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CRITICAL REVIEW ON ACCLIMATIZATION APPROACH FOR ENHANCED SURVIVAL OF SHRIMP POST-LARVAE IN GROW-OUT PONDS

Monikandon Sukumaran[1],*, Kesavan Devarayan[2] and Anand Theivasigamani[3]
[1]Department of Basic Engineering, [2]Department of Basic Sciences, [3]Department of Fisheries Sciences, College of Fisheries Engineering, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Nagapattinam 611002, India
E-mail: monikandon@tnfu.ac.in (**Corresponding Author*)

Abstract: In recent years, technological expansion has introduced numerous advancements in farming sector. However, there is no feasible technology available for acclimation of shrimp post-larvae to date. For successful rearing of shrimp commercial producers has to rely on the survival rate of the post-larvae. In hatcheries, the post-larvae are maintained at stable environment. However, it has to bear a fluctuating environment in grow-out ponds at natural environments. The post-larvae harvested from hatcheries have to be slowly adopted for the conditions of grow-out ponds. Though the effects of stress on the post-larvae transported from the hatcheries are not immediate, the consequences result in mortality or decreased survival rate of the post-larvae. It is difficult to define precise influence on the acclimation of post-larvae and it remains as a challenge in stocking and success of culture. Prior acclimation and stocking in grow-out pond is the ideal method encouraged by numerous researchers for the better survival rate of post-larvae. Though the merits of acclimatization technique are higher, there were very few researches done in this area. In this review, the importance of acclimation approach and its features are highlighted for shrimp post-larvae growth.
Keywords: Acclimation, low salinity acclimation, temperature acclimation, Post-larvae survival.

Introduction

Acclimation is a key technology involved prior to stocking of transported post-larvae in to the culture pond. This process is a challenging operation due to the survival rate of the post-larvae. The very purpose of acclimation is to make the transport water condition, temperature and salinity, as close as possible to the pond water condition in order to minimize stress on the post-larvae. If acclimation is carried out properly, it can reduce the stress of post-larvae which lead to lower mortality rate. Over the years, number of methods has been adopted by farmers to minimize the stress of transported larvae such as short term acclimation and long term acclimation. Long term acclimation or nursery systems are adopted if the seedlings are too young or weak. Generally local farmers adopt short term acclimation before stocking. Various methods are adopted by the local farmers in acclimation

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but still there is an unanswered question on how to separate or identify the weak post-larvae. Normally healthier post-larvae can withstand the stress of rigorous harvest and transport conditions, even it can adapt to the temperature, salinity and water conditions of the grow-out ponds.

Benefits of acclimation

Acclimation is a process in which the post-larvae are adapted to the natural environmental conditions in grow-out ponds. Generally post-larvae at hatchery experiences a stable environment but when it is transported and introduced into a fluctuating environment prior acclimation is required for maintaining its survival in the ponds. Shrimp farmers especially those who are culturing shrimp in inland low saline waters (< 5 ppt) has acknowledged the benefits of acclimation of post-larvae before stocking and the survival rate of post-larvae increases based on the duration of final acclimation [1]. In order to successfully rear shrimp from high salinity hatchery waters to low salinity grow-out ponds, the post-larvae should be acclimated from high salinity to low salinity in rearing systems [2].

The post-larvae of *Penaeus vannamei* and other crustaceans tolerate the changes in salinity based on the acclimation time, which can be associated with the respiratory behaviour adjustment mechanisms [3].

Approaches for acclimation

There are two basic approaches for acclimation, one is acclimation on shipment bag and other is acclimation on tanks. The former technique does not require capital expenditure and the later requires acclimation tanks. If acclimation is done on the shipment bags then ammonia may be a problem and moreover control on acclimation process is tedious. Acclimation using tanks is the best suited approach when acclimation is done for longer duration. In the case of acclimation of the shipment bags, the density of the post-larvae will be more whereas it is less for tank-based acclimation. The density of the post-larvae should be below 500 post-larvae (PL)/litre for young 6/7 days old PL (PL6/PL7) and 50PL/litre for PL15 [4].

