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Popular Article

## Moina – The Boon for Finfish Hatcheries

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### Introduction

Aquaculture is the fastest-growing sector, mainly depending on larval production and rearing. Fishes, like other animals, require adequate nutrition in order to grow and survive. Fish larvae are very delicate organisms. Fishes, prawns and other cultivable aquatic animals at the time of their first feeding are tiny, fragile and delicate creatures. It is most 'critical phase' of their life when they need right type and right size of nourishment for their survival and growth. Despite the recent progress in the production of inert diets for fish larvae, feeding of most species of interest for aquaculture still relies on live feeds during the early life stages.

Live preys are able to swim in the water column and are thus constantly available to the larvae. Live feeds are the main item in the diet of cultured fish larvae. At first-feeding the digestive system is still rudimentary, lacking a stomach, and much of the protein digestion takes place in hindgut epithelial cells (Govoni *et al.*, 1986). Such a digestive system, in most cases is incapable of processing formulated diets in a manner that allows survival and growth of the larvae comparable to those fed with live feeds.



## Role of Live feeds in aquaculture

The success of any aquaculture activity depends on the timely production and supply of healthy seeds. The availability of wild seeds is seasonal and erratic. Hence, a dependable source of the seed of fish is possible only through large-scale hatchery production. Feeding fish larvae with appropriate feed is essential for the successful hatchery operation. The larvae are tiny sized and the size of their mouth is even smaller. Therefore, the size of the feed particles should be small enough to pass through the mouth, must be having package of balanced nutrients for the growth and development of fish seed and should remain suspended in water. Such feeds are highly beneficial and can be used for rearing the larvae successfully.

Generally, successful seed production activity depends on the availability of suitable live feed organisms. As live food promotes high growth rates, easy digestion, assimilation and possesses the exceptional quality of not polluting the culture water when compared to other artificial feeds. By providing such living cells the larvae can be successfully reared in a hatchery with higher survival rates. The important live-feed organisms used for this purpose are diatoms, microalgae, rotifers, copepods, cladoceran and brine shrimp (*Artemia*).

Among zooplankton, most freshwater fish are fed with *Moina* as a first feed (Tawaratmanikul *et al.*, 1988). *Moina*, a cladoceran, because of its tiny size and high nutritional value, serves as an ideal live feed, enhancing the growth, survival, and overall health of fish larvae. This article explores the multifaceted benefits of incorporating *Moina* into finfish hatcheries. It stands as a boon for finfish hatcheries, addressing the challenges of nutrition, cost-effectiveness, and water quality management.

### Characteristics of *Moina*

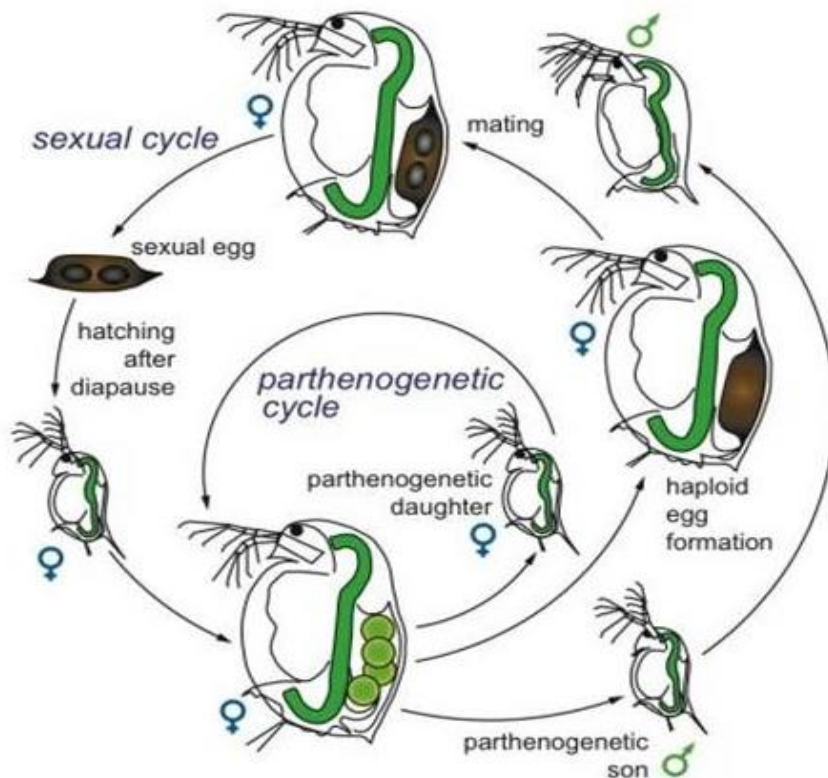
*Moina* is commonly known as water fleas, generally they are filter feeders. Their small size



(250-1000  $\mu\text{m}$ ) makes them suitable as a live feed for small aquatic organisms. They have a transparent or semi-transparent, laterally compressed body with a bivalve carapace that protects the thoracic and abdominal regions and have a pair of long antennae. The head is usually smoothly rounded dorsally. Generally alkaline water is favourable for *Moina* with a pH between 6.5-9.5 (Rottmann 1992). They do not tolerate salinities higher than 3 ppt. It also demonstrates a broad range of ability to adapt to various environmental parameters (Rizo *et al.*, 2017).

