

Quarantine, Surveillance and Monitoring of Koi Herpesvirus in Singapore

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Abstract

The Koi industry in Singapore is a sizable one. Thus the potential introduction of any significant disease such as Koi Herpesvirus (KHV) or Spring Viremia of Carp Virus (SVCV), will be of concern to Singapore. Singapore's ornamental fish are imported and exported by traders licensed under the 'Accredited Ornamental Fish Exporters Scheme'. Under this Scheme, the exporters have to get their premises approved according to guidelines set by the Agri-Food and Veterinary Authority of Singapore (AVA), which include the provision of designated quarantine area, fish disease treatment area, and packing area. These approved premises are inspected monthly by AVA inspectors. As part of routine fish disease surveillances conducted by AVA, regular fish samples are taken from each exporter premise once every six months for laboratory examinations, to ensure the absence of any significant diseases. Additional samples are taken for laboratory examinations at greater frequencies should any significant disease outbreaks occur in these premises. Significant results from these surveillances are reported in the Quarterly Aquatic Animal Disease Report (Asia and Pacific Region), which is submitted to the OIE and NACA. Since January 2003, no positive case has been detected to date from AVA's surveillance for KHV in Singapore.

Key words: Koi Herpes Virus, Accredited Ornamental Fish Exporters Scheme, laboratory examinations, surveillances, Aquatic Animal Disease, consignments, compulsory inspection, Quarantine

Introduction

Since reports of Koi Herpesvirus (KHV) as a significant disease of Koi in Israel, Europe and United States in 1998 (Hedrick *et al.*, 2000), and the Koi Mass Mortality Syndrome in Indonesia in June 2002 (Sunarto and Rukyani, 2004), ornamental fish traders dealing with Kois in Singapore have been concerned about this disease. The Agri-Food and Veterinary Authority of Singapore (AVA) has dialogue sessions with Singapore Koi farmers and traders in July 2003, to address their concerns and to promote measures to prevent the import of KHV-infected fish into Singapore. Since reports of KHV outbreak in Japan in October 2003 (Kimiya, 2004), AVA has instituted compulsory inspection, testing and

quarantine of all Koi consignments imported from Japan and Indonesia. Quarantine is for a minimum period of 3 weeks. Koi samples from a particular consignment, or sentinel KHV-free Koi placed together with these imported Koi, are subjected to testing for KHV by tissue culture. Only Koi tested negative for KHV will be released from quarantine. KHV positive Koi consignments will be destroyed, and the premise and equipment disinfected accordingly.

Singapore is known as the ornamental fish capital of the world. Despite the steep competition in recent years, Singapore still remains as a major player in the global business of ornamental fish export. In 2002 Singapore export about 235 million pieces of ornamental fish worth S\$ 74 million (US\$43 million) to more than 70 countries

(Anonymous, 2002). There are 64 ornamental fish farms and 103 ornamental fish exporters in Singapore. The local farms produced about 44% of the total export value of S\$72.8 million (US\$42.3 million) in 2003 (Ling and Lim, 2003). The increase in international trade of ornamental fish over the years poses a great challenge to national authorities in their vigilance against the potential establishment of exotic aquatic diseases in their countries. This has prompted many importing countries to impose more stringent health requirements on the incoming fish with particular emphasis on the specific disease-free status of the originating source. Over the years, AVA has been working closely with the Singapore's exporters in ensuring the Singapore export consignments meeting the increasing demand on fish quality and health status. AVA's quality assurance programmes aim to provide a credible and all-rounded approach towards the promotion of good hygiene and sanitation practices within the premises of the exporters. Emphasis is placed on the exporters' abilities to maintain an established standard of practice and a proper documentation process. AVA monitors the exporters' premises through regular inspection and water and fish samples to ensure compliance and provides technical advice on quality and health management matters. These programmes hence offer a comprehensive assurance of quality and fish health status for the export of Singapore ornamental fish to the global market.

Current Status of Koi Herpes-virus Disease (KHVD) in the Production of Common Carp and Koi Carp

Production of Common Carp

Owing to a very small market demand of common carp, there is no commercial farming of common carp in Singapore. There is limited number of wild common carps thriving in reservoirs and lakes in Singapore. These are for leisure and control of pest, but not for consumption. Hence, there is no harvesting or fishing of common carps activities being carried out in reservoirs and public lakes. Singapore imported less than 50 metric ton of common carps yearly for the last 3 years, mainly from Malaysia for offering in special festivals (Table 1).

Detailed breakdown of import in the past 3 years is summarized as follows: Being low in market demand, there is no export or re-export of common carp's trading activity in Singapore.

Table 1. Import of live common carp in Singapore for 2001- 2003.
Source: Singapore Trade Statistics (2003), Unit: metric tons.

