

# Importance of Larval Nutrition in Freshwater Fish Hatchery Industry at West Bengal

## Highlight Points

► West Bengal, leading freshwater fish hatchery industry possessed 495 hatcheries and 70 seed supply farms. ► The hatchery market has varieties of seedlings which meets the domestic requirement, but attempts need to be made to reach its international market. ► The main problem for not reaching its international status due to traditional method which is still not updated. ► No proper or nutritionally balance diets during larval rearing. ► International and domestic concerns like De Heus Animal Nutrition, Netherlands and Aquatic International, Chennai, India made effort to provide such balanced larval diet.

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## SUMMARY

Larval feeding and nutrition are one of the important criteria for a successful aquaculture practice. West Bengal is one the leading market for freshwater fish hatchery industry. In the state, nearly 495 freshwater fish hatchery and 70 seed supply farms, however it's not reached its international market. Initially, the breeding and hatching techniques was started with Indian major carps and tilapia followed by catfishes like singi and pangasius and now recently rupchanda in West Bengal. Though, it is a potential market, but the market is still not reaching outside of the country. The main reason is that still the many farmers are following the traditional method and not updated their breeding and hatching techniques. Another main issue in the larval rearing sector is not providing nutritionally balance diets. Hence, the feed industries like De Heus Animal Nutrition, the Netherlands and Aquatic International, Chennai, India understand the fish hatchery requirement and developed special and nutritionally balanced fish hatchery feeds. De Heus is importing its hatchery feed to India through its Vietnam outlet; similarly, Aquatic International is preparing its juvenile fish feed under a brand name of 'Joven' in India with the collaboration of Scientists from Israel and there are few more like these. These kind of hatchery diets contained necessary protein levels which meet the metabolic and physiological function of the larvae and also the feed comes in different pellet size that suits from hatchlings to fingerlings. This nutritional balanced hatchery diet produced better yield in terms of profitability and counts per Kg fish. After the arrival of these kinds of hatchery diets in the market, the farmers also realised the nutritional importance during larval rearing period. Overall, most of the farmers now understand the need of good larval diets for their young ones, hence they started using these

kinds of readymade feed in which De Heus fish hatchery feed and Joven from Aquatic International are considered as best products among the available hatchery diets due to their cost effective, growth and survival performance and high profitability.

## Introduction

Fish hatchery is one of important the accessory in the promising aquaculture industry. The whole culture is depending on the seeds produced from the hatchery. The seeds should be healthy and disease free or in other words should be disease resistance individuals. Mostly, seeds depend on the brooders, in terms of possessing good inheritance characters including growth and survival rate, quality flesh, muscle protein, etc. Simply, seed is the major criteria for the culture practice; based on the quality seed only the farmers receive their potential and progressive yield in the form of growth and survival. Hence, the place where the hatchery is present also a notable parameter especially on hygienic aspect, that lead to pathogen free seed production. So far, the value of freshwater aquaculture hatchery and nursery production has not been estimated worldwide like the culture production statistics [1-4]. This data is required and it is also essential for the measurement of the ratio between the hatchery production and culture production, so a prediction on growth and survival rate is possible from larval to grow-out.

Considering a fish hatchery, there are several factors included, but mainly breeding and nursery rearing are the critical factors. The hatchery farmers from West Bengal produced various freshwater fish seeds from their hatcheries. Initially, the farmers focused on breeding Indian major carps such as Catla, Rohu and Mrigal, followed by common carp and tilapia. Later, once they establish the artificial breeding

(Fig. 1A) techniques in the Indian major carps, they included Calbasu, Bata, Silver Carp, Grass Carp, Japan Puti, Black Carp, Common Carp and Koi Carp (Fig. 1B). The farmers obtained more experience on these carps species, then they tried in singi, pangasius, magur, murrels and ompak (Fig. 1C) breeding and succeeded in their attempts. Recently, the farmers succeeded in breeding attempts on Pacu or Roopchand (Fig. 1D), Sea Bass, Anabass (Fig. 1E) and Notopterus (Fig. 1F). Later, the farmers struggled in proper larval rearing techniques especially on the non-availability of nutritionally balanced hatchery diets.