## Reproduction in *Moina*

The reproductive cycle of *Moina* has both sexual and asexual phase but often reproduce through parthenogenesis, a form of asexual reproduction in which females produces offsprings without the need for fertilization by males. Females possess a brood chamber, a specialized structure where eggs are carried until they hatch. They have the advantage of high reproduction rates, wide temperature tolerance and the ability to thrive on phytoplankton and organic wastes.



Source: Generalized Cladocerans life cycle (Ebert, 2005)

The period to reach reproductive maturity takes four to five days at 26 °C. At maturity, it is possible to notice distinct sexual dimorphism in the animal size and antennule morphology. Males (0.6-0.9 mm) are smaller than females (1.0-1.5 mm) and have long graspers which are used



for holding the female during copulation. The adult releases young ones at the rate of 10-12 nos./day and the young ones become adult in 18-24 hours and begin to reproduce. It is possible to obtain 42,000 nos. of young ones within 12 days from a single female (Kandasamy *et al.*, 1998). Due to the virtue of high reproduction rates, moinids are utilized as one of the potential feeds for fish larvae in commercial aquaculture.

### **Nutritional value of *Moina***

In finfish hatcheries, where the challenge of providing optimal nutrition for developing larvae is paramount, *Moina* stands out as an exceptional live feed. They are considered palatable and attractive feed for many ornamental fish seed (Saini *et al.*, 2013). These miniature crustaceans contain a high protein as well as digestive enzymes, such as peptidases, proteinases, lipases and amylases in their intestines, which can act as exoenzymes in the gut of fish larvae (Miah *et al.*, 2013) which making them an ideal dietary supplement for young fish during their early developmental stages. The nutritional profile of *Moina* ensures the proper growth and vitality of finfish larvae, promoting robust health and enhancing overall survival rates.

The nutritional value of *Moina* depends on the stage of life cycle and the form of feed obtained. The average protein content is 50% dry and adults typically have higher fat content (20-27%), then juveniles (4-6%) (Rottman *et al.*, 2014). *Moina* is effectively used throughout freshwater aquaculture as larval live feed.

### **Advantages of *Moina* as a feed**

- It occurs in various sizes, and this flexibility allows them to be suitable for feeding a range of larval organisms.
- It reproduces rapidly under favourable conditions, leading to a high yield of live feed. This reproductive capability ensures a consistent and abundant supply of *Moina*.
- It is relatively easy to culture and can tolerate higher population densities which making them a practical choice for aqua-culturists where space may be limited, allowing for a more efficient use of culture containers.
- It can adapt to a range of environmental conditions, including changes in temperature and p<sup>H</sup>. This adaptability contributes to their robustness in culture systems and makes them suitable for diverse aquaculture setups.
- Their nutritional composition makes them a valuable source of balanced nutrition for the development of larvae in aquaculture.



- They offer a cost-effective and sustainable alternative to commercially produced larval feeds, especially for those with limited resources.
- It exhibits active swimming behaviour, making them more attractive as prey for certain larval organisms. The movement of live prey can stimulate feeding responses in larvae.
- In addition, it can contribute to algae control in aquaculture ponds, as they consume microalgae as a part of their diet.
- *These* are generally quite tolerant to poor water quality. They live in water where the amount of dissolved oxygen varies from almost zero to supersaturation. *These* are particularly resistant to changes in the oxygen concentration and often reproduce in large quantities in water bodies strongly polluted with sewage.

### **Disadvantages of *Moina* as a feed**

- It can exhibit size variation, and if the size of the *Moina* is not suitable for the larvae you are feeding, it may lead to inefficient or ineffective feeding.
- The nutritional content can vary depending on their diet. If the *Moina* culture is not consistently provided with a well-balanced and nutritious feed source, the larvae may not receive optimal nutrition.
- It can exhibit cannibalistic behaviour, particularly in crowded or stressful conditions. This can lead to a decrease in the overall population and may affect the availability of live feed for larvae.
- Poor water quality can impact the health of *Moina* and, subsequently, the quality of the live feed offered to the larvae. *Moina* cultures can be susceptible to diseases, and there is a risk of transmitting diseases to the larvae being fed.
- Relying solely on live feed sources like *Moina* may introduce a level of unpredictability into the feeding regimen. Availability, quality, and consistency of the *Moina* culture can be influenced by external factors such as environmental conditions.
- In some cases, alternative and commercially available larval feeds may be more convenient, predictable, and nutritionally balanced compared to relying on live organisms like *Moina*.

Despite these potential disadvantages, *Moina* remains a valuable live feed source in many larval rearing systems. Successful use of *Moina* as larval feed requires careful management and attention to the specific needs of the target organisms.



## Conclusion

*Moina* stands out as a boon for finfish larval rearing due to its multifaceted advantages. Its nutrient-rich composition provides essential proteins and fatty acids crucial for the optimal growth and development of finfish larvae. The adaptability of *Moina* allows for easy integration into diverse larval diets, offering versatility to finfish hatcheries. Furthermore, its role in nutrient cycling aligns with sustainable aquaculture practices, contributing to the overall health and environmental sustainability of larval rearing systems.

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