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FEEDING STRATEGIES IN THE LARVAL REARING OF PRAWNS

A.R. THIRUNAVUKKARASU

Central Marine Fisheries Research Institute
Marine Prawn Hatchery Laboratory
Narakkal-682 505

INTRODUCTION

In the early life history of extremely fecund fishes and shellfishes food and feeding is the most important factor. Availability adequate right kind of food in the growing environment is essential for the survival and growth of the larvae. Because of the complex life history of prawns with different larval stages and sub-stages and the process of metamorphosis requires lot of energy, identification of suitable feed and feeding techniques becomes very important in the larval rearing of prawns. In recent years significant achievements have been made in the development suitable diets and evolving feeding strategies in the prawn hatchery techniques worldwide. Though a general agreement could be seen in the type of feed, experiences gained indicate that it is not easy to evolve a fixed strategy in feeding the larvae as it varies according to the techniques followed various other physico-chemical environmental and biological factors. However, the following general outline may be considered in adopting the feeding strategies in the penaeid prawn larval rearing.

FOOD AND FEEDING OF THE LARVAE

Different type of feed such as live feed (phyto and zooplankton) and artificial feed are being used in the larval rearing of penaeid prawns. The phytoplankton generally include the species of Chaetoceros, Skeletonema, Thalassiosira, Tetrasulmis, Isochrisis etc. in the early stages of the larvae. Zooplankters such as the brine shrimp Artemia nauplii, Rotifers (Brachionus sp.) and cladoceran (Moina sp.) are used as live diets from mysis stages. Microencapsulated and microparticulated compounded feed are also used in recent years.

Penaeid prawn egg hatches out into Nauplius stage which undergo six substages before metamorphosing into the next protozoea stage in 2 days period. Nauplius does not have move or alimentary canal and cannot feed and subsists on yolk material present in the body.

Protozoea stage has three substages and lasts for 3-4 days before metamorphosing into mysis stage. The larvae in this stage have an alimentary canal, mouth and feeding appendages and starts feeding on the unicellular algae. It has an efficient mechanism to seive the algal cells from the water.

Mysis stage also has three substages lasting for 3-4 days period after which it metamorphosis into postlarval stage. In mysis stage also the larvae retain the filtering mechanism for feeding on algal cells. The clams in the first three walking legs are not functional and cannot be used effectively for capturing fast moving prey.

In the post larval stage, the food and feeding habit changes drastically. The larvae becomes a particulate feeder, capable of capturing and ingesting zooplankton and other particles. It is essential for evolving a suitable

feeding strategy this food and feeding behaviour of the larval stages should be duly considered.

LARVAL REARING SYSTEMS

The feeding strategy mainly depends upon the methods followed and the following are the important rearing systems practiced worldwide in penaeid prawn larval rearing.

The Japanese system:

In this system large concrete tanks of 60-200 tonne capacity are used. Tanks filled with filtered seawater in low level (about 0.40 m) and spawners are kept in net cages for spawning. After spawning the spawners are removed. The tank is fertilized with nutrients and the water level is gradually increased. The desirable algal blooms are allowed to develop *in situ* . The cell concentration is maintained @ 5,000 to 20,000 cells/ml in the rearing tanks. From mysis stage onwards larvae are fed with *Artemia* Nauplii or washed clam meat to postlarval stage. The rearing techniques have been well documented by various authors (Hudinaga and Kittaka, 1966, 1967; Shigueno, 1975; Yang, 1975). In Taiwan also this technique has been successfully used (Liao and Huang, 1973). In Philippines and some of the private hatcheries in other parts of the world also this system is being practiced.

The Galvaston system:

A close cycle system for the larval rearing of penaeid prawns was developed in Galvaston Laboratory, USA (Cook, 1969; Mick and Murphy, 1973; Mick and Neal, 1974). This involves the independent process of larval rearing and live feed cultures and suitable integrating the two with proper water management. Desirable species of pure culture of diatoms especially unicellular algae are used as feed

for protozoea stages, maintaining a concentration of 10,000 to 15,000 cells/ml in the rearing medium. From mysis stage onwards Artemia nauplii are fed and a concentration of 3-5 nos/ml is maintained as food concentration in the rearing container.

