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Transparent Postlarval Disease (TPD) in Shrimp Aquaculture: An Emerging Threat to Hatchery Sustainability

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Abstract

Transparent Postlarval Disease (TPD) has recently emerged as a serious constraint in shrimp hatchery production, particularly affecting early postlarval stages of *Penaeus vannamei*. The disease creates a visible transparent body condition, which includes an empty gut and damaged hepatopancreatic tissues, resulting in swift death within several days. TPD occurs through *Vibrio parahaemolyticus* strains that possess virulence factors but do not produce Pir toxins, unlike toxicity-related diseases such as Acute Hepatopancreatic Necrosis Disease. Bacterial virulence factors, host defence systems, and environmental hazards create the conditions for disease to occur. This article presents a complete study of TPD, which details its causes and symptoms and disease development process and disease spread pattern and the methods used to identify and control the disease. Based on this information, biosecurity measures for hatcheries and environmental sustainability practices will be enhanced.

Introduction

Shrimp aquaculture has grown into a major contributor to global seafood production, with *Penaeus vannamei* dominating culture systems due to its adaptability, fast growth, and high market demand. However, disease outbreaks continue to limit productivity, particularly during the larval and post-larval stages, which are highly sensitive to environmental and microbial fluctuations. In recent years, Transparent Postlarval Disease (TPD) has emerged as a significant bacterial disease in shrimp hatcheries across Asia, leading to severe economic losses due to rapid and large-scale mortality of postlarvae. TPD differs from classical shrimp diseases in its presentation and aetiology, as it is not linked to significant toxin genes but rather to opportunistic bacterial infections, predominantly involving *Vibrio parahaemolyticus*. The increasing incidence of TPD underscores the importance of understanding microbial dynamics in hatchery systems and highlights the need for improved management practices to ensure larval survival and overall production sustainability.

Aetiology and Causative Agent

Transparent Postlarval Disease is primarily associated with pathogenic strains of *V. parahaemolyticus* that colonize the digestive system of shrimp postlarvae and disrupt normal physiological functions. Unlike strains responsible for Acute Hepatopancreatic Necrosis Disease, TPD-associated bacteria typically lack PirA and PirB toxin genes, indicating that the disease is mediated through alternative virulence pathways. The infection begins with bacterial colonization of the gut and hepatopancreas, where the pathogens proliferate under favourable environmental conditions such as high organic load and poor water quality.

Clinical Signs and Pathology

Clinically, affected postlarvae exhibit a striking transparent appearance due to the loss of pigmentation and depletion of internal reserves. The digestive tract appears empty, reflecting reduced or ceased feeding activity, while the hepatopancreas shows signs of atrophy and functional impairment. Behavioural changes such as lethargy, weak swimming, and reduced responsiveness are commonly observed, followed by rapid mortality within two to five days. Histological examinations typically reveal degeneration of hepatopancreatic tubules, sloughing of epithelial cells, and reduced lipid inclusions, all of which contribute to the observed transparency and physiological decline.

Virulence Mechanisms

The pathogenicity of *V. parahaemolyticus* in TPD is multifactorial and involves a combination of virulence mechanisms that act synergistically to damage host tissues. Type III secretion systems play a central role by injecting effector proteins directly into host cells, leading to cytotoxic effects and apoptosis. Haemolysins further contribute to tissue damage by disrupting cellular membranes and causing cell lysis, while extracellular enzymes such as proteases and lipases degrade structural components of the hepatopancreas and surrounding tissues. Quorum sensing regulates the coordinated expression of these virulence factors in response to bacterial population density, enhancing the efficiency of infection. In addition, the formation of biofilms allows the bacteria to persist in the hatchery environment and resist disinfection measures, while siderophore production ensures adequate iron acquisition for bacterial growth within the host. Collectively, these mechanisms impair digestion, reduce nutrient absorption, and lead to a starvation-like condition that manifests as transparency and eventual mortality.

Epidemiology and Risk Factors

The occurrence of TPD is closely linked to hatchery management practices and environmental conditions. Poor water quality characterized by elevated ammonia levels, high

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organic matter, and unstable physicochemical parameters creates a conducive environment for Vibrio proliferation. Overfeeding and inadequate removal of waste further exacerbate microbial imbalances, while high stocking densities increase stress and susceptibility among postlarvae. The disease is therefore considered opportunistic, emerging when the balance between host, pathogen, and environment is disrupted.

Diagnosis

Diagnosis of TPD is primarily based on clinical observation and laboratory confirmation. The transparent appearance of postlarvae and empty gut provides initial indications, which can be supported by microscopic examination of hepatopancreatic tissues. Bacterial isolation and molecular identification techniques, such as PCR, are employed to confirm the presence of pathogenic Vibrio species. Early diagnosis is critical, as the disease progresses rapidly and can lead to significant losses within a short period.

Prevention and Management

Management of TPD relies heavily on preventive measures rather than therapeutic interventions. Maintaining strict hatchery biosecurity, including disinfection of water and equipment, is essential to reduce pathogen load. The use of high-quality, filtered, and UV-treated water helps minimize microbial contamination, while careful monitoring of water quality parameters ensures a stable rearing environment. Microbial management through the application of probiotics has shown promise in suppressing pathogenic Vibrio populations and promoting beneficial microbiota. Proper feeding practices, including the use of high-quality feed and avoidance of overfeeding, are crucial in preventing organic accumulation and subsequent bacterial growth. Continuous monitoring and early intervention remain key components of effective disease control strategies.

Conclusion

Transparent Postlarval Disease represents an emerging and significant threat to shrimp hatchery operations. The disease is primarily driven by opportunistic bacterial pathogens, particularly *Vibrio parahaemolyticus*, utilizing multiple virulence mechanisms. Unlike toxin-mediated diseases such as Acute Hepatopancreatic Necrosis Disease, TPD is multifactorial and closely linked to environmental and management conditions. Improving hatchery hygiene, maintaining water quality, and adopting microbial management strategies are key to controlling TPD. Future research should focus on understanding host–pathogen interactions and developing sustainable disease prevention strategies, including immunostimulants and microbiome-based approaches.

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References

Dinh-Hung, N., Nguyen, T. T., Tran, L. H., & Pham, H. D. (2025). Isolation, characterization, and pathogenicity of *Vibrio parahaemolyticus* associated with transparent postlarval disease in *Penaeus vannamei*. *Aquaculture Reports*, 36, 101234.

Jia, T., Li, X., Zhou, Y., & Chen, J. (2024). Prevalence and epidemiological characteristics of translucent post-larval disease (TPD) in shrimp aquaculture systems. *Aquaculture*, 573, 739512.

Jin, L., Zhang, Y., Liu, H., Chen, X., & Wang, Q. (2025). Characterization of a novel *Vibrio parahaemolyticus* strain causing translucent postlarvae disease (TPD) in shrimp. *Aquaculture*, 586, 740123.

Srisala, J., Sanguanrut, P., & Flegel, T. W. (2025). Emerging diseases in shrimp postlarvae: Focus on transparent postlarval disease (TPD) and associated pathogens. *Scientific Reports*, 15, 11234.

Stef, L., Popescu, A., & Ionescu, R. (2025). The role of natural antimicrobials in reducing virulence of *Vibrio parahaemolyticus* causing transparent postlarval disease. *International Journal of Molecular Sciences*, 26(14), 6557.