	2001	2002	2003
Malaysia	32.68	43.26	41.03
Hong Kong			0.02
Taiwan	0.50		
Total	33.18	43.26	41.05

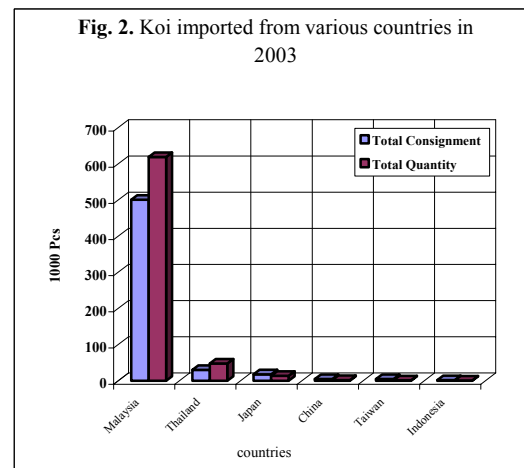
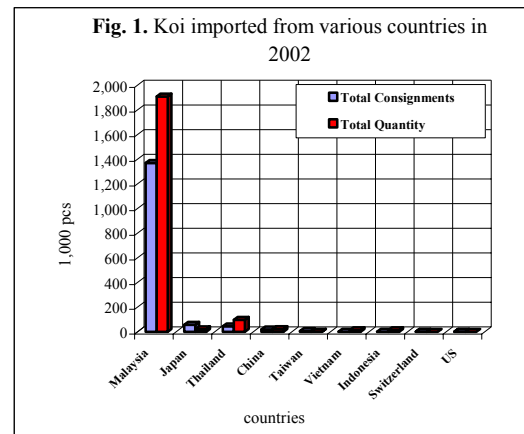
Production of Koi Carp

There are 4 fancy Koi farms and about 40 major Koi importers/exporters in Singapore. The activities of Koi farms are mainly involved in import of Koi fingerlings and nursing them into bigger size for local sale or export. Besides growing and nursing of high quality Koi, the farms also provide Koi hotel services for Koi hobbyists. Many Koi hobbyists in Singapore are HDB flat dwellers. They do not have sufficient space for their pet fish, thus they rent pools or ponds from the Koi hotel. Rental ranging from \$100 per month for a pond with a capacity of 10m³ to \$350 for a pond with 50m³. Rental covers daily feeding, maintaining and checking of the Koi during weekdays. Owners are required to provide feeds for daily feedings. They usually spend weekends and public holidays with their pet fish at the Koi hotel. Local production of Koi is negligible. The importers/exporters with holding and quarantine facilities, import Koi from different sources, quarantine them for a period of 3 week or hold for a longer period until the fish grow bigger or are in better shape, then exported to other countries. Singapore imports Koi of different sizes mainly from Malaysia, Japan, Thailand and China. The import figures of Koi for the last 2 years are shown in Figs. 1 and 2. The main supplier of Koi to Singapore is Malaysia which supplied more than 90% of the total quantity imported, followed by Japan (about 2 %) and China (1.5%), (Singapore Trade Statistics, 2003).

Singapore exports about 2.4million pcs of Koi annually to other countries.

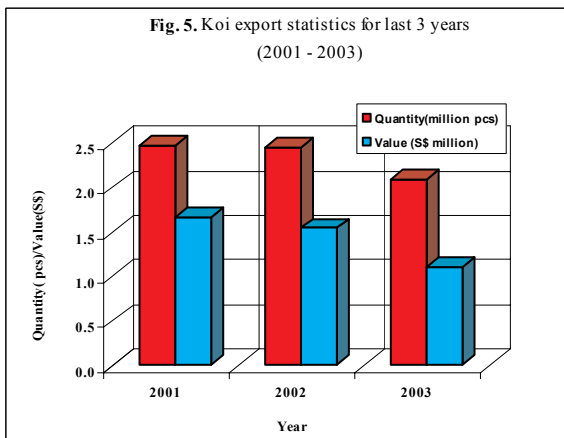
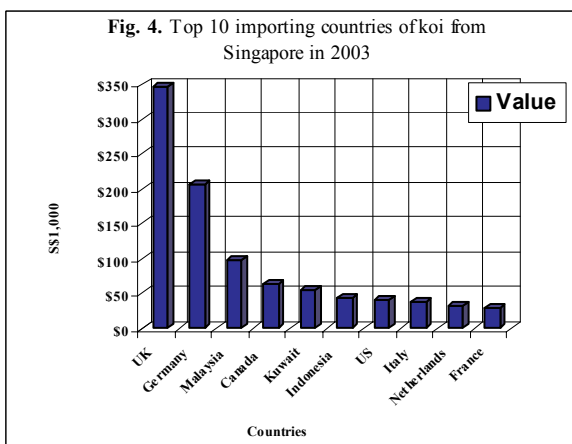
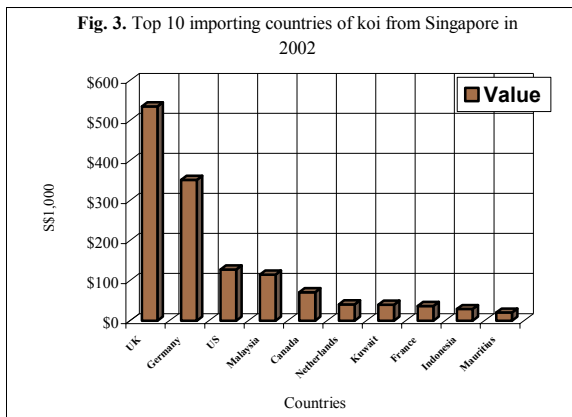
The major importers of Koi from Singapore are United Kingdom, Germany, United States and Malaysia (Figs. 3 and 4).