**Fig. 1A: Fertilized fish eggs; 1B: Koi carp; 1C: Ompak sp; 1D: Rupchand; 1E: Anbas & 1F: Notopterus**

Larval rearing in the early stages of a fish is a crucial process because of the larval sensitive nature or response to varieties of biotic (microbial pathogens) and abiotic conditions (water quality parameters). A successful hatchery process is overcoming or managing all these kinds of issues and producing high quality seeds. Apart from these discussed parameters, feed is one of the essential criteria for a successful larval rearing. Based on the quality of the diet only, the larvae exhibit their growth and survival rates and later, the farmers understand the nutritionally balanced diet concept for their high profitability.



**Fig. 2A: De Heus (The Netherlands) freshwater fish hatchery diet & 2B: Joven, a fish juvenile diet from Aquatic International, India with Israel collaboration technology**

The animal nutrition companies like De Heus Animal Nutrition, the Netherlands and Aquatic International, Chennai, India realised the requirements of the farmers, thus formulated varieties of fish hatchery feed at different protein level as well as different size (mm). All over the world, De Heus is the first in its kind that produced a diet for 7-day old fish larvae, which

received a great welcome among the farmers (Fig. 2A). De Heus is a Netherland based company which established during 1911 and extended their business nearly 75 countries that have its own reputation. For its importing business to India, it is using its Vietnam outlet. Likely, Aquatic International is one of the leading fish and shrimp feed producing company in the domestic, which establishes in Chennai during 2000 and specialised in varieties of animal feed business and Joven, the juvenile fish feed (Fig. 2B) is one among them. This company have research collaboration with various countries especially importing animal nutrition technologies from Israel. These animal nutrition concerns studied the farmers requirement and produced high quality diets to increase the profit of the farmers. This article is dealing with the various aspects of West Bengal breeding techniques, hatchery development and larval nutrition.

#### Different Fish Hatchery Units

Different kinds of hatchery techniques are being used in West Bengal. In which, the notable techniques are being used to hatch the fish eggs in West Bengal are jar hatchery (Fig. 3A), Chinese hatchery (Fig. 3B) and hapa breeding (Fig. 3C). Considering the hatching rate among, these three techniques there won't be much difference except their handling efficiency [5, 6]. However, the jar hatchery and Chinese hatchery are required adequate water flow. The jar hatchery can be run on limited quantity of water and space. The water temperature shoots up over 32 °C during summer; hence the hatching is adversely affected in hapas. But, in jar hatcheries, the temperature is reported within the range even in summer. Also, the developing embryos can be easily observed in jar hatcheries with naked eyes, so if rectification is required, that can be attempted depending on exigencies [7, 8]. The Chinese hatchery system is functioning based on the water flow by gravity, thus eggs hatch. Its construction and operation cost is also less compared to some other system with the same production capacity. In Indian sub-continent, especially in places West Bengal, this Chinese hatchery system has been considered as a highly suitable for the production of quality fish seed [9-11].



**Fig. 3A: Jar hatchery; 3B: Chinese hatchery & 3C: Earthen hapa (Courtesy: Biswas Hatchery, W. Bengal)**

#### Breeding Techniques

The hatcheries are producing the seeds through artificial breeding techniques. In brief, the conditioned male and female fishes received breeding hormones through either intra-peritoneal or intra-muscular injection. The dosage of the breeding hormones depending on the weight of the brooders; however, at the concentration of 5-7ml/ kg fish. The breeding set was basically designed at the ratio of either 1 (Female): 3 (Male) or 1 (Female): 2 (Male). The number of male fish has been decided based on the weight of the female or its predicted fecundity rate, so that enough quantity of milt can be attained from the males to fertilize the eggs completely [12-14]. Both the eggs and milt were squeezed out

for the artificial fertilization and then, they were shifted to the respective hatchery units. The incubation period depends on the species, usually it takes between 8 and 14 h.

