether the fish is still infected.
    - unknown how long antibodies persist

## Effect of temperature

- Temperature is the predetermining factor that controls whether KHV develops into lethal infection.
- Peak mortality at permissive temperature of 22 – 27°C.
- KHV outbreak can result in up to 98 % mortality

## Other factors

- host susceptibility
- transport stress
- stocking density
- water quality – ammonia



gas super-saturation

## Diagnostic limitations

- Where KHV is causing mortality the current diagnostic techniques are highly accurate in identifying the virus.
- Once fish have recovered or if they have been exposed but are held outside of the permissive temperature it may be difficult to detect the presence of the virus

## Limitations of our response

- No single or group of measures will give absolute certainty that a single fish or a group of fish are free from Koi herpesvirus unless the fish originate from a certifiable KHV free population

## KHV Regulations

- KHV has been included in the OIE Aquatic Animal Health Code
- EU import certification requirements have been amended to include guarantees for freedom from KHV

## Virus free status

- The international norm for a virus free status in an animal population is that no virus is detectable in at least 2 percent of the population at the 95 % confidence level with six monthly testing over a two year period
- Problematic for KHV compared to SVC

## Breeding certified KHV free fish for the market



## Prerequisites for a disease free status

- Closed population of fish
- Closed water supply
- Any newly introduced fish must originate from a source with the identical or higher standard of disease free certification
- Disease free status based on EU directives and on principles laid down by the International Aquatic Animal Health Code (OIE)

## Prevent transmission from brood fish to ova

- Hormonally induced artificial spawning
- Fertilization of eggs
- Disinfection of eggs
- Incubation of eggs in isolation hatchery
- Raising fry and fingerlings in isolation ponds







- ### Principles of good biosecurity
- Access control
  - Brood fish separated from hatchery and grow out facility
  - Separate staff designated to each facility
  - Closed water supply
  - Fenced and net covered ponds
  - Strategic disinfection
  - All in all out stocking

## **Disease free testing procedure**

1. After harvesting of earth ponds fish are placed into holding ponds for observation for at least 2 weeks
2. Large numbers of fish are packed in bags with oxygen and subjected to normal transport stress
3. Quarantine in recirculated facility for further minimum of 2 weeks at or near permissible temperature
4. Minimum of 150 fish destroyed humanely for sampling purposes
5. Submit for SVC (*Rhabdovirus carpio*) testing on tissue culture
6. Submit for KHV testing by PCR

