


Editorial

Probiotics in aquaculture

Md Shahjahan* 

Laboratory of Fish Ecophysiology, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

*Corresponding author: Md Shahjahan, Laboratory of Fish Ecophysiology, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. E-mail: mdshahjahan@bau.edu.bd

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Given the growing need for fish-based animal protein, aquaculture is one of the most promising industries for generating money and ensuring human nutritional security. Despite the industry's notable progress, the field's revenue is dropping due to enormous feed costs, which usually represent more than 70% of all production costs (Rahman *et al.*, 2012; Hossain *et al.*, 2023). Furthermore, profitable aquaculture operations depend on the feed quality and efficiency to provide nutrition for the growth of fishes (Akter *et al.*, 2021). Probiotic use may be the best strategy for improving fish development and feed utilization while lowering feed costs (Rohani *et al.*, 2022).

Probiotics are a class of live bacteria that adapt, colonize, and reproduce in the host's gut, resulting in improving host's health (Carbone and Faggio, 2016). Probiotics have been shown to improve growth, enzymatic nutrition, regulate gut microbiota, and improve hematological and immunological responses in shellfish (Ringø, 2020). It has been reported that dietary probiotics (*Saccharomyces cerevisiae*) improved the growth, gut microbial profile, and gut morphology of rohu (*Labeo rohita*) (Jahan *et al.*, 2021), Nile tilapia (*Oreochromis niloticus*) (Islam *et al.*, 2021), and Asian snakehead (*Channa striata*) fingerlings (Munir *et al.*, 2018). According to Hoseinifar *et al.* (2015), dietary *Lactobacillus acidophilus* shown positive benefits on growth, gut microbiota, stress tolerance, and mucosal immunological markers of the black swordtail (*Xiphophorus hellerii*).

Surprisingly, most of the research has focused on the use of single species probiotics, which may not be as helpful at all phases of nursing. Two or more probiotic bacterial strain rather than just one is probable to yield superior results (Beck *et al.*, 2015). It has been reported that multi-strain probiotics (*Enterococcus faecalis*, *Lactobacillus fermentum*, and *Leuconostoc mesenteroides*) in feed significantly improved growth, feed conversion ratio, and protein efficiency in Javanese carp, *Puntius gonionotus* (Allameh *et al.*, 2016). Probiotics introduced to water had the greatest positive benefits on the survival and growth of *Perca flavescens*, the yellow perch in the early stages (Shaheen *et al.*, 2014). Concurrent administration of various probiotic species had markedly positive effects on larval development in the zebrafish (Padeniya *et al.*, 2022), and rohu, *Labeo rohita* (Ferdous *et al.*, 2024c). The whole growth performance of mrigal (*Cirrhinus cirrhosus*) (Hossain *et al.*, 2022a), Nile tilapia (Hossain *et al.*, 2022b), stinging catfish (*Heteropneustes fossilis*) (Sohel *et al.*, 2023), gulsha *Mystus cavasius* (Gaffar *et al.*, 2023) and rohu (Ferdous *et al.*, 2024b) were all improved by the administration of multi-strain probiotics in water.

Following that, researchers investigated their effect on gonadal development and reproduction. It has found that applying *Bacillus subtilis* to female ornamental fish increased fecundity, egg viability, and larval quality (Ghosh

et al., 2007). Probiotic administration improved gonadal development and reproductive efficiency in *Danio rerio* (Gioacchini *et al.*, 2010), *Xiphophorus helleri* (Abasali and Mohamad, 2010), *Fundulus heteroclitus* (Lombardo *et al.*, 2011), *Ompok pabda* (Rahman *et al.*, 2018), and *Oreochromis niloticus* (Hossain *et al.*, 2024b).

Probiotics have recently been shown to improve immunity during extreme temperature events in Nile tilapia (Hossain *et al.*, 2024a) and rohu (Ferdous *et al.*, 2024a). It was also discovered that probiotics reduce chromium-induced growth retardation and stress in rohu, *Labeo rohita* (Ferdous *et al.*, 2024d), and Nile tilapia (Zannat *et al.*, 2024). This knowledge could be extremely useful in climate-change scenarios involving commercially important fish species.

Ethical approval and informed consent

Not applicable.

Data availability

Not applicable.

Conflict of interest

None to declare.

Author's contribution

Conceptualization, formal analysis, writing-original draft preparation, review and editing: Md Shahjahan. The author has read and approved the final version of the published editorial.

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