

## Koi Herpesvirus – A new threat to fish culture: Mobilizing Southeast Asian Capacity

by Kazuya Nagasawa

Mass mortality of common carp cultured in Lake Kasumigaura, Japan  
(Photo courtesy of Takeaji Iida, NRI, Japan)



### Introduction

Aquaculture production is the fastest growing agricultural sector in the world, especially in Asia. In 2002, countries in Asia produced 91.2 % of the total world aquaculture production (51.4 million tons by volume including aquatic plants). Although China is the biggest producer, countries in Southeast Asia also contribute a high percentage of world aquaculture production.

Diseases are the major constraint to the growth of aquaculture production in various parts of the world including Southeast Asia. Viral, bacterial and parasitic diseases cause significant losses in aquaculture production. In this region, some transboundary pathogens and diseases, like White Spot Syndrome Virus (WSSV), Epizootic Ulcerative Syndrome (EUS), Viral Nervous Necrosis Virus (VNNV) and Taura Syndrome Virus (TSV) have been reported to spread with the movement of live aquatic animals.

**“Koi herpesvirus (KHV) is a new pathogen in Southeast Asia, where its infection was first detected in common and koi carps”**

### **KHV in Southeast and East Asia: a New, Serious Threat to Freshwater Aquaculture**

Koi herpesvirus (KHV) is a new pathogen in Southeast Asia, where its infection was first detected in common and koi carps (*Cyprinus carpio*) from Indonesia in March 2002. There is also fragmentary information that KHV is present in Malaysia. In neighbouring East Asia, KHV disease was found in pond-reared koi from Taiwan in December 2002 and in common carp cultured in Japan in November 2003. In Indonesia, there have been numerous cases of KHV-induced mass mortality of common carp and koi since 2002. Losses were

estimated to be more than 15 million US dollars as of December 2003. It has been thought that KHV was brought to Indonesia with koi imported from Hong Kong.

**“The common carp is an important food resource in the rural areas of Southeast Asia and is abundantly cultured, especially in Indonesia.”**

The common carp is an important food resource in the rural areas of Southeast Asia and is abundantly cultured, especially in Indonesia. Koi, on the other hand, is internationally traded as an ornamental fish among Southeast Asian countries. Considering its high virulence and devastating impact on both food and ornamental aquaculture sectors, KHV is regarded as a new and very serious threat to carp culture in the region.

## **The Regional Fish Disease Project of SEAFDEC**

The “Regional Fish Disease Project” is implemented at the S E A F D E C Aquaculture Department (AQD), in the Philippines, through the Government of Japan Trust Fund to address various fish disease problems and food safety issues in Southeast Asia. The first phase of the project entitled

“Development of Fish Disease Inspection Methodologies for Artificially-Bred Seeds” started in 2000 and will end in 2004. It was initially planned to end in 2003 but it was extended to 2004 because of the urgent need to study KHV infection. After this first 5-year project, the second phase of the Regional Fish Disease Project has been proposed under the title of “Development of a Fish Disease Surveillance System” for another 5 years from 2004 to 2008.

The Regional Fish Disease Project aims to: (1) enhance disease diagnosis and health management of aquatic animals in aquaculture in Southeast Asia; (2) promote healthy and wholesome trading of aquaculture products in the region; and (3) develop a fish disease surveillance network in the region.

Research is the main activity component of the Regional Fish Disease Project. Various aspects of viral, bacterial and parasitic diseases of fishes and shrimps have been studied. When the project started in 2000, research was carried out only by scientists of AQD. Subsequently scientists of research institutions under the Department of Fisheries, Thailand, and those of the Marine Fisheries Research Department of SEAFDEC in Singapore joined the project in 2001 and 2002, respectively. A total of 24 research studies were conducted from 2000 to 2003 in terms of (1) the establishment and standardisation of diagnostic methods, (2) biology and pathogenesis of disease pathogens, (3) disease prevention and control, and (4)



*Koi carp is internationally traded as an ornamental fish among Southeast Asian countries.*

establishment of evaluation methods for residual chemicals in aquaculture products.

## **Planning Meeting: KHV to be the focus of the Regional Fish Disease Project**

Study leaders involved in the Regional Fish Disease Project met at the Annual Progress and Planning





### The Regional Fish Disease Project: Activities

To achieve its objectives, the project conducted the following activities from 2000-2004:

1. **Research** to (1) develop standardized diagnostic methods for major diseases affecting economically important aquaculture species in the region; (2) develop effective prevention and control measures against microbial and parasitic diseases; (3) assess the pathogenesis of newly emerging diseases; and (4) develop monitoring methods for residual chemicals in aquaculture products.
2. **Hands-on training** to develop the capability in aquatic animal health diagnosis and management of technical staff working at research centres and institutions in the region.
3. **International meetings** to (1) discuss the status of fish disease problems, available diagnostic methods, and prevention and control measures employed in the region; (2) discuss the results of research studies conducted under the project and those generated in other countries in the region; (3) identify and discuss aquatic animal disease issues to be solved for further sustainable aquaculture growth; and (4) discuss collaboration with other international organizations like the Office Internationale des Epizooties (OIE).
4. **Extension** to disseminate research results and technology generated by the Project through (1) training courses on fish diagnosis and health management; (2) production of manuals; (3) publication of primary results in international scientific journals; and (4) presentation of results in international meetings.

