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Recent Updates on *Enterocytozoon hepatopenaei* (EHP): A Growing Concern in Shrimp Aquaculture

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Abstract

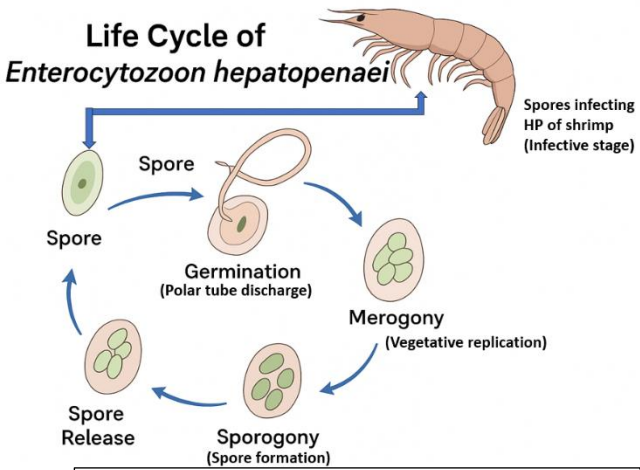
Enterocytozoon hepatopenaei (EHP) now regarded as ***Ecytonucleospora hepatopenaei*** **(EHP)** has become one of the significant shrimp pathogens causing production and economic loss among the global shrimp industries. It causes severe growth retardation without obvious mortality, leading to major economic losses and is known for its infectious disease Hepatopancreatic microsporidiosis (HPM) in shrimps. This article provides an overview of recent updates on EHP, including its biology, transmission, diagnostic advancements, environmental influences, and current management practices.

Introduction

Enterocytozoon hepatopenaei (EHP) is an intracellular microsporidian parasite that infects the hepatopancreas of cultured shrimp species such as *Penaeus vannamei* and *Penaeus monodon*. Unlike bacterial or viral pathogens that cause acute mortalities, EHP leads to chronic growth retardation and poor feed conversion efficiency leading to the severe economic loss to the farmers. Over the past decade, this "silent" infection has spread widely across shrimp-producing countries, including India, Thailand, Vietnam, and China.

Understanding the pathogen and its effects

The main target organ for EHP is the epithelial cells of the hepatopancreas which is the vital organ for digestion and absorption. Once infected, the cells lose their normal shape and function, resulting in reduced nutrient utilization and poor growth performance. Recent research indicates that EHP infection disrupts the shrimp's metabolic pathways, increases oxidative stress, and reduces immunity ultimately resulting in the growth retardation and severe growth differences among the cultured shrimps.



Schematic diagram of EHP transmission cycle in shrimp ponds.

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Transmission and host range

EHP is mainly transmitted through ingestion of spores present in infected feces, sediments, or contaminated feed. Spores are extremely resilient and can survive harsh pond conditions. Cannibalism and cohabitation of shrimp further enhance transmission.

Recent studies have revealed that EHP spores can also be found in other aquatic organisms like mud crabs and mollusks, which act as carriers and reintroduce infection into cleaned ponds.

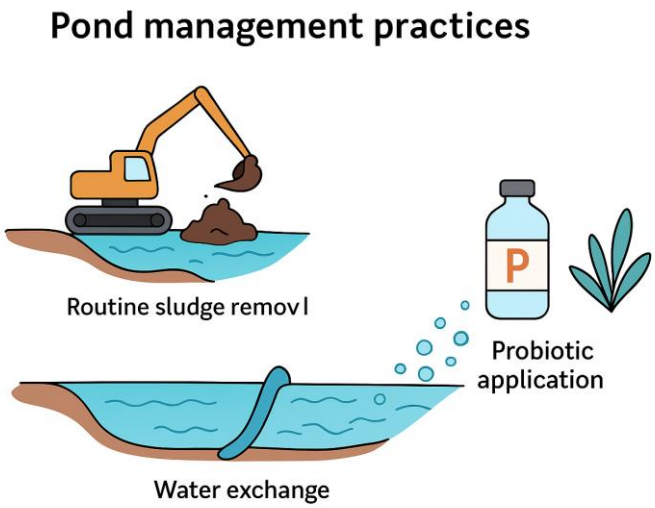
Advances in Diagnosis

Accurate and early detection is vital for controlling EHP. Polymerase Chain Reaction (PCR) remains the most reliable method for confirming infection. However, recent developments in rapid field-based diagnostic tools such as LAMP (Loop-Mediated Isothermal Amplification) and RPA (Recombinase Polymerase Amplification) offer promising alternatives for quick, on-farm detection. Microscopic examination of hepatopancreas smears and histopathology remain valuable for screening, particularly in resource-limited settings.

Environmental and Management Factors

Environmental stress is one of the most critical triggers for EHP outbreaks. Ponds with high organic load, poor water exchange, or unstable salinity are more prone to infection. Infected ponds often show poor plankton balance and higher levels of nitrite and ammonia.

Maintaining good water quality, minimizing organic waste, and promoting beneficial microbial communities through probiotics can help suppress infection risk.



Caption: Pond management practices—routine sludge removal, water exchange, and probiotic application.

Prevention and Control Measures

Currently, there are no effective chemotherapeutic treatments available for EHP.

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Therefore, prevention through biosecurity remains the most effective strategy.

- Use certified EHP-free broodstock and post-larvae.
- Thoroughly clean and dry ponds before stocking.
- Disinfect equipment and water sources using calcium hypochlorite or UV-C treatment.
- Prevent entry of wild crabs and other carriers.
- Conduct routine diagnostic screening to monitor infection levels.

Strict biosecurity practices and pond hygiene can significantly reduce the risk of EHP outbreaks.

Economic Impact

While EHP does not cause mass mortality, its chronic effect on shrimp growth leads to severe economic losses. Farmers often experience up to 30–50% reduction in yield and downgraded market value due to uneven shrimp sizes. EHP with a 17% probability of occurrence in India during the year 2018-2019, accounted for a production loss of 0.77 M tons, with a corresponding revenue loss of Rs. 3977 crores (US$ 567.62 M). This economic loss underscores the importance of proactive management and routine disease monitoring.

Future Directions and Research Need

Scientists are actively exploring several areas to strengthen EHP control:

- Decoding the complete life cycle and host–pathogen interactions.
- Developing EHP-resistant shrimp strains.
- Identifying natural bioactive compounds with anti-EHP properties.
- Studying EHP–*Vibrio* co-infections to understand synergistic effects.
- Designing environment-based management strategies for long-term sustainability.

Collaborative efforts between researchers, hatcheries, and farmers will be crucial to combat EHP effectively.

Conclusion

EHP has transformed from an obscure pathogen to a major challenge in shrimp aquaculture. Its silent nature, environmental resilience, and wide host range make control difficult. However, through improved diagnostics, strict biosecurity, and farmer awareness, the industry can minimize its impact. A proactive, ecosystem-based approach will ensure sustainable shrimp farming and safeguard global aquaculture production.

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