

Status of an emerging viral fish pathogen

Tilapia Lake Virus (TiLV) in India

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Tilapia has been considered as the Food Fish of the 21st century and is popularly known as aquatic chicken. The world aquaculture production of tilapia is 4.0 million tonnes with an estimated value of around \$ 3 billion. Food and Agriculture Organization (FAO) reports indicated that, the Global Tilapia production is expected to reach 7.3 million tonnes by 2030. Globally, Tilapia aquaculture production had reached up to 6.4 million metric tonnes.

Key words: TiLV, Tilapia lake virus, Virus outbreak

NILE Tilapia (*Oreochromis niloticus*) is the most widely cultured species among the different culturable species of Tilapia, viz. Blue Tilapia (*O. aureus*), Mozambique Tilapia (*O. mossambicus*) and Zanzibar Tilapia (*Urolepis hornorum*). Rajiv Gandhi Centre for Aquaculture (RGCA) under Marine Products Export Development Authority, Government of India is promoting culture of Genetically Improved Farmed Tilapia (GIFT), *Oreochromis niloticus* (through all-male seed production). Nile Tilapia was introduced to India during late 1970's and only Genetically Improved Farmed Tilapia (GIFT) farming is approved with some guidelines. Genetically Improved Farmed Tilapia (GIFT) was characterised by its uniform size and high survival rate and is dominating the commercial aquaculture industry. The demand is also high in local and international markets as fresh and frozen fillets because of its less spiny and short skin characteristics. The type of Tilapia fish farming ranges from ponds, raceways, concrete tanks to intensive and super-intensive practices like pen and cage culture in reservoirs, canals and lakes etc. Considering the invasive nature of

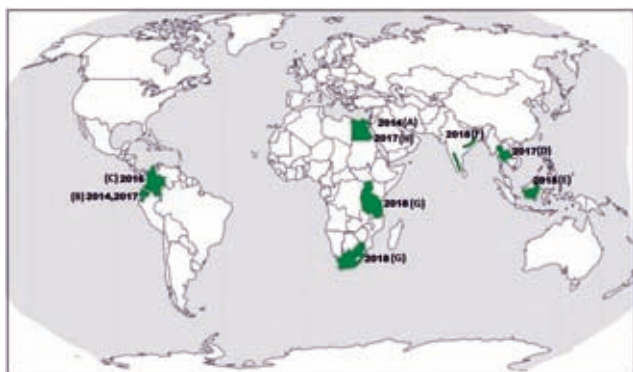
this fish species, the Government of India permits the seed production and farming of Tilapia to different fish farmer groups. Monosex tilapia farming is practicing in India with a yield of 500-2,000 kg/ha/yr.

Recently the incidence of Tilapia Lake Virus (TiLV) infection created an alarming situation in the Tilapia culture scenario. This dreaded virus affects Tilapia population from larval, juvenile and to adult stages, thus affecting the Tilapia industry to a great extent. Considering the threat of this virus to Indian Aquaculture and Open Water Fisheries where large proportion of Tilapia Lake Virus is existing in resident fish population, it is utmost necessary to prevent the spread of this virus into the culture system. Additionally, the growing international trade in live aquatic animals and their products have been accompanied by long distance geographical redistribution of aquatic animal species and pathogens. The result is a continuous emergence of transboundary diseases which may cause huge production losses to the culture system. Therefore, farmers, seed growers, traders, policy makers and researchers including educational institutes need to be sensitised about preventive health management of

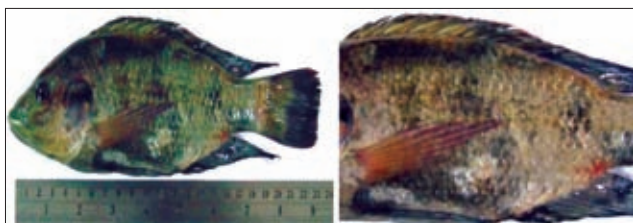
Tilapia Lake Virus infection in the aquaculture system. A brief account of aetiology, clinical signs and symptoms, diagnostic methods are described here.