Meeting held in Iloilo City, Philippines on 2<sup>nd</sup>-3<sup>rd</sup> December 2003 and discussed fish disease issues for 2004 and onward. During the discussion, several viruses were identified as serious, transboundary, pathogens that the Fish Disease Project should tackle as targets for fish disease surveillance in Southeast Asia. For fishes, these were KHV, spring viremia of carp virus (SVCV), and grass carp (*Ctenopharyngodon idella*) hemorrhagic virus (GCHV). For shrimps and prawns, the viruses were white spot syndrome virus (WSSV) and Taura syndrome virus (TSV) of black tiger shrimp (*Penaeus monodon*) and Pacific white shrimp (*Litopenaeus vannamei*), and the extra small virus (XSV) associated with white tail disease of the giant freshwater prawn (*Macrobrachium rosenbergii*). In particular, KHV was recognized as the pathogen that the project must combat most urgently.

### Activities of SEAFDEC for KHV Disease under the Regional Fish Disease Project

Based upon the output of the meeting, AQD made a plan to implement various activities for KHV infection through the Regional Fish Disease Project. Some research studies were planned for 2004 under the first phase of the project, while others were for 2004-2008 under the second phase. AQD believes that the project should proceed efficiently in coordination with the SEAFDEC Member Countries.

Important activities for KHV disease, some of which were initiated in the first half of 2004, are as follows:

#### Research

During the first phase of the project, planned research includes the survey of the distribution of KHV in the region, standardization of the PCR (polymerase chain reaction) detection methods for the virus,

characterization of the virus isolated from the region, mode of transmission of KHV, and pathology of KHV-infected fish. These studies are presently being undertaken at AQD. Also, there will be a study to develop vaccines for KHV, using inactivated virus or a recombinant viral envelope protein, at the Fish Health Research Laboratory in Jakarta, Indonesia.

During the second phase of the project, when new information on KHV infection becomes available in the SEAFDEC Member Countries, AQD will dispatch a diagnosis team to disease sites to isolate the virus and diagnose the disease together with scientists of the country in question. In April and July 2004, a survey was actually conducted by scientists from AQD in Indonesia and Taiwan, respectively, in collaboration with the scientists of each respective country.

In addition to these activities under the Regional Fish Disease Project, in 2004 AQD joined a 3-year research project on KHV infection, which was funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan. The National Research Institute of Aquaculture (based in Nansei and Tamaki, Mie, Japan) leads the project. Comparison of characteristics of KHV isolates from Asian countries is a research subject to be tackled at AQD.

**Hands-on training**

Since 2002, AQD has conducted annually a hands-on training on viral diseases of fishes and shrimp for scientists and technical staff working at research centres and institutions in Southeast Asia. The training course aims to provide executive training on the diagnosis of viral diseases to core

persons from the SEAFDEC Member Countries. The trainees are expected to play key roles in the diagnosis, prompt information exchange, and surveillance of fish diseases and to serve as national trainers in their respective countries. For 2004, a special training course on KHV and some other important viral pathogens is planned for scientists from some countries of the region.

**International meetings**

The Regional Fish Disease Project organized two meetings in March 2004 and also convened another meeting in June 2004.

**The Pre-KHVD Symposium Meeting** was held at the Fisheries Research Agency (FRA) of Japan in Yokohama, Japan, on 12<sup>th</sup> March 2004 as a satellite meeting to the International Symposium on Koi Herpesvirus Disease. Participants in this meeting were nine scientists from the SEAFDEC Member Countries



*The International Symposium on Koi Herpesvirus Disease was co-organized by FRA, SEAFDEC (through the Regional Fish Disease Project), MAFF and OIE in Yokohama on 13<sup>th</sup> March 2004 (photos courtesy of the Fisheries Research Agency, Japan).*



(one participant from each country, except for Brunei) and three scientists from AQD. The scientists from the Member Countries reported on the current status of the KHV disease, fish disease quarantine and surveillance in their respective countries.

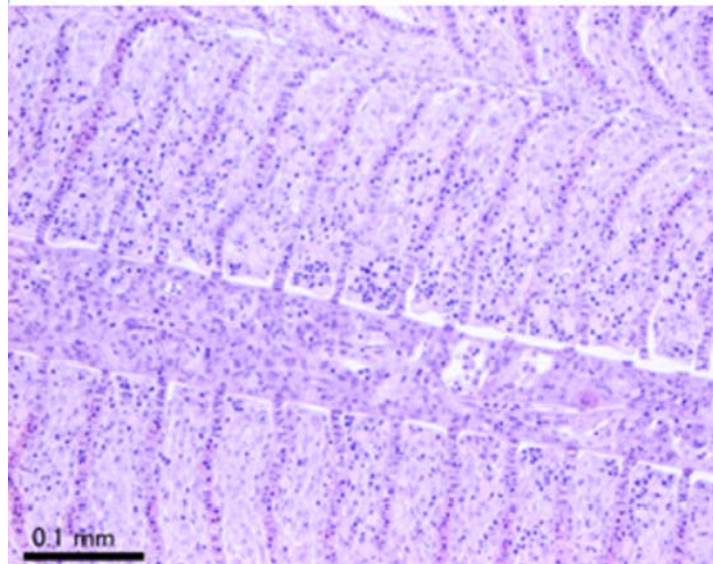
**The International Symposium on Koi Herpesvirus Disease** was co-organized by FRA, SEAFDEC (through the Regional Fish Disease Project), MAFF and OIE in Yokohama on 13<sup>th</sup> March 2004. This meeting was attended by scientists from Japan, the United States, South Korea, China, Israel and the Netherlands and scientists from the SEAFDEC Member Countries and AQD. A total of 16 papers were presented by invited speakers, and four of these speakers came from the region (Indonesia, Thailand, Singapore, and AQD).