Methods followed in India:

In India the CMFRI has developed a viable hatchery technique for the large scale seed production of penaeid prawn seed under Indian conditions. The technique includes feeding the larvae from protozoea stage onwards with mixed culture of diatom, dominated by Chaetoceros sp. upto post-larval stage after which the larvae are fed with compounded microparticulated feed. This system is found to be successful in rearing almost all the cultivable penaeid prawn species under Indian conditions. The water quality is maintained by suitably changing the water. Food concentration of diatom is maintained @ 20,000 to 30,000 cells/ml (Silas et al., 1985).

Addition of dry formula feed developed at the MPHL, Narakkal, in the larval rearing tanks also gave encouraging results by developing suitable ecosystem in the larval rearing tank. The particle size of the compounded feed and the quantity is adjusted to the required level. (Mohamed et al., 1983).

In the regular commercial hatchery operations at Azhikode, in Kerala ground tissue of mantis shrimp is used as feed in suspension form. This feed addition in outdoor rearing tanks serves the purpose partly as feed and helping adequate algal blooms in the rearing tank (Alikunhi et al., 1980).

Quality of the Feed

The feed supplied should meet the nutritional requirements of the larvae and should be available in the rearing medium adequately continuously.

In the larval rearing procedures where the larvae are fed with pure cultures or mixed cultures of diatom the culture should be in the developing phase. Exponential phase or declining phase cultures often deteriorates the water quality in the rearing container by immediate breakdown of cells and thereby accumulating the organic load in the tanks. The larvae could not feed. Under this circumstances, especially during night hrs. mass mortality is encountered mainly due to oxygen depletion.

In the case of compounded feed freshly prepared are desirable. Long stored feed should be tested before used for nutritive value and toxins before feeding.

Quantity of the feed

Normally in quantifying the feed to be supplied in the aquaculture systems the biomass is considered. But in the larval rearing the larval concentration, the general conditions of the larvae the quantities of food in the rearing medium, the food concentration of the source, water quality, other environmental conditions such as light intensity, photoperiod, temperature are to be considered in determining the quantity of the feed to be supplied.

In the feeding of phyto cultures under Indian conditions normally 150-200 litres of phytoplankton/day (of the concn. of 2-3 lakhs cells/ml) is recommended for 2 tonne capacity rearing tank with 150-200 thousand larvae. However, this quantity has to be adjusted according to the conditions already mentioned (Silas et al., 1985).

Artemia nauplii feed is given at the rate sufficient enough to maintain a concentration of 3-5 nos/ml in the rearing tank (Murphy, 1969). Rotifer is fed at the rate of 100 nos/postlarvae/day. Frozen cladoceran Moina is provided as food for the postlarvae @ 20 nos/larva per day.

In the outdoor tanks 12-25 gm/day for a 2 tonne capacity rearing tank is suggested dosage for post-larval feeding (Silas et al., 1985).

Size of the feed

Considering the feeding habits of the larvae, the appropriate size of the feed supplied is important for successful rearing. Over the years much efforts were put in this field. The feed should be a reasonably appropriate size so that the larvae can ingest. Diatom of 5-10 micron (Chaetoceros sp.) is desirable especially in the early stages. Rotifers used in the mysis stage or postlarval stage range from 150-250 microns in size. Mysis/postlarval diet Artemia nauplii is about 400 micron. Postlarval feed like cladoceran Moina is in the size range of 0.70 to 1.2 mm.

The microencapsulated and microparticulated diet developed for various stages of penaeid prawn also of this size. Hence in any feed development and feeding strategy the size of the feed also to be considered.

Feeding time

Supply of quality of feed in optimal concentration is important step. Unlike the adult where feeding periodicity is exhibited in most of the cases, the larvae are continuous feeder and hence fall for continuous food abundance in the rearing medium for avoiding starvation.

Dispensing the required food and desired concentration continuously is most desirable but practice not possible. Hence, the rationing can be adjusted 5-6 hourly

intervals in the feeding schedule.

Water quality

The feeding strategy should give due consideration for the ecological requirement of the larvae. It has been observed that in the rearing containers the permissible range are as follows (Silas et al., 1985).

Salinity	..	29-34 ppt
Temperature	..	27-32°C
pH	..	8 - 8.5
Dissolved oxygen	:	4.0 to 8.0ml O_2/l
Ammonia	..	< 0.1 ppm
Nitrite	..	< 0.05 ppm
Light intensity (during day time)	..	2000-1,25,000 lux.

Since, the feeding quantity especially in outdoor tanks by the interaction of environmental factors tends to create unforeseen developments care should be given to maintain the above said water conditions in the rearing container.

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