Tolerance to salinity with acclimation

Shrimp culture is technically feasible in well water with low salinity but the survival rate of the post-larvae mainly depends on the prior acclimation. The first step in culture of *P. vannamei* to low salinity water is acclimation of the post-larvae to low salinity conditions [2]. In dry season, generally there will be less difference in salinity between the ponds and hatchery. Therefore, acclimation can be done using grow-out pond water. Salinity will be

greater between hatcheries and grow-out ponds during the rainy season and to bring down the salinity fresh untreated water should be added along with the high salinity grow-out pond water [5].

In gradual acclimation of *Penaeus monodon Fabricius* to fresh water three day acclimation period was favorable for all ages of post-larvae. Shorter durations of acclimation produced survival values as low as 20% while high survival rate was achieved upon a lengthy acclimation period [6]. Basically, farmers have the question of whether the hatchery can acclimatize the post-larvae and what could be the charge for it. Indeed, few hatcheries acclimatize the post-larvae to the clients as per the low salinity requirements. Low salinity shrimp producers can also acclimatize the post-larvae at their own facilities, so that they have flexibility of purchase of healthy post-larvae [4]. Decreasing acclimation at higher salinities at (30 ppt) and increasing the acclimation at lower salinities (< 1 ppt) has allowed successful acclimation of post-larvae to fresh water shrimp culture systems within 32 hours duration [1].

Influence of acclimation

Lower survival rates of post-larvae were observed in reciprocation to the salinity and temperature. When temperature was lower or higher than the optimal temperature for shrimp, younger post-larvae (10-30 days) were found to be more sensitive to temperature than the older ones (>30days) [7]. Low water-temperature resulted in reduced growth and less survival in the shrimp *P.paulensis* [8].

It was reported that acclimation for 8 hours duration for PL15 and PL20 showed more tolerance towards salinity reduction from 24 ppt to 1 ppt [2]. An extended acclimation time has increased the survival rates of the post-larvae in 2 days acclimation [6]. The PL20 of *P.monodon* was subjected to acclimatization for fresh water ranging from 2 days to 20 days. The best result of acclimatization was achieved in 5 days and the survival rate was 95% and the survival rate of 75% was achieved for 2 days of acclimatization. The survival rate was only increased to 80% when acclimatization was carried out for 20 days but in case of *M.monoceros* the best survival was 93% for 5days acclimatization and 80% for 2 days acclimatization [9].

Acclimation based on age of post-larvae

When the post-larvae attains the stage of PL12 to PL14 they can acclimatized to fresh water [10]. At the stage of PL12 to PL14, the gills can withstand the osmotic stress [11]. The gill development of the post-larvae should be ensured before acclimatizing to salinities less than 15 ppt. The branched gills play an important role in osmoregulatory function of the post-

larvae. At PL12 stage the post-larvae has extensive branched gill filament and this is the ideal stage and the post-larvae can be acclimatized to freshwater easily [10].

Acclimation – Features and Remarks

Apart from salinity and temperature pH, ammonia and carbon dioxide levels in the transportation medium, stocking density in acclimation waters also play a major role in deciding the survival rate of post-larvae in grow-out ponds. The preceding researches for the past two decades on acclimation of post-larvae have been reviewed in this article and all of them indicated that acclimation is very much important and it is an adaptable technique for better survival rate of post-larvae.

Above all, the quality of post-larvae viz., gill development, age of post-larvae, gut development, external parasites and water quality of grow-out ponds influence the survival rate of the post-larvae. It is difficult to give precise predictions on the influence and interferences of the acclimation period and habituation period but some of the effects of acclimation can be overlooked in terms of survival rates of post-larvae. In spite of the benefits of acclimation there is no data that correlates the growth and the acclimation. It is suggested that studies on correlation of gill development, age, and acclimatization period of post-larvae could be helpful in modeling of the growth versus effect of acclimatization.

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