Export figures for the past 2 years are summarized in Fig. 5.



Koi Herpesvirus Disease (KHVD) of Common Carp and Koi Carp

Singapore has so far effectively controlled KHV from transboundary transmission through quarantine measures. Basically this quarantine process for Koi imported from suspected areas is for a period of 21 days. Therefore, Singapore is free from KHVD.



The National Aquatic Animal Health Management Strategy in Singapore

AVA is the only national authority responsible for aquatic animal health management in Singapore. It is empowered by the Fisheries Act (Chapter 111), Animal and Birds Act (Chapter 7) and the

Wholesome Meat and Fish Act (Chapter 349A), which provide the legislative framework for the regulation and monitoring of live aquatic animal trade and health management. Apart from implementation of specific monitoring programmes for the purpose of health certification for live fish trade, AVA also carries out surveillance for significant pathogens and conduct regular surveys and inspections of fish farms and exporters premises.

Fish Health Certification Programme

Certification has become a prerequisite for international movement of aquatic animal and a means of facilitating trade among countries. AVA is the only authority in Singapore to provide fish health certification services to live fish trade and industry. With the ever-increasing live fish consignments being exported from Singapore, certification is primarily based on a good reliable system on inspection and monitoring of the fish farms and export premises.

Accredited Ornamental Fish Exporter Scheme

For the purpose of health certification for export or ornamental fish, AVA implements the accredited Ornamental Fish Exporters Scheme to monitor fish health status and sanitation of export premises. The Scheme, initiated in 1983, is to encourage Singapore ornamental fish exporters to export healthy fish that are of high quality through maintenance of high standard of hygiene and sanitation in their export premises. The Scheme enables exporters with good management practices to obtain accreditation for their export premises and obtain health certificates based on their good track record of management practice on hygiene and sanitation, and fish quality rather than through inspection of every consignment. Membership to the Scheme is voluntary and through application by companies that are licensed importers and exporters of ornamental fish. Prior to the approval of

membership, the premises would be subjected to initial screening by AVA, including inspection of the premises and fish stock, water sampling for laboratory examination and checking the records of the fish sales maintained by the company. There must not have any history of fish disease occurrences or any gross mortality in the fish stocks in the export premises during the one month preceding the commencement of membership. A Code of Practice is incorporated into the Scheme to provide guidelines on the management of incoming and outgoing fish, routine care of fish held in the premises and packing of fish for export and maintenance of the packing premises. In addition, members also have their own quality control measures to ensure that only good quality and healthy fish are included in their consignments. More importantly, members must also meet the requirements of the importing countries.

Surveillance and Monitoring Programmes for Aquatic Animal Pathogens

Ornamental fish samples taken from exporters' premises have been screened for Epizootic Haematopoietic Necrosis Virus (EHNV), Infectious Pancreatic Necrotic Virus (IPNV), Infectious Haematopoietic Necrosis Virus (IHNV), Viral Haemorrhagic Septicaemia Virus (VHSV), Spring Viremia of Carp Virus (SVCV), and KHV with negative results to date.

Farm and Export Premises Survey

Surveys of fish farms and exporter premises are carried out on a monthly & quarterly basis by AVA. For these surveys, AVA officers visit the fish farm and audit the farmers/exporters on their farming production methods. In addition, farmers/exporters who encounter disease problems/outbreaks can approach AVA for assistance, either by telephone/fax, email or directly in-person at AVA Services Centres. Disease investigation is carried out by officers from Aquatic Animal Health Branch,

Epidemiology and Surveillance Branch and Aquaculture Branch, who work closely on these reported disease cases. Prompt action is always taken to ensure that farm visits are made and the affected species inspected. Samples are usually taken back to the laboratories for full post-mortem examination and disease diagnosis. Farmers/exporters are then advised on the course of action to take. If treatment is necessary, AVA staff will be on hand to train or guide farmers/exporters on proper treatment procedures. They will also be notified of the results of the investigations and given the necessary advice.

