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# Outbreaks of Tilapia lake virus (TiLV) threatens the livelihoods and food security of millions of people dependent on tilapia farming

## Highlights

- Tilapia lake virus (TiLV) poses a great threat to the tilapia sector, a significant contributor to affordable animal protein, income to fishfarmers and fishers, and domestic and export earnings.
- TiLV has been confirmed in some countries in Asia, Africa and Latin America. It is likely that TiLV may have a wider distribution than is known today and its threat to tilapia farming at the global level is significant.
- While there is no public health concern for this pathogen, there is a significant risk of TiLV being translocated both inter- and intra-continentally through the movement of infected live tilapias in the absence of appropriate biosecurity measures.
- Tilapia producing countries need to be vigilant and take appropriate risk management measures (e.g. enhanced diagnostic testing of imported stocks and unexplained tilapia mortalities and reporting to biosecurity authorities, active surveillance, public information campaigns and contingency plans) to reduce the further spread and potential socio-economic impacts of this emerging disease.

An outbreak of fish disease Tilapia lake virus (TiLV), an orthomyxo-like virus belonging to the family Orthomyxoviridae, threatens to compromise the livelihoods and food security of millions of people, particularly of highly vulnerable subsistence fishers and small fish farms. The disease is highly pathogenic, with no known control methods, and poses significant threat to cultured and wild stocks of tilapia. Tilapias are farmed globally and are the second most important aquaculture species in terms of volumes produced, providing a key source of affordable animal protein, income to fishfarmers and fishers, and domestic and export earnings.

Tilapias are often transported, live or in processed form, between countries and many nations may still be unaware of the emerging threat posed by TiLV. Several countries have experienced significant mortalities of tilapia, but have not yet identified the cause. A reliable diagnostic test for TiLV is available and it should be applied to rule out TiLV as the causative agent of unexplained mortalities. As of today, the TiLV has been confirmed in some countries in Africa, Asia and Latin America. There is a significant risk of TiLV being translocated both inter- and intra-continentally through the movement of infected live tilapias in the absence of appropriate biosecurity measures. There is no public health significance for this pathogen. More research is urgently needed to determine if the virus is transmitted via frozen tilapia products. *It is likely that TiLV may have a wider distribution than is known today and its threat to tilapia farming at the global level is significant.*

## Importance and distribution of Tilapias

Tilapias are the second-most important farmed finfish worldwide (next to the Cyprinids), with Nile Tilapia (*Oreochromis niloticus*), ranking 6th among the most important cultured species. Their importance is also due to their affordability, good source high quality protein and micronutrients, tolerance to high-density aquaculture and resistance to disease.

Globally, tilapia aquaculture production for 2015 was about 5.6 million tonnes. The top 10 tilapia producers for 2015 were: China (1.8 million tonnes), Indonesia (1.1 million tonnes), Egypt (875 thousand tonnes), Bangladesh (324 thousand tonnes), Viet Nam (283 thousand tonnes), the Philippines (261 thousand tonnes), Brazil (219 thousand tonnes), Thailand (177 thousand tonnes), Colombia (61 thousand tonnes) and Uganda (57 thousand tonnes)[1]. In 2015, world tilapia production (aquaculture and capture) amounted to 6.4 million tonnes, with an estimated value of USD 9.8 billion, and worldwide trade was valued at USD1.8 billion[2].

## Science of TiLV, known distribution and associated impacts

The Network of Aquaculture Centres in Asia-Pacific (NACA) released a TiLV Disease Advisory[3] and the World Organisation for Animal Health (OIE) released a Disease Card[4] in May 2017. They summarize the available scientific knowledge about TiLV in terms of causative agent, modes and risk of transmission, host range, clinical signs and diagnostics. No information, however, is available on survival of pathogen outside host, stability of the agent, levels of mortality at different life stages, suspected aquatic animal carriers/vectors, and possible treatments. The WorldFish Center also released a Factsheet: TiLV: what to know and do[5].

The virus affecting TiLV has been described as an orthomyxo-like virus, belonging to the family

*Source:* *Farmed Nile tilapia (Oreochromis niloticus) Bangladesh, © FAO/M. Hasan.*

[1] http://www.fao.org/fishery/statistics/global-production/en.

