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Emerging Fish Diseases in Indian Aquaculture: Challenges and Management Strategies

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Aquaculture is one of the fastest-growing food production sectors in India and plays a crucial role in food security, nutrition, employment generation, and economic development. Over the past few decades, fish production has increased substantially due to the adoption of improved farming technologies and intensified culture practices. However, the rapid expansion of aquaculture has also led to an increase in disease outbreaks, which have become a major constraint to sustainable fish production (FAO, 2024). Emerging fish diseases are increasingly threatening aquaculture systems by causing high mortality, reduced growth, and significant economic losses (Subasinghe et al., 2009).

Factors Contributing to Disease Emergence

The emergence of fish diseases is influenced by multiple factors, including high stocking densities, poor water quality, environmental stress, climate variability, and the movement of live fish and seed across regions (Mohan et al., 2018). Climate change-induced fluctuations in water temperature and rainfall patterns can alter host-pathogen interactions, increasing disease susceptibility in cultured fish populations (FAO, 2024). Additionally, the excessive use of antibiotics has contributed to the development of antimicrobial resistance, creating new challenges for disease management (Pridgeon and Klesius, 2012).

Major Emerging Fish Diseases in India

Tilapia Lake Virus (TiLV)

Tilapia Lake Virus (TiLV) is an emerging viral pathogen that poses a serious threat to global and Indian tilapia aquaculture. The disease is characterized by lethargy, loss of appetite, skin lesions, eye abnormalities, and high mortality rates. As tilapia farming continues to expand in India, the risk associated with TiLV has become a major concern for farmers and health managers (WOAH, 2024).

Epizootic Ulcerative Syndrome (EUS)

Epizootic Ulcerative Syndrome, caused by the oomycete *Aphanomyces invadans*, affects a wide range of freshwater fish species. Infected fish develop severe ulcerative lesions that may penetrate deep into muscular tissues. Environmental stress and seasonal changes often contribute to disease outbreaks (Jithendran et al., 2019). EUS remains one of the most significant diseases affecting freshwater fisheries in India.

Motile Aeromonas Septicemia (MAS)

Motile Aeromonas Septicemia is caused primarily by *Aeromonas hydrophila* and is increasingly reported in intensive aquaculture systems. Clinical signs include hemorrhages, skin ulcers, abdominal distension, and systemic infections. The disease is often associated with poor water quality and stressful farming conditions (Pridgeon and Klesius, 2012).

Streptococcosis

Streptococcal infections caused by *Streptococcus agalactiae* and *Streptococcus iniae* have emerged as important bacterial diseases in warm-water aquaculture. Affected fish exhibit

abnormal swimming behavior, exophthalmia, and neurological disorders. Increasing water temperatures may further enhance the prevalence and severity of these infections (Mohan et al., 2018).

Viral Nervous Necrosis (VNN)

Viral Nervous Necrosis, caused by betanodaviruses, is a major viral disease affecting marine and brackish water fish species. Larval and juvenile fish are particularly susceptible, often experiencing severe mortality. The disease has become a growing concern for India's developing marine aquaculture sector (WOAH, 2024).

Economic and Environmental Impacts

Disease outbreaks can significantly reduce aquaculture productivity by increasing mortality, lowering feed efficiency, and raising treatment costs. Economic losses associated with fish diseases can affect farmer livelihoods and regional fish supply chains (FAO, 2024). Furthermore, disease transmission between cultured and wild fish populations may threaten aquatic biodiversity and ecosystem stability (Lightner et al., 2017).

Disease Prevention and Management

Prevention remains the most effective strategy for controlling emerging fish diseases. Maintaining optimal water quality, using disease-free seed, implementing biosecurity measures, and conducting regular health monitoring are essential components of fish health management (Jithendran et al., 2019). The use of probiotics, immunostimulants, and vaccines can improve disease resistance and reduce dependence on antibiotics (Pridgeon and Klesius, 2012). Recent advancements in molecular diagnostics, artificial intelligence, and digital aquaculture technologies have enhanced disease surveillance and early warning capabilities. These tools can facilitate rapid detection and timely intervention, thereby minimizing production losses (Mishra et al., 2020).

Conclusion

Emerging fish diseases represent a major challenge to the sustainability of Indian aquaculture. The combined effects of intensification, environmental changes, and pathogen evolution continue to increase disease risks. Strengthening biosecurity, surveillance systems, research efforts, and farmer awareness programs will be critical for ensuring healthy and productive aquaculture systems in the future (FAO, 2024; Mishra et al., 2020).

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