Specific Import and Quarantine Requirements

Besides the compulsory requirement of import licences and permits for all aquatic animals consignments coming into Singapore as described above, AVA imposes specific import and quarantine requirements for certain high-risk consignments coming in from sources where outbreaks of significant diseases are known. In the recent outbreak of KHV around the region, AVA has instituted compulsory inspection, testing and quarantine of all Koi consignment imported from countries with known outbreaks of the infectious disease. Fish are required to be quarantined in an isolated area at the importers' premises for a minimum period of 3 weeks, during which 10 samples from the consignment should be collected and send to the laboratory under Aquatic Animal Health Branch for screening of KHV virus. For the case of high quality and expensive Koi, 10 sentinel Koi cohabiting with these imported Koi for 7 days, are subjected to test for KHV by tissue culture. Only when the test for KHV is negative, will the fish be released from quarantine. KHV positive Koi consignments will be destroyed, and the premises disinfected accordingly. Water from the quarantine area are to be disinfected with chlorine and discharged into the sewage system to prevent KHV from entering into

waterways that lead to reservoirs where there are wild carps.

Development of Good Management Practice for Aquaculture

A Good Management Practice Scheme has been established for ornamental fish farms in Singapore. The Scheme, currently on a trial basis involving participation from some 13 farms, is voluntary and members are required to fulfil certain criteria in good farm management and adhere to a Code of Practice. The Code specifies guidelines on the various aspects of farming such as maintenance of farm premises, water quality management, farm hygiene, husbandry, pond/tank management, feeds and feeding, fish health management, water drainage and treatment, harvesting and post harvest & packing procedures and proper recordings. The farm is subject to regular inspection by AVA to ensure compliance. AVA is also in the process of developing a Good Aquaculture Practice (GAP) Scheme for food-fish farms.

Conclusion

As KHVD is very infectious and causes heavy mortality once succumbed. AVA has imposed all necessary controls to prevent KHV from entering into Singapore. This included a compulsory quarantine of all Koi imported from suspected country for at least 21 days. From the information gained from the International Symposium on Koi Herpesvirus Disease and study trips in Japan, we observed that the KHV problems faced in Japan have been due to the transmission of the virus to carps in lakes and reservoirs whereas KHV in Koi has been effectively contained. Therefore Koi farmers, importers, and exporters are recommended to pay attention the followings:

- (1) Be vigilant to prevent similar disasters that have occurred in other countries.
- (2) Quarantine Koi imported from suspect country in an isolated area for at least 3 weeks prior to obtaining laboratory report.
- (3) Send 10 Koi sample to Aquatic Animal Health Branch, AVA for screening of KHV and generation of the laboratory report.
- (4) Cohabite 10 sentinel Koi with the high quality and expensive Koi for 7 days and send the sentinel Koi to the Aquatic Animal Health Branch for screening of KHV. This has been an innovation from Singapore and was acknowledged by the Symposium in Japan.
- (5) Disinfect water from the quarantine area with chlorine and discharge water into the sewage system to prevent KHV from entering into waterways that lead to reservoirs where there are wild carps.
- (6) Release quarantined Koi for culture or export only upon confirmation of KHV negative results from the Aquatic Animal Health Branch.

References

- Anonymous, 2001: FAO Yearbook of Fisheries Statistic, Vol. 89. FAO, Rome.
- Hedrick R.P., Gilad O., Yun S., Spangenberg J.V., Marty G.D., Nordhausen R.W., Kebus M.J., Bercovier H. and Eldar A., 2000: A herpesvirus associate with mass mortality of juvenile and adult koi, a strain of a common carp. *J. Aquat. Anim. Health.*, **12**, 44-57.
- Kimiya H., 2004: The Status of Koi Herpesvirus Disease and Management Measures in Japan. *Abstracts of Intern. Symp. on Koi Herpesvirus Disease* (eds. by Hayase S. and Nakajima K.), 23p.
- Ling K.H. and Lim Y.L., 2003: The Status of Ornamental Fish Industry in Singapore (In press). *Singapore J. Prim. Industry*.
- Sunarto A. and Rukyani A., 2003: Indonesian Experience on the outbreak of koi herpesvirus in koi and carps (*Cyprinus carpio*). *Abstracts of Intern. Symp. on Koi Herpesvirus Disease* (eds. by Hayase S. and Nakajima K.), 9p.
- Singapore Trade Statistic, 2003: Stat. Link, Singapore Trade Statistic. *International Enterprise Singapore*.