[2] FAO Statistics and Information Branch, Fisheries and Aquaculture Department/FAO 2017, Fishery and Aquaculture Statistics. Global production by production source 1950-2015 (FishstatJ). In: FAO Fisheries and Aquaculture Department (online), Rome. Updated 2017, www.fao.org/fishery/statistics/software/fishstatj/en.

[3] https://enaca.org/?id=864&title=tilapia-lake-virus-disease-advisory, (3 May 2017).

[4] http://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/A_TiLV_disease_card.pdf, (May 2017).

[5] http://pubs.iclarm.net/resource_centre/FISH-2017-03.pdf.

*Source: Nile tilapia (Oreochromis niloticus) aquaculture, Fiji's Islands, ©FAO/Aquaculture photo library.*

Orthomyxoviridae[6]. The causative agent of Infectious Salmon Anaemia (ISA), a member of the genus Isavirus, also belongs to the same family. This should be a cause for great concern, considering the socio-economic impacts that the ISA virus has brought about to the salmon farming industry. Further, as tilapia is a cheap source of protein for many millions of people worldwide, losses in production due to epizootic-level disease outbreaks could be disastrous to a global food security and nutrition.

TiLV has been confirmed in Colombia, Ecuador, Egypt, Israel and Thailand, with reports indicating heavy fish mortalities in most countries. In Israel, the tilapia wild catch (main species: *Sarotherodon galilaeus*) in Lake Kinneret (The Sea of Galilee) dropped significantly from an average level of 257 tonnes per year to 8 tonnes per year in 2008. The drop was linked to TiLV disease. Since 2009, the tilapia catch in Lake Kinneret has been growing continuously and reached 320 tonnes in 2015. Although tilapia breeders report variable survival rates especially during the hot season, the total production of cultured tilapia in the last decade has been stable, ranging from 7 000 to 8 000 tonnes per year[7]. In Thailand, during 2015 and 2016 TiLV outbreaks resulted in mortalities of 20 to 90 percent[8], with records indicating many deaths of farmed Nile tilapia and red tilapia hybrid[9]. In Egypt, unexplained mortality of tilapia during the summer months in recent years indicated a potential economic impact of around USD 100 million in 2015[10].

[6] Eyngor, M.; Zamostiano, R.; Tsofack, J. E. K.; Berkowitz, A.; Bercovier, H.; Tinman, S.; Lev, M.; Huryitz, A.; Galeotti, M.; 7 Eldar, A. (2014). Identification of a novel RNA virus lethal to tilapia. Journal of Clinical Microbiology, 52 (12), 4137-4146, https://doi.org/10.1128/JCM.00827-14.

[7] Dr Nadav, Israeli Veterinary Service, (pers. comm.).

[8] Dong, H.T.; Siriroob, S.; Meemetta, W.; Santimanawong, W.; Gangnonngiw, W.; Pirarat, N.; Khunrae, K.; Rattanarojpong, T.; Vanichviriyakit, R.; Senapin, S. (2017a). Emergence of tilapia lake virus in Thailand and an alternative semi-nested RT-PCR for detection. Aquaculture 476, 111-118.

[9] Dong HT, Siriroob, S., Meemetta, W., Santimanawong, W., Gangnonngiw, W., Pirarat, N.; Khunrae, P.; Rattanarojpong, T.; Vanichviriyakit, R. and Senapin, S. (2017b). A warning and an improved PCR detection method for tilapia lake virus (TiLV) disease in Thai tilapia farms, https://enaca.org/?id=858.

[10] Fathi, M.; Dickson, C.; Dickson, M.; Leschen, W.; Baily, J.; Muir, F.; Ulrich, K. and Weidmann, M. (2017). Identification of Tilapia Lake Virus in Egypt in Nile tilapia affected by "summer mortality" syndrome. Aquaculture Vol. 472, 430-432.

## Recommendations at country level

### *Import of live tilapias*

Countries importing tilapias of any species for use in aquaculture or for the ornamental fish industry are urged to take appropriate risk management measures to reduce the likelihood that imported stocks are infected with TiLV.