Tilapia Lake Virus Outbreak in India

Tilapia lake Virus disease is an emerging disease in Tilapia fishes caused by an orthomyxo-like virus that was first reported in the freshwater lake, Israel in the year 2014 and has subsequently been reported from Ecuador, Columbia, Egypt, Thailand, Malaysia and India. The disease has been called Tilapia one month mortality syndrome, as it is frequently reported within one month after fry or juvenile tilapias have been moved from hatcheries to the grow-out cages. The lack of screening of imported stocks of fry and fingerlings resulted in transboundary movement of Tilapia Lake Virus in the countries like Egypt, Ecuador, Colombia, Thailand, Taiwan and India. The first report of Tilapia Lake Virus incidence from India was reported from West Bengal and Kerala. The porous border across the neighbouring countries of India helps the transmission of this fish pathogen through seeds and fingerlings of Tilapia. Reported areas



Reported areas and the year of outbreak of Tilapia Lake virus: A, Israel; B, Ecuador; C, Colombia; D, Thailand; E, Malaysia; F, India; G, Africa; H, Egypt.



Tilapia Lake Virus infected fish with discolouration and haemorrhages in the body

of Tilapia Lake Virus include Egypt, India, Africa, Thailand etc.

Aetiology and pathogenesis

Tilapia Lake Virus (TiLV) is an orthomyxo-like virus with a total genome size of 10.323kb. It is a 10 segmented negative sense RNA virus with each segment ranging from 456 to 1641 nucleotides. The conserved complementary sequences at the 5' and 3' termini are consistent with the genomic organization found in orthomyxoviruses. Tilapia Lake Virus have been reported in wild tilapia *Sarether odongalilaenus*, farmed tilapia *Oreochromis niloticus* and commercial hybrid tilapia (*O. niloticus* × *O. aureus*). High level of mortality of Tilapia fishes associated with skin erosions, haemorrhagic leptomeninges and moderate congestion of spleen and kidney are the suspected signs of Tilapia Lake Virus infection. Eye, brain and liver are the targeted organs of Tilapia Lake Virus infection. The disease outbreak mainly recorded in the summer and reports showed that stages like fry, fingerling

and adult tilapia fish are susceptible to Tilapia Lake Virus infection. The Cohabitation studies revealed that, Tilapia Lake Virus is not affecting any other carp species or other culturable species along with Tilapia culture. But, recently the reports on TiLV detection in the cultured species such as river barb (*Barbonymus schwanenfeldii*) and java barb (*Barbonymus gonionotus*) indicated that the freshwater fish industry would be extremely at risk in constricting Tilapia Lake Virus.

Diagnostic measures

The affected fish showed haemorrhagic patches in the body, detached scales, skin and fin discolouration (Fig. 2).

Tilapia Lake Virus can be cultured in primary tilapia brain cells or in an E-11 cell line, inducing a cytopathic effect at 5-10 days. Two cell lines from the brain (OnlB) and liver (OnlL) of the Nile tilapia, *Oreochromis niloticus* were developed for the efficient propagation of TiLV. Molecular methods like RT-PCR, nested RT-PCR, semi-nested RT-PCR, SYBR quantitative RT-PCR, are developed for the detection of Tilapia Lake Virus in the infected fishes. Recently ICAR-CIFRI, developed one step RT-PCR TiLV detection kit for the direct detection of TiLV in Tilapia samples.

In-situ hybridization reveals the presence of this pathogen in liver, kidney, brain, gills, spleen and muscular connective tissue. Histopathological findings include the

gliosis, encephalitis and perivascular cuffing in the brain cortex, multifocal chronic hepatitis and multifocal interstitial haemorrhage in the kidney. Serological and immunological studies are required for understanding the pathogenesis of this virus in the infected fishes.

Future perspectives

The best options for preventing the continuous emergence of viral diseases in aquaculture are ideally at the farm level where better knowledge about the viral diseases and their improved diagnosis, inspection and surveillance programs translate into higher profits for the farmer and, therefore, motivation for a sustainable industry. The economic loss of Tilapia production associated with Tilapia Lake Virus mortality is to be addressed. Owing to the importance of Tilapia fish in the International trade, strict governance policies are necessary for the control of Tilapia Lake Virus infection in future. Since no treatment is available, prevention is the only measure to control this viral infection. Following biosecurity measures can be practised in the Tilapia farming to prevent the occurrence of this disease: scientific screening of the brooders, periodic sampling and diagnosis of the imported Tilapia stocks; culling or removal of infected stock; stocking of specific pathogen free stocks etc.

It was recently shown that TiLV is inactivated in tilapia fillets stored at -20°C for 90–120 days demonstrating that frozen seafood (e.g. whole fish or fillets) imports may be associated with lower risk of virus dissemination than non-frozen products. Synthesis of suitable antibodies and vaccination strategies are the measures ahead for the complete resistance of this pathogen in the Tilapia population.

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