Information presented at the symposium varied from basic knowledge of KHV through epidemiology of KHV infection in Indonesia and Japan, KHV vaccine development in Israel, to fish disease quarantine in Singapore and Thailand. It was useful in understanding of various aspects of KHV infection including control and prevention.

**A Meeting on the Current Status of Transboundary Fish Diseases in Southeast Asia: Occurrence, Surveillance, Research and Training**

was held in Manila, Philippines, on 23<sup>rd</sup>-24<sup>th</sup> June 2004. The meeting aimed to exchange the latest information on transboundary fish diseases and fish surveillance, research and training in Southeast Asian countries. The Regional Fish Disease Project funded 11 scientists from all SEAFDEC Member Countries, two invited speakers from Taiwan and Canada and 10 scientists from AQD

to participate in the meeting. Two scientists, from OIE in Tokyo and the Network of Aquaculture Centres in Asia-Pacific (NACA) in Bangkok, also attended. Transboundary fish and shrimp pathogens, KHV, WSSV and TSV were highlighted. Thus, the meeting consisted of five discussion sessions: (1) KHV; (2) WSSV and TSV; (3) quarantine services of aquatic animal diseases; (4) surveillance, monitoring and diagnosis of aquatic animal diseases; and (5) research and training on diseases of aquatic animals. For each session, at least one invited lecture was given, followed by reports from the 10 Southeast Asian countries. During the first session, the current status of KHV infection was reported by scientists from Indonesia, Taiwan and Japan. Through the country reports, detailed information on the current status of KHV, WSSV and TSV also fish disease



*Top: Common carp affected by KHV; the symptoms are not apparent but discoloration and necrosis of the gills are sometimes seen (inset)  
Down: Gill tissues of common carp affected by KHV, as appearing on optical microscope after proper coloration.  
(Photos courtesy of Takaji Iida, NRLA, Japan).*

quarantine, surveillance, monitoring, diagnosis, research and training in Southeast Asian countries was assembled.

### **Extension**

Research results will be published in international scientific journals, and standardized PCR diagnostic techniques will be disseminated through manuals and hands-on training. As the output of the Pre-KHVD Symposium Meeting, one report is available from AQD. FRA will publish in 2005 the proceedings of the International Symposium on Koi Herpesvirus Disease in the Bulletin of the Fisheries Research Agency, Supplement 2. By October 2004, AQD will publish the proceedings of the Meeting on the Current Status of Transboundary Fish Diseases in Southeast Asia: Occurrence, Surveillance, Research and Training (see further reading).

**“...the Regional Fish Disease Project will mobilize existing [regional] capacity through various activities of research, training, international meetings and extension, and put in place an efficient regional network to control the spread of fish disease.”**

### **Further reading**

Lavilla-Pitogo, C.R. and K. Nagasawa (eds.)(2004). Transboundary Fish Diseases in Southeast Asia: Occurrence, Surveillance, Research and Training. Southeast Asian Fisheries Development Center/ Aquaculture Department, Iloilo, Philippines.

### **About the author**

Kazuya Nagasawa, Ph.D. in fish parasitology and diseases, was a senior scientist of the Hokkaido Prefectural Fisheries Experimental Station (1981-1991) and National Research Institute for Far Seas Fisheries (1991-2001) and Director of the Nikko Branch of the National Research Institute of Aquaculture (2001-2003) in Japan. Since April 2003, he is Fish Disease Expert at the Aquaculture Department of Southeast Asian Fisheries Development Center (SEAFDEC), based in Tigbauan, Philippines.

## **Conclusion**

Transboundary pathogens of fish and shrimp can easily invade and spread through the international trade of aquatic animals in the region. We have so far experienced serious outbreaks of EUS and some other transboundary viral diseases caused by WSSV, VNNV and TSV. Now, we have another new viral pathogen, KHV. The SEAFDEC Aquaculture Department will continue to exert all efforts to prevent the spread of these transboundary diseases in the region in collaboration with each SEAFDEC Member Country and international organizations (e.g., OIE, NACA, and FAO). With these partners, the Regional Fish Disease Project will mobilize existing capacity through various activities of research, training, international meetings and extension, and put in place an efficient regional network to control the spread of fish disease.