These measures should include:

- Diagnostic testing of the imported stocks for presence of TiLV, applying the presumptive and confirmatory methods outlined in the OIE Disease Card.
- Requirement of an international health certificate for shipments originating from infected or suspect countries, certifying the absence of TiLV.
- Quarantine and monitoring of imported stocks upon arrival for any unusual mortalities and diagnostic testing if such mortalities occur.
- Contingency planning to ensure containment and eradication if TiLV is present.

Chapter 5.4. Criteria to assess the safety of aquatic animal commodities of the OIE Aquatic Animal Health Code applies.

### *Countries with confirmed cases of TiLV:*

- Initiate an active surveillance programme to determine the geographical extent of the infection and undertake mitigation measure to restrict the spread of infection; identify risk factors that may assist in appropriate interventions.
- Initiate public information campaigns to advise aquaculturists of the threat posed by TiLV, its clinical signs, potential economic and social impacts, and the need to report unexplained large-scale mortalities to biosecurity authorities.
- Conduct appropriate diagnostic testings, where unexplained mortalities of tilapias occur, particularly if clinical signs similar to those reported for TiLV are observed.

### *Countries with unknown status of TiLV:*

- Initiate an active surveillance programme to determine if TiLV is present as well as to identify the susceptible species and country distribution.
- Initiate public information campaigns to advise aquaculturists of the threat posed by TiLV, its clinical signs and the need to report unexplained large-scale mortalities to biosecurity authorities.

Information provided to FAO on actions taken by countries to deal with the risk posed by TiLV are presented in the Box.

*Source:* *Nile tilapia (Oreochromis niloticus) culture in fixed cages, Africa, © FAO/J. Moehl.*

**Box: Actions taken by some countries to deal with the risk posed by TiLV**

***India:*** An inter-agency alert containing information on clinical signs, histopathology and protocols for TiLV detection has been issued by the National Surveillance Programme for Aquatic Animal Diseases (NSPAAD), State Fisheries Departments, the Indian Council of Agricultural Research (ICAR) and National Bureau of Fish Genetic Resources.

***Indonesia:*** In collaboration with the Agricultural Quarantine Agency and the Research Agency, active surveillance is being conducted by the Directorate General of Agriculture in 13 provinces covering the major tilapia production centers during May-June 2017.

***Israel:*** The Israeli Veterinary Services and the Koret School of Veterinary Medicine designed an epidemiological retrospective survey that will identify factors influencing low survival rates and overall mortalities including relative importance of TiLV. A private Israeli vaccines company is currently working on the development of live attenuated vaccine for TiLV.

***Mexico:*** Research institutes are testing tilapia samples using available PCR diagnostic tests. National fisheries authorities provided warning to national committees of tilapia farmers.

***China:*** Urgent monitoring of TiLV is ongoing; archived tilapia samples will also be examined for TiLV.

***The Philippines:*** The Bureau of Fisheries and Aquatic Resources (BFAR) disseminated the TiLV Disease Advisory to all Regional Offices and Centers of BFAR to monitor/coordinate/report any tilapia mortality events. TiLV surveillance is being planned.

## Urgent Research Recommendations

There are many knowledge gaps about TiLV and research is urgently needed to answer the following questions:

- Does TiLV infect only tilapias?
- Can other non-tilapiine fish species act as carriers of the virus?
- Can other organisms (e.g. piscivorous birds and mammals, crustaceans, annelids, molluscs) act as carriers of the virus?
- Do other microorganisms and plankton act as passive carriers?
- Does the virus survive freezing, and can infective virus be isolated from whole frozen tilapia and other frozen products (e.g. gutted fish, fillets)?
- Does the virus survive in fresh products such as whole fish, gutted head, fillets?
- Given that the causative agent of TiLV has been described as a novel orthomyxo-like virus, family Orthomyxoviridae, to which ISA virus of salmon belongs, does TiLV share the same properties as that of ISA virus?
- Is it possible to develop a vaccine similar to those developed for the ISA virus?

TiLV is included in the FAO Quarterly Early Warning Bulletin, Issue 23, April 2017 to June 2017[11]. FAO will continue to monitor TiLV, work with FAO member governments and their constituents as well as development partners and search for resources in order to support the tilapia sector and the communities dependent on it, as requested and as necessary.

[11] http://www.fao.org/food-chain-crisis/early-warning-bulletin/en/.

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