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The Status of Viral Diseases of Carp in Korea: Its Control and Research Development

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The carp (*Cyprinus carpio*) is the most common species of cultured fish, in particular, common carp and Israel carp have been cultured as an edible fish for several decades in Korea. Viral diseases of carp have never been reported until 1998 despite its long history of aquaculture in Korea. However, mass mortality occurred in populations of cultured carp from 1998 to 1999 resulting in a drastic reduction of carp production in Korea. The infected fish showed dark coloration, excessive mucus secretion from the surface and gills and branchial necrosis (Figs. 1 and 2).

Fig. 1. External signs of moribund fish show the characteristic of white patches.

Several cases were reported that dermal ulcers were noticed due to secondary infection by bacteria or parasites.

Fig. 2. Internal characteristics of VSNC: Branchial necrosis and white patch on gill.

In moribund carp, the clinical signs were formation of white patches on body surface or gills due to excessive mucus secretion. Dermal lesions caused by secondary infection were also found.

So, we called that the viral disease is a “viral systemic necrosis of carp (VSNC)” based on their clinical signs. The mortality was the highest at 20~28℃, and there being virtually no occurrence at below 20℃ or above 30℃. Although the characteristics of VSNC are similar to those of KHV, PCR tests proved that it was not KHV.

Oh *et al.* (2001) reported that the virions with 70~80nm diameter were presumed to be a causative virus in the kidney and spleen tissues of infected fish. They also reported that the artificial infection using a viral

suspension of 10^3TCID$_{50}$/mL obtained from the infected FHM (fathead minnow) cells, gave 80 to 100 percent mortality in carp (Fig. 3).

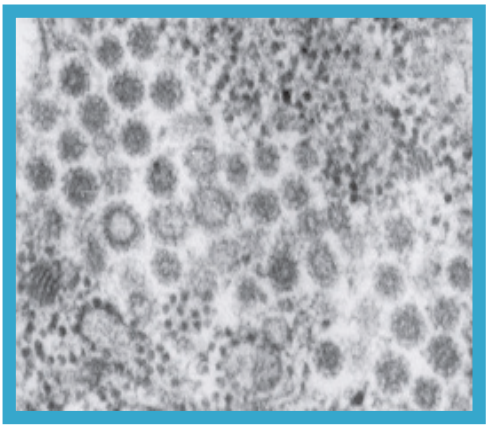

Fig. 3. Virions (Oh *et al*., 2001).

Kim *et al*. (2002), as a result of conducting gene cloning of the virus, suggested that the virus being a new species different from the known reported viruses of carps such as grass carp reovirus (GCRV), grass carp hemorrhage virus (GCHV), koi herpesvirus (KHV) and spring viremia of carp virus (SVCV).

Unlikely such findings, Choi *et al*. (2004) found a herpes-like virus of 82nm size within the nucleus of spleen cells from infected carps (Fig. 4).

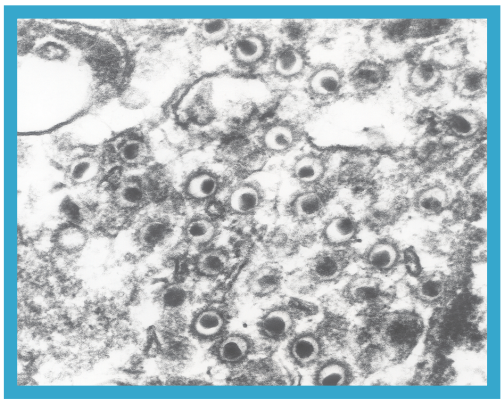

Fig. 4. Isolation of herpes-like virus from infected carp (Choi *et al.*, 2004).

During the past three years, the present study was established to development of prevention technologies for epidemics in order to protect the carps from the viral diseases.

First, two types of inactivated vaccines were prepared with the viral suspension of VSNC that obtained from the infected FHM cells: formalin-killed vaccine (FKV: 0.4% formalin) and heat-killed vaccine (HKV: 60 ^{o}C, 1hour).

The lysozyme activity of serum and chemiluminescent responses of head-kidney leucocytes showed increasing in the vaccinated fish, and as measured by ELISA (enzyme-linked immunosorbent assay), vaccinated groups showed a significant increasing in the virus-specific serum antibodies between 2 week post-first injection and 6weeks post-boost injection.

Results of the virus challenge showed that the fish vaccinated with FKV have induced protective immunity, while HKV injection hardly provided protection. And secondly, the antiviral activity of carp was examined using the potent inducers of interferons such as poly inosinic: cytidylic acid (Poly I:C) and spring viremia of carp virus (SVCV).

The results showed that carp injected Poly I:C developed an anti-viral protection which resulted in lower cumulative mortality against SVCV than untreated fish did. Moreover, in vitro study showed that head kidney leucocytes produced an interferon-like cytokine (ILC) after stimulation with Poly I:C (Fig. 5).

Since 1998, many studies have been conducted in diversified aspects to find out the causative virus of the diseases and prevention measures against viral disease of carp in Korea. However, identification of the virus was not clear and effective control measures were not established so far. Therefore, further studies on the causative virus including characterization and infection mechanisms are required.

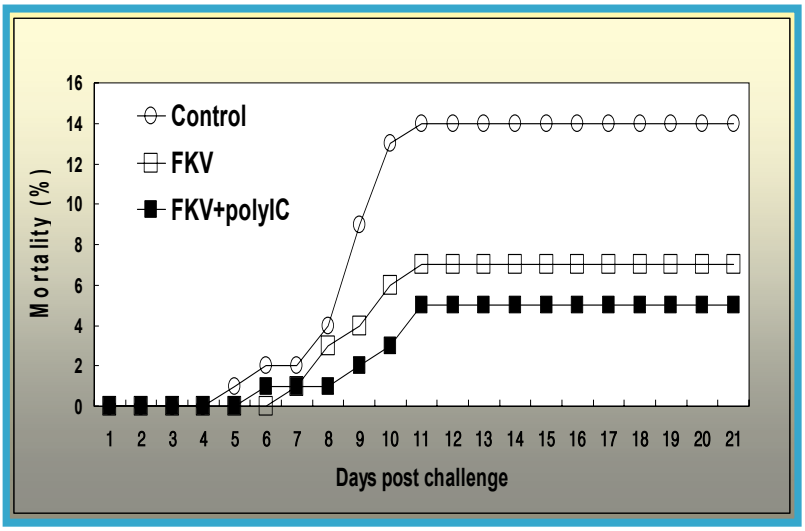

Fig. 5. Effect of Poly I:C on cumulative mortality against SVCV in vaccinated carps with formalin-killed SVCV.

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