**Hatching different Freshwater Fish Species**

West Bengal is the top freshwater fish seed producing state (Fig. 4). From the state, the seeds have been transported to all over India by train, road and flight [15-17]. In the West Bengal hatcheries, there are varieties of fish species has been handled for breeding purpose namely, Catla, Rohu, Mrigal, Calbasu, Bata, Silver Carp, Common Carp, Grass Carp, Japan Puti, Black Carp, Pangasius, Koi Carp, Singi, Clarias sp., and Pacu or Roopchand. There are nearly 465 freshwater fish seed hatchery units are available throughout the state, in which 13 hatchery units are belong to the Directorate of Fisheries, West Bengal. Also, there are 70 seed farms are present all-over West Bengal.



Fig. 4: Some clicks from India's biggest live fish seed market, Naihati, West Bengal

**Nursery Rearing and Larval Diseases**

The larvae were also reared in both cement tanks (Fig. 5A) and earthen ponds (Fig. 5B); in which, the larvae received effective water flow through in the cement tanks. During the rearing period also, the larvae affected by different disease like the grow-out individuals. The infection and disease are due to various microbial pathogen including bacteria, virus, fungus and parasites. They are infectious haematopoietic necrosis, spring viraemia of carp (SVC), viral haemorrhagic septicaemia (VHS), epizootic haematopoietic necrosis, red seabream iridoviral disease (RSID), koi herpesvirus disease (KHV), grouper iridoviral disease, viral encephalopathy and retinopathy, enteric septicaemia of catfish, *Aeromonas hydrophila* infection, *Edwardsiella tarda* infection, *Vibrio anguillarum* infection, *Falvobacterium columnare* infection, *Streptococcus iniae* infection, infectious pancreatic necrosis, *Myxobolous* spp infection, *Ichthyophthirius multifiliis* infection, *Saprolegnia parasitica* infection, *Argulus* infection, infestation with *Dactylogyrus* spp., infestation with *Lernoea* spp, infestation with *Coligus* spp, etc [18].



Fig. 5A: Larval rearing in cement tank & 5B: Larval rearing in earthen pond (Courtesy: Biswas Hatchery, W. Bengal)

**Larval Feed**

In the hatcheries, still there are people following the traditional feed preparation and providing to the larvae. The tradition feed preparation (Fig. 6) includes boiled rice, broken soybean, pea, corn, wheat, etc. Altogether, they were boiled in an iron pot and supplying to the larvae. This is a cost-effective method of feed supply, but it is questionable whether the individuals are receiving enough nutrition for their growth and survival and other metabolic and physiological function [18]. Hence, the commercial feed industries including De Heus Animal Nutrition, The Netherlands and Aquatics International, India understand the fish hatchery requirement, thus developed a special and balanced fish hatchery feeds as supplying them to the hatchery industry as reported above. There are many other companies supplying fish hatchery diet, however based on the farmers satisfaction in terms of profitability and growth and survival performances, these two feeds were considered the best in the hatchery industry.



Fig. 6: Preparation of traditional larval diet in hatchery (Courtesy: Biswas Hatchery, W. Bengal)

The feed or nutrition is not only increasing the production rate, but also helps to produce healthy and quality or disease-free aqua species. Such a complete nutritionally balanced diets from these said brands promotes the growth as well as health of aquaculture organisms, thus feed is playing a major role in the production sector of the aquaculture system. These efficient aqua feed producers mainly focused on preparation of nutritionally balanced and high-quality diet within an affordable cost.

**Table 1:** List of fish hatchery feed (floating feed) from companies including De Heus, The Netherlands and Joven (Aquatics International, Chennai, India)

Feed Preferred Species	Feed Size (mm)	Nutritional Composition (%)		
		Protein	Fat	Fibre
Catla, Rohu, Mrigal, Calbasu, Bata,	0.3	35 & 40	6 - 8	6
Silver Carp, Grass Carp, Japan Puti, Black Carp, Common Carp,	0.8	35 & 40	6 - 8	6
Koi Capr, Pangasuis sp., Pacu or Roopchand, Ompak, Murrels, Singi, Magur,	1.2	35 & 40	6 - 8	6
Tilapia, Red Tilpia, Sea Bass, Anabass, Notopterus	1.4	35 & 40	6 - 8	6

Also, these complete commercial feeds from the said banners possessed a balanced nutritional composition such as protein, lipid, carbohydrate, fibre, ash, vitamins and minerals. These are the important nutritional elements of the feed which provide adequate growth and health benefits to the fish larvae. The larval feed contained the following nutritional factors: protein 35 and 40%, lipid 6-8%, fibre 6% and moisture less than 10% and of course a trace amount of vitamins and minerals. Also, these fish larval feed comes in different pellet sizes such as 0.3, 0.8, 1.2 and 1.4 mm (Table 1).

**Table 2:** Performance of fish larvae in West Bengal hatchery on traditional feed and commercial feed

Traditional Feed	Commercial Feed (De Heus, Netherlands & Joven, Aquatic International, India)
Non or Semi cooked feed	Completely cooked feed
Less than 60% survival	99 % survival
More mortality in Transportation	No mortality in Transportation
More fat / big belly fishes	No fat and good body shape
Unequal size of growth	Equal size of growth
More disease problem	No disease
No resistant to climate change	More resistant due to right baby nutritional feed
Attain per kg 10000 to 5000 line in 7 days	10000 to 5000 line in 4 days only
Attain per kg 5000 to 3000 line in 9 days	5000 to 3000 line in 5 days only
Attain per kg 3000 to 1000 line in 14 days	3000 to 1000 line in 8 days
Attain per kg 1000 to 500 line in 20 days	1000 to 500 line in 12 days
Ammonia accumulation in pond water	Limited amount in water
More Digestion problem	Easy assimilation and digestion
Less growth due to imbalanced nutrition	Higher growth due to balanced diet
No pellet stability and more water pollution	Floating feed supplied until satiation, so no pollution
Feed conversion very high (1:2)	Low feed conversion (1:0.7)
No Feeding protocol at larvae stage	Right Feeding protocol and feed frequency
Antibiotics usage for control diseases	No disease, No antibiotics
Only 50% profitability	92 to 98% profitability
Too much counts in per kg fish (20-25 Nos)	Less counts per kg (7-10 Nos)

It is interesting to note that these commercial feeds producing better performance in all the aspects compared to the traditional feed (Table 2). The best performances of the commercial feed in the larvae due to various beneficial reason such as i. the ingredients or raw materials in the feed are properly cooked, so no pathogenic effect, ii. The nutrition in the feed are evenly and properly distributed in the pellets, so that each and every one of the larvae receive same amount nutrition, thus lead to uniform growth, iii. the amount of necessary essential amino acids, fatty acids, vitamins and minerals present in the feed provide them strong immunity that leads 100% survival, iv. Easy assimilation and good digestibility, v. the pellets did not pollute the water and vi. The feeds are cost effective and high profitability in good number counts per kg fish. Over all, the fish hatchery farmers from West Bengal understand the beneficial effect these commercial feeds such as De Heus and Joven, thus knowing the importance of larval nutrition and changing their larval feeding protocol from traditional to commercial hatchery feeds, which is a good and progressing sign of culture practices.

#### Problems and Recommendations

In India, West Bengal is the potential market for freshwater fish hatcheries. Though, there are 465 hatcheries and 70 seed farms in the state, the market yet to reach its international level. Hence, frequent meetings or gathering may be recommended among the hatchery farmers for sharing knowledge and ideas. It helps the farmers to updating themselves about the industry. Also, the famers need to be educated or updated more about the breeding techniques, brood stock maintenance, larval rearing protocols, larval nutrition etc., by subject experts as well as technical experts. These experts may educate them by showing videos, photos, elaborating success story of other farmers, etc. Government bodies may take initiative for the farmers international business collaboration in terms of export and import. It is also developed direct or indirect jobs in the field, develop self-employment, socio-economic impact and more earning of foreign exchange. Another important requirement is proper drainage system for the hatcheries, thus avoid infection and produce healthy seeds for